Syntactically and Semantically Complex Predicates

Evidence from Danish

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Abstract

The basic idea to be explored in this thesis is that the number and type of arguments a predicate takes is predictable from the semantics of that predicate. The information in lexical entries may be confined to phonology, word class and semantics, and general constraints specify the number of arguments and how they may be realized.

An event structure is proposed in which (descriptions of) simple situations, states or processes, may be combined to a very limited set of (descriptions of) complex events. Further, a theory of argument structure is developed based on the assumption that it is semantically determined: Simple situations come with a fixed number and order of arguments. It is described what happens to argument structure and semantics when simple situations are combined to complex situations both in a single word when it is in itself semantically complex, and in syntactically complex predicates, i.e. cases where the situation is described by a predicative word in combination with another predicate.

The thesis provide answers to two central questions raised by syntactically complex predicates: How is the combination of predicates licensed and how is it possible to determine the valence of the complex predicates from the valence of the simple predicates that it is composed of.

The thesis treats three types of complex predicate. A rather detailed account of the inventory of Danish prepositions is given, arguing that there are two types, *raising prepositions* and *lexical prepositions*, which may combine to form complex prepositions. Complex prepositions may function as co-predicates in *Support Verb Constructions* and *Resultative Constructions*, the two other types of complex predicate treated in the thesis. The inventory of Danish support verbs is described and it is suggested that they are characterized by having a lexically underspecified semantics and by selecting a co-predicate with which they obligatorily combine. The main characteristics of the resultative construction are described and it is shown that the

proposed theory can be extended in a natural way to handle it. It is argued that the verbs participating in the resultative construction are full verbs with a lexically specified semantics and therefore have no need to combine with a co-predicate.

The proposal is formalized within the framework of HPSG (Head-Driven Phrase Structure Grammar) and implemented on the ConTroll platform.

Dansk resume

Den grundlæggende ide der skal undersøges i denne afhandling, er at det antal og den type argumenter et prædikat tager, er forudsigeligt ud fra det pågældende prædikats semantik.

En situationsstruktur foreslås hvori (beskrivelser af) simple situationer – tilstande og processer – kan kombineres til et meget begrænset antal (beskrivelser af) komplekse situationer. Endvidere udvikles en teori om argumentstruktur ud fra den antagelse at argumentstruktur er semantisk bestemt: simple situationer er 'født' med et fast antal argumenter i en fast rækkefølge. Det beskrives hvad der sker med argumentstrukturen og semantikken når simple situationer sættes sammen til komplekse situationer både i det enkelte ord når det i sig selv er semantisk komplekst, og i syntaktisk komplekse prædikater, det vil sige de tilfælde hvor en situation beskrives af et prædikativt ord i kombination med et andet prædikat.

Afhandlingen giver svar på to centrale spørgsmål som syntaktisk komplekse prædikater rejser: Hvilke regler tillader kombinationen af prædikater og hvordan er det muligt at bestemme et komplekst prædikats valens ud fra valensen af de simple prædikater det er sammensat af.

Afhandlingen behandler tre typer komplekse prædikater. Der gives en temmelig detaljeret redegørelse for danske præpositioner, hvori der argumenteres for at der er to typer, *raising præpositioner* og *leksikalske præpositioner* som kan kombineres og danne komplekse præpositioner. Komplekse præpositioner kan fungere som medprædikater i støtteverbumskonstruktioner og i resultativkonstruktion. Den danske bestand af støtteverber beskrives og det foreslås at de er karakteriseret ved at have en leksikalsk underspecificeret semantik og ved at selektere et medprædikat som de obligatorisk kombineres med. De vigtigste træk ved resultativkonstruktionen beskrives og det pvises at den foreslåede teori på en naturlig måde kan udvides til at håndtere den. Der argumenteres for at verber der indgår i resultativkonstruktionen er fuldverber med leksikalsk specificeret semantik som derfor ikke har behov for at

kombineres med medprædikater.

Analysen er formaliseret inden for rammerne af HPSG (Head-Driven Phrase Structure Grammar) og implementeret på ConTroll-platformen.

Chapter 1

Introduction

The basic idea to be explored in this thesis is that the number and type of arguments a predicate takes is predictable from the semantics of that predicate. The information in lexical entries may be confined to phonology, word class and semantics, and general constraints specify the number of arguments and how they may be realized.

I first present a general theory on event structure and argument structure and then treat three types of complex predicate, giving detailed descriptions of the Danish inventory of locative adverbs and prepositions, the Danish inventory of support verbs and a description of the Danish resultative construction.

The proposal is formalized within the framework of HPSG (Head-driven Phrase Structure Grammar (Pollard and Sag, 1987, 1994)) and implemented on the ConTroll platform (Götz et al., 1997). This serves a number of purposes. The formalization has been a great help in the development of the theory because it has forced me to be precise and explicit, revealing inconsistencies in my ideas and making me aware of generalization I might otherwise have missed. The implementation has made it possible to test the formalization. It is my hope that the formalization may help the reader follow my thoughts and easier spot possible shortcomings.

1.1 The HPSG framework

HPSG is a formal theory about linguistic entities and also a formal language in which to express this theory. It is a declarative formalism with only one level of representation not employing transformations.

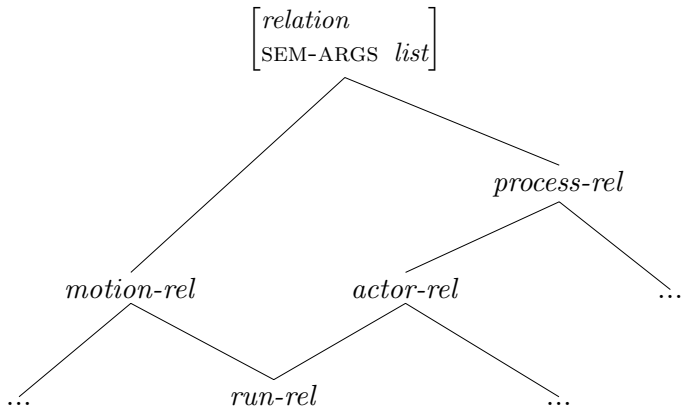
As is common practice in HPSG, in this thesis attribute-value matrices, *AVMs*, are used to describe the feature structures of the linguistic entities under investigation. (1) shows an example of an AVM, the lexical entry for the verb *løbe*, 'run'.

(1)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon} \langle \textit{løbe} \rangle \\ \textsc{synsem} \begin{bmatrix} \textit{synsem} \\ \textsc{local} \begin{bmatrix} \textit{local} \\ \textsc{category} \begin{bmatrix} \textit{category} \\ \textsc{head} \ \textit{verb} \end{bmatrix} \\ \textsc{content} \begin{bmatrix} \textit{simple-psoa} \\ \textsc{e1} \ \textit{run-relation} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(1) is a description of an object of type *word* as indicated in the upper left corner. It consist of a number a features or attributes in SMALL CAPS which each takes a value in *italics*. The value may be atomic, as *verb*, the value for the feature HEAD. Or it may be complex, itself introducing features.

The values are types which are arranged in a *type hierarchy*. A small portion of the type hierarchy to be introduced in this dissertation is shown in (2).

(2)



In this hierarchy *relation* is the supertype of all other types indicated by the lines. Features are introduced on types in the hierarchy and inherited by all subtypes. This means that the feature SEM-ARGS introduced on *relation* is also a feature on all other types in (2). A type may have more than one supertype. In (2) this is the case for the type *run-rel* which has two immediate supertypes, *motion-rel* and *actor-rel* from which it inherits all properties.

The type hierarchy with multiple inheritance is very well suited for expressing regularities in an economical fashion. Regularities need only be expressed once for the appropriate type of object and will then automatically be inherited to all subtypes.

Constraints express such regularites. (3) gives an example.

(3) $$\textit{act-rel} \longrightarrow \begin{bmatrix} \textsc{sem-args} & \left\langle \left[\textsc{loc} \mid \textsc{cont} \mid \textsc{index} \ \boxed{1}\right]^1 \mid \ \textit{list} \right\rangle \\ \textsc{act} & \boxed{1} \end{bmatrix}$$

The *antecedent*, the left-hand side, describes the object in question, in this case the type *act-rel*, and the right-hand side states what must be the case for the antecedent. The antecedent need not be a simple type, but may be any description of an object, (4) gives an example.

(4) $$\begin{bmatrix} \textit{sign} \\ \textsc{ss} \mid \textsc{loc} \begin{bmatrix} \textsc{cat} \mid \textsc{co-pred} \ \langle\rangle \\ \textsc{cont} \ \textit{simple-psoa} \end{bmatrix} \end{bmatrix} \longrightarrow \begin{bmatrix} \textsc{ss} \mid \textsc{loc} \mid \textsc{cont} \begin{bmatrix} \textsc{sem-args} & \boxed{1} \\ \textsc{e1} \mid \textsc{sem-args} & \boxed{1} \end{bmatrix} \end{bmatrix}$$

This constraint says that any object of type *sign* with an empty CO-PRED-list and a CONTENT-value of type *simple-psoa* must structure share its SEM-ARGS-list with its E1|SEM-ARGS-list. Structure sharing is indicated with *tags*, ($\boxed{1}$), and means that the value at all occurences of the tag is the same (token identical).

1.2 Overview of dissertation

In chapter 2 I present the basic components of the theory. I first suggest an event structure, that is, a description and analysis of the types of situation that verbs and other predicates denote, in which (descriptions of) simple situations – states or processes – may be combined to a very limited set of (descriptions of) complex events.

[1]For perspicuity AVMs are often abbreviated. Indication of type is often omitted, feature-names are shortened and non-branching paths are indicated with | instead of square brackets. In this case the non-abbreviated version would be $\begin{bmatrix} \textit{synsem} \\ \textsc{local} \begin{bmatrix} \textit{local} \\ \textsc{content} \begin{bmatrix} \textit{nom-obj} \\ \textsc{index} \ \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix}$

I develop a theory of argument structure based on the assumption that it is semantically determined. Simple situations come with a fixed number and order of arguments. It is therefore predictable from the meanings of the words that *løbe*, 'run', has only one argument and that *kende*, 'know', has two arguments:

(5) a. Peter løber.
Peter runs

b. Bo kender Ole.
Bo knows Ole

It is also described what happens to the argument structure when a word is semantically complex, i.e. has more than one simple situation in its semantics. Two examples are given in (6).

(6) a. Ole byggede huset.
Ole built house_the

b. Ulla dræbte løven.
Ulle killed lion_the

In (6a) the verb denotes a complex situation consisting of a build situation with two arguments, and a resulting exist situation with one argument. The second argument of the first situation is identical to the argument of the second situation and the verb therefore has two syntactic arguments. In (6b) the verb denotes a complex situation consisting of an underspecified situation with one argument resulting in a being-dead situation with one argument.

In chapters 3 through 5 I describe the semantics and argument structure of syntactically complex predicates, i.e. cases where the situation is described by a predicative word in combination with another predicate. Syntactically complex predicates raise at least two important questions: How is the combination of predicates licensed and how is it possible to determine the valence of the complex predicates from the valence of the simple predicates that it is composed of. Three types of complex predicate are dealt with.

In chapter 3 I give a rather detailed account of the inventory of Danish prepositions, arguing that there are two types, *raising prepositions* and *lexical prepositions*, which may combine to form complex prepositions. (7) gives some examples.

(7) a. Han kom **ind i** huset.
He came in in house_the[2]

b. De boede **inde i** byen.
They lived in in city_the

c. De sejlede **indad mod** kysten.
They sayled inwards toward coast_the

Complex prepositions may function as co-predicates in *Support Verb Constructions* and *Resultative Constructions*, the two other types of complex predicate treated in the thesis.

Chapter 4 describes the inventory of Danish *support verbs*. Support verbs are lexically underspecified and obligatorily combine with a co-predicate. (8) gives som examples.

(8) a. Peter **havde** kontrol over firmaet.
Peter had control over company_the

b. Peter **fik** kontrol over firmaet.
Peter got control over company_the

c. Ole **gav** Peter kontrol over firmaet.
Ole gave Peter control over company_the

Support verbs are characterized by having a lexically underspecified semantics and by selecting a co-predicate with which they obligatorily combine.

In chapter 5 the main characteristics of the *Resultative Construction* are described and it is shown that the proposed theory can be extended in a natural way to handle it. It is argued that the verbs participating in the resultative construction are full verbs with a lexically specified semantics and therefore have no need to combine with a co-predicate. (9) exemplifies two subtypes of this construction.

(9) a. Peter **løb ud i** haven.
Peter ran out in garden_the

b. Pia **sang** barnet **i søvn**.
Pia sang child_the in sleep

[2]Throughout I restrict myself to word by word translations except for a few cases where real translations seem needed.

In chapter 6 I conclude on the work and give some suggestions regarding future research.

Chapter 7 gives an introduction to the Controll platform with a test suite and the files containing the implementation.

Chapter 2

Events, Predicates and Linking

In this chapter I lay down the basic ingredients of my theory, namely a theory of Event Structure, a Linking Theory, and a theory of Complex Predicates.

A basic concept in the description of predicates is Event Structure. Event structure is a classification and possibly an analysis of situations as they are described in human language. It is important to note that the situations we talk about here are situations as they are conceptualized by language users, not the real-world situations directly. Linking theory is concerned with how we know what role the referent of a noun plays in the situation denoted by the verb and how semantic arguments are realized syntactically. Verbs always denote situations, but in many cases they do not do so on their own but in combination with other words forming syntactically complex predicates.

I first review some approaches to Event Structure and then some approaches to Thematic Roles. Finally, I present my own proposal showing that a combination of these two areas can be very fruitful.

2.1 Event Structure

2.1.1 Vendler's classification

A seminal work is that of Vendler (1957) who on the basis of a series of mainly syntactic tests proposes a classification of verbs.

Vendler distinguishes between English verbs with *ing*-form and verbs without *ing*-form, a distinction between something going on in time and something

that does not.

Verbs with *ing*-form can be subjected to the test below, later dubbed The Imperfective Paradox (e.g. Dowty (1979, pp. 134–135)).

(10) If somebody is V-ing, then even if he stops, he has V-ed

Verbs that pass this test are called **activity terms**. There is no terminal point, and you can ask *For how long did he ...* :

(11) a. For how long did he run?
b. For how long did he push the cart?

Verbs that do not pass the test in (10) are called **accomplishment terms**. In this case there is a terminal point, a climax, and you can ask *How long time did it take him to ...* :

(12) a. How long time did it take him to draw a circle?
b. How long time did it take him to run a mile?

Verbs without *ing*-form are either compatible with *When ...*, these are called **achievement terms**:

(13) a. When did he reach the hilltop?
b. When did he win the race?

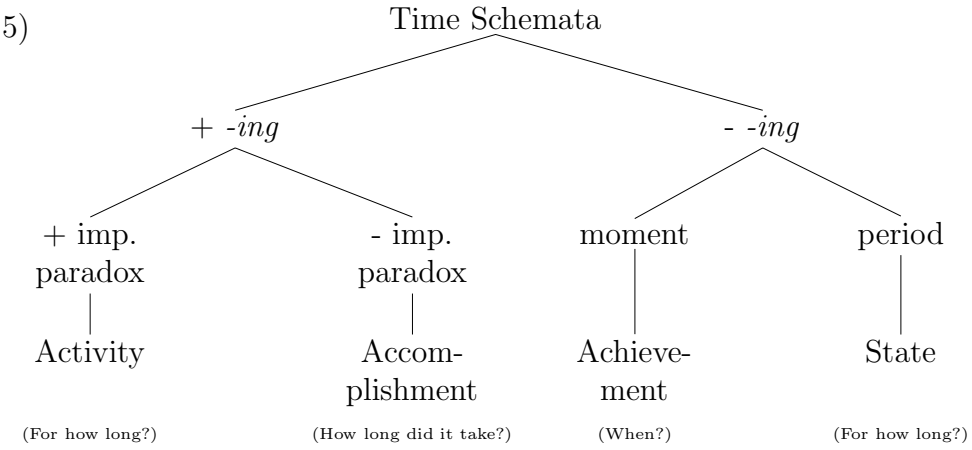
or they are **state terms**, something that is the case for some time, so again we may ask *For how long did he ...* :

(14) a. For how long did he believe the story?
b. For how long did he love her?

In connection with *achievement terms* you can of course say *It took him three hours to reach the hilltop* but that means something else than in connection with *accomplishment terms: It took him three hours to write the letter.* In the course of those three hours he can say *I am writing a letter* but he cannot say *I am reaching the hilltop.* (Vendler, 1957, p.107–108)

(15) summarizes Vendler's classification and diagnostics.

(15)

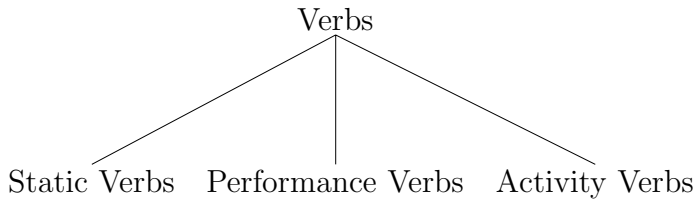


Some of Vendler's examples:
Activities: *running, walking, swimming, pushing/pulling something*,
Accomplishments: *paint a picture, make a chair, build a house, write/read a novel, deliver a sermon, give/attend a class, play a game of chess, grow up, recover from illness, get ready for sth.*,
Achievements: *recognize, realize, spot/identify sth., lose/find an object, reach the summit, win the race, cross the border, start/stop/resume sth., be born, die*,
States: *have/possess/desire/want sth., like/dislike/love/hate/rule/dominate sb/sth., know/believe sth.*. Qualities and habits are states.)

There are a number of problems with the Vendlerian classification. A constant cause for confusion is that Vendler does not properly distinguish between verbs, verb phrases and whole sentences. Thus he does not take into account the fact that not just the verb, but also the object, adverbials or the subject may play a role in determining the event structure denoted by a sentence, cf. e.g. Verkuyl (1993). Also the nature of - and diagnostics for - achievements is problematic as we shall see below.

Kenny (1963) proposes a similar scheme, but with a three-way distinction:

(16)



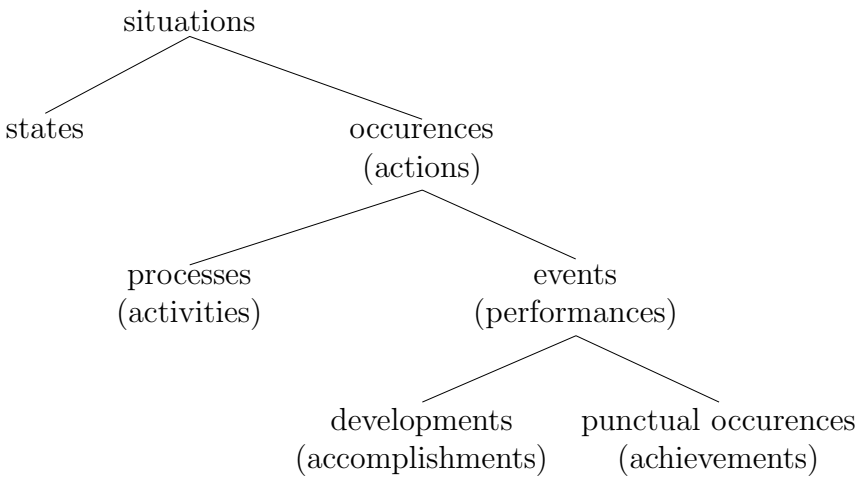
Kenny's *Performance Verbs* encompass Vendler's accomplishments and achievements. However, as also pointed out by Mourelatos (1981), one of Kenny's

criteria for performance verbs in fact, contrary to intention, picks out only accomplishments.

A good reason for grouping together achievements and accomplishments is that they both involve some kind of outcome or result.

Mourelatos (1981) suggests the scheme in (17).

(17)

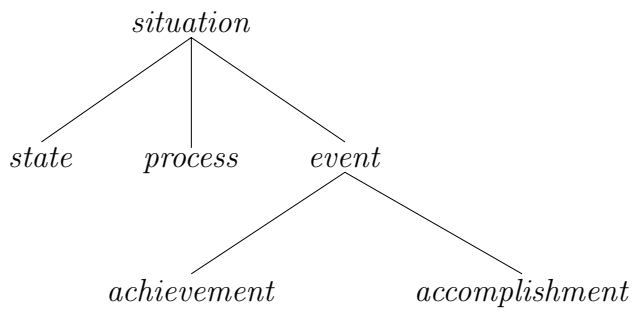


Some examples:
STATE: *The air smells of jasmine.*
PROCESS: *It's snowing.*
DEVELOPMENT: *The sun went down.*
PUNCTUAL OCCURENCE: *The cable snapped. He blinked. The pebble hit the water.*

As Vendler's *achievements*, here again the problematic category seems to be *punctual occurences* encompassing cases with some kind of end point or result, *The cable snapped, He reached the top*, the common characteristics for *events*, and cases without, *He blinked*, missing the generalization that all *events* have some kind of outcome or result.

Over the last twenty years a consensus has emerged of a scheme more or less as shown in (18), though terminology and details vary.

(18)



States and *processes* are homogeneous, that is, any subpart is of the same nature as the whole, while *achievements* and *accomplishments* may be decomposed.

2.1.2 Decomposition

The idea of decomposing event structure goes back at least to Lakoff (1965) and McCawley (1968) who analyze sentences like those in (19) and (20), respectively.

(19) a. The soup is cool.
b. The soup cooled.
c. John cooled the soup.

(20) a. Harry is dead (not alive).
b. Harry died.
c. John killed Harry.

While Lakoff concentrates on morphologically related verbs and adjectives, McCawley takes the analysis one step further by including cases where there is no morphological relationship and gives (21) as the underlying structure for (20c).

(21) (CAUSE *john* (BECOME (NOT (ALIVE *harry*))))

In his analysis of *aspectual classes of verbs* Dowty (1979) combines this kind of decompositional approach with the Vendlerian classification.

Pustejovsky (1988, 1991, 1995) investigates another way of decomposing event structure. Pustejovsky operates with three event types:

(22) Process
State
Transition

Transitions consist of two[1] *subevents* (Pustejovsky, 1995, 69-73) that are ordered in one of the following three ways:

(23) a. Exhaustive ordered part of e1 $\leq_\propto$ e2
build, arrive, give
b. Exhaustive overlap part of e1 $\circ_\propto$ e2
buy, sell, marry
c. Exhaustive ordered overlap e1 $\leq \circ_\propto$ e2
walk, walk home

In (23a) e_1 precedes e_2 and there is no overlap between the two. In (23b) the two subevents are simultaneous – in a buying event one subevent would be the transfer of money from the buyer to the owner of something, the other subevent the transfer of the bought entity in the opposite direction. In (23c) e_1 starts before e_2 and then continues simultaneously with e_2. In the example e_1 is the motion of the legs and e_2 is the subsequent motion of the entire body.

Furthermore, Pustejovsky (1995) introduces the notion *event headedness*. In structures with subevents, *transitions*, at least one of the subevents must be headed, i.e. marked as the most prominent. Transitions where e_1 is headed are *accomplishments* while structures where e_2 is headed are *achievements*. The difference between *buy* and *sell* is a matter of heading of one or the other subevent.

I find the basic idea attractive, but I also see several weak points in this proposal. If *buy* and *sell* denote an *accomplishment* and an *achievement*, respectively, we would expect there to be differences in their behaviour with regard to time adverbials, but there does not seem to be any:

(24) John bought a house yesterday / in two weeks / * for two weeks.

(25) John sold a house yesterday / in two weeks / * for two weeks.

Pustejovsky is very brief in his description of what happens when verbs of motion are combined with directionals. (Pustejovsky, 1995, p. 73):

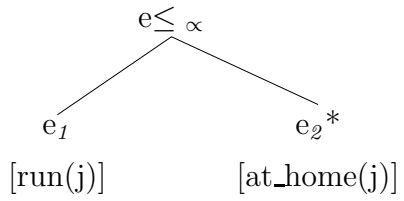
[1]Or sometimes more. Pustejovsky is neither explicit nor apparently consistent on that point.

(26) walk [e1* $\leq \circ_{\propto}$ e2]

(27) walk home [e1 $\leq \circ_{\propto}$ e2*]

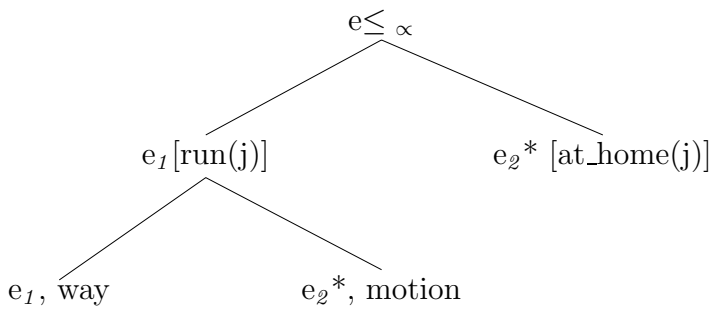
Apparently the only difference is the heading: when *walk* is used without a specification of source or goal of the motion it is the *way* that the motion is accomplished that is the most important, whereas for *walk* in *walk home* it is the motion itself that is the most important. If this interpretation is correct the description in (27) only covers *walk* and *home* must denote an e3:state. However, *John ran home for an hour* gets the representation in (28).

(28)



e_2 is here the state John is in after having run. e_2 is *headed* and according to Pustejovsky that is the reason why a duration adverbial is possible. Unfortunately Pustejovsky does not account for e_1. We might speculate that the two subevents of *run* (assuming that *run* has a structure similar to that of *walk* in (26)) are somehow packed together (as suggested in (29)) but we lack an explanation of how and why this happens and also what goes on with the heading.

(29)



Pustejovsky distinguishes between lexically process denoting verbs such as *walk*, *run* and *push*, which via *event composition* can be part of *transitions* (30a) and lexically accomplishment denoting verbs (30b).

(30) a. Mary walked to the store in an hour.

b. Mary built a house in a year.
(Pustejovsky, 1995, p.13)

However, I believe that Pustejovsky (as well as Vendler and others) confuse matters by not clearly distinguishing between V and VP:

(9) a. John is running. *Entails* John has run.
b. John is building a house. *Does not entail* John has built a house.

> What this difference in entailment indicates is whether an action is homogeneous in nature or has a culmination of some sort. Sentence (9a) is an activity and entails the statement *John has run*. That is, John has already engaged in some running. Sentence (9b), on the other hand, does not allow the entailment *John has built a house* because building is not a homogeneous process, but rather culminates in a changed state, i.e. it is an accomplishment. Thus, if *x is V-ing* entails *x has V-ed*, then either the verb or the predicate is a process.
>
> (Pustejovsky, 1991, p. 51)

If a goal-locative is added to (9a) making it an accomplishment, it will behave as (9b) above:

(31) John is running out of the house. *Does not entail* John has run out of the house.

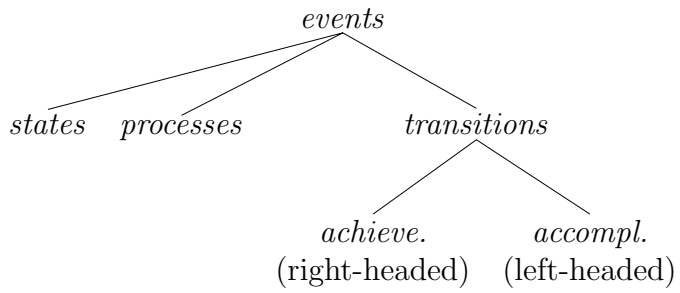
And if we limit the entailment to the verb itself in (9b) it behaves like (9a):

(32) John is building a house. *Entails* John has built (i.e. has been engaged in a building activity).

It is true that you cannot build without building something, but it is equally true, I believe, that you cannot move without going somewhere. My conclusion on this point is that verbs of creation like *build* as well as verbs of motion like *run* denote processes and a potential resulting state which may be specified and perhaps instantiated by other constituents in the sentence in which case we end up with an accomplishment reading.

(33) illustrates Pustejovsky's event structure:

(33)



2.2 Proposal for an Event Structure

In the following sections I present an ontology of situations. The label *Event Structure* is actually misleading here, since it subsumes *states* which can hardly be called events. However, it has become standard teminology, and I shall use it instead of the perhaps more adequate but also more cumbersome *situation structure*.

2.2.1 Simple situations

Simple situations are construed as being homogeneous and without any intrinsic starting or terminal point. They are either **states** (34) or **processes** (35).

(34) Ole vidste det.
Ole knew it

(35) Ole løb.
Ole ran

Intuitively the distinction between states and processes is quite clear, though in some cases it may be difficult to draw the exact line. As a test the frame in (36) may be used allowing only non-stative verbs.

(36) X var lige ved at V.
X was just about to V

Participles as well as non-verbal predicates always denote states.

2.2.2 Complex situations

While processes and states are simple, accomplishments and achievements are complex, i.e. have internal structure. Complex situations consist of two subevents, subevent_1 - a process -, which is construed as the cause for the coming about of subevent_2 - a state. This is a reflection of the conception that stative situations in the world, states, do not change spontaneously, but only under the influence of some process.

There are various kinds of evidence for this view. One is entailment: Both accomplishments and achievements entail (the coming about of) some state as shown in (37) with accomplishments and in (38) with achievements.

(37) a. Peter built a house
entails: The house existed

b. Jane flew to New York
entails: Jane was in New York

(38) a. Peter reached the summit
entails: Peter was on the summit

b. Jane lost her purse
entails: Jane did not have her purse

Furthermore, there is a presupposition common to all predicates denoting complex situations, namely, that the negation of the subevent_2-state must hold prior to subevent_2. Thus in (37a) it is presupposed that the house does not exist prior to Peter's building it, and in both sentences in (39) Ole is presupposed to be alive prior to the event causing his death.

(39) a. Ole died.

b. Jan killed Ole.

Another piece of evidence is the behaviour of time adverbials. It is well-known that processes and states are compatible with *for*-PPs (40), while accomplishments are compatible with *in*-PPs (41).

(40) a. Peter walked *for* hours.

b. Jane was poor *for* many years.

(41) John built the house *in* two months.

Achievements are supposed not to be compatible with either, but in fact, as Pustejovsky (1995, p.74) notes, both accomplishments and achievements are in some cases compatible with *for*-PPs:

(42) a. John ran home for an hour
b. My terminal died for two days
c. Mary left town for two weeks

Clearly, the adverbials do not modify the entire situation, but only subevent$_2$, the *result state*-part of it, thus corroborating the claim that accomplishments and achievements do have internal structure - that they do have a state as subevent$_2$. In (42a) it is not John's running that lasted an hour, nor is his running included in the span of an hour, but it is the state of John being at home that lasts an hour. Similarly, in (42b), it is the terminal being 'dead' that lasts two days, and in (42c) it is Mary's being out of town that lasts two weeks.

Achievements are in some cases compatible with *in*-PPs, just like accomplishments. Vendler acknowledges the existence of these cases, though he does not try to explain it:

(43) The fact that we often say things like

It took him three hours to reach the summit
He found it in five minutes

> might tempt a novice to confuse achievements (which belong to the second genus) with accomplishments (which belong to the first). A little reflection is sufficient to expose the fallacy. When I say that it took me an hour to write a letter (which is an accomplishment), I imply that the writing of the letter went on during that hour. This is not the case with achievements. Even if one says it took him three hours to reach the summit, one does not mean that the 'reaching' of the summit went on during those hours. Obviously it took three hours of climbing to reach the top. (Vendler, 1957, pp. 103-104)

Yes, obviously, and to me the compatibility of achievements with *in*-PPs suggests that they too have a subevent$_1$, a process, which is construed as causing subevent$_2$.

We have so far established that accomplishments as well as achievements denote complex situations consisting of a process causing a state.

The distinction between the two, I suggest, is a question of specificity of subevent$_1$, accomplishments having a specified subevent$_1$, and achievements having an underspecified subevent$_1$. A possible time adverbial headed by *in* measures out the duration of this process until the coming about of the result state. In the case of accomplishments this is unproblematic, while in the case of achievements we have to fill in the missing/underspecified process from context or on the basis of world knowledge. Consider the examples with achievement verbs in (44).

(44) a. The old man died in two weeks.
b. Paul found his keys in five minutes.
c. Surprisingly, Eric found one hundred dollars in the street (?in five minutes)

In (44a) what took two weeks was the process that led to the death of the old man - his illness, we may infer. In (44b) Paul must have looked for the keys during those five minutes, while (44c) is hardly compatible with an *in*-adverbial because, at least on the most salient interpretation, we do not know which process to measure.

In the complex situations discussed above subevent$_1$ precedes subevent$_2$, but in some cases, in particular sentences with locative prepositional phrases, other temporal orderings seem possible.

Compare the sentences in (45):

(45) a. Bolden trillede hen til hegnet.
Ball_the rolled over to fence_the
b. Bolden trillede langs hegnet.
Ball_the rolled along fence_the
c. Bolden trillede inde fra haven.
Ball_the rolled in.ST from garden_the

(45a) has the accomplishment-structure discussed above with a specified process denoted by *trille* and a resulting state denoted by the prepositions *hen til* of the ball being at the fence. (45b) denotes exactly the same two subevents as (45a), a rolling process and a being-at-the-fence state. The difference lies in the temporal relation between the two events, in (45a) subevent$_1$ precedes subevent$_2$, in (45b) the two subevents overlap. An overlapping structure is also found in *depictives* like (46).

(46) Peter spiste bøffen rå.
Peter ate steak_the raw

In (45c) the state precedes the process. This structure is only relevant in the locative domain. In other domains it is equivalent to the cause relation + the opposite state relation:

(47) a. * Situationen kom inde fra kontrol.
Situation_the came in from control
b. Situationen kom ud af kontrol.
Situation_the came out of control

Note that (45c) is atelic:

(48) * Bolden trillede inde fra haven på ti sekunder.
Ball_the rolled in.ST from garden_the on ten seconds

Finally, in (49) one could say that the process is temporally embraced by the state, in the sense that the state may hold not just simultaneously with the process as in (45b) but also both before and after[2].

(49) Bolden trillede inde i målet.
Ball_the rolled in in goal_the

In causative structures it must be the case that the relation in subevent_1 holds of an interval prior to the interval where the relation in subevent_2 holds, and the relation for subevent_2 must not hold for (the majority of) subevent_1. Obviously, you can walk into a room only in case you are not already in it, and you can only become something that you are not already. Contrary to Pustejovsky, I do not demand that there be no overlap between subevent_1 and subevent_2 (Pustejovsky, 1995, p. 69). If you walk into a room there will necessarily be some period where you are already in the room, but still walking.

As mentioned above, both *Accomplishments* and *Achievements* have a causative relation between subevent_1 and subevent_2. In both cases a process, subevent_1,

[2]There is no problem in interpreting these relations as basically locational instead of chronological if one prefers that, cf. Jackendoff (1983, pp.169–170). *Source* would then mean that subevent_2 was placed in front of subevent_2, *goal* that it was placed behind subevent_1, *path* that the two events covered one another and *stative* that subevent_1 was contained within subevent_2.

is construed as resulting in the coming about of a certain state, subevent$_2$. The difference between the two, I suggest, lies in the specificity of subevent$_1$. *Accomplishments* have a specified subevent$_1$ whereas *Achievements* have an underspecified subevent$_1$. I first consider *Accomplishments*, a subsort of which are *Resultatives*, then *Achievements* which also include *Causatives*.

2.2.2.1 Accomplishments

Accomplishments specify the process leading to the result state. (50) and (51) give some examples.

(50) a. Peter byggede et hus.
Peter built a house

b. Pia spiste kagen.
Pia ate cake_the

(51) a. Børnene løb ud i haven.
Children_the ran out in garden_the

b. Spillerne løb sig i form.
Players ran themselves in shape

In (50a) it is the building process that brings about the result state of the house existing. In (50b) it is the eating process resulting in the cake being gone. In both sentences in (51) it is the process of running that leads to the result, in (51a) the children being in the garden and in (51b) the players being in shape. Sentences like those in (51) are treated in chapter 5 on Resultatives. The difference between (50) and (51) lies in how the constructions are licensed, a subject I shall return to in various places below.

2.2.2.2 Achievements

Achievements have an underspecified subevent$_1$. While the accomplishment sentences in (52) tell us which process led to the state *(being) at the building*; the achievements in (53) do not tell us.

(52) Jan gik hen til bygningen.
Jan walked over to building_the

(53) a. Jan kom hen til bygningen.
Jan came over to building_the

b. Jan bragte varerne hen til bygningen.
Jan brought goods_the over to building_the

Achievements may be combined with a *ved* 'by'-phrase:

(54) a. Han døde ved at få en mursten i hovedet.
He died by to get a brick in head_the

b. Hun vågnede ved at han pustede hende i øret.
She woke up by that he blew her in ear_the

c. Han vækkede hende ved at puste hende i øret.
He woke her up by to blow her in ear_the

d. Manden åbnede dåsen ved at smide den mod muren.
Man_the opened can_the by to throw it against wall_the

These *ved*-phrases serve to specify subevent$_1$ and their compatibility with achivements thus seems to corroborate our claim that achievements have an underspecified subevent$_1$. As a diagnostics for achievements it does not really work, though, because also accomplishments may be combined with a *ved*-phrase which in that case serves to further specify an already specified subevent$_1$. Some are more felicitous than others depending, presumably, on how specific the relation in subevent$_1$ is:

(55) ?Ole gik ud i haven ved at sætte den ene fod efter den anden.
Ole walked out into garden_the by to put the one foot after the other

Achievements come in two syntactic types, *lexical achievements* where the verb lexically specifies the result state, and *periphrastic achievements* which are the combination of a lexically underspecified verb and another predicative element specifying the result state. Periphrastic achievements are dealt with in chapter 4 on Support Verb Constructions.

Both lexical and periphrastic achievements can be divided into inchoatives and causatives.

2.2.2.2.1 Inchoatives are structures where a completely underspecified process, subevent$_1$, leads to a result state. The term *inchoative* was originally associated with verbs that are morphologically and semantically related to, possibly derived from, adjectives like the ones in (56) and (57).

(56) a. Kanariefuglen døde.
Canary_the died

b. Kanariefuglen var død.
Canary_the was dead

(57) a. Sigurd vågnede tidligt.
Sigurd woke up early

b. Sigurd var vågen.
Sigurd was awake

However, I shall use the term in an extended sense also covering the combination of a support verb and a co-predicate denoting the result state as exemplified in (58).

(58) a. Drengen blev glad.
Boy_the became happy

b. Hunden kom ud på gaden.
Dog_the came out on street_the

2.2.2.2.2 Causatives systematically have an extra argument, the causer, compared to inchoatives. I suggest that this argument plays the role of actor in an otherwise underspecified process-subevent$_1$. In the normal case, then, a causative verb does not say anything specific about the process[3], it can be paraphrased 'X did something as a consequence of which Y ended up in a certain situation'. The process may be specified by a *ved-*, 'by', phrase as shown in (54) above. *Ved*-phrases are treated in more detail in Bjerre (2001).

Similar to inchoatives, causatives may be divided into *lexical causatives* (*lærte*, 'taught', *vækkede*, 'woke sb. up', *dræbte*, 'killed'), and *periphrastic causatives*, e.g. *gjorde tam*, 'made tame'.

Simple causatives denote situations in which this underspecified actor-relation is construed as causing a state denoted by the relation in subevent$_2$, whereas *complex causatives* denote situations in which the caused situation may in itself be complex, i.e. not just a state, but a process plus possibly a state. (59) through (61) show some examples.

(59) The general marched the soldiers to their tents.

[3]Many verbs of killing are exceptions to this generalization, e.g. *drukne*, 'drown', *hænge*, 'hang', *kvæle*, 'choke', etc.

(60) Jeg rullede bolden hen over gulvet.
I rolled ball_the (over) over floor_the

(61) Moren fik børnene til at gå ud i haven.
Mother_the got children_the to to go out in garden_the

Just as in simple causatives, subevent$_1$ is the causing event with an actor.

Apparently, sentences like (62) pose a problem:

(62) Moren lod børnene gå ud i haven.
Mother_the let children_the go out in garden_the

It seems that the difference between (61) and (62) is that in the situation denoted by the former the mother is doing something, whereas in the latter she is not. This is not the whole truth, though. In a situation where the mother does not notice the children going out, (62) is not felicitous. It seems that *lod* poses a constraint on the situation to the effect that the actor of the relation in subevent$_1$ is not just doing nothing, but is deliberately abstaining from doing something. This can be seen as a special kind of process, and I will therefore distinguish between positive and negative process-relations. This corresponds quite closely to Dowty's DO operator. He notes:

(63) ... DO does not necessarily connote action in the usual sense, because of examples like *John is being quiet, John is ignoring Mary, What John did was not eat anything for 3 days* (Cruse, 1973) which seem to entail merely deliberate avoidance of action of a certain kind. (Dowty, 1979, p. 117)

2.2.2.2.3 Actual and Potential States In the descriptions of complex situations dealt with above the resulting states are described as actually occurring. However, the resulting state may also be described as only potentially occurring, cf. the sentences in (64).

(64) a. Ulla løb hen **til** bussen.
Ulla ran over to bus_the

b. Ulla løb hen **mod** bussen.
Ulla ran over towards bus_the

(64a) is an ordinary accomplishment with a verb denoting the process and a preposition denoting the resulting state which must occur for the sentence to

be true. In the syntactically identical sentence in (64b) the preposition also denotes a resulting state, but in this case the state need not come about for the sentence to be true. The state is merely described as a likely possibility.

The two sentences display a number of differences. (64a) may be combined with a *på*-adverbial (65a), if it is combined with an *i*-adverbial (65b) this measures out the state, not the process, and it is not possible to deny that the goal was reached (65c). For (64b) the opposite holds: It cannot be combined with a *på*-adverbial (66a), an *i*-adverbial measures out the process, not the state, and it is possible to deny that the goal is reached (66c).

(65) Ulla løb hen **til** bussen

a. ... på to minutter.
in to minutes

b. ... (*) i to minutter.
for to minutes

c. ... * men nåede den ikke.
but reached it not

(66) Ulla løb hen **mod** bussen

a. ... * på to minutter.
in to minutes

b. ... i to minutter.
for to minutes

c. ... men nåede den ikke.
but reached it not

It is therefore vital to distinguish between actual and potential states. An actual state in an accomplishment or an achievement is a state that necessarily follows from the process for the sentence to be true, whereas a potential state must only be construed as a likely result of the process, i.e. as occurring in case nothing intervenes to prevent it from occuring. Both *hen til bussen* and *hen mod bussen* denotes the state of being *at the bus*, but only in the former case is the state described as actually occurring.

Another instance of the same phenomenon is the difference between the short-forms and *ad*-forms of locative adverbs (cf. chapter 3):

(67) a. Peter gik hjem på en time.
Peter walked home in an hour

b. Peter gik hjemad i en time.
Peter walked homewards for an hour

In (67a) the state is actual, in (67b) it is potential.

Also verbs may exhibit this distinction:

(68) a. Ekspeditionen nåede bjergtoppen.
Expedition_the reached summit_the

b. Ekspeditionen nærmede sig bjergtoppen.
Expedition_the approached REFL summit_the

(68a) is actual, while (68b) is potential.

A number of constructions may be described in terms of a potential state. This is the case for the English progressive and the Danish counterpart shown in (69), the *build on a house*-type constructions, (70), as well as many uses of the prepositon *efter, 'after'* exemplified in (71).[4] I shall not pursue the matter further here[5].

(69) Jane var i gang / færd med at bygge et hus.
Jane was in - - with to build a house
'Jane was in the process of building a house'

(70) Ole byggede på sit hus i mange år.
Ole built on his house in many years
'Ole built on his house for many years'

(71) a. Peter løb efter bilen.
Peter ran after car_the

[4]In Finnish, partitive case has a similar effect:

(1) a. Hän rakensi talon.
He built house-AKK
'He built a/the house'

b. Hän rakensi taloa.
He built house-PART
'He built at a/the house'

(cf. i.e. Swart and Verkuyl (1999, pp. 32–36) and Kiparsky (1998)).

[5]Cf. also Pustejovsky (1995, p. 260) on verbs like *look for, grope for, reach for, work on* which he calls *intensionally telic.*

b. Peter gravede efter guld.
Peter digged after gold

2.3 Thematic Roles

Thematic roles are labels such as *agent, patient, beneficiary, goal*, etc. assigned to the arguments of verbs and other predicates. Thematic roles are employed to give a semantic classification of arguments and to express generalizations with regard to the syntactic realization of arguments, often in the form of a thematic hierarchy, a ranking of thematic roles.

Without reviewing any specific proposals, in the next section I point out some problems for the traditional approaches to thematic roles, and in section 2.3.2 I present in more detail a very influential recent proposal within HPSG, Davis (2001).

2.3.1 The traditional approach

In the traditional approach (Gruber, 1965; Fillmore, 1968) etc. it is assumed that there is a finite, small set of thematic roles which can be assigned to the arguments of a predicate in such a way that no argument is assigned more than one role, and no role is assigned to more that one argument of the same predicate.

Furthermore, various thematic hierarchies have been proposed to account for the surface order of arguments. (72) gives an example.

(72) AGENT $\prec$ BENEFACTIVE $\prec$ RECIPIENT/EXPERIENCER $\prec$ INSTRUMENT $\prec$ THEME/PATIENT $\prec$ LOCATIVE (Bresnan and Kanerva, 1989)

Thematic roles are supposed to be independently assigned, that is, it should not be possible to tell from the presence or absence of one role whether another role will also be present or absent.

It has proved immensely difficult to find a small, finite set of thematic roles that can be precisely defined, and in particular the handling of causatives has turned out to be a major problem for the traditional approach. Thus in (73) both Søren and the dog qualify as actors, and in (74) the house seems to have multiple roles, both the role of actor and the role of bearer.

(73) Søren fik hunden til at gø.
Søren got dog_the to to bark

(74) Peter malede huset hvidt.
Peter painted house_the white

2.3.2 Thematic Roles etc. in HPSG

Pollard and Sag (1994) do not have much to say on relations and thematic roles. Through the majority of the book relations are expressed as values for the feature RELATION and the thematic roles as features on the same level. (75) gives an example.

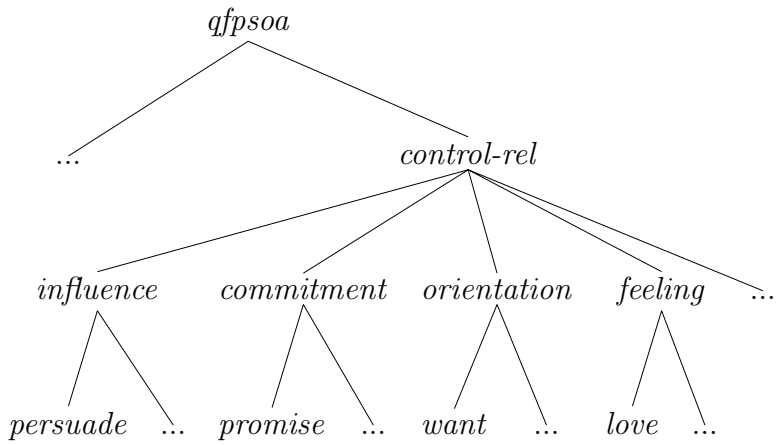
(75) *sees*

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb[fin]} \\ \text{SUBCAT} & \left\langle \text{NP}[\textit{nom}]_{\boxed{1}[\textit{3rd,sing}]}, \text{NP}[\textit{acc}]_{\boxed{2}} \right\rangle \end{bmatrix} \\ \text{CONTENT} & \begin{bmatrix} \text{RELN} & \textit{see} \\ \text{SEER} & \boxed{1} \\ \text{SEEN} & \boxed{2} \end{bmatrix} \end{bmatrix}$$

Pollard and Sag (1994, p. 29)

As they themselves recognize (Pollard and Sag, 1994, p. 338), the problem with this kind of representation is that it makes it impossible to reflect the fact that the thematic roles depend on the expressed relation. They therefore suggest to eliminate the feature RELATION and let relations be subtypes of *qfpsoa* as shown in (76).

(76)



The appropriate thematic roles are then introduced as features on the relations, e.g. INFLUENCER and INFLUENCED on *influence*. Instead of the CONTENT-value in (75) we would then get (77).

(77) $\begin{bmatrix} \textit{see} & \\ \textsc{seer} & \textit{ref} \\ \textsc{seen} & \textit{ref} \end{bmatrix}$

Davis (2001) builds on this latter suggestion with one major modification. To be able to express generalizations on thematic roles, instead of specific thematic roles like *seer* and *seen* above, he uses *proto-roles* (Dowty, 1991) like *actor, undergoer* etc. The idea is that there are certain entailments holding of e.g. the specific thematic roles *walker, runner, builder, eater* which therefore are lumped together under the label *actor*. Specific roles seem unnecessary, at least for linking purposes.

(78) gives an overview of Davis' proto-roles with associated entailments.

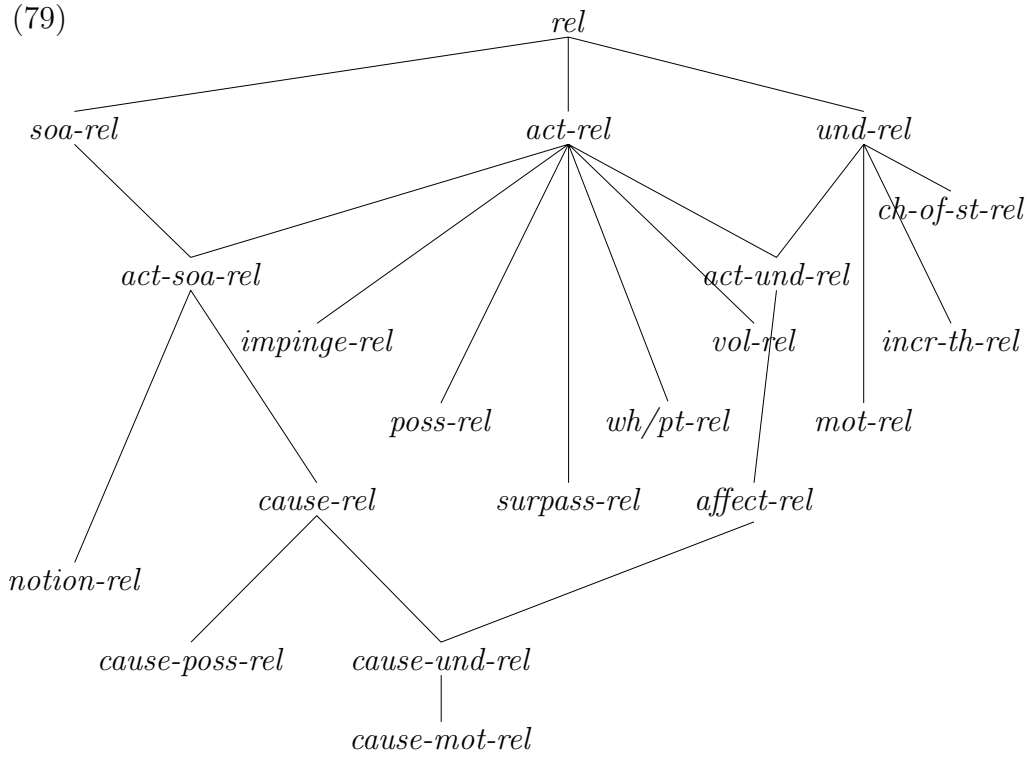
(78) Summary of proto-role attributes and their associated entailments (Davis, 2001, p. 132):

Proto-role attribute	Entailments
ACT	Causally affects or influences other participant(s) or event(s).
	Volitionally involved in event.
	Has a notion or perception of other participant(s) in event or state.
	Exerts forceful contact on other participant(s) in event.
	Includes another participant in state or event.
	Is superior compared to another participant.
	Possesses another participant in state or event.
UND	Causally affected or influenced by another participant in event.
	Undergoes change of state in event.
	Is an incremental theme in event.
	Moves with respect to another participnat in event.
SOA	Is conceived of or perceived by another participant in event or state.
	Is a resulting event or state caused in event.
	Is an event or state that necessarily accompanies another event.
GRND	Path traversed by another participant in event.
IMP-ON	Is forcefully impinged on in event.
PART	Is included in or part of another participant in state or event.
INF	Is inferior compared to another participant.
POSSD	Is possessed by another participant in state or event.

This list of proto-role attributes is not exhaustive. Other thematic roles mentioned are: MEANS, SOURCE, VIA, ENDPT, ARG1, ARG2, SOA2.

(79) shows how the semantic relations that introduce these proto-role attributes, are organized in the type hierarchy.

(79)



(Davis, 2001, p. 131)

Act-rel thus introduces ACT, *und-rel* introduces UND and their common subtype *act-und-rel* will inherit both. (79) shows only the top of the hierarchy. At the bottom of the hierarchy we find the relations that occur in the semantics of individual predicators, and between these and the types in (79) are a number of intermediate types. Furthermore, Davis discusses relations with arguments of which no proto-role entailments hold. These will therefore be immediate subtypes of *rel*.

The Attribute-to-Entailment Condition in (80) ensures that the values of the proto-role attributes are associated with the relevant entailments.

(80) Attribute-to-Entailment Condition, Davis (2001, p. 81)

Let A be a proto-role attribute in feature structures of type *rel*, representing situations of type S. Then there exists a participant role Q such that:

- $Q(x,y)$[6] $\rightarrow P(x)$, where P is a proto-role entailment associated

[6]The notation $Q(x,y)$ indicates that a participant x in a situation y plays the partici-

with A.

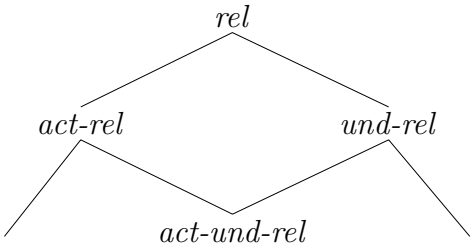
- If the value of A denotes a in a feature structure of type *rel* denoting situation s, then $Q(a,s)$.

The linking of semantic arguments to syntactic positions is fairly complicated in Davis (2001). Firstly, (81) ensures a parallelism between relations and the predicators having those relations as content values.

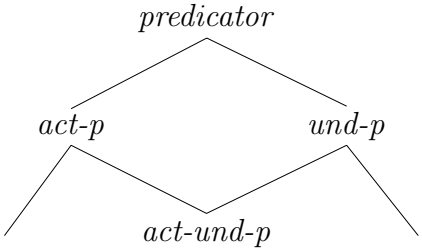
(81) If s is a type in the semantic relations hierarchy and there exists a type in the lexical hierarchy with CONTENT of type s, then there exists a type *s-p* in the lexical hierarchy with CONTENT of type s such that every type in the lexical hierarchy with CONTENT a subtype of s is a subtype of *s-p*. (Davis, 2001, p. 190)

The effect of (81) is illustrated in (82).

(82) a. Hierarchy of semantic relation types



b. Hierarchy of relation predicator types



(Davis, 2001, p. 190)

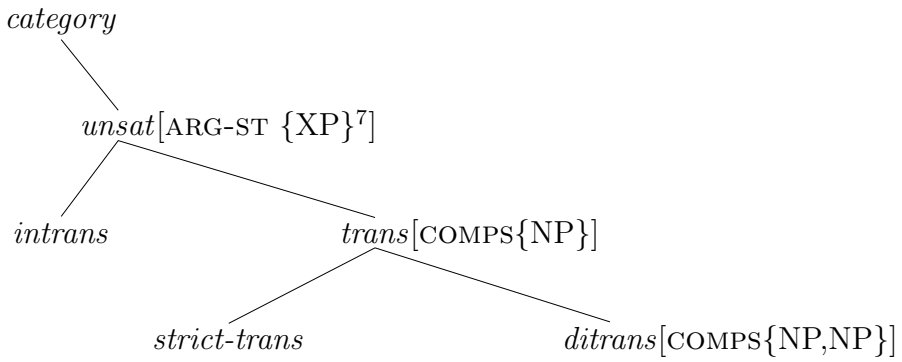
Secondly, (83) ensures a similar parallelism between types of valence and predicators with that particular valence.

pant role Q.

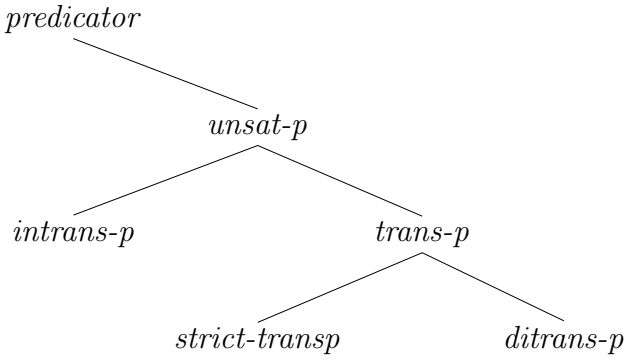
(83) If v is a type of valence (a subtype of *category*) and there exists a type in the lexical hierarchy with CATEGORY of type v, then there exists a type *v-p* in the lexical hierarchy with CATEGORY of type v such that every type in the lexical hierarchy with CATEGORY a subtype of v is a subtype of *v-p*. (Davis, 2001, p. 191)

This is illustrated in (84).

(84) Hierarchy of valence types (Davis, 2001, p. 192)



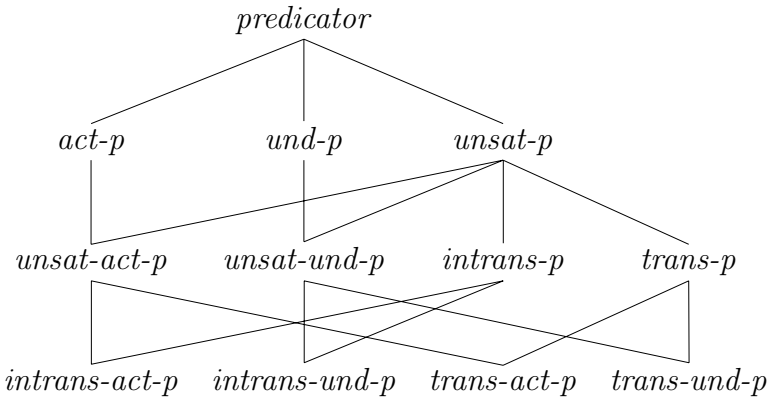
(85) Hierarchy of valence predicator types (Davis, 2001, p. 193)



Types in the lexical hierarchy that inherit from a relation predicator and from a valence predicator are called linking types. (86) shows some of the most general of these, *unsat-act-p, unsat-und-p, intrans-act-p, intrans-und-p, trans-act-p* and *trans-und-p*.

[7]Elsewhere in Davis (2001) ARG-ST takes a list as value so this notation must be assumed to be a shorthand for *list* $\oplus$ < XP | *list* >. $\oplus$ stands for the ternary ralation of list concatenation (append).

(86) Subtypes of relation and valence predicators at the top of the lexical hierarchy, (Davis, 2001, p. 195)



Davis' most straightforward generalization on linking is that actors precede other participants. This is stated in (87).

(87) Actor Priority

Elements of the ARG-ST list linked to an ACT attribute precede elements that are not. (Davis, 2001, p. 202).

Part of (87) is formalized as the constraint in (88).

(88) The linking type *unsat-act-p*, (Davis, 2001, p. 195)

$$\begin{bmatrix} \textit{unsat-act-p} \\ \text{ARG-ST} & \langle \text{XP:}\boxed{1}, \ldots \rangle \\ \text{CONTENT} & \begin{bmatrix} \textit{act-rel} \\ \text{ACT} & \boxed{1} \end{bmatrix} \end{bmatrix}$$

(88) ensures that a top-level actor is linked to the first argument on the ARG-ST list. I return to the handling of embedded actors.

All other semantic roles are linked to an arbitrary element on the ARG-ST list or not linked at all. (89) shows the linking of top-level undergoers.

(89) Top-level Undergoer Linking, (Davis, 2001, p. 196–197)

$$\begin{bmatrix} \textit{und-linked-p} \\ \text{ARG-ST} \quad \{\text{XP:}\boxed{1}\} \\ \text{CONTENT} \quad \begin{bmatrix} \textit{und-rel} \\ \text{UND} \ \boxed{1} \end{bmatrix} \end{bmatrix}$$

This is the supertype of verbs such as transitive *eat* and transitive and intransitive *shatter*, but not of verbs with unspecified object deletion such as intransitive *eat* which are subtypes of *unsat-und-p*.

Further, Davis discusses the pair of sentences in (90) and (91).

(90) a. Marge showed/gave/got Homer a chocolate donut.
b. *Marge schmowed a chocolate donut Homer.

(91) a. Smoke entered the room.
b. *The room bentered smoke.

(90b) shows that a ditransitive verb like *schmow* which reverses the second and third argument is not possible. Assuming the structure in (92) for verbs like *gave* and *got* (and a similar one for *show*), (90b) is ruled out because the embedded actor must precede the embedded possessed entity according to (87).

(92)
$$\begin{bmatrix} \textit{cause-possess-rel} \\ \text{ACT} \\ \text{UND} \ \boxed{1} \\ \text{SOA} \quad \begin{bmatrix} \textit{poss-rel} \\ \text{ACT} \quad \boxed{1} \\ \text{POSSD} \end{bmatrix} \end{bmatrix}$$

Davis (2001, p. 116)

Davis suggests the structure in (93) for the semantics of *enter*.

(93)
$$\begin{bmatrix} \textit{enter-rel} \\ \text{UND} \\ \text{GRND} \quad \begin{bmatrix} \textit{path} \\ \text{ENDPT} \quad \begin{bmatrix} \textit{place} \\ \text{IN} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Davis (2001, p. 105)

To rule out (91b) Davis formulates the constraint in (94).

(94) Top-level Priority

> Some element of the ARG-ST list linked to a top-level attribute precedes each element that is linked only to an embedded attribute. (Davis, 2001, p. 202).

In (91) *smoke* is linked to the top-level UND-attribute and therefore must preced *the room* which is linked only to the embedded IN-attribute.

The formalization of the constraints in (87) and (94) turns out to be rather complicated and I shall not go into that here. The reader is referred to Davis (2001, pp. 202–215).

Davis (1996, 2001) has been extremely influential in the HPSG society and has meant a tremendous step ahead in the area of thematic roles and linking. In many respects my proposal builds on Davis' work, but there are many differences as well, both in the inventory of thematic roles and in particular in the linking. In general I think that Davis' formalization is unnecessarily complicated and with an unnecessary proliferation of types in the hierarchy.

Later in this chapter I show how the corresponding constraints in my theory are formalized in a much more simple fashion.

2.3.3 My proposal

In section (2.2) I was concerned with how predicates describe situations with possible subsituations. This section will be on the entities that participate in the situations, the arguments.

My proposal is in many respects similar to Davis (2001), but there are a number of differences. Among other things I have reduced the inventory of thematic roles to only six. This is possible because some of Davis' roles in my proposal are expressed in the event structure instead. Also I have changed some entailments to indicate bearer and not actor reserving actors for processes. Finally, my linking is entirely different from that of Davis (2001).

Below I first describe the system of thematic roles and the hierarchy of relations with a fixed number and ordering of thematic roles, and then the rather simple relationship within predicative lexical items between their SEM-ARG list(s) containing semantic arguments and their SYN-ARGS list containing syntactic arguments.

2.3.4 Relations and Arguments

It is part of understanding what kind of situation some predicate denotes, to know how many participants are involved in that situation. I therefore propose a system similar to the one presented in Davis (1996, 2001) in which semantic relations come with a fixed number of semantic arguments.

The concept of two related subevents as described in section 2.2 makes it possible to limit the number of thematic roles. Causation is expressed as a relation between subevents so there is no need for features like CAUSER or ACC-EV (Davis, 1996), nor for relations like *change-of-state-relation* or *cause-relation* (Davis, 2001). Furthermore, the set-up with subevents simplifies matters because although the same thematic role cannot occur twice in the same subevent (cf. Fillmore (1968, p. 21) 'each case relationship occurs only once in a simple sentence'), it **can** occur in two subevents within one situation. And one entity can have only one role within each subevent, but may have different roles in two subevents within one situation. The former is the case with a subtype of causatives exemplified in (95).

(95) Søren fik hunden til at gø
Søren got dog_the to to bark

Here Søren is the *actor* in subevent$_1$, and the dog *actor* in subevent$_2$. In (96) *the house* has two roles.

(96) Peter malede huset hvidt
Peter painted house_the white

It is *undergoer* in subevent$_1$, while in subevent$_2$ it is the *bearer* of the state of being white.

(97) shows my inventory of thematic (proto-)roles.

(97) *actor* $\prec$ *(undergoer)*
bearer $\prec$ *(theme)*
figure $\prec$ *ground*

The notation indicates that thematic roles are related in pairs with a fixed order, *actors* precede *undergoers*, *bearers* precede *themes* and *figures* precede *grounds*. The parentheses indicate that a relation may have an *actor* but no

undergoer or a *bearer* but no *theme*, but not the other way around, no relation can have just an *undergoer* or a *theme*.

All processes[8] have an *actor*. No distinction is made at this point between volitional and non-volitional processes, because this does not seem to play a role in linking, cf. (98).

(98) a. Peter løber.
Peter runs

b. Vandet løber.
Water_the runs

The thing acted upon in a process is called the *undergoer*. (99) gives some examples.

(99) a. Ole byggede et hus.
Ole built a house

b. Laila spiste kagen.
Laila ate cake_the

c. Jan reparerede bilen.
Jan repaired car_the

Clearly, the house, the cake and the car are acted upon during the processes denoted by the verbs in (99).

The sentences in (99) denote accomplishments as indicated by their compatibility with *på*-phrases:

(100) a. Ole byggede et hus på fire måneder.
Ole built a house on(in!) four months

b. Laila spiste kagen på to minutter.
Laila ate cake_the on(in) two minutes

c. Jan reparerede bilen på en time.
Jan repaired car_the on(in) one hour

This means that they have a state subevent$_2$, the state of the house existing, the cake being gone, or the car being fixed. The entities denoted by

[8]Except for metereological relations denoted by verbs like *regne*, 'rain', *sne*, 'snow' etc.

the grammatical objects of these sentences thus have the role *undergoer* in subevent$_1$ and *bearer* in subevent$_2$.

A similar structure is displayed by one subtype of *resultatives* exemplified in (101).

(101) a. Peter malede huset hvidt.
Peter painted house_the white

b. Jørgen skubbede kassen hen i hjørnet.
Jørgen pushed box_the over in corner_the

The house is the *undergoer* in the painting situation and the *bearer* of the being-white state, the box is the *undergoer* in the pushing situation and the *figure* in the locational state.

In another type of resultatives the objects do not denote *undergoers*:

(102) a. Ulla sang barnet i søvn.
Ulla sang child_the to sleep

b. Han spiser sin mor ud af huset.
He eats his mother out of house_the

In the situation denoted by (102a) Ulla did sing something, but it was not the child. The child is merely the *bearer* of the sleep state, and similarly in (102b) the thing eaten is not the mother. Resultatives are treated in more detail in chapter 5.

States are divided into locational states with the thematic roles *figure* and *ground*, and non-locational states with the thematic roles *bearer* and possibly *theme*.

If a locational state is the result of movement the moving entity invariably has the role of *figure* as in (103).

(103) Peter gik ud i haven.
Peter went out in garden_the

Peter is the *actor* in subevent$_1$ and the *figure* in subevent$_2$, and there is no way of expressing the same situation with the garden as *figure*. However, static locational states may often be described in two ways reversing the order of arguments:

(104) a. Bogen ligger ved siden af lampen.
Book_the lies next to lamp_the

b. Lampen står ved siden af bogen.
Lamp_the stands next to book_the

(105) a. Søen ligger mellem træerne.
Lake_the lies among trees_the

b. Træerne står rundt om søen.
Trees_the stand round lake_the

In other cases such a reversal is not possible:

(106) a. Bogen ligger på bordet.
Book_the lies on table_the

b. * Bordet står under bogen.
Table_the stand under book_the

(107) a. Lampen hænger ned fra loftet.
Lamp_the hangs down from ceiling_the

b. * Loftet hænger over lampen.
Ceiling hangs over lamp_the

I suggest that the ascription of *figure/ground* roles is free (though limited, of course, by the meaning of the predicate in question and by context) except for the constraint that the location of the *ground* entity must be independent of the *figure* entity. In (106) the book could not maintain its position if it was not for the table, and therefore the book cannot have the role of *ground*, in (107) the location of the lamp is dependent on the ceiling. (108) below is quite similar to (107) with the exception that the location of both entities is independant of each other, and as predicted both may have the *ground*-role:

(108) a. Lampen hænger over bordet.
Lamp_the hangs over table_the

b. Bordet står under lampen.
Table_the stands under lamp_the

The sentences in (109) seem problematic for this account:

(109) a. Bogen ligger på papirerne.
Book_the lies on papers_the

b. Papirerne ligger under bogen.
Papers_the lie under book_the

Both orderings are possible, though it would seem that the location of the book is dependant on the papers which should preclude the book from having the role of ground as in (109b). I suggest that the reason why (109b) is ok. is that even if we remove the papers the book will maintain approximately the same position, that is, we conceptualize the situation as both entities lying on a third entity, e.g. a table.

Non-locational states always have a *bearer*, non-locational states with two arguments also have a *theme*. To account for the order of *bearer* and *theme* four entailments employed by Davis (2001) as *actor* entailments seem necessary: *bearer* has a notion of *theme*, *theme* is part of or contained in *bearer*, *bearer* is superior to *theme*, or *bearer* possesses *theme*.

The first of these was introduced in Wechsler (1995) as The Notion Rule. It seems useful in cases like (110).

(110) a. Peter kender Michael Laudrup fra TV.
Peter knows Michael Laudrup from TV

b. Peter kender vejen.
Peter knows way_the

Here the *bearer* must have a notion of the *theme* though the opposite need not be the case.

In cases like (111) the first argument is the whole and the second argument the parts or the first argument contains the second.

(111) a. Bilen har fire air bags.
Car_the has four air bags

b. Sækken indeholder tøj.
Sack_the contains clothes

In cases like (112) the first argument is the owner of the second.

(112) Ulla ejer en diamantring.
Ulla owns a diamond ring

In cases like (113) the first argument is superior in some sense to the second argument.

(113) Microsoft kontrollerer markedet.
Microsoft controls market_the

Generally these entailments work reasonably well, and, with a few exceptions, the reversed order of arguments does not occur. One such exception is shown in (114).

(114) De elleve spillere udgør et hold.
The eleven players form a team

It does seem to me, though, that these entailments should somehow be related, that they are subcases of a more general entailment. I will leave these questions for further reseach.

(115) shows my inventory of thematic roles with attached entailments.

(115)

Thematic role	Entailment
actor	The most active entity in a process
undergoer	The entity being acted upon in a process
figure	The entity that is located in relation to *ground*
ground	The entity that *figure* is located in relation to. The location of *ground* must be independent of *figure*
bearer	The entity that a non-locative state is predicated of
theme	The possible second argument of a non-locative state, *bearer* has a notion of *theme* or *theme* is part of or contained in *bearer* or *bearer* is superior to *theme* or *bearer* possesses *theme*

In non-inverted active sentences arguments from subevent_1 precede arguments from subevent_2 corresponding to the Top-level Priority constraint of Davis (2001, p. 202).

This correctly predicts that a 'causer' - the actor of an underspecified process in subevent_1 - will precede any arguments from subevent_2 and thus obviates the need for any hierarchy of semantic roles.

2.3.5 Complex Predicates

I assume that the bold-faced expressions in (116) denote arguments.

(116) a. **Ole** byggede *på* **sit hus** i mange år.
Ole built on his house in(for) many years

b. **Peter** malede **huset** *hvidt.*
Peter painted house_the white

c. **Ulla** løb **sig** *træt.*
Ulla ran herself tired

For technical as well as conceptual reasons I reserve the valence-lists for the realization of arguments. Therefore some other means is needed to license the realization of the italizised elements in (116). These elements are predicates with an argument structure, and I therefore treat them as co-predicates that unite with the verb to form complex predicates.

The co-predicate may further specify some part of the meaning of the verb, in (116a) that the result state is potential, in (116b) the colour of the painted state, or it may add new information not present in the content of the verb, in (116c) a result state.

Verbs split into full verbs which may under certain conditions combine with a co-predicate but may also function alone, cf. (116), and support verbs which necessarily combine with a co-predicate, exemplified in (117).

(117) a. Søren bragte kassen ud i haven.
S ren brought box_the out in garden_the

b. Pigen var glad.
Girl_the was happy

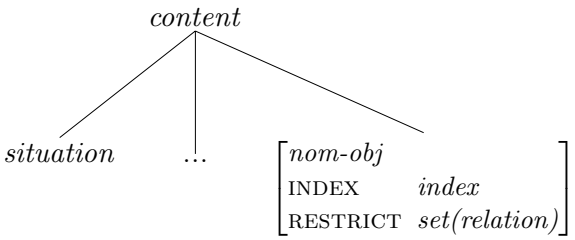
The benefit of this analysis and terminology is that it makes much clearer the distinction between **predicates** – words and phrases describing situations, and **arguments** – the entities involved in the described situations. This is, I think, conceptually more satisfactory, having pedagogical advantages, and specifically it makes the stating of a linking theory much more simple as was shown in Chapter 2.3.3.

2.4 Formalization

The semantics of words and phrases is expressed as the value for the feature CONTENT.

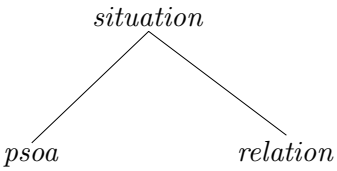
Predicates like verbs, prepositions and adjectives have a content value of type *situation*, while nouns have a content value of type *nom-obj* as shown in (118).

(118)



Situation splits into *psoa*, the content-value for verbs and *relation*, a subtype of which is the content-value for participles, adjectives and prepositions:

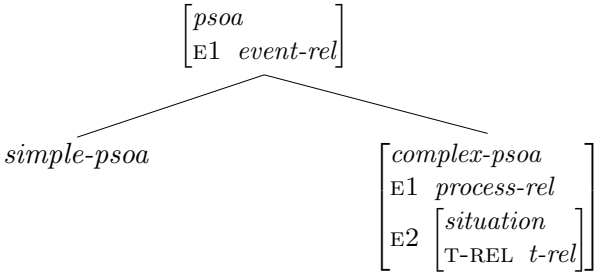
(119)



2.4.1 Simple and Complex Psoas

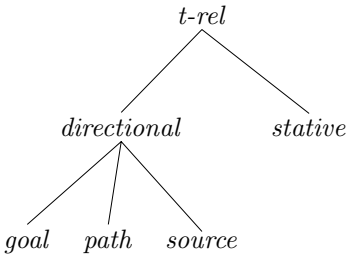
A *psoa* may be *simple* with only one situation, or *complex* with two situations. A *simple-psoa* has only one feature, E1, taking as value the relation that holds for subevent$_1$, either a state or a process. In a *complex-psoa* the feature E1 takes as value *process-rel*. Furthermore, a *complex-psoa* has a feature E2 (subevent$_2$) taking *situation* as value. This means that the value may be a *psoa* (simple or complex) relevant for a subtype of periphrastic causatives, e.g. *Moren fik børnene til at løbe ud i haven*, 'The mother made the children run out in the garden', *Moren lod børnene løbe ud i haven*, 'The mother let the children run out in the garden', (cf. page 23), or it may be just an *event-rel(ation)*, the value in all other cases.

(120)



The value for the feature T-REL on *situation* expresses the temporal (and in part causal) relation between the two subevents, E1 and E2, taking as value *t-rel*, see (121).

(121)



- *goal*
  Subevent$_1$ precedes subevent$_2$, and is construed as causing it.

- *path*
  Subevent$_1$ and subevent$_2$ are simultaneous.

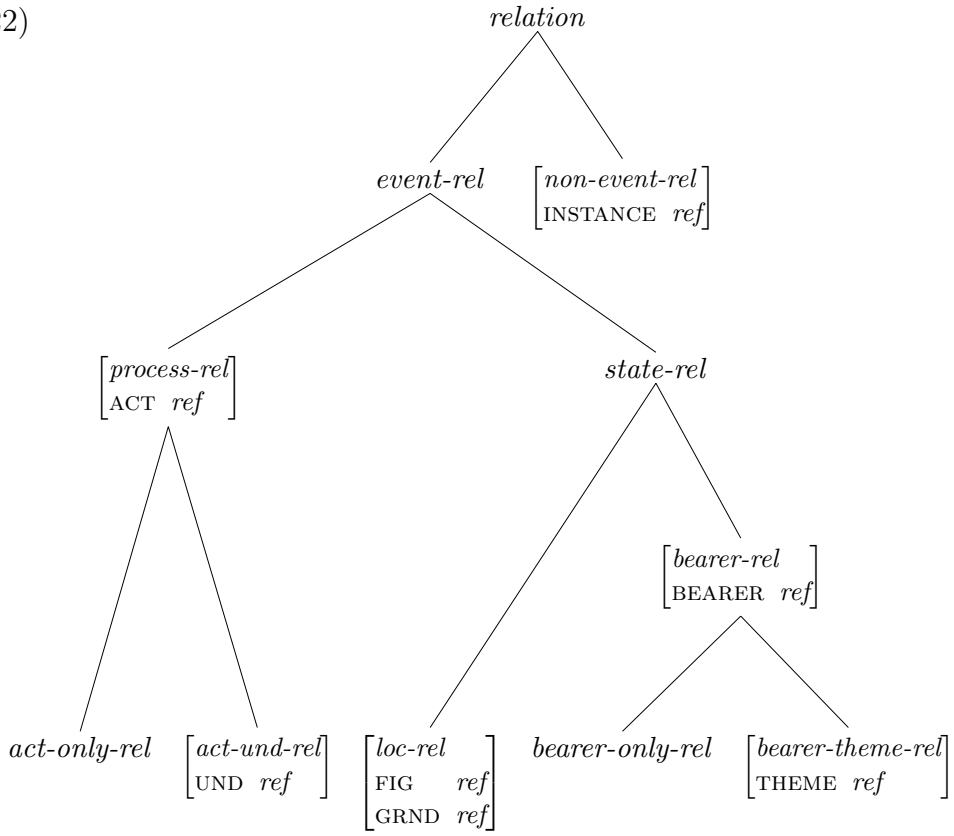
- *source*
  Subevent$_1$ follows subevent$_2$.

- *stative*
  Subevent$_1$ is included in subevent$_2$, i.e. the relation in subevent$_2$ holds both before, during, and after subevent$_1$.

2.4.2 Relations

Semantic arguments are functions of the situations they participate in and have no existence independently of these situations. They are therefore introduced as features on relations as shown in the hierarchy in (122).

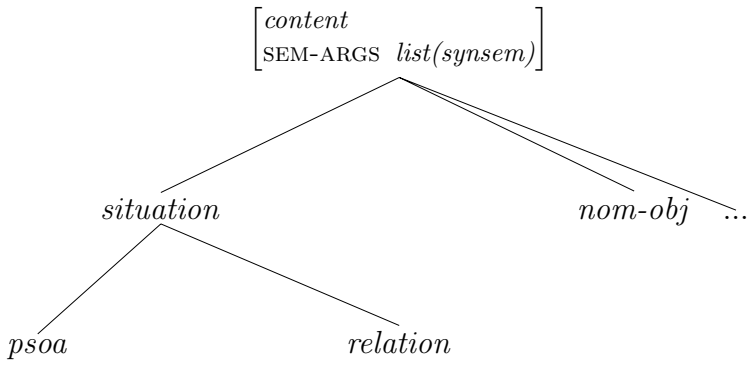
(122)



Relations split into *event-rel(ation)* and *non-event-rel(ation)*. *Non-event-relation* has the feature INSTANCE and is the supertype of relations like *table-rel, house-rel* etc. *Event-rel* splits into *process-rel* and *state-rel*. *Process-rel* has an ACTOR feature and splits into an *act-only-rel* which has only an actor, and *act-und-rel* which has the additional feature UND(ERGOER). *State-rel* splits into *loc(ation)-rel* with the features FIGURE and GROUND, and *non-loc-rel* with a BEARER feature splitting into *bearer-only-rel* and *bearer-theme-rel* with an additional THEME feature.

I further introduce a new feature, SEM(ANTIC)-ARG(UMENTS), for the type *content* taking a list of synsem-objects as value, see (123).

(123)



As indicated *situation* is the supertype of both *psoa* and *relation* which means that they both have a SEM-ARGS list.

Each type of *relation* is subject to a constraint that specifies how many (semantic) arguments the *relation* in question has, and which semantic roles these arguments fulfill. This is shown in (124).

(124)

no-args-rel $\longrightarrow$ $\left[\text{SEM-ARGS } \langle\rangle\right]$

act-rel $\longrightarrow$ $\begin{bmatrix}\text{SEM-ARGS } \left\langle\left[\text{LOC}\,|\,\text{CONT}\,|\,\text{INDEX } \boxed{1}\right]|\ \textit{list}\right\rangle \\ \text{ACT } \boxed{1}\end{bmatrix}$

act-only-rel $\longrightarrow$ $\left[\text{SEM-ARGS } \left\langle[\ ]\right\rangle\right]$

act-und-rel $\longrightarrow$ $\begin{bmatrix}\text{SEM-ARGS } \left\langle[\ ], \left[\text{LOC}\,|\,\text{CONT}\,|\,\text{INDEX } \boxed{1}\right]\right\rangle \\ \text{UND } \boxed{1}\end{bmatrix}$

loc-rel $\longrightarrow$ $\begin{bmatrix}\text{SEM-ARGS } \textit{list} \oplus \left\langle\left[\text{LOC}\,|\,\text{CONT}\,|\,\text{INDEX } \boxed{1}\right],\left[\text{LOC}\,|\,\text{CONT}\,|\,\text{INDEX } \boxed{2}\right]\right\rangle \\ \text{FIG } \boxed{1} \\ \text{GRND } \boxed{2}\end{bmatrix}$

loc-spec-rel $\longrightarrow$ $\left[\text{SEM-ARGS } \left\langle[\ ], [\ ]\right\rangle\right]$

bearer-rel $\longrightarrow$ $\begin{bmatrix}\text{SEM-ARGS } \left\langle\left[\text{LOC}\,|\,\text{CONT}\,|\,\text{INDEX } \boxed{1}\right]|\ \textit{list}\right\rangle \\ \text{BEARER } \boxed{1}\end{bmatrix}$

bearer-only-rel $\longrightarrow$ $\left[\text{SEM-ARGS } \left\langle[\ ]\right\rangle\right]$

bearer-theme-rel $\longrightarrow$ $\begin{bmatrix}\text{SEM-ARGS } \left\langle[\ ],\left[\text{LOC}\,|\,\text{CONT}\,|\,\text{INDEX } \boxed{1}\right]\right\rangle \\ \text{THEME } \boxed{1}\end{bmatrix}$

(124) says that a *no-args-rel* has no semantic arguments, a *process-rel* has a semantic argument, an ACTOR, which is the first element on the ARGS list. An *act-only-rel* has only this element on its ARGS list, while a *act-und-rel* has an additional element co-indexed with the UNDERGOER-feature. A *loc-rel* has at least two arguments, a FIGURE and a GROUND in that order possibly preceded by other elements, *loc-spec-rel* has ony these two arguments. A *bearer-rel* either has only a BEARER, *bearer-only-rel* or a BEARER and a THEME, *bearer-theme-rel*.

All relations are subtypes of one of these linking-types and inherit the constraints. Thus *walk-rel* is a subtype of *act-only-rel* and therefore has one element on the SEM-ARGS list co-indexed with the ACT-feature. *Push-rel* is a subtype of *act-und-rel* and has two semantic arguments, an ACTOR and an UNDERGOER, etc.

As shown in (123) not just *event-rel(ation)* but also *psoa* has a SEM-ARGS list. The SEM-ARGS list of a *psoa* is the concatenation of the SEM-ARGS lists of the subevents in that *psoa*. This is trivial for words denoting simple situations. In a sentence like *Peter walks*, the *walk-rel* has one ACTOR-argument, and so has the *psoa*. This is expressed in (125).

(125)
$$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{CO-PRED} \langle\rangle \\ \text{CONT} \ \textit{simple-psoa} \end{bmatrix} \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CONT} \begin{bmatrix} \text{SEM-ARGS} \ \boxed{1} \\ \text{E1} \mid \text{SEM-ARGS} \ \boxed{1} \end{bmatrix} \end{bmatrix}$$

Semantically complex words are more intricate. Here the SEM-ARGS list of the predicate consists of the elements from the SEM-ARGS lists of the subevents as described in (126).

(126)
$$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{CO-PRED} \langle\rangle \\ \text{CONT} \ \textit{compl-psoa} \end{bmatrix} \end{bmatrix} \longrightarrow$$

$$\begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CONT} \begin{bmatrix} \text{SEM-ARGS} \ \boxed{1} \\ \text{E1} \mid \text{SEM-ARGS} \ \langle\rangle \\ \text{E2} \mid \text{SEM-ARGS} \ \boxed{1} \end{bmatrix} \end{bmatrix}$$

$$\vee$$

$$\begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CONT} \begin{bmatrix} \text{SEM-ARGS} \ \langle \boxed{1}, \boxed{2} \rangle \\ \text{E1} \mid \text{SEM-ARGS} \ \langle \boxed{1} \rangle \\ \text{E2} \mid \text{SEM-ARGS} \ \langle \boxed{2} \rangle \end{bmatrix} \end{bmatrix}$$

$$\vee$$

$$\begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CONT} \begin{bmatrix} \text{SEM-ARGS} \langle \boxed{1}, \boxed{2} \rangle \\ \text{E1} \mid \text{SEM-ARGS} \langle \boxed{1}, \boxed{2} \rangle \\ \text{E2} \mid \text{SEM-ARGS} \langle \boxed{2} \rangle \end{bmatrix} \end{bmatrix}$$

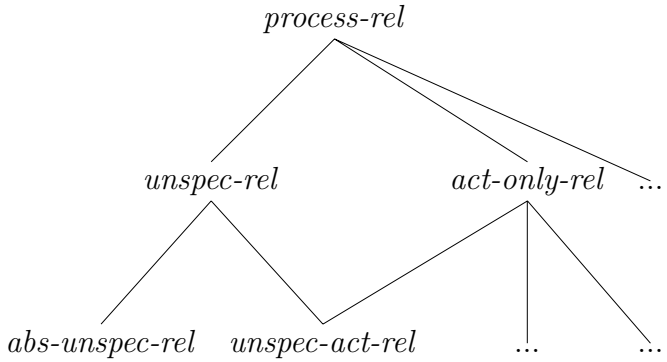
(126) says that either the E1 | SEM-ARGS list is empty and the SEM-ARGS list contains the element(s) from the E2 | SEM-ARGS list, this concerns inchoatives, e.g. *vågne*, 'wake up', *forsvinde*, 'disappear', or the E1 | SEM-ARGS list has one element which must precede the element from the E2 | SEM-ARGS list on the higher SEM-ARGS list, this is the case for lexical causatives like *dræbe*, 'kill', or the higher SEM-ARGS list is identical to the E1 | SEM-ARGS list and the second and last element on the E1 | SEM-ARGS list is identical to the element on the E2 | SEM-ARGS list. This is the case for verbs like *spise*, 'eat'.

Note that the constraints in (125) and (126) apply to words with empty CO-PRED lists only. The CO-PRED list expresses the possible need for a predicate to combine with a co-predicate. Full verbs, i.e. verbs with at least one lexically specified relation have an empty CO-PRED list, while support verbs, which are lexically underspecified, have a non-empty CO-PRED list and must combine with their co-predicate before their number and type of arguments may be determined. I come back to this issue below.

2.4.2.1 Underspecified Processes

I have suggested that the difference between *Accomplishments* and *Achievements* lies in the specificity of subevent$_1$, *Accomplishments* having a specified subevent$_1$ and *Achievements* having an underspecified subevent$_1$. Because relations come with a specified number of arguments it is not possible simply to leave the E1-value of *achievements* underspecified because this would mean that it could be instantiated as any process-rel in the hierarchy, e.g. a *build-relation* with two arguments, an actor and an undergoer. Instead I introduce underspecified relations in the type hierarchy as shown in (127).

(127)



Inchoatives have an *abs(olutely)-un(der)spec(ified)-rel* without any arguments as ensured by the constraint in (128).

(128) $\textit{abs-unspec-rel} \longrightarrow \left[\text{SEM-ARGS } \langle\rangle\right]$

(129) shows the representation of the content value of the inchoative *vågne*, 'wake up' intr.:

(129)
$$\begin{bmatrix} \text{SEM-ARGS } \boxed{1} \\ \text{E1} \begin{bmatrix} \textit{abs-unspec-rel} \\ \text{SEM-ARGS } \langle\rangle \end{bmatrix} \\ \text{E2} \begin{bmatrix} \textit{awake-rel} \\ \text{BEARER } \boxed{2} \\ \text{SEM-ARGS } \boxed{1}\left\langle \text{NP}_{\boxed{2}}{}^{9} \right\rangle \end{bmatrix} \end{bmatrix}$$

This representation has the intended interpretation that some process of which we have no knowledge at this point causes somebody to be awake. This verb has one argument, the *bearer* of the *being-awake*-relation.

Causatives have an *unspec-act-rel*, subtype of *act-only-rel* with an actor as sole argument.

There are two subtypes of causative. One with a caused state exemplified in (130).

[9] $\text{NP}_{\boxed{i}}$ is a shorthand for the AVM $\begin{bmatrix} \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD } \textit{noun} \\ \text{SUBJ } \langle\rangle \\ \text{COMPS } \langle\rangle \end{bmatrix} \\ \text{CONT} \mid \text{INDEX } \boxed{i} \end{bmatrix} \end{bmatrix}$

(130) Pia vækkede Poul.
Pia woke up Poul

The semantics of (130) is represented in (131).

(131)
$$\begin{bmatrix} \textsc{sem-args} \langle \boxed{1} \mid \boxed{2} \rangle & \\ \textsc{e1} & \begin{bmatrix} \textit{unspec-act-rel} & \\ \textsc{act} & \boxed{3}(\textit{pia}) \\ \textsc{sem-args} & \langle \boxed{1}\textsc{np}_{\boxed{3}} \rangle \end{bmatrix} \\ \textsc{e2} & \begin{bmatrix} \textit{awake-rel} & \\ \textsc{bearer} & \boxed{4}(\textit{poul}) \\ \textsc{t-rel} & \textit{cause} \\ \textsc{sem-args} & \boxed{2}\langle \textsc{np}_{\boxed{4}} \rangle \end{bmatrix} \end{bmatrix}$$

The intended interpretation is that Pia does something causing Poul to be awake, and as shown the verb has two arguments.

The other subtype of causative has a caused process plus possibly a state as exemplified in (132).

(132) Jan rullede bolden hen i hullet.
Jan rolled ball_the (over) in hole_the

The semantics of (132) is represented in (133). The syntax of this construction is dealt with in chapter 5.

(133)
$$\begin{bmatrix} \textsc{sem-args} \langle \boxed{1} \mid \boxed{2} \rangle & \\ \textsc{e1} & \begin{bmatrix} \textit{unspec-act-rel} & \\ \textsc{act} & \boxed{3}(\textit{jan}) \\ \textsc{sem-args} & \langle \boxed{1}\textsc{np}_{\boxed{3}} \rangle \end{bmatrix} \\ \textsc{e2} & \begin{bmatrix} \textsc{sem-args} & \boxed{2}(\boxed{4} \oplus \boxed{5}) \\ \textsc{e1} & \begin{bmatrix} \textit{roll-rel} & \\ \textsc{act} & \boxed{6}(\textit{ball}) \\ \textsc{sem-args} & \boxed{4}\langle\rangle \oplus \langle \boxed{6}\textsc{np}_{\boxed{7}} \rangle \end{bmatrix} \\ \textsc{e2} & \begin{bmatrix} \textit{loc-rel} & \\ \textsc{figure} & \boxed{7}(\textit{ball}) \\ \textsc{ground} & \boxed{8}(\textit{hole}) \\ \textsc{t-rel} & \textit{cause} \\ \textsc{sem-args} & \boxed{5}\langle \boxed{6}, \textsc{np}_{\boxed{8}} \rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The intended interpretation is that Jan does something causing the ball to roll and the rolling-process in turn causing the ball to be in the hole.

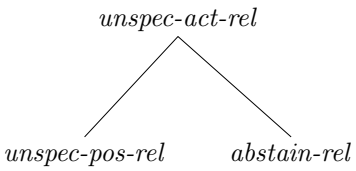
To be able to represent the difference between (134) where the mother does something to make the children walk out in the garden and (135) where the mother abstains from preventing it from happening, we have to make a further distinction.

(134) Moren fik børnene til at gå ud i haven.
Mother_the got children_the to to go out in garden_the

(135) Moren lod børnene gå ud i haven.
Mother_the let children_the go out in garden_the

As shown in (136) *unspec-act-rel* has two subtypes.

(136)



(134) have the content value shown in (137) with an *unspec-pos(itive)-rel* as value for the highest E1-feature.

(137) Content value for *(Moren) fik (børnene) til at gå ud i (haven)*

$$\left[\begin{array}{l}\textsc{sem-args}\ \langle \boxed{1} \mid \boxed{2} \rangle \\ \textsc{e1}\ \left[\begin{array}{ll} \textit{unspec-pos-rel} & \\ \textsc{act} & \boxed{3}(\textit{mother}) \\ \textsc{sem-args} & \langle \boxed{1}\mathrm{NP}_{\boxed{3}} \rangle \end{array}\right] \\ \textsc{e2}\ \left[\begin{array}{l} \textsc{sem-args}\ \boxed{2}(\boxed{4} \oplus \boxed{6}) \\ \textsc{e1}\ \left[\begin{array}{ll} \textit{gaa-rel} & \\ \textsc{act} & \boxed{7}(\textit{children}) \\ \textsc{sem-args} & \boxed{4}\langle \boxed{5}\mathrm{NP}_{\boxed{7}} \rangle \end{array}\right] \\ \textsc{e2}\ \left[\begin{array}{ll} \textit{loc-rel} & \\ \textsc{figure} & \boxed{7} \\ \textsc{ground} & \boxed{8}(\textit{garden}) \\ \textsc{t-rel} & \textit{cause} \\ \textsc{sem-args} & \boxed{6}\langle \boxed{5}, \mathrm{NP}_{\boxed{8}} \rangle \end{array}\right] \end{array}\right] \end{array}\right]$$

(135) have almost identical the CONTENT-value differing only in that it has an *abstain-rel* as value for the highest E1-value, (138).

(138) Content value for *(Moren) lod (børnene) gå ud i (haven)*

$$\begin{bmatrix} \text{E1} & \begin{bmatrix} \textit{abstain-rel} \\ \text{ACT} & (\textit{mother}) \end{bmatrix} \\ \text{E2} & \begin{bmatrix} \text{E1} & \begin{bmatrix} \textit{gaa-rel} \\ \text{ACT} & (\textit{children}) \end{bmatrix} \\ \text{E2} & \begin{bmatrix} \textit{loc-rel} \\ \text{FIGURE} & (\textit{children}) \\ \text{GROUND} & (\textit{garden}) \\ \text{T-REL} & \textit{cause} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The *abstain-rel* also plays a role in the representation of *continuatives* cf. section 4.4.2 on page 119.

2.4.2.2 Actual and Potential States

The difference between the PPs in (139) and (140) was described on page 23 as a question of actual occurence, *til bussen* describing an actual state and *mod bussen* a potential state.

(139) Ulla løb hen **til** bussen.
Ulla ran over to bus_the

(140) Ulla løb hen **mod** bussen.
Ulla ran over towards bus_the

This distinction is modelled with a feature ACTUAL on *state-rel* taking the values *plus/minus*. *Til*, 'to', is then ACTUAL *plus* while *mod*, 'toward', is ACTUAL *minus*, see (141).

(141) Content value for *til* and *mod*

$$\textit{til:} \begin{bmatrix} \textit{at-rel} & \\ \text{FIGURE} & \textit{ref} \\ \text{GROUND} & \textit{ref} \\ \text{ACTUAL} & \textit{plus} \\ \text{T-REL} & \textit{cause} \end{bmatrix} \qquad \textit{mod:} \begin{bmatrix} \textit{at-rel} & \\ \text{FIGURE} & \textit{ref} \\ \text{GROUND} & \textit{ref} \\ \text{ACTUAL} & \textit{minus} \\ \text{T-REL} & \textit{cause} \end{bmatrix}$$

2.4.3 Syntactic Realization of Arguments

In the previous sections it was described how arguments originate from relations. This section describes how the elements on the SEM-ARGS list through

structure sharing are 'copied' onto the SYN-ARGS list from where they may be distributed to the SUBJ list and COMPS list. Furthermore, I show the formalization of complex predicates.

Words with an empty CO-PRED list – words that do not obligatorily combine with a co-predicate, see below – are subject to the constraint in (142) saying that their SYN-ARGS list is identical to the highest SEM-ARGS list, thus ensuring that these words have the number of syntactic arguments that their semantics dictates.

(142)
$$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED} \ \langle\rangle \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{SYN-ARGS} \ \boxed{1} \\ \text{CONT} \mid \text{SEM-ARGS} \ \boxed{1} \end{bmatrix} \end{bmatrix}$$

For example, the verb *løbe*, 'run', with one semantic argument, the *actor* of the *run-relation*, has one syntactic argument, while the verb *vække*, 'wake up' tr., with two semantic arguments, the *actor* in subevent$_1$, and the *bearer* in subevent$_2$ has two syntactic arguments.

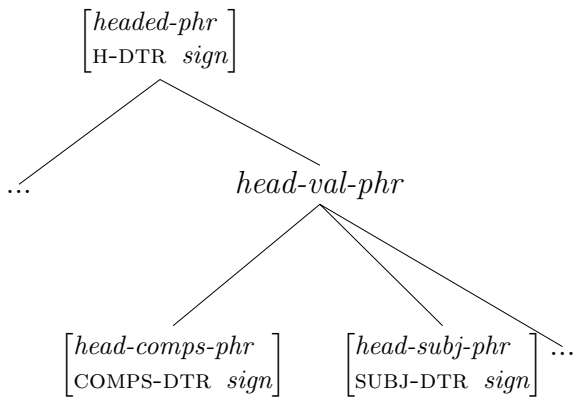
The constraint in (142) does not apply to raising prepositions combining with lexical prepositions nor to support verbs both of which have non-empty CO-PRED lists and raise an argument from the co-predicate.

The motivation for these two lists, the SEM-ARGS list and the SYN-ARGS list, which in this case are identical, is that while the SEM-ARGS list directly reflects the semantics of a word and thus remains unaltered, the SYN-ARGS list changes.

The SYN-ARGS list corresponds to the SUBCAT, ARG-S-, or ARG-ST list in other theories (e.g. Pollard and Sag (1994, ch. 9), Manning and Sag (1998), Davis (1996, 2001)) with the important exception that the SYN-ARGS list is relevant not just for words but also for phrases. When realized, arguments are cancelled from this list as well as from the valence lists, among other things to ensure that the *Locality Principle* (Pollard and Sag, 1987, pp. 143-144) is observed.

(143) shows part of the hierarchy of headed phrases.

(143)



The type *headed-phr*, introduces the feature H-DTR taking as value a sign (*word* or *phrase*). In the subtype *head-val-phr* the head-daughter must have an empty CO-PRED list ensuring that words combine with their co-predicates before they combine with their subjects or objects. This is stated in (144).

(144) $$\textit{head-val-phr} \longrightarrow \left[\text{H-DTR} \mid \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED} \left\langle\right\rangle\right]$$

(145) shows the constraint on *head-comps-phr* which licenses the combination of a head with its complement.

(145)

$$\textit{head-comps-phr} \longrightarrow \begin{bmatrix} \text{PHON} \left\langle \boxed{1} \mid \boxed{2} \right\rangle \oplus \boxed{3} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{SUBJ} & \boxed{4} \\ \text{COMPS} & \boxed{5} \\ \text{SYN-ARGS} & \boxed{6} \end{bmatrix} \\ \text{H-DTR} \begin{bmatrix} \text{PHON} \left\langle \boxed{1} \mid \boxed{3} \right\rangle \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{SUBJ} & \boxed{4} \\ \text{COMPS} & \boxed{5} \oplus \left\langle \boxed{7} \right\rangle \\ \text{SYN-ARGS} & \boxed{6} \oplus \left\langle \boxed{7} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{COMPS-DTR} \begin{bmatrix} \text{PHON} & \boxed{2} \\ \text{SS} & \boxed{7} \end{bmatrix} \end{bmatrix}$$

This constraint is identical to a standard HPSG approach except for two things. When realized the complement is cancelled off not just on the COMPS list but also on the SYN-ARGS list. To be able to handle complex predicates which have more than one element on their PHON list, the PHON list of the mother consists of the first element from the PHON list of the head-daughter, the PHON list of the complement and the rest of the PHON list of the head in that order. This means that, in Danish, the complement must follow the

first word in a complex predicate. An example: *bære ud i (haven)*, 'carry out in (the garden) is a complex predicate, and the complement must follow the verb: *bære stolen ud i haven*, carry the chair out in the garden.'

Similarly, in a *head-subj(ect)-phr(ase)* the element corresponding to the subject is cancelled off on both the SUBJ- and the SYN-ARGS list, see (146).

(146)

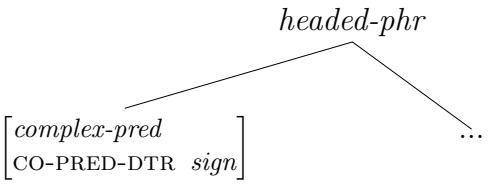
$$\textit{head-subj-phr} \longrightarrow \begin{bmatrix} \text{PHON } \boxed{1} \oplus \boxed{2} \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \boxed{3} \end{bmatrix} \\ \text{H-DTR} \begin{bmatrix} \text{PHON } \boxed{2} \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \begin{bmatrix} \text{SUBJ} & \langle \boxed{4} \rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \boxed{3} \oplus \langle \boxed{4} \rangle \end{bmatrix} \end{bmatrix} \\ \text{SUBJ-DTR} \begin{bmatrix} \text{PHON} & \boxed{1} \\ \text{SYNSEM} & \boxed{4} \end{bmatrix} \end{bmatrix}$$

Note that the element cancelled off the SYN-ARGS list is the last element. In most cases it will also be the only element so that $\boxed{3}$ is the empty list, but in some cases there is a remaining unrealized argument, cf. *situationen under kontrol* on page 131.

2.4.3.1 Complex Predicates

The combination of a predicate and a co-predicate is licensed as the type *complex-pred(icate)*, a subtype of *headed-phr(ase)*:

(147)



A *complex-pred* has a head-daughter and a co-pred-daughter. Being a subtype of *headed-phr* means that the HEAD-value of the head-dtr is equal to that of the mother. Furthermore, the PHON list of the mother consists of the element from the PHON list of the head-dtr (constraining it to be a word, not a phrase) followed by the element(s) from the PHON list of the co-pred-dtr. To represent the need of a lexical item to combine with a co-predicate I introduce the CATEGORY feature CO-PRED taking as value a list of maximally

one synsem-object. Words that select a co-predicate have an element on this list, otherwise it is empty. The CO-PRED list of the mother is constrained to be empty, i.e. a complex predicate cannot obligatorily combine with yet another co-predicate. The co-pred-dtr must also have an empty CO-PRED list which means that it must already have combined with a possible co-predicate. Also the COMPS list must be empty, the co-pred-dtr must have combined with possible complements. This is stated in (148).

(148)
$$\textit{complex-pred} \longrightarrow \begin{bmatrix} \text{PHON } \langle \boxed{1} \mid \boxed{2} \rangle \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED } \langle\rangle \\ \text{H-DTR} \begin{bmatrix} \textit{word} \\ \text{PHON } \langle \boxed{1} \rangle \end{bmatrix} \\ \text{CO-PRED-DTR} \begin{bmatrix} \text{PHON } \boxed{2} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{CO-PRED } \langle\rangle \\ \text{COMPS } \langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

As mentioned above, complex predicates come in two sorts, one where the verb selects a co-predicate, (149a), and one where it does not, (149b).

(149) a. Ole fik situationen under kontrol.
Ole got situation_the under kontrol

b. Jan løb sig i form.
Jan ran himself in shape

This is stated in the two constraints in (150).

(150)
$$\textit{obli-pred} \longrightarrow \begin{bmatrix} \text{H-DTR} \mid \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED } \langle \boxed{1} \rangle \\ \text{CO-PRED-DTR} \mid \text{SS } \boxed{1} \end{bmatrix}$$

$$\textit{result-pred} \longrightarrow \left[\text{H-DTR} \mid \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED } \langle\rangle\right]$$

In *obli(gatorily complex)-pred*, exemplified in (149a), the head-daughter has an element on its CO-PRED list and must combine with a co-predicate the *synsem*-value of which must correspond to this element and in *result-pred*, exemplified in (149b), the head-daughter has an empty CO-PRED list which means that this word does not obligatorily combine with a co-predicate.

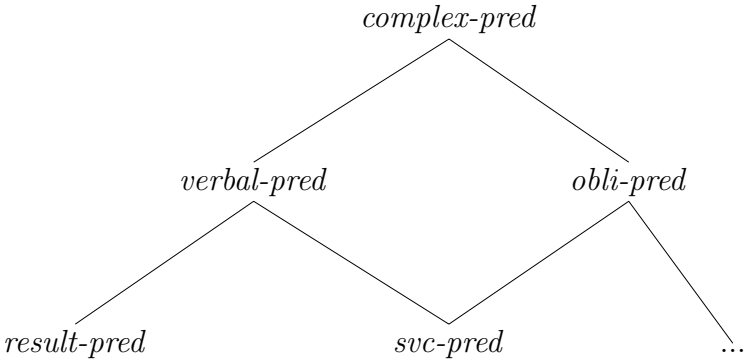
The constraint on a third subtype of *complex-pred*, *verbal-pred*, expresses what is common to all complex predicates with verbal heads, viz. that the head-daughter has the HEAD-value *verb*, that the E1-value of the complex

predicate is structure-shared with the E1-value of the head and that the co-pred-dtr must be T-REL *goal*:

(151)
$$\textit{verbal-pred} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CONT} \mid \text{E1} \boxed{1} \\ \text{H-DTR} \mid \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD} & \textit{verb} \\ \text{CONT} \mid \text{E1} & \boxed{1} \end{bmatrix} \\ \text{CO-PRED-DTR} \mid \text{SS} \mid \text{LOC} \mid \text{CONT} \mid \text{T-REL} & \textit{goal} \end{bmatrix}$$

(152) shows part of the hierarchy of complex predicates.

(152)



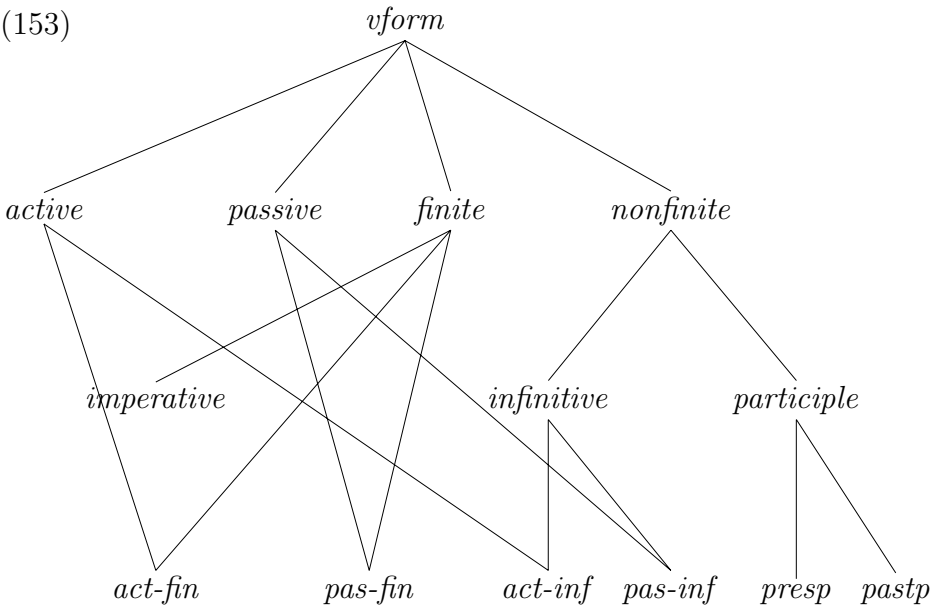
S(upport)v(erb)c(onstruction)-pred is treated in chapter 4 and *result(ative)-pred* is treated in chapter 5.

In the following section I take a closer look at the valency of verbs, that is, the relationship between the SYN-ARGS list and the SUBJ- and COMPS list for various types of verb. In section (2.4.3.3) I deal with nouns.

2.4.3.2 Verbs and Valency

(153) shows the subclassification of verbs expressed with subtypes of *vform*, the value for the feature VFORM.

(153)



To make it possible to handle morphological structure the PHON list is a list of lists. Each embedded list corresponds to one word. In the lexicon the ending of a word is underspecified.

The constraint in (154) specifies the relationship between VFORM-value and morphological ending.

(154)

$$\begin{bmatrix} word \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \;\; verb \end{bmatrix} \longrightarrow$$

$$\begin{bmatrix} \text{PHON} \left\langle \left\langle string\ ,\ \text{-}er \right\rangle \right\rangle \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \mid \text{HEAD} \mid \text{VFORM} \;\; act\text{-}fin \end{bmatrix}$$

$$\vee$$

$$\begin{bmatrix} \text{PHON} \left\langle \left\langle string\ ,\ \text{-}e \right\rangle \right\rangle \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \mid \text{HEAD} \mid \text{VFORM} \;\; act\text{-}inf \end{bmatrix}$$

$$\vee$$

$$\begin{bmatrix} \text{PHON} \left\langle \left\langle string\ ,\ \text{-}es \right\rangle \right\rangle \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \mid \text{HEAD} \mid \text{VFORM} \;\; passive \end{bmatrix}$$

$$\vee$$

$$\begin{bmatrix} \text{PHON} \left\langle \left\langle string\ ,\ zero \right\rangle \right\rangle \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \mid \text{HEAD} \mid \text{VFORM} \;\; imperative \end{bmatrix}$$

$$\vee$$
$$\begin{bmatrix}\textsc{phon} & \langle\langle \textit{string , -et}\rangle\rangle \\ \textsc{synsem} \mid \textsc{local} \mid \textsc{cat} \mid \textsc{head} \mid \textsc{vform} & \textit{pastp}\end{bmatrix}$$
$$\vee$$
$$\begin{bmatrix}\textsc{phon} & \langle\langle \textit{string , -ende}\rangle\rangle \\ \textsc{synsem} \mid \textsc{local} \mid \textsc{cat} \mid \textsc{head} \mid \textsc{vform} & \textit{presp}\end{bmatrix}$$

Throughout the thesis the morphological material is only a rough approximation, and I will not be concerned with irregular forms.

For active verbs the COMPS list consists of the elements (including zero) on the SYN-ARGS list minus the first element as stated in (155).

(155)
$$\begin{bmatrix}\textit{predicate} & & \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} & \begin{bmatrix}\textsc{head} \mid \textsc{vform} & \textit{active} \\ \textsc{co-pred} & \langle\rangle\end{bmatrix}\end{bmatrix} \longrightarrow$$
$$\begin{bmatrix}\textsc{ss} \mid \textsc{loc} \mid \textsc{cat} & \begin{bmatrix}\textsc{subj} & \langle \boxed{1} \rangle \\ \textsc{comps} & \boxed{2} \\ \textsc{syn-args} & \langle \boxed{1} \mid \boxed{2} \rangle\end{bmatrix}\end{bmatrix}$$

Note that this and the following constraints concern *predicate*, the supertype of *word* and *complex-pred*. This is because the distribution af arguments to the valence lists must be postponed until the predicate is completed. This constraint and the following do not apply to words with nonempty CO-PRED list, but once these words have combined with their co-predicate in a *complex-pred* the CO-PRED list is empty and the constraints apply.

Passive verbs have the same SYN-ARGS list as their active counterparts. The difference is that verbs in passive form realize the second element on their SYN-ARGS list as their subject and that the first element is left unrealized. This is stated in (156).

(156)
$$\begin{bmatrix}\textit{predicate} & & \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} & \begin{bmatrix}\textsc{head} \mid \textsc{vform} & \textit{passive} \\ \textsc{co-pred} & \langle\rangle\end{bmatrix}\end{bmatrix} \longrightarrow$$
$$\begin{bmatrix}\textsc{ss} \mid \textsc{loc} \mid \textsc{cat} & \begin{bmatrix}\textsc{subj} & \langle \boxed{1} \rangle \\ \textsc{comps} & \boxed{2} \\ \textsc{syn-args} & \langle [\ ], \boxed{1} \mid \boxed{2} \rangle\end{bmatrix}\end{bmatrix}$$

Imperatives may or may not realize a subject as shown in (157).

(157) a. Spis du din mad!
Eat you your food

b. Spis din mad!
Eat your food

That is, the SUBJ list may be empty, though it need not be. Furthermore, the possible subject must be second person. This is stated in (158).

(158)
$$\begin{bmatrix} \textit{predicate} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM} & \textit{imperative} \\ \text{CO-PRED} & \langle\rangle \end{bmatrix} \end{bmatrix} \longrightarrow$$

$$\begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{SUBJ} & \langle\rangle \vee \langle \boxed{1} \rangle \\ \text{COMPS} & \boxed{2} \\ \text{SYN-ARGS} & \left\langle \boxed{1}\left[\text{LOC} \mid \text{CONT} \mid \text{INDEX} \mid \text{PERSON} \ \textit{second}\right] \mid \boxed{2} \right\rangle \end{bmatrix} \end{bmatrix}$$

2.4.3.3 Nouns

The data in (159) and (160) suggest that even though predicative nouns have arguments, they are unable to realize these arguments directly, that is, they have empty SUBJ- and COMPS lists.

(159) a. Ole fandt Peter irriterende.
Ole found Peter annoying

b. Ole fandt Peter ude af sig selv.
Ole found Peter out of himself
'Ole found Peter beside himself'

c. Ole fandt Peter afsløret.
Ole found Peter disclosed

(160) a. * Ole fandt Peter kontrol.
Ole found Peter control

b. * Ole fandt situationen kontrol.
Ole found situation_the control

c. * Ole fandt Peter kontrol situationen
Ole found Peter control situation_the

The verb *finde*, 'find', may combine with a predicate and one of its arguments as shown in (159). However, in the case of predicative nouns this is not possible, (160).

The general constraint on nouns therefore looks as (161).

(161)
$$\begin{bmatrix} word \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \ noun \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle \end{bmatrix} \\ \text{CONT} & nom\text{-}obj \end{bmatrix} \end{bmatrix}$$

It says that nouns do not take subject or complement[10].

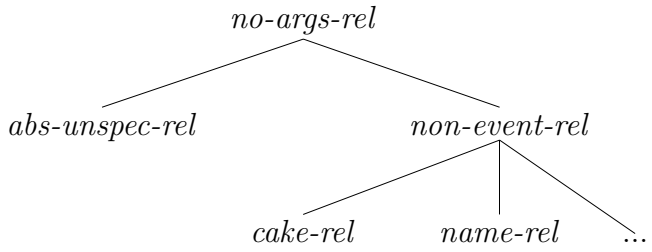
Non-predicative nouns have a *non-event-rel* in their set of restrictions with an INSTANCE-feature co-indexed with the INDEX-feature, (162).

(162)
$$\begin{bmatrix} word \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD} & noun \\ \text{CONT} \mid \text{RESTRICT} & \{non\text{-}event\text{-}rel\} \end{bmatrix} \end{bmatrix} \longrightarrow$$

$$\begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CONT} \begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{RESTRICT} & \left\{ \left[\text{INSTANCE } \boxed{1} \right] \right\} \end{bmatrix} \end{bmatrix}$$

Non-event-rel is a subtype of *no-arg-rel* which does not have any arguments as stated in the constraint in (124) on page 46.

(163)



The constraint in (164) ensures that the SEM-ARGS list is identical to the lower SEM-ARGS list.

(164)
$$\begin{bmatrix} word \\ \text{SS} \mid \text{LOC} \left[\text{CAT} \mid \text{HEAD} \ noun \right] \end{bmatrix} \longrightarrow$$

[10]Note that 'prepositional objects' are not objects in this theory. Predicative nouns may combine with prepositions to form complex predicates

$$\left[\text{SS} \mid \text{LOC} \mid \text{CONT} \left[\begin{array}{l}\text{SEM-ARGS } \boxed{1} \\ \text{RESTRICT } \left\{\left[\text{SEM-ARGS } \boxed{1}\right]\right\}\end{array}\right]\right]$$

According to the constraint in (142) on page 53 the SYN-ARGS list is identical to the highest SEM-ARGS list causing non-predicative nouns to have an empty SYN-ARGS list and predicative nouns to have the syntactic arguments that the *psoa* in their set of restrictions suggest.

(165) shows the predicative noun *kontrol*, 'control'.

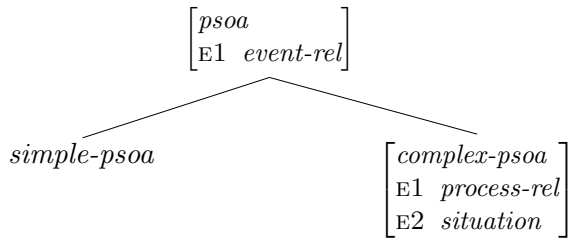
(165)
$$\left[\begin{array}{ll}\textit{word} & \\ \text{PHON} & \left\langle\left\langle \textit{kontrol} \right\rangle\right\rangle \\ \text{SS} \mid \text{LOC} & \left[\begin{array}{ll}\text{CAT} & \left[\begin{array}{ll}\text{HEAD} & \textit{noun} \\ \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \boxed{3}\end{array}\right] \\ \text{CONT} & \left[\begin{array}{ll}\textit{nom-obj} & \\ \text{RESTRICT} & \left\{\left[\begin{array}{ll}\textit{simple-psoa} & \\ \text{E1} & \left[\begin{array}{ll}\textit{control-rel} & \\ \text{SEM-ARGS} & \boxed{3}\left\langle \text{NP}_{\boxed{1}}, \text{NP}_{\boxed{2}} \right\rangle \\ \text{BEARER} & \boxed{1} \\ \text{THEME} & \boxed{2}\end{array}\right] \\ \text{SEM-ARGS} & \boxed{3}\end{array}\right]\right\} \\ \text{SEM-ARGS} & \boxed{3}\end{array}\right]\end{array}\right]\end{array}\right]$$

To realize its arguments a predicative noun must combine with raising verbs and/or prepositions, see chapter 4.

2.5 Summary

In this chapter I argued that verbal predicates may describe situations as either simple or complex, modelled with the type *psoa* as value for their CONTENT-feature.

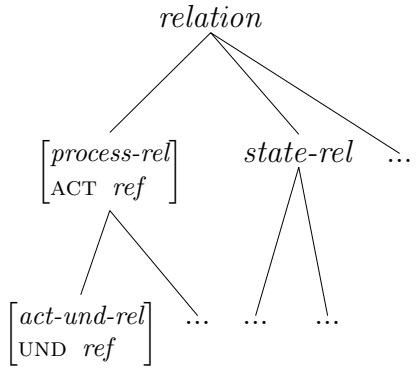
(166)



Simple-psoa has an event-relation, either a process or a state as value for their E1-value. *complex-psoa* has two features, E1 and E2, which in most cases take as values a process-relation and a state-relation, respectively, where the process precedes and is seen as causing the coming about of the state. This type comprises both achievements and accomplishments, the difference between the two being that subevent_1 is underspecified for achievements and specified for accomplishments. The difference between the achievement subtypes inchoatives and causatives is that in the case of inchoatives subevent_1 is completely underspecified, while in the case of causatives a known actor must participate in the underspecified situation.

In the type hierarchy relations are partioned according to whether they are processes or states and according to number and types of thematic roles expressed as features on relations as sketched in (167)

(167)



To these types are attached various constraints ensuring that the type in question has the appropriate number of elements on their SEM-ARGS list. Thus the three constraints in (168) ensure that *act-only-rel* and subtypes thereof has one element on its SEM-ARGS list co-indexed with the ACT feature, while ACT-UND-REL has two elements co-indexed with the ACT and UND feature respectively.

(168)
$$\textit{process-rel} \longrightarrow \begin{bmatrix} \textsc{sem-args} \left\langle \left[\textsc{loc} \mid \textsc{cont} \mid \textsc{index} \ \boxed{1}\right] \mid \ \textit{list} \right\rangle \\ \textsc{act} \ \boxed{1} \end{bmatrix}$$

$$\textit{act-only-rel} \longrightarrow \left[\textsc{sem-args} \left\langle [\ ] \right\rangle\right]$$

$$\textit{act-und-rel} \longrightarrow \begin{bmatrix} \textsc{sem-args} \left\langle [\ ], \left[\textsc{loc} \mid \textsc{cont} \mid \textsc{index} \ \boxed{1}\right] \right\rangle \\ \textsc{und} \ \boxed{1} \end{bmatrix}$$

In the case of complex psoas a higher SEM-ARGS list contains all arguments from subevent$_1$ and all arguments from subevent$_2$ in that order. An element that is an argument of both subevent$_1$ and subevent$_2$ will appear only once on the higher SEM-ARGS list.

Lexically specified words, i.e. words that need not combine with a co-predicate, are subject to the constraint in (169) saying that their SYN-ARGS list is identical to the highest SEM-ARGS list, thus ensuring that they have the number of arguments that their semantics dictate.

(169)
$$\begin{bmatrix} \textit{word} \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{co-pred} \ \langle\rangle \end{bmatrix} \longrightarrow \left[\textsc{ss} \mid \textsc{loc} \begin{bmatrix} \textsc{cat} \mid \textsc{syn-args} \ \boxed{1} \\ \textsc{cont} \mid \textsc{sem-args} \ \boxed{1} \end{bmatrix}\right]$$

The possible need of a word to combine with a co-predicate is expressed with the feature CO-PRED taking a list of maximally one *synsem*-object as value. The combination of a word with an element on its CO-PRED list with a sign with that SYNSEM-value is licensed as a subtype of *complex predicate*. One example of this is support verb constructions treated in chapter 4. Also words with empty CO-PRED list may in some cases combine with co-predicates to form complex predicates. The resultative construction treated in chapter 5 is an example of this.

Finally, various constraints applying to words and complex predicates with empty CO-PRED list regulate the distribution of arguments to the valence lists and specifying the verbal ending.

Chapter 3

Locative Prepositions

This chapter is concerned with the analysis of prepositions with spatial meaning, including not just what is traditionally considered to be prepositions, but also particles with a spatial meaning, in traditional Danish grammar considered adverbs, e. g. Diderichsen (1957); Allan et al. (1995).

The same slot may be filled with a spatial adverbs, (170a), a locative PP, (170b), or a locative particle plus a locative PP, (170c).

(170) a. Det skete **hjemme**.
It happened at home

b. Det skete **i Sverige**.
It happened in Sweden

c. Det skete **ovre i Sverige**.
It happened over in Sweden

On the basis of such observations it has been suggested (e.g. Klima (1965); Emonds (1976); Jackendoff (1973, 1977); Riemsdijk (1978)) as a generalization to view these spatial adverbs as a special kind of preposition.

Furthermore, Danish has a large number og compound adverbs/prepositions consisting of a deictic element, *der-*, 'there', or *her-*, 'here', and a preposition *deri, derpaa, derefter, hertil* etc. or a 'spatial adverb' *derud, heroppe* etc. Again, it would mean missing a generalization not to consider prepositions and 'spatial adverbs' subtypes of a general type.

The data in (170) further suggest that the combination of a spatial adverb and a spatial PP is one constituent. This is corroborated by their behaviour

in clefted sentences. The combination of adverb and PP may be focused, (171a), while neither the spatial adverb nor the locative PP may be focused alone, (171b), (171c).

(171) a. Det var **ovre i Sverige** det skete.
It was over in Sweden it happened

b. *Det var **ovre** det skete **i Sverige**.
It was over it happened in Sweden

c. *Det var **i Sverige** det skete **ovre**.
It was in Sweden it happened over

There are various suggestions wrt. the analysis of the combination of adverb and PP. It has been suggested (Emonds, 1972; Riemsdijk, 1978) that the locative particle is a specifier in the PP, or that the particle is a transitive preposition taking the PP as complement (Jackendoff, 1973, 1977).

In line with the suggestions in previous chapters, I suggest that spatial 'adverbs' combine with 'ordinary' prepositions to form complex prepositions. The meaning of the complex preposition is composed of the meaning of its parts. I term 'ordinary' prepositions *Lexical Prepositions* because in most cases they have a lexically specified locative relation. Spatial adverbs are characterized by a totally underspecified locative relation and by raising an argument from the lexical preposition. They are termed *Raising Prepositions*.

In the set-up I propose here, locative prepositions (lexical and raising prepositions) always denote a state, viz. a locational relation between two entities, *figure* and *ground*. This locational state is related temporally to another situation. The semantics of locative prepositions may therefore to a large degree be modelled with two features, a locational relation and a temporal relation, both of which may be partially underspecified lexically.

Raising Prepositions come in three forms, a long form, *inde, ude, hjemme* etc., a short form, *ind, ud, hjem*, and an *-ad* form, *indad, udad, hjemad* etc., differing primarily in the temporal relation expressed. One function of Raising Prepositions is to specify the temporal relation in combination with partially underspecified lexical prepositions. To give an example, the complement of the lexical preposition *i*, 'in', may be the stative location of something or the goal of a motion, but in combination with various forms of a raising prepostion there is no ambiguity, (172a) has only a goal-reading, (172b) only a stative reading.

(172) a. Hunden løb ind i haven.
Dog_the ran in in garden_the

b. Hunden løb inde i haven.
Dog_the ran in in garden_the

Raising prepositions furthermore express a locational relation between two locations. In (173) the raising preposition *ind* expresses that the garden is 'in' in relation to the street.

(173) Hunden løb fra gaden ind i haven.
Dog_the ran from street_the in in garden_the

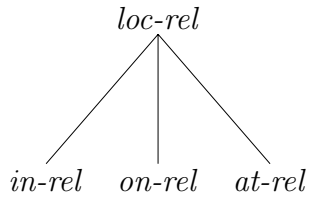
What locations are related depends on the type of preposition (directional or stative), and if stative on the context.

Sections 3.1 and 3.2 introduce the locative and temporal relations, then in section 3.3 the inventory of Danish Lexical Prepositions is described, and section 3.4 deals with the inventory of Danish Raising Prepositions and their interaction with Lexical Prepositions. Section 3.5 shows the formalization.

3.1 Locative relations

Locative prepositions denote locative relations between two entities. There are three basic locative relations, *in-relation, on-relation* and *at-relation.*

(174)



The Danish preposition *i*, 'in', denotes an *in-relation*, *på*, 'on', an *on-relation* and *ved*, 'at', an *at-relation*, while the classification of other prepositions is less clearcut. To determine what relation a directional preposition expresses, one must imagine the corresponding stative situation(s) and see which of the basic locative relations describes it. *Gennem, via* and *af* in (175) all express an *in-relation* but vary with regard to which temporal relation they express (cf. section 3.2).

(175) a. Hunden løb gennem haven.
Dog_the ran through garden_the

b. Vi rejste via Berlin.
We travelled via Berlin

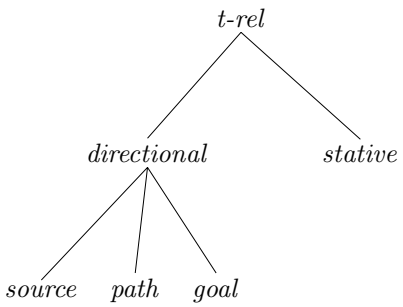
c. De kørte ud af byen.
They drove out of city_the

If we freeze the picture of the dog running through the garden, we will see that it is **in** the garden, etc.

3.2 Temporal relations

The locational state denoted by locative prepositions is temporally (in some cases also causally) related to another subevent, cf. chapter 2. There are four possible temporal relations as shown in (176).

(176)



The temporal relations expressed by prepositions are exemplified in (177).

(177) a. Hunden kom inde fra haven
Dog_the came in from garden_the

b. Hunden løb langs hegnet
Dog_the ran along fence_the

c. Hunden løb ind i haven
Dog_the ran in in garden_the

d. Hunden løb rundt inde i haven
Dog_the ran about in in garden_the

In (177a) the state denoted by the preposition precedes the process denoted by the verb. The dog must have been in the garden prior to its motion

and it must have left the garden (stopped being in the garden) at some point during the motion. I follow tradition in calling this kind *source*. In (177b) the state denoted by the preposition and the process denoted by the verb are simultaneous. This is called *path*. In (177c) the state denoted by the preposition follows the process of the dog running and is (construed as) caused by it. The process may go on simultaneously with the state, but there must be a period where the process but not the state obtains, i.e. the dog must start running before it reaches the garden. This is called *goal*. Finally, in (177d) the state denoted by the preposition is simultaneous with the event denoted by the verb but may obtain before as well as after this event. In contrast to (177b) the preposition is appropriate even if the dog stops running. This is called *stative*.

3.3 Lexical Prepositions

With the exception of *fra*, 'from', all lexical prepositions are specified for locative relation as opposed to raising prepositions which are always totally underspecified for this relation. Below the inventory of Danish lexical prepositions is presented arranged by temporal relation.

3.3.1 Source

Danish has two *source* prepositions, *fra* and *af*. As may be seen from (178), *fra* is underspecified for locative relation :

(178) a. Peter kom inde **fra** haven.
Peter came in from garden_the
'Peter came from within the garden.'

b. Bolden rullede inde **fra** fortovet ud på gaden.
Ball_the rolled in from pavement_the out onto street_the

c. Pigen kom løbende henne **fra** træet.
Girl_the came running (over) from tree_the

In (178a) Peter was **in** the garden, in (178b) the ball was **on** the pavement, and in (178c) the girl was **at** the tree.

The other *source* preposition is *af*, (179).

(179) Vandet løb ud **af** badekarret på to minutter.
Water_the ran out of bath-tub_the on two minutes

Af expresses an *in-relation*, in (179) the water is in the bathtub prior to its running out.

It is interesting that even though both *fra* and *af* express an *in-relation* in (178a) and (179) respectively, the two prepositions cannot be interchanged:

(180) a. * Peter kom inde **af** haven.
Peter came in of garden_the
b. * Vandet løb ud **fra** badekarret.
Water_the ran out from bathtub_the

To account for the data in (180) I suggest that Danish has in fact two *fra* prepositions. Fra_1 combines with long forms of raising prepositions and is underspecified for locative relation as in (178). Fra_2 is underspecified as having either an *on-relation* or an *at-relation*, but not an *in-relation* which explains why (180b) is out. Both fra_2 and *af* combines with short form raising prepositions explaining the ungrammaticality of (180a).

Another difference between fra_1 on the one hand and fra_2 and *af* on the other is shown in (181).

(181) a. *Peter kom inde **fra** haven på et minut.
Peter came in from garden_the on one minute
b. Hunden løb ud **af** haven på et minut.
Dog_the ran out of garden_the on one minute

Compatibility with *på et minut* indicates telicity, in this case the presence of a goal in the semantic structure. The sentence with a fra_1-PP cannot be modified by *på et minut* while the sentence with a fra_2 or an *af*-PP can, suggesting that fra_2 and *af* are more complex than fra_1, denoting not just the source but also, though entirely underspecified, the goal.

3.3.2 Path

There are three simple *path* prepositions, each expressing one of the basic locative relations.

(182) a. De rejste **via** Berlin.
They travelled via Berlin

b. Soldaten marcherede hen **ad**$_1$ vejen.
Soldier_the marched along road_the

c. Hunden løb **langs** hegnet.
Dog_the ran along fence_the

In (182a) the travellers were **in** Berlin at some point during their travel, in (182b) the soldier was **on** the road while marching and in (182c) the dog was **at** the fence while running. The sentences in (182) may not be modified with a *på et minut* phrase.

Three *path* prepositions may be modified by a *på et minut* phrase indicating that they are complex denoting also an underspecified *goal*.

(183) a. Drengen kravlede ud **ad**$_2$ vinduet på ti sekunder.
Boy_the climbed out of window_the in ten seconds

b. Hunden løb **gennem** røret på et minut.
Dog_the ran through tube_the in one minute

c. Manden gik **forbi** søen på en halv time.
Man_the went past lake_the in a half hour

Ad$_2$ and *gennem* have an *in-relation*, while *forbi* has an *at-relation*.

3.3.3 Goal

There are two clearcut *goal* prepositions exemplified in (184).

(184) a. Peter løb hen **til** bussen.
Peter ran (over) to bus_the

b. Peter løb hen **mod** bussen.
Peter ran (over) toward bus_the

In both cases the PP denotes the resulting state '(Peter) at the bus', but while (184a) says that the state occurs, (184b) says that the state will occur in case nothing prevents it from occuring, cf. section 2.2.2.2.3 on page 23.

Two prepositions have an underspecified temporal relation being either goal or stative.

I denotes an *in-relation*, in (185a) the garden is the goal of the motion, and in (185b) it is the stative location of the reading-situation.

(185) a. Han gik ud **i** haven.
He went out in garden_the

b. Han læste ude **i** haven.
Han read out in garden_the

På denotes an *on-relation*, in (186a) the road is the goal of the running, and in (186b) it is the stative location of the running.

(186) a. De løb ud **på** vejen.
They ran out on road_the

b. De løb ude **på** vejen.
They ran out on road_the

The six prepositions in the sentences below do not readily fit into the system. They denote goal (a.-sentences) or a stative location (b.-sentences), but at least some of them may also denote path (c. sentences). Furthermore, the locational relation they express is in each case more specific than just *at-relation*.

(187) a. Han gik ud **foran** bilen.
He went out in front of car_the

b. Han stod ude **foran** bilen.
Han stood out in front of car_the

(188) a. Han gik hen **bag** træet.
He went (over) behind tree_the

b. Han stod henne **bag** træet.
Han stood (over) behind tree_the

c. Han gik **bag** træet ud på plænen.
Han went behind tree_the out on lawn_the

(189) a. De fløj ind **over** byen.
They flew in over city_the

b. De fløj inde **over** byen.
They flew in over city_the

c. De fløj **over** byen på vej til havet.
They flew over city_the on way to sea_the

(190) a. Han gik ind **under** halvtaget.
He went in under lean-to_the

b. Han stod inde **under** halvtaget.
Han stood in under lean-to_the

c. Han gik **under** halvtaget hen til bilen.
Han went under lean-to_the (over) to car_the

(191) a. Han gik ind **blandt** de andre tilskuere.
He went in among the other spectators

b. Han stod inde **blandt** de andre tilskuer.
Han stood in among the other spectators

(192) a. Han gik ind **mellem** træerne.
He went in between trees_the

b. Han stod inde **mellem** træerne.
Han stood in between trees_the

c. Han gik **mellem** træerne hen til huset.
Han went between trees_the (over) to house_the

3.3.4 Stative

Danish has two non-underspecified stative prepositions shown in (193) and (194).

(193) Katten lå henne **ved** skorstenen.
Cat_the lay (over) at chimney_the

(194) Han boede **hos** sin moster.
He lived at his aunt

Both have an *at-relation*, the difference is that *ved* takes a non-human complement, while *hos* takes a human complement.

3.3.5 Inventory of *Lexical Prepositions*

In (195) the inventory of Danish lexical prepositions are arranged according to the locational and temporal relations they express.

(195)

<table>
<tr><th></th><th colspan="2">Source</th><th colspan="2">Path</th><th rowspan="2">Goal</th><th rowspan="2">Stative</th></tr>
<tr><th></th><th>simple</th><th>+goal</th><th>simple</th><th>+goal</th></tr>
<tr><td>in</td><td rowspan="3">fra₁
from</td><td>af
of</td><td>via
via</td><td>ad₂, gennem
of, through</td><td colspan="2">i
in</td></tr>
<tr><td>on</td><td rowspan="2">fra₂
from</td><td>ad₁
along</td><td></td><td colspan="2">på
on</td></tr>
<tr><td rowspan="2">at</td><td>langs
along</td><td>forbi
past</td><td>mod, til
toward, to</td><td>hos/ved
at</td></tr>
<tr><td colspan="2"></td><td colspan="4">foran - bag, over - under, blandt/mellem
in front of, behind, over, under, between</td></tr>
</table>

3.4 Raising Prepositions

Danish has a small group of what is traditionally called spatial adverbs or locative particles characterized by three different forms; a short-form expressing the goal of a motion (196a), an *ad*-form expressing the potential goal of a motion (196b), and a long-form expressing the source of a motion (196c) or the stative location of something (196d) .

(196) a. Drenden løb **hjem**.
Boy_the ran home

b. Drengen løb **hjemad**.
Boy_the ran homeward

c. Drengen løb **hjemme** fra haven (ud til stranden).
Boy_the ran home from garden_the (out to beach_the)

d. Drengen legede **hjemme**.
Boy_the played home

3.4.1 The interaction of Raising and Lexical Prepositions

Raising prepositions combine optionally with lexical prepositions to form complex prepositions except for *hen* and *om* which cannot function on their own but must be part of a complex preposition.

(197) a. Peter løb ind.
Peter ran in

b. Peter løb ind i huset.
Peter ran into in house_the

(198) a. * Peter løb hen / om.
Peter ran (over) (behind)

b. Peter løb hen / om bag huset.
Peter ran (over) (behind) behind house_the

The semantics of the complex preposition is composed of the semantics of the raising and the lexical preposition. Raising prepositions express a locative relation, though totally underspecified. They may therefore combine with lexical prepositions expressing any of the three locative relations:

(199) a. ind i huset
in in house_the

b. ind på marken
in on field_the

c. ind til muren
in at wall_the

Raising prepositions are to some degree specified for temporal relation. To give an example, the lexical preposition *i*, 'in', may be either goal or stative, but in combination with a raising preposition there is no ambiguouity, (200a) being goal, and (200b) stative.

(200) a. Hunden løb **ind i** haven.
Dog_the ran into garden_the

b. Hunden løb **inde i** haven.
Dog_the ran inside garden_the

The long form of raising prepositions may also express *source* as in (201).

(201) Hunden kom løbende **inde fra** haven.
Dog_the came running in from garden_the
'The dog came running from within the garden.'

However, no ambiguouity arises, since no lexical prepositions have a similar underspecification.

When used alone, i. e. not in combination with a lexical preposition, the long form of raising prepositions expresses stativity. (202) can only mean that the children rollerskated somewhere, presumably inside the house, not that the house was the source of their motion going somewhere else.

(202) Børnene løb på rulleskøjter **inde**.
Children_the ran on rollerskates in_STAT

When used alone short raising prepositions express actual state goal, (203).

(203) Han svømmede **ind**.
He swam in.

They may be combined with actual state prepositions, (204a), in which case the result is an actual state reading, but also with potential state prepositions, (204b), yielding a potential state reading.

(204) a. Han svømmede **ind til** bredden (* men nåede den ikke).
He swam in to shore_the but reached it not
b. Han svømmede **ind mod** bredden (men nåede den ikke).
He swam in toward shore_the but reached it not

The *-ad*-form of raising prepositions describes the resulting state as potential both alone and in the combination with a preposition which must also denote a potential state:

(205) a. Han svømmede **indad**.
He swam inward

b. Han svømmede **indad mod** bredden.
He swam inward toward shore_the

c. *Han svømmede **indad til** bredden.
He swam inward to shore_the

3.4.2 Inventory of *Raising Prepositions*

.

(206) shows the central inventory of raising prepositions displaying the morphological pattern described above.

(206)

Goal		Stative(/Source)	Gloss
ext (/int)	potential		
ind	*indad*	*inde*	'in(to)'
ud	*udad*	*ude*	'out'
op	*opad*	*oppe*	'up'
ned	*nedad*	*nede*	'down'
frem	*fremad*	*fremme*	'ahead'
om	*omad*	*omme*	'(behind)'[1]
over	*overad*	*ovre*	'over'
hjem	*hjemad*	*hjemme*	'home'
hen	*henad*	*henne*	'(over)'[2]
bort	-	*borte*	'away'
tilbage	*tilbagead*[3]	*tilbage*	'back'

Other raising prepositions do not exhibit this pattern and will not be treated here. They include *væk*, away, with semantics and distribution very similar to *bort(e)* and a large number of compounds like *udenfor*, 'outside', *ovenover*, 'above', etc.

3.4.3 Interlocational relations

Raising prepositions furthermore contribute information on the relation between two locations. In cases involving motion this relation holds between

[1] *Om* has no direct English equivalent.
[2] *Hen* has no direct English equivalent.
[3] For some speakers the acceptability of *tilbagead* is low, especially when written.

source and goal, in stative cases typically between the location denoted by the complement of the preposition and the location of the speaker or addressee. The various forms of a raising preposition express the same interlocational relation, thus *ud, ude, udad* all say that some location is 'out' in relation to some location, which is 'in'. In both sentences in (207) the sea is 'out' in relation to the place from where the dog ran.

(207) a. Hunden løb **ud til** havet.
Dog_the ran out to sea_the

b. Hunden løb **udad mod** havet.
Dog_the ran outwards toward sea_the

In (208) *inde* says that the garden is 'in' in relation to the place the dog goes.

(208) Hunden kom **inde fra** haven.
Dog_the came in from garden_the
'The dog came from within the garden.'

In statives there are more options. In most cases the place denoted by the complement of the prepositions is related to the location of the utterance (209a), but it may also be related to the location of the addressee (209b) (e.g. shouted into the house or said on a cellular phone) or indeed any other point of reference (209c) if none of the above mentioned two possibilities are available.

(209) a. Børnene leger **ude i** haven.
Children_the play out in garden_the

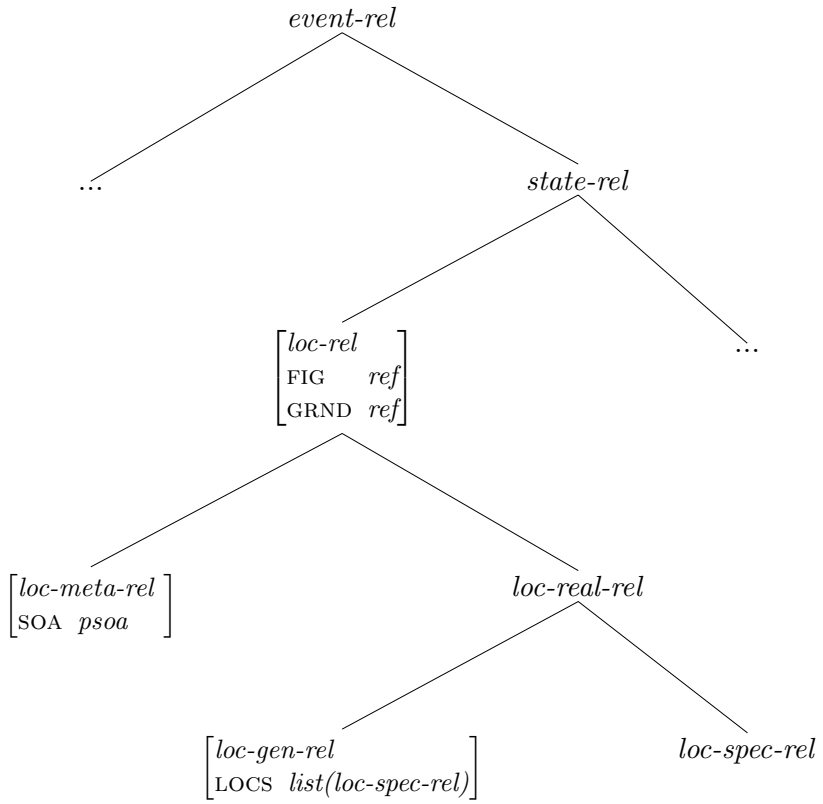
b. Vi sidder her **ude i** haven.
We sit here out in garden_the

c. Der er dejligt her **ude/oppe/nede i** haven, hva'.
There is lovely here out/up/down in garden_the, right

3.5 Formalization

Locative prepositions express locative relations. These are arranged in the type hierarchy as shown in (210) and (211).

(210)

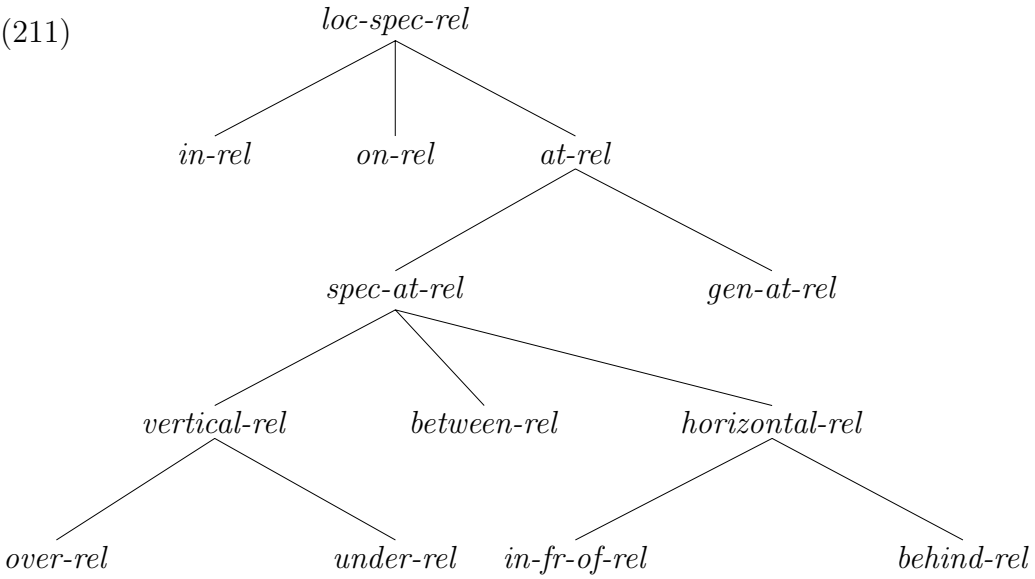


Loc(ative)-rel(ation) with two features FIGURE and GROUND is a subtype of *state-rel(ation)*. There are two immediate subtypes. *Loc-meta(phorical)-rel(ation)* with the feature SOA is used for prepositions combining with predicative nouns, e.g. *i tvivl* 'in doubt', *magt over*, 'power over', cf. chapter 4. *Loc(ative)-real-rel(ation)* has the two subtypes, *loc(ative)-gen(eral)-rel(ation)* which is the CONTENT-value of locative prepositions with a LOCATIONS-feature taking as value a list of *loc(ative)-spec(ified)-rel(ation)*, the other subtype.

3.5.1 Lexical Prepositions

Loc-spec-rel has a number of subtypes, as shown in (211).

(211)



The three basic locative relations *in-rel, on-rel* and *on-rel* are immediate subtypes of *loc-spec-rel*. *At-rel* subsumes *gen(eral)-at-rel*, the relation expressed by the prepositions *ved* and *hos*, and *spec(ific)-at-rel* subsuming a *vertical-rel* splitting into *under-rel* and *over-rel*, a *between-rel* and a *horizontal-rel* splitting into *in-front-of-rel* and *behind-rel*.

The representation of the lexical preposition *på* looks like (212)

(212)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon} \left\langle \langle \textit{på} \rangle \right\rangle \\ \textsc{ss} \mid \textsc{loc} \begin{bmatrix} \textsc{cat} \mid \textsc{head} \ \textit{prep} \\ \textsc{cont} \begin{bmatrix} \textit{loc-gen-rel} \\ \textsc{locs} \left\langle \begin{bmatrix} \textit{on-rel} \\ \textsc{t-rel} \ \ \textit{goal} \vee \textit{stative} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The rationale for the LOC(ATION)S list is prepositions like *gennem* which as mentioned above seem to denote two locative states, in this case a simultaneous state and an underspecified result state. (213) shows the representation of *gennem*.

(213)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle\left\langle \textit{gennem} \right\rangle\right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD } \textit{prep} \\ \text{CONT} \begin{bmatrix} \textit{loc-gen-rel} \\ \text{FIG } \boxed{1} \\ \text{GRND } \boxed{2} \\ \text{LOCS} \left\langle \begin{bmatrix} \textit{loc-spec-rel} \\ \text{FIG } \boxed{1} \\ \text{GRND } \textit{ref} \\ \text{T-REL } \textit{goal} \end{bmatrix}, \begin{bmatrix} \textit{in-rel} \\ \text{FIG } \boxed{1} \\ \text{GRND } \boxed{2} \\ \text{T-REL } \textit{path} \end{bmatrix} \right\rangle \\ \text{T-REL } \textit{path} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Perhaps the LOCS list can also be used to handle cases where one motion verb combines with more than one locative PP in one sentence as in (214).

(214) Hunden løb fra haven gennem hækken ud på vejen.
Dog_the ran from garden_the through hedge_the out on road_the

The representation of this sentence could have the CONTENT-value shown in (215).

(215)
$$\begin{bmatrix} \text{E1} \begin{bmatrix} \textit{run-rel} \\ \text{ACT } \boxed{1} \end{bmatrix} \\ \text{E2} \begin{bmatrix} \textit{loc-gen-rel} \\ \text{FIG } \boxed{1} \\ \text{GRND } \boxed{2} \\ \text{LOCS} \left\langle \begin{bmatrix} \textit{on-rel} \\ \text{FIG } \boxed{1} \\ \text{GRND } \boxed{2}\textit{(road)} \\ \text{T-REL } \textit{goal} \end{bmatrix}, \begin{bmatrix} \textit{in-rel} \\ \text{FIG } \boxed{1} \\ \text{GRND } \boxed{3}\textit{(garden)} \\ \text{T-REL } \textit{source} \end{bmatrix}, \begin{bmatrix} \textit{in-rel} \\ \text{FIG } \boxed{1} \\ \text{GRND } \boxed{4}\textit{(hedge)} \\ \text{T-REL } \textit{path} \end{bmatrix} \right\rangle \\ \text{T-REL } \textit{goal} \end{bmatrix} \end{bmatrix}$$

The combination of a motion verb and a directional PP is licensed as a subtype of *resultative-pred* treated in chapter 5. I assume that subsequent directional PPs may be attached as adverbials, but I shall not go into that here.

All prepositions may realize at most two arguments, a subject and a complement. In the case of prepositions with locative meaning, these two arguments denote *figure* (the subject) and *ground* (the complement). The complement is allways realized locally, while the subject may be raised and ralized as the subject, (216a), or object of a complex predicate (216b), (216c).

(216) a. Bogen lå på hylden.
Book_the lay on shelf_the

b. Jeg lagde bogen på hylden.
I put book_the on shelf_the

c. Peter spiste sin mor ud af huset.
Peter ate his mother out of house_the

Raising prepositions do not take complements:

(217) Peter løb ud (*haven).
Peter ran out garden_the

(218) shows the general constraint on prepositions.

(218) $\begin{bmatrix} \textit{word} \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{head} \ \textit{prep} \end{bmatrix} \longrightarrow$

$$\begin{bmatrix} \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \begin{bmatrix} \textsc{subj} & \langle \boxed{1} \rangle \\ \textsc{comps} & \langle \boxed{2} \rangle \vee \langle\rangle \\ \textsc{syn-args} & \textit{list} \oplus \langle \boxed{1}, \boxed{2} \rangle \end{bmatrix} \end{bmatrix}$$

It says that SUBJ list contains an element corresponding to the second-last element on the SYN-ARGS list, and that the last element may or may not be realized as a complement. Non-metaphorical locative prepositions only have two arguments, but in certain SVCs such as *situationen under kontrol*, 'situation_the under control', there is a third argument not realized locally, cf. chapter 4.

(219) shows the constraint on lexical prepositions both locative and metaphorical.

(219) $\begin{bmatrix} \textit{word} \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{head} \ \textit{prep-lex} \end{bmatrix} \longrightarrow$

$$\begin{bmatrix} \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \begin{bmatrix} \textsc{co-pred} & \langle\rangle \\ \textsc{comps} & \langle [\ ] \rangle \end{bmatrix} \end{bmatrix}$$

This constraint states that lexical prepositions take an obligatory complement, and have an empty CO-PRED list.

(220) shows the constraint on all locative prepositions.

(220)
$$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD } \textit{prep} \\ \text{CONT } \textit{loc-gen-rel} \end{bmatrix} \end{bmatrix} \longrightarrow$$

$$\begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CONT} \begin{bmatrix} \text{SEM-ARGS } \boxed{1} \\ \text{T-REL } \boxed{2} \\ \text{LOCS} \left\langle \begin{bmatrix} \textit{loc-rel} \\ \text{SEM-ARGS } \boxed{1} \\ \text{T-REL } \boxed{2} \end{bmatrix} \mid \textit{list} \right\rangle \end{bmatrix} \end{bmatrix}$$

It says that the higher SEM-ARGS- and T-REL-features have values identical to the SEM-ARGS- and T-REL-features within the first element on the LOCATIONS list.

Of course, lexical prepositions are subject to the constraint in (142) repeated here as (221) causing them to have two syntactic arguments.

(221)
$$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED } \langle\rangle \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{SYN-ARGS } \boxed{1} \\ \text{CONT} \mid \text{SEM-ARGS } \boxed{1} \end{bmatrix} \end{bmatrix}$$

3.5.2 Raising Prepositions

Raising prepositions may take co-predicates. The combination of a raising preposition with its prepositional co-predicate is licensed as a *prep-pred* a subtype of *obli-pred*, see page 55. In a *prep-pred* the SYN-ARGS list of the mother is identical to that of the head-daughter, and the CONT- and CONX-values of the mother is structure-shared with the CONT- and CONX-values of both daughters.

(222)
$$\textit{prep-pred} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{CONT } \boxed{2} \\ \text{CONX } \boxed{3} \end{bmatrix} \\ \text{H-DTR} \mid \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{prep} \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{CONT } \boxed{2} \\ \text{CONX } \boxed{3} \end{bmatrix} \\ \text{CO-PRED-DTR} \mid \text{SS} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \mid \text{SYN-ARGS } \langle \boxed{1} \rangle \\ \text{CONT } \boxed{2} \\ \text{CONX } \boxed{3} \end{bmatrix} \end{bmatrix}$$

Raising prepositions never take objects as stated in (223).

(223) $\left[\begin{array}{l}\textit{predicate}\\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{head}\ \textit{prep-raise}\end{array}\right] \longrightarrow$

$$\left[\textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{comps} \langle\rangle\right]$$

The constraint in (224) states the relationship between morphological ending and other values for raising prepositions.

(224) $\left[\begin{array}{l}\textit{word}\\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{head}\ \textit{prep-raise}\end{array}\right] \longrightarrow$

$$\left[\begin{array}{l}\textsc{phon} \left\langle \langle \textit{string}\ ,\ \textit{-}\emptyset \rangle \right\rangle \\ \textsc{ss} \mid \textsc{loc} \left[\begin{array}{l}\textsc{cat} \mid \textsc{co-pred} \left\langle [\ ] \right\rangle \\ \textsc{cont} \mid \textsc{locs} \left\langle \left[\textsc{t-rel}\ \ \textit{goal} \vee \textit{path}\right] \mid \textit{list} \right\rangle\end{array}\right]\end{array}\right]$$

$\vee$

$$\left[\begin{array}{l}\textsc{phon} \left\langle \langle \textit{string}\ ,\ \textit{-}\emptyset \rangle \right\rangle \\ \textsc{ss} \mid \textsc{loc} \left[\begin{array}{l}\textsc{cat} \mid \textsc{co-pred} \langle\rangle \\ \textsc{cont} \mid \textsc{locs} \left\langle \left[\begin{array}{ll}\textsc{actual} & \textit{plus}\\ \textsc{t-rel} & \textit{goal}\end{array}\right] \mid \textit{list} \right\rangle\end{array}\right]\end{array}\right]$$

$\vee$

$$\left[\begin{array}{l}\textsc{phon} \left\langle \langle \textit{string}\ ,\ \textit{-ad} \rangle \right\rangle \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cont} \mid \textsc{locs} \left\langle \left[\begin{array}{ll}\textsc{actual} & \textit{minus}\\ \textsc{t-rel} & \textit{goal}\end{array}\right] \mid \textit{list} \right\rangle\end{array}\right]$$

$\vee$

$$\left[\begin{array}{l}\textsc{phon} \left\langle \langle \textit{string}\ ,\ \textit{-e} \rangle \right\rangle \\ \textsc{ss} \mid \textsc{loc} \left[\begin{array}{l}\textsc{cat} \mid \textsc{co-pred} \left\langle [\ ] \right\rangle \\ \textsc{cont} \mid \textsc{locs} \left\langle \left[\textsc{t-rel}\ \ \textit{source} \vee \textit{stative}\right] \mid \textit{list} \right\rangle\end{array}\right]\end{array}\right]$$

$\vee$

$$\left[\begin{array}{l}\textsc{phon} \left\langle \langle \textit{string}\ ,\ \textit{-e} \rangle \right\rangle \\ \textsc{ss} \mid \textsc{loc} \left[\begin{array}{l}\textsc{cat} \mid \textsc{co-pred} \langle\rangle \\ \textsc{cont} \mid \textsc{locs} \left\langle \left[\textsc{t-rel}\ \ \textit{stative}\right] \mid \textit{list} \right\rangle\end{array}\right]\end{array}\right]$$

The short-forms come in two sorts. One combines with a co-predicate the other does not. In the former case the element on the LOCATIONS list is specified to be either *goal* or *path*. The short-form which does not combine

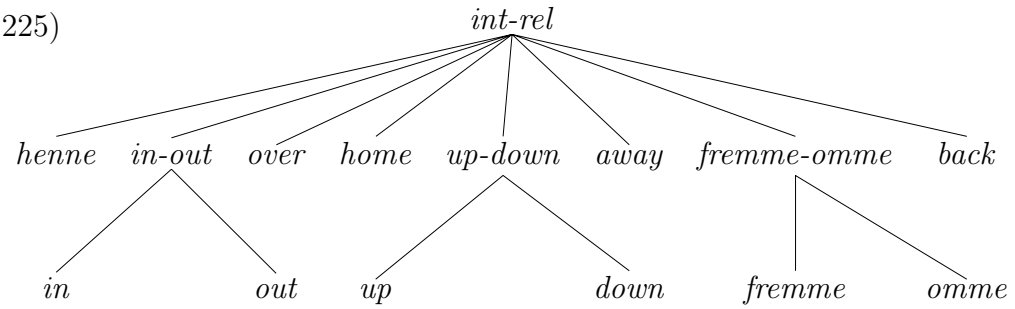
with a co-predicate has an element on the LOCATIONS list which is extensional goal.

Raising prepositions with the ending *-ad* has an element on the LOCATIONS list which is potential. This type may or may not combine with a co-predicate.

The long-forms with the ending *-e* also come in two sorts, one with a co-predicate and one without. For the former the T-REL is *source* or *stative*. The sort without co-predicate has the T-REL-value *stative*.

The hierarchy of interlocational relations is shown in (225)

(225)



I let locative raising prepositions express these relations as value for the contextual indices A and B. The various forms of a preposition with the same stem have the same values as shown in (226) for *ind*.

(226)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \left\langle \textit{ind} \ , \ \textit{-string} \right\rangle \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD} \ \textit{prep-raise} \\ \text{CONX} \mid \text{C-INDS} \begin{bmatrix} \text{A} & \textit{in} \\ \text{B} & \textit{out} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

These features are structure-shared with various other contextual indices, depending on what type of location the preposition denotes.

If the preposition denotes goal or path the A feature is structure-share with a GOAL-LOC(ATION) feature and the B feature with a SOURCE-LOC(ATION) feature. In the case of *ind-* this means that the goal is 'in', (227).

(227)
$$\begin{bmatrix} \textit{predicate} \\ \text{SS} \mid \text{LOC} \mid \text{CONT} \mid \text{LOCATIONS} \left\langle \left[\text{T-REL} \ \ \textit{goal} \vee \textit{path} \right] \middle| \textit{list} \right\rangle \end{bmatrix}$$

$$\longrightarrow$$

$$\left[\begin{array}{l}\text{SS} \mid \text{LOC} \mid \text{CONX} \mid \text{C-INDS} \left[\begin{array}{l}\text{A } \boxed{1}\ (\textit{in}) \\ \text{B } \boxed{2}\ (\textit{out}) \\ \text{SOURCE-LOC } \boxed{2} \\ \text{GOAL-LOC } \boxed{1}\end{array}\right]\end{array}\right]$$

If the preposition denotes source, the structure-sharing is reversed, in that case goal is 'out', (228).

(228)
$$\left[\begin{array}{l}\textit{predicate} \\ \text{SS} \mid \text{LOC} \mid \text{CONT} \mid \text{LOCATIONS} \left\langle \left[\text{T-REL } \textit{source}\right] \mid \textit{list}\right\rangle\end{array}\right]$$

$$\longrightarrow$$

$$\left[\begin{array}{l}\text{SS} \mid \text{LOC} \mid \text{CONX} \mid \text{C-INDS} \left[\begin{array}{l}\text{A } \boxed{1}\ (\textit{in}) \\ \text{B } \boxed{2}\ (\textit{out}) \\ \text{SOURCE-LOC } \boxed{1} \\ \text{GOAL-LOC } \boxed{2}\end{array}\right]\end{array}\right]$$

If the preposition denotes a stative location, the A feature is structure-shared with the occurence location and the B feature with either UTT(ERANCE)-LOC(ATION,) ADDR(ESSEE)-LOC(ATION) or some other point of reference, (229).

(229)
$$\left[\begin{array}{l}\textit{predicate} \\ \text{SS} \mid \text{LOC} \mid \text{CONT} \mid \text{LOCATIONS} \left\langle \left[\text{T-REL } \textit{stative}\right] \mid \textit{list}\right\rangle\end{array}\right]$$

$$\longrightarrow$$

$$\left[\text{SS} \mid \text{LOC} \mid \text{CONX} \mid \text{C-INDS} \left[\begin{array}{l}\text{A } \boxed{1}\ (\textit{in}) \\ \text{OCC-LOC } \boxed{1}\end{array}\right]\right]$$

$$\wedge$$

$$\left[\text{SS} \mid \text{L} \mid \text{C} \mid \text{C-INDS} \left[\begin{array}{l}\text{B } \boxed{2}\ (\textit{out}) \\ \text{UTT-LOC } \boxed{2}\end{array}\right] \vee \left[\begin{array}{l}\text{B } \boxed{2}\ (\textit{out}) \\ \text{ADDR-LOC } \boxed{2}\end{array}\right] \vee \left[\begin{array}{l}\text{B } \boxed{2}\ (\textit{out}) \\ \text{REF-LOC } \boxed{2}\end{array}\right]\right]$$

Below I give some examples on how this machinery works.

(230) shows the lexical entry for *ind-*.

(230)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{ind} \ , \ \textit{-string} \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD} \ \textit{prep-raise} \\ \text{CONT} \ \textit{loc-gen-rel} \\ \text{CONX} \mid \text{C-INDS} \begin{bmatrix} \text{A} & \textit{in} \\ \text{B} & \textit{out} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(231) shows the lexical entry for the lexical preposition *i*.

(231)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{i} \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD} \ \textit{prep-lex} \\ \text{CONT} \mid \text{LOCATIONS} \left\langle \textit{in-rel} \right\rangle \\ \text{CONX} \ \textit{conx} \end{bmatrix} \end{bmatrix}$$

As the word *ind* is underspecified for its CO-PRED value it may or may not combine with a co-predicate. (232) shows what is common to all combinations of *ind- , i, haven* licensed as a *prep-pred*, cf. (222).

(232)
$$\begin{bmatrix} \textit{prep-pred} \\ \text{PHON} \left\langle \boxed{1} \mid \boxed{2} \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \boxed{3} \\ \text{CO-PRED} & \langle\rangle \\ \text{SUBJ} & \langle \boxed{10} \rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \boxed{4} \langle \boxed{10} \rangle \end{bmatrix} \\ \text{CONT} \ \boxed{5} \\ \text{CONX} \ \boxed{6} \end{bmatrix} \\ \text{H-DTR} \ \boxed{7} \\ \text{CO-PRED-DTR} \ \boxed{8} \end{bmatrix}$$

$$\boxed{7} \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \boxed{1} \langle \textit{ind} \ , \ \textit{-string} \rangle \right\rangle \\ \text{S} \mid \text{L} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \ \boxed{3} \textit{prep-raise} \\ \text{CO-PRED} \ \langle \boxed{9} \rangle \\ \text{SYN-ARGS} \ \boxed{4} \langle \boxed{10} \rangle \end{bmatrix} \\ \text{CONT} \ \boxed{5} \begin{bmatrix} \textit{loc-gen-rel} \\ \text{SEM-ARGS} \ \boxed{4} \end{bmatrix} \\ \text{CNX} \ \boxed{6} \mid \text{C-INDS} \begin{bmatrix} \text{A} & \textit{in} \\ \text{B} & \textit{out} \end{bmatrix} \end{bmatrix} \end{bmatrix} \quad \boxed{8} \begin{bmatrix} \textit{head-comps-phr} \\ \text{PHON} \ \boxed{2} \langle \langle \textit{i} \rangle, \langle \textit{haven} \rangle \rangle \\ \text{S} \ \boxed{9} \mid \text{L} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{prep-lex} \\ \text{SUBJ} & \langle \boxed{10} \rangle \end{bmatrix} \\ \text{CNT} \ \boxed{5} \mid \text{LCS} \left\langle \begin{bmatrix} \textit{in-rel} \\ \text{T-REL} & \textit{goal} \vee \textit{stat} \\ \text{ACTUAL} & \textit{plus} \end{bmatrix} \right\rangle \\ \text{CONX} \ \boxed{6} \textit{conx} \end{bmatrix} \end{bmatrix}$$

The *prep-pred* in (232) has a PHON list consisting of the PHON-value of the head-daughter, *ind* + an underspecified ending, and the PHON-value of the co-pred-daughter, *i haven*. *Prep-pred* is a subtype of *headed-phr* so the HEAD-value is identical to that of the head-daughter, in this case *prep-raise*. The element on the CO-PRED list of the head-daughter is identical to the *synsem* value of the co-pred-daughter. The CO-PRED list of *prep-pred* is empty. The CONT value of *prep-pred* is structure-shared with the CONT value of both daughters. The CONT value of *ind* is lexically underspecified, while *i* specifies the LOCATIONS list to have one element, an *in-rel* which is either *goal* or *stative*. The CONX value is also structure-shared with both daughter. *ind* specifies the two contextual indices A *in* and B *out*.

Ind- in (232) cannot be *indad* because according to (224) it has EXT *minus* while *i* is EXT *plus*. If it is *ind-Ø* the constraints in (224) and (227) apply yielding (233).

(233)
$$\left[\begin{array}{l} \textit{prep-pred} \\ \text{PHON} \left\langle \langle \textit{ind}, \emptyset \rangle, \langle \textit{i} \rangle, \langle \textit{haven} \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \left[\begin{array}{ll} \text{CAT} & \left[\begin{array}{ll} \text{HEAD} & \textit{prep-raise} \\ \text{CO-PRED} & \langle\,\rangle \\ \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle\,\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{array}\right] \\ \text{CONT} & \left[\begin{array}{ll} \textit{loc-gen-rel} & \\ \text{LOCS} & \left\langle \left[\begin{array}{ll} \textit{in-rel} & \\ \text{T-REL} & \textit{goal} \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{array}\right] \right\rangle \end{array}\right] \\ \text{CONX} \mid \text{C-INDS} & \left[\begin{array}{ll} \text{A} & \boxed{2}\textit{in} \\ \text{B} & \boxed{3}\textit{out} \\ \text{SOURCE-LOC} & \boxed{3} \\ \text{GOAL-LOC} & \boxed{2} \end{array}\right] \end{array}\right] \end{array}\right]$$

If *ind-* in (232) is *ind-e* the constraints in (224) and (229) apply yielding (234).

(234)
$$\begin{bmatrix} \textit{prep-pred} \\ \text{PHON} \left\langle \langle \textit{ind,e} \rangle, \langle \textit{i} \rangle, \langle \textit{haven} \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{prep-raise} \\ \text{CO-PRED} & \langle\rangle \\ \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{loc-gen-rel} \\ \text{LOCS} \left\langle \begin{bmatrix} \textit{in-rel} \\ \text{T-REL} \quad \textit{stative} \\ \text{SYN-ARGS} \ \langle \boxed{1} \rangle \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{CONX} \mid \text{C-INDS} \begin{bmatrix} \text{A } \boxed{2} \textit{in} \\ \text{B } \boxed{3} \textit{out} \\ \text{OCC-LOC } \boxed{2} \\ \begin{pmatrix} \text{UTT-LOC} & \boxed{3} \vee \\ \text{ADDR-LOC} & \boxed{3} \vee \\ \text{REF-LOC} & \boxed{3} \end{pmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

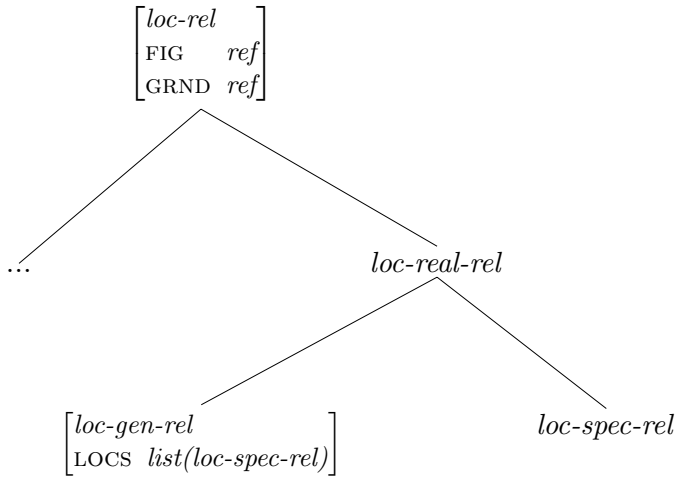
3.6 Summary

In this chapter I argued that Danish has two types of preposition, lexical prepositions like *i*, 'in', *på*, 'on', *til*, 'to', etc. and raising prepositions like *ind*, 'in', *ude*, 'out(side), *opad*, 'upwards' etc. These two types may combine to form complex predicates.

I presented the Danish inventory of locative prepositions modelling their semantics with two relations, an event relation expressing a stative, locative relation between two entities, and a relation expressing the temporal relation between the locative state and another situation, e.g. the situation denoted by the verb.

(235) shows the most general subtypes of *locative-relation*.

(235)



Locative prepositions have *loc-gen-rel* as CONTENT-value. Raising prepositions have one general *loc-spec-relation* on their LOCS list, while lexcial prepositions in most cases have a more specific *loc-spec-relation*, some have two *loc-spec-relations* denoting e.g. the path and the goal of a motion.

Raising prepositions may have an element on their CO-PRED list allowing them to combine with lexical prepositions to form complex prepositions, *prep-stem-phr*. The meaning of a *prep-stem-phr* is composed of the meaning of the raising preposition and the meaning of the lexical preposition. The lexical preposition contributes specific information on the locative relation(s) while both prepositions contribute information on the temporal relation.

Raising prepositions furthermore relate the denoted location to another location, e.g. *ind*, 'in', says that the denoted *goal*-location is *in* in relation to the *source*-location.

Chapter 4

Auxiliaries and Support Verbs

The two sentences in (236) mean more or less the same, but the meaning is arrived at in different ways.

(236) a. Gaven glædede Pia.
Present_the pleased Pia

b. Gaven gjorde Pia glad.
Present_the made Pia happy

While the verb *glædede* in (236a) in itself specifies a resulting state, the state of Pia being happy, *gjorde* in (236b) does not, it is lexically underspecified. In (236b) the state is provided by the adjective *glad* with which *gjorde* combines to form a complex predicate. In fact *gjorde* must combine with another predicative element to form a sentence.

There is a basic distinction between *full verbs* or *lexical verbs* that may on their own function as predicates and *non-full verbs* that are partially underspecified lexically and **must** combine with another predicative element, a *co-predicate*, to form a (syntactically) complex predicate. This latter type of verb subsumes auxiliaries, copula verbs, modals (not treated in this thesis) and support verbs.

Verbs that only optionally combine with a co-predicate are thus considered full verbs. (237) gives an example.

(237) a. Peter stillede stolene (ude i haven).
Peter stood chairs_the out i garden_the

b. Peter stillede stolene ud i haven.
Peter stood chairs_the out in garden_the

In (237a) *ude i haven* is not a co-predicate but a location adverb and *stille* means something like 'cause sth. to be in a standing/upright position'. (237b) is licensed as a resultative predicate, cf. chapter 5.

A non-full verb combines with a predicative element, i.e., an element denoting a situation. This element may be a noun, an adjective, a preposition or a participle. The non-full verb is the carrier of verbal inflection and also to a large extent responsible for the event structure expressed by the complex predicate. The co-predicate supplies a state-relation and the arguments of that relation.

The sentences in (238) show examples of non-full verbs.

(238) a. Gæsten **var** ude i haven.
Guest_the was out in garden_the

b. Gæsten **kom** ud i haven.
Guest_the came out into garden_the

c. Værten **bragte** gæsten ud i haven.
Host_the brought guest_the out into garden_the

d. Værten **lod** gæsten gå ud i haven.
Host_the let guest_the go out into garden_the

e. Gæsten **blev** ude i haven.
Guest_the stayed out in garden_the

In each case the verb itself has a rather vague meaning, and a significant part of the semantics of the construction is contributed by the predicative element. What part varies with the different kinds of support verbs. Support verbs may be divided into five groups according to their semantics. Following the tradition in the literature on SVCs (Krenn and Erbach (1994) and references there) I distinguish between *Duratives* (238a), *Inchoatives* (238b), *Causatives* (238c), *Permissives* (238d), and *Continuatives* (238e). I argue that both *permissives* and *continuatives* are in fact subtypes of *causatives*. Below I treat these types one at a time.

4.1 Durative

Danish has three durative support verbs, *have*, 'have', *være*, 'be', and *blive*, 'be, become', plus a few others, less frequently used.

(239) shows the use of *have*, *være* and *blive* as auxiliaries combining with past participles and the closely related use of *være* as a copula combining with an adjective. This is treated in section 4.1.1.

(239) a. Hunden har spist.
Dog_the has eaten

b. Kyllingen er spist.
Chicken_the is eaten

c. Der blev danset meget til den fest.
There was danced much to that party.

d. Ulla er glad.
Ulla is happy

(240) shows *have* and *være* in combination with predicative nouns, this is treated in sections 4.1.2 and 4.1.3.

(240) a. Peter har kontrol over situationen.
Peter has control over situation_the

b. Peter har situationen under kontrol.
Peter has situation_the under control

c. Situationen er under kontrol.
Situationen_the is under control

I suggest that there is no significant difference between the sentences in (239) and (240) and show that only one lexical entry is needed for *have* and *være* respectively.

(241) shows examples of other durative support verbs, briefly treated in section 4.1.4.

(241) a. Ole og Ulla ligger i skilsmisse.
Ole and Ulla lie in divorce
'Ole and Ulla are divorcing '

b. Biblioteket står til rådighed for de ansatte.
Library_the stand at disposal for the employees

4.1.1 *Være* and *have* with past participles

The distribution of *have* and *være* combining with past participles to form the perfect is as follows[1] .

Intransitive non-motion verbs denoting a process (unergatives) or a state are combined with *have*:

(242) a. Ole har sovet.
Ole has slept

b. * Ole er sovet.
Ole is slept

(243) a. Jens har ligget på sofaen.
Jens has lain on sofa_the

b. * Jens er ligget på sofaen.
Jens is lain on sofa_the

Inchoatives (ergatives) are combined with *være*:

(244) a. * Peter har ankommet.
Peter has arrived

b. Peter er ankommet.
Peter is arrived

Transitive non-motion verbs are combined with *have* when the first argument is realized as subject, and with *være* when the second argument is realized as subject, the socalled periphrastic stative passive. However, this last option is not possible with all verbs.

(245) a. Peter har spist æblet.
Peter has eaten apple_the

b. Æblet er spist.
Apple_the is eaten

(246) a. Han har kendt løsningen siden i går.
He has known solution_the since yesterday

b. Løsningen er kendt.
Solution_the is known

[1]Parts of this section was published in Bjerre and Neville (2002).

(247) a. Pia har kysset Jørgen.
Pia has kissed Jørgen
b. * Jørgen er kysset.
Jørgen is kissed

With motion verbs in combination with directional PPs, only *være* is possible:

(248) a. * Peter har løbet ud i haven.
Peter has run out in garden_the
b. Peter er løbet ud i haven.
Peter is run out in garden_the

Without a directional PP, verbs of motion combine with both *være* and *have*:

(249) a. Peter har løbet.
Peter has run
b. Peter er løbet.
Peter is run

4.1.1.1 Previous Analyses

4.1.1.1.1 Introduction In this section I discuss various accounts of perfect and passive constructions with auxiliaries and past participles. The analyses all assume one past participle form which may occur in both perfect and passive constructions. This means that the participle have one argument structure, and that it is the auxiliaries which provide the correct perfect and passive argument structure.

4.1.1.1.2 Heinz and Matiasek (1994) Heinz and Matiasek (1994) provide an account of the argument structure of participles, auxiliary selection in connection with perfect, and agentive and stative passive constructions.

The account of argument structure is based on Haider's notion of a designated argument, (Haider (1986)). They introduce the feature DA, designated argument, which takes a list of *synsem* object as its value. The feature picks out the argument on the SUBCAT list with 'subject properties' and not 'object properties'. In entries for transitive and unergative verbs the first element on the SUBCAT list also appears on the DA. In entries for ergative verbs, the DA list is empty.

A designated argument reduction rule is applied to base verb forms and results in past participle forms with a different argument structure. The designated argument is blocked, which means that the designated argument is removed from the SUBCAT list. The Past Participle Rule is given in (250), (Heinz and Matiasek (1994, p. 219)).

(250)
$$\begin{bmatrix} \text{HEAD} & \textit{verb}\begin{bmatrix}\text{VFORM} & \textit{bse}\end{bmatrix} \\ \text{DA} & \boxed{1} \\ \text{SUBCAT} & \boxed{1} \oplus \boxed{2} \end{bmatrix} \longmapsto \begin{bmatrix} \text{HEAD} & \textit{verb}\begin{bmatrix}\text{VFORM} & \textit{ppp}\end{bmatrix} \\ \text{DA} & \boxed{1} \\ \text{SUBCAT} & \boxed{2} \end{bmatrix}$$

The Past Participle Rule gives rise to the forms in (251) through (253), (Heinz and Matiasek (1994, p. 220)).

(251) *geschlagen*
$$\begin{bmatrix} \text{HEAD} & \textit{verb}\left[\text{VFORM} \;\; \textit{ppp}\right] \\ \text{DA} & \langle \text{NP}[\textit{str}] \rangle \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}] \rangle \end{bmatrix}$$

(252) *geschlafen*
$$\begin{bmatrix} \text{HEAD} & \textit{verb}\left[\text{VFORM} \;\; \textit{ppp}\right] \\ \text{DA} & \langle \text{NP}[\textit{str}] \rangle \\ \text{SUBCAT} & \langle\rangle \end{bmatrix}$$

(253) *aufgewacht*
$$\begin{bmatrix} \text{HEAD} & \textit{verb}\left[\text{VFORM} \;\; \textit{ppp}\right] \\ \text{DA} & \langle\rangle \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}] \rangle \end{bmatrix}$$

These participle forms are selected by auxiliaries to form perfect and passive constructions. The different argument structures in them determine whether the participle form is preceded by *haben* or *sein* in perfect constructions and whether the participle forms can occur in passive constructions of which they assume two types, the agentive passive and the stative passive.

The perfect auxiliaries select a past participle and the argument structure of the complex construction is shown in (254), (Heinz and Matiasek (1994, p. 221)).

(254)
$$\begin{bmatrix} \text{DA} & \boxed{1} \\ \text{SUBCAT} & \boxed{1} \oplus \boxed{2} \oplus \left\langle \begin{bmatrix} \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb}\begin{bmatrix}\text{VFORM} & \textit{ppp}\end{bmatrix} \\ \text{LEX} & + \\ \text{DA} & \boxed{1} \\ \text{SUBCAT} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

In effect, the auxiliary reinserts the designated argument on its SUBCAT list together with the SUBCAT list of the participle complement. Heinz and Matiasek do not distinguish between the two auxiliaries, but they nevertheless anticipate that a distinction can be encoded in the lexical entries of the two auxiliaries, so that *sein* selects participles with an empty DA list, and *haben* selects all other participles, presumably this can be generalized to mean participles with a non-empty DA list. There are exceptions to these generalizations, so they introdce a feature AUXFORM with the possible values *haben* and *sein* and a 'morphological operator' returning the irregular form if there is one or else the regular form. Auxiliaries subcatogorize for the AUXFORM-value (Heinz and Matiasek, 1994, p. 222).

The rules account for the perfect auxiliary selection in (255).

(255) a. Peter hat Paul geschlagen.
Peter has beaten Paul

b. Peter hat geschlafen.
Peter has slept

c. Peter ist aufgewacht.
Peter has woken

The transitive participle is preceded by *haben* and the designated argument of the participle appears as the subject of the auxiliary. The unergative participle is also preceded by *haben*, and again the designated argument of the participle appears as the subject of the auxiliary. Finally, the ergative participle is preceded by *sein*. As the base form of this verb has an empty DA list, the subject of the participle has not been removed from the SUBCAT list by the Past Participle Rule, and so it appears as the subject of the auxiliary.

Heinz and Matiasek claim that auxiliary selection in perfect constructions follow these rules and cannot be given a semantic explanation. They give the semantically equivalent examples in (256) to show that the selection cannot be asscociated with semantic properties, (Heinz and Matiasek (1994, p. 222)).

(256) a. Hans hat Maria geholfen
Hans$_{nom}$ has Maria$_{dat}$ helped
'Hans helped Maria'

b. Hans ist Maria zu Hilfe gekommen
Hans$_{nom}$ ist Maria$_{dat}$ to aid come
'Hans came to Maria's aid'

The same participle forms can be used to form passive constructions. They distinguish between an agentive and a stative passive. The agentive passive is formed by a past participle preceded by the auxiliary *werden*. Agentive passives can be formed with participles which have a designated argument, i.e. a non-empty DA list as shown in (257), (Heinz and Matiasek (1994, p. 224)).

(257)
$$\begin{bmatrix} \text{HEAD} & [\text{AUXFORM } \textit{sein}] \\ \text{DA} & \langle\rangle \\ \text{SUBCAT} & \boxed{1} \oplus \left\langle \begin{bmatrix} \text{LOC} \mid \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb}[\text{VFORM } \textit{ppp}] \\ \text{LEX} & + \\ \text{DA} & \langle \textit{synsem} \rangle \\ \text{SUBCAT} & \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

This correctly predicts that ergative participles do not occur in agentive passives, and that it is the object of the transitive participle that appears as subject of the auxiliary. The unergative participles have an empty SUBCAT list and an impersonal passive results.

Another entry for *sein* is assumed to form stative passive constructions. This entry is shown in (258), (Heinz and Matiasek (1994, p. 227)).

(258)
$$\begin{bmatrix} \text{DA} & \langle\rangle \\ \text{SUBCAT} & \boxed{1} \oplus \left\langle \begin{bmatrix} \text{LOC} \mid \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb}[\text{VFORM } \textit{ppp}] \\ \text{LEX} & + \\ \text{SUBCAT} & \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

This entry predicts that stative passives can be formed with all three types of participle. For transitive participles, the object appears as subject of the auxiliary. For ergatives, the subject of the participles appears as subject of the auxiliary. It also predicts that for unergatives an impersonal stative passive results, as the empty SUBCAT list becomes the subject of the auxiliary.

Heinz and Matiasek's analysis makes a number of wrong predictions. Firstly, it predicts that impersonal stative passives can be formed with unergatives, as in (259).

(259) *Es ist geschlafen
There is slept

Also, not all transitive participles occur in stative passive constructions, and examples such as (260) seem questionable.

(260) ?Sie ist geküsst
She is kissed

Further, the analysis predicts that constructions with *sein* followed by an ergative participle is ambiguous between a perfect and a stative passive reading. This means that an example like (261) is ambiguous.

(261) Er ist angekommen
He is arrived

I see no justification for assuming an ambiguity here.

4.1.1.1.3 Kathol (1994) Kathol (1994, p. 268) proposes an analysis of perfect constructions and the agentive passive construction. The basic idea is to let participles have a passive argument structure, and then have the perfect auxiliary recover the active argument structure. A feature EXT encodes the argument which is the subject in the corresponding active form. He proposes the entries in (262) through (264) for the three types of participle.

(262) *geliebt*

$$\begin{bmatrix} \text{SUBJ} & \langle \text{NP}[\text{ACC}] \rangle \\ \text{COMPS} & \langle\rangle \\ \text{EXT} & \langle \text{NP}[\text{NOM}] \rangle \end{bmatrix}$$

(263) *geschlafen*

$$\begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle \\ \text{EXT} & \langle \text{NP}[\text{NOM}] \rangle \end{bmatrix}$$

(264) *angekommen*

$$\begin{bmatrix} \textsc{subj} & \boxed{1}\langle \textsc{np}[\textsc{nom}]\rangle \\ \textsc{comps} & \langle\rangle \\ \textsc{ext} & \boxed{1} \end{bmatrix}$$

Participles which have SUBJ and EXT features the values of which are different, form perfect constructions with *haben*, as the valence specification for *haben* in (265) shows.

(265) *haben*

$$\begin{bmatrix} \textsc{subj} & \boxed{3} \\ \textsc{comps} & \boxed{2} \oplus \boxed{1} \oplus \left\langle \textsc{v} \begin{bmatrix} \textsc{comps} & \boxed{1} \\ \textsc{subj} & \boxed{2} \\ \textsc{ext} & \boxed{3} \end{bmatrix} \right\rangle \end{bmatrix}$$

constraint: $\boxed{2} \neq \boxed{3}$

The argument on the EXT list appears as the subject of the auxiliary, and the argument on the SUBJ list appears as the complement of the auxiliary, and an active argument structure results. The ergative participle cannot form a perfect with *haben* as its SUBJ and EXT value is structure shared. Instead it forms a perfect construction with *sein* in which it is specified that the participle complement must have identical SUBJ and EXT value. The entry for *sein* is shown in (266).

(266) *sein*

$$\begin{bmatrix} \textsc{subj} & \boxed{2} \\ \textsc{comps} & \boxed{1} \oplus \left\langle \textsc{v} \begin{bmatrix} \textsc{comps} & \boxed{1} \\ \textsc{subj} & \boxed{2} \\ \textsc{ext} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix}$$

The participles which can form passive constructions with *werden* are those which have an accusative argument on the SUBJ list, i.e. the transitive participles. The entry for *werden* is given in (267).

(267) *werden*

$$\begin{bmatrix} \textsc{comps} & \boxed{1} \oplus \left\langle \textsc{v} \begin{bmatrix} \textsc{comps} & \boxed{1} \\ \textsc{subj} & \left\langle \textsc{np}[\textsc{acc}]_{\boxed{2}} \right\rangle \end{bmatrix} \right\rangle \\ \textsc{subj} & \left\langle \textsc{np}[\textsc{nom}]_{\boxed{2}} \right\rangle \end{bmatrix}$$

The subject of the participle becomes the subject of the auxiliary, i.e. the passive argument structure is maintained.

Kathol does not cover impersonal passives or stative passives in this analysis.

Just as Heinz and Matiasek's analysis, Kathol's analysis does not account for unergative motion verbs which may form perfect constructions with both *haben* and *sein*, repeated here as (268).

(268) a. Er hat gelaufen
he has run

b. Er is nach Hause gelaufen
He is to home run
'He has run home'

The unergative may not form perfect with *sein*, as *sein* requires the SUBJ list and EXT list of the participle to be identical.

4.1.1.1.4 Pollard (1994) Pollard (1994) aims to give a unified account of Passive in German. Based on Borsley's valence feature analysis, i.e. the division of the SUBCAT list into SUBJ and COMPS lists, (Borsley (1989) and Borsley (1990)), and Kathol's ERGATIVE feature, (Kathol (1991)). The ERG feature encodes the subject of ergative verbs and the accusative object of transitive verbs. He proposes the hypothesis that 'passivization in German is disallowed in case the SUBJ and ERG values of the participle are one and the same structural NP', (Pollard (1994, p. 282)).

The syntactic argument structures for the three basic types of participle are shown in (269) through (271), (Pollard (1994, p. 280)).

(269) *geschlagen*

$$\begin{bmatrix} \text{COMPS} & \langle \boxed{1} \rangle \\ \text{SUBJ} & \langle \text{NP}[str] \rangle \\ \text{ERG} & \langle \boxed{1} \text{NP}[str] \rangle \end{bmatrix}$$

(270) *angekommen*

$$\begin{bmatrix} \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{ERG} & \langle \boxed{1} \text{NP}[str] \rangle \end{bmatrix}$$

(271) *geschlafen*

$$\begin{bmatrix} \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \langle \text{NP}[str] \rangle \\ \text{ERG} & \langle\rangle \end{bmatrix}$$

Thus transitive and ergative participles group together in having a non-empty ERG list. Unergatives have an empty ERG list.

This argument structure predicts the possible passive constructions in German. Ergative participles cannot form passives in German as their SUBJ and ERG features share the same value.

German passive is formed by the auxiliary *werden* followed by a past participle. The entry for *werden* is given in (272), (Pollard (1994, p. 291)).

(272) *werden*

$$\begin{bmatrix} \text{HEAD} & verb[bse] \\ \text{SUBJ} & \boxed{2} \\ \text{ERG} & \boxed{2} \\ \text{COMPS} & \boxed{3} \oplus \left\langle \begin{bmatrix} \text{HEAD} & verb[part] \\ \text{SUBJ} & \langle \text{NP}[str]_{ref} \rangle \\ \text{ERG} & \boxed{2} \\ \text{COMPS} & \boxed{2} \oplus \boxed{3} \end{bmatrix} \right\rangle \end{bmatrix}$$

The selection specified for *werden* gives rise to a personal passive if the participle is transitive. The argument which is on the ERG list and the COMPS list is the object and it appears as the subject of the auxiliary. It gives rise to an impersonal passive if the participle is unergative. The ERG and COMPS lists are empty, and an empty list appears as the subject of the auxiliary, resulting in an impersonal passive. Ergative participles do not meet the constraint that the element on the ERG list and the first element on the COMPS list is the same, and they cannot form passives. It should be noted that Pollard's passivization hypothesis is based on the argument structure of the participles, not the passive auxiliary.

Pollard's analysis does not extend to stative passives or perfect constructions.

A problem with Pollard's analysis is that it does not account for constructions in which the past participle occurs without an auxiliary. This is because the participles have an active argument structure with the argument surfacing as subject of an active sentence on the SUBJ list, whereas the object is on the COMPS list. Müller (2000, p. 250) notes this, and refers to the examples in (273) as problematic for the analysis.

(273) a. weil er die Äpfel gewaschen ißt.
because he the apples washed eats
'because he eats the apples washed'

b. So lange gilt die 39-Jährige als nicht suspendiert.
so long counts the 39 year old as not suspended
'The 39 year old woman is regarded as suspended for this period'

In these examples the 'object' appears as subject of the participle, but there is no auxiliary to change the argument structure.

4.1.1.1.5 Concluding remarks Above I have outlined various accounts of argument structure in connection with the past participle form and its occurrence in perfect and passive constructions. The discussion above of the various analyses shows that the more extensive analysis wrt. coverage the more problems arise when one wants to give as uniform an analysis as possible. Heinz and Matiasek (1994) and Kathol (1994) provide no account of unergative motion verbs which may occur with both perfect auxiliaries. Another problem concerns the stative passive construction. The analysis which Heinz and Matiasek (1994) propose does not differentiate between different types of transitive verb and predicts that all transitive participles occur in stative passive constructions. Finally, as no distinction is made between the participle in perfect and passive constructions, and the auxiliaries provide the appropriate valence structure, a problem may arise when the participle occurs in constructions without perfect or passive auxiliaries. Pollard (1994) assumes that the past participle has an active valence structure, and so his analysis runs into difficulties explaining the auxiliary-free constructions in which the participle typically has a passive valence structure.

In spite of these problems with the uniform perfect/passive account, I think it is worth while pursuing the idea behind these approaches. This is in contrast to assuming both a passive and perfect participle with each their argument structure, cf. e.g. Müller (2000). Below I want to put forward an analysis which solves the problems that the analyses in this section were shown to have.

4.1.1.2 Proposal

The central claim in the proposal below is that verbs split into a number of semantic classes reflected in their event and argument structure, and that the

auxiliaries *have*, *være* and *blive* select co-predicates with different argument and valence structure.

4.1.1.2.1 Past Participles All past participles denote a state related to the situation denoted by the active verb. A context like (274) divides them into two types.

(274) X frygtede / fandt Y PastPart
X feared / found Y PastPart

One type is allowed and the other disallowed in this context as exemplified in (275)

(275) a. Peter frygtede sit kæledyr spist / forsvundet.
Peter feared his pet eaten disappeared

b. * Peter fandt sin kone kysset / danset.
Peter found his wife kissed danced

Assuming that Y in (274) is the subject of the past participle, I suggest that only one subtype of past participle may have a subject. Semantically this type is characterized by having a result state in its semantics identical to the result state of the related active verb. Both *spist* and *forsvundet* in (275a) have such a result state, and it is the first argument of this state that may be realized as subject. I refer to this type of participle as *result participle*

The other type of participle, *non-result participle*, denotes a state of having formerly been engaged in a process or state. In this case the related active verb has a specified subevent$_1$, a process or a state, and possibly also a result state. Verbs like *danse*, 'dance', and *kysse*, 'kiss', form *non-result* participles. Furthermore, if the related active verb denotes a complex situation, the participle must have two syntactic arguments to form a *non-result* participle. This means that inchoatives, *forsvundet*, 'disappeared', *vågnet*, 'woken up', etc. and complex predicates with only one argument, e.g. comples predicates consisting of an intransitive motion ver in combination with a directional PP cannot form *non-result* participles:

(276) gået ud i haven.
gone out into garden_the

Participles related to active verbs with both a specified subevent$_1$ and a result state, where the first argument of the process or state in subevent$_1$ is not the first argument of the result state give rise to both a *result* participle and a *non-result* participle. An example is *spist*, 'eaten', as in (275a). Note, however, also that (275a) is not ambiguous. The subject of *spist* can only be understood as the thing eaten, not as the eater. That is, though *spist* may be both a *result* and a *non-result* participle, only in the former case does it have a subject. The first argument cannot surface as subject.

4.1.1.2.2 Auxiliaries do not contribute much to the semantics of the sentence. *Have* and *være* have a durative event structure, i.e. denote a simple situation with only a subevent$_1$. The value of subevent$_1$ is lexically underspecified but structure-shared with the CONTENT-value of the co-predicate. The basis for 'auxiliary selection' is the argument and valence of the co-predicate.

The auxiliary *have* The auxiliary *have*, 'have', takes a co-predicate with an empty SUBJ list and a remaining argument of the participle is raised.

This means that *have* may combine with *non-result* participles, (277), but not with *result* participles, (278).

(277) a. Jens har ligget på sofaen.
Jens has lain on sofa_the

b. Peter har løbet.
Peter has run

c. Peter har danset.
Peter has danced.

d. Peter har kysset konen.
Peter has kissed wife_the

e. Peter har spist maden.
Peter has eaten food_the

(278) a. *Peter har forsvundet.
Peter has disappeared

b. *Peter har gået ud i haven.
Peter has gone out into garden_the

The auxiliary *være* The auxiliary *være*, 'be', takes a co-predicate with an element on its SUBJ list and raises this element.

This means that it may combine with *result* participles as shown in (279).

(279) a. Peter er forsvundet.
Peter is disappeared.

b. Maden er spist.
Food_the is eaten.

c. Hunden er løbet ud.
Dog_the is run out

(280) gives an example of an apparent problem, the combination of a motion verb with *være*.

(280) Peter er løbet.
Peter is run

The explanation is that (280) does not mean the same as (277b), (280) does have a resulting state, the state of Peter not being at a certain place anymore. I suggest that *løbet* in (280) is actually a complex-predicate consisting of the participle and a phonetically empty co-predicate.

Unergative participles like *danset*, 'danced', do not occur with the auxiliary *være* as they form *non-result* participles that have no subject, cf. (281).

(281) *Peter er danset.
Peter is danced.

Transitive participles of the type without a resulting state like *kysset*, 'kissed', normally do not occur with *være* either, (282a), but in contexts where the sentence can be reinterpreted as expressing some kind of resulting state as in (282b) *være* is possible.

(282) a. *Konen er kysset.
Wife_the is kissed.

b. Når konen er kysset og middagen er spist, er det tid at sove[2].
When wife_the is kissed and dinner_the is eaten is it time to sleep

[2]I thank Bjarne Ørsnes for this example.

The auxiliary *blive* The combination *blive* + past participle, the socalled *periphrastic passive* has the same meaning as the passive verb to which the participle is related, as is the case with the synthetic passive, either the second argument is realized as subject or the expletive *der* is inserted. (283) gives some examples with transitive verbs.

(283) a. Pia blev kysset (af Peter).
Pia was kissed (by Peter)

b. Æblet blev spist.
Apple_the was eaten

c. Stolen blev skubbet hen i hjørnet.
Chair_the was pushed over in corner_the

Blive may combine with some intransitive verbs and with transitive verbs with unspecified object deletion or incorporated objects. In this case *der* is inserted as dummy subject

(284) Der blev danset / kysset / drukket (øl) til festen.
There was danced kissed drunk beer at party_the

Blive does not combine with inchoative participles, (285a), or complex predicates of the sort exemplified in (285b).

(285) a. * Der / Peter blev forsvundet.
There Peter was disappeared

b. * Der / Peter blev gået ud i haven.
There Peter was gone out in garden_the

In both cases *Peter* is the first argument and hence cannot surface as subject of *blive* which realizes the second argument as subject. But what prohibits *der* insertion?

I suggest a constraint to the effect that either the SUBJ list of a co-predicate must be empty or else the element on this SUBJ list must be raised. This allows *non-result* participles as co-predicates because they have an empty SUBJ list, but disallows the combination of *blive* and *result* participles like *forsvundet* and *gået ud i haven* because they have subjects that are not raised by *blive*.

Multiple auxiliaries Auxiliaries may combine to form more complex constructions, i.e. the co-predicate may itself be complex. As expected complex predicates with *være* which give rise to *non-result* participles can only combine with *have*, (286).

(286) Peter har (*er) været forsvundet.
Peter has is been disappeared

Complex predicates with *blive* giving rise to *result* participles as expected combine with *være*, (287).

(287) Maden er (*har) blevet spist.
Food_the is has been eaten

However, it is at present not clear why also complex predicates with *blive* giving rise to *non-result* participles combine with *være*.

(288) a. Der er blevet danset til festen.
There has been danced at party_the
b. Ulla er blevet kysset af postbudet mange gange.
Ulla is been kissed by postman_the many times

I leave this question for further research.

4.1.1.2.3 Past participles in auxiliary-free constructions As already indicated in (274) and (275) the proposed analysis also accounts for participles in auxiliary-free constructions with raising verbs. In (289) we are dealing with *result* participles the subjects of which are raised to be realized as subject of the verb. (290) shows that *non-result* participles are not possible here, according to the analysis because there is no subject to raise.

(289) a. Mand frygtes forsvundet.
Man is feared disappeared
b. Præsidenten forsøgtes myrdet.
President_the was attempted murdered

(290) a. *Mand frygtes danset.
Man is feared danced
b. *Konen frygtes kysset.
Wife_the is feared kissed.

4.1.2 *have* with predicative nouns

(291) shows the two types of construction with *have* combining with a predicative noun.

(291) a. Bo havde kontrol over situationen.
Bo had control over situation_the
b. Bo havde situationen under kontrol.
Bo had situation_the under control

In both cases the predicative noun *kontrol* contributes the major part of the semantics, and both sentences mean more or less the same as (292), where support verb + predicative noun is replaced by a lexically specified verb.

(292) Bo kontrollerede situationen
Bo controlled situation_the

In spite of their differences in word order – in (291a) the support verb *havde*, 'had', is immediately followed by the predicative noun *kontrol*, 'control', while in (291b) *kontrol* is the complement of a preposition and the PP is preceded by another noun, *situationen*, 'the situation', – there are reasons for wanting to assume that both support verb constructions in (291) have a similar structure: They have (almost) identical meaning, they may contain the same range of support verbs, and the choice of preposition seems to be dictated by the same metaphor.

I suggest to view *kontrol over situationen* (291a) as well as *situationen under kontrol* (291b) as saturated PPs. Locative prepositions including metaphorically locative prepositions denote a locative relation between two entities. As a consequence they have two arguments with the roles *figure* and *ground*. The order of these two arguments may be reversed. When that happens, the preposition changes. It seems obvious to suggest that there is a metaphor involved, and that it is no coincidence that *over* is replaced by *under* given the meaning of these prepositions in non-metaphorical contexts, cf. chapter 3.

Metaphorically locative prepositions like *over* and *under* in (291) take as one of their arguments a predicative noun from which the preposition takes over the meaning and raises the arguments. The *theme* argument is realized by the preposition as either complement (291a), or subject (291b), but due to the fact that prepositions have only two argument slots one of which is in

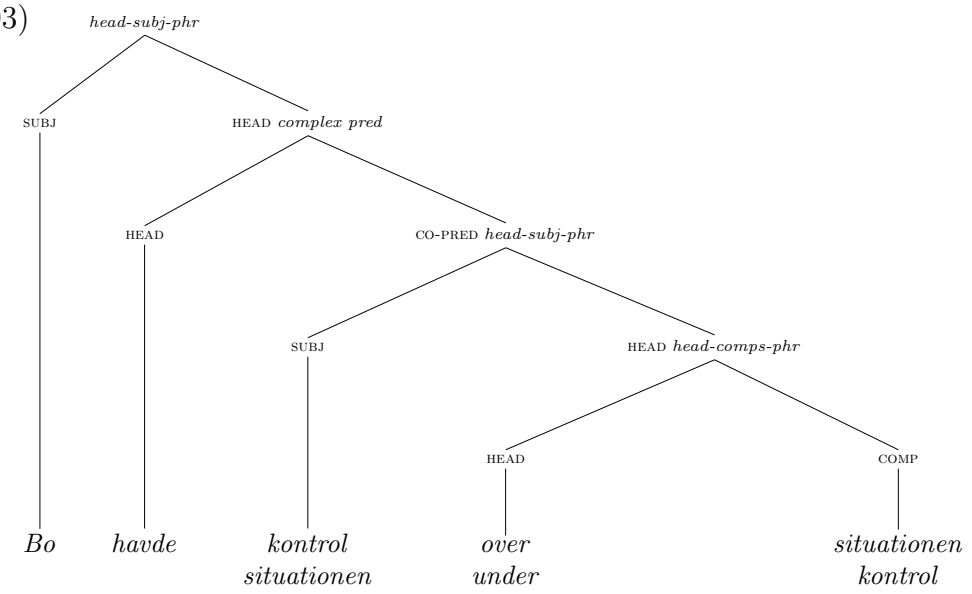
this case occupied by the predicative noun, the *bearer* argument (*Bo*) is left unrealized.

The noun *kontrol* denotes a simple situation where a *control relation* obtains. The *control relation* is a subtype of *state relation* with two semantic roles, a *bearer* and a *theme*. However, nouns are unable to realize arguments directly, but must combine with predicative words like verbs and prepositions.

Have combines with the saturated PP, taking over the meaning from it and raising the remaining argument, the *bearer*, realizing it as subject. In both sentences in (291) *Bo* originates as the first semantic argument of the predicative noun *kontrol*, but is realized as the subject of *have*.

(293) sketches the composition of the sentences in (291).

(293)



4.1.3 *Være* with predicative nouns

The durative support verb *være* in combination with a predicative noun is exemplified in (294).

(294) Situationen var under kontrol.
situation_the was under control

(294) is similar to (291b) with *have*, repeated here as (295).

(295) Bo havde situationen under kontrol.
Bo had situation_the under control

The difference is, as we saw above, that *have* combines with a co-predicate with an empty SUBJ list while *være* raises the SUBJ-element from its co-predicate realizing it as subject. In fact, in this respect there is no reason to distinguish between the auxiliaries and support verbs.

The sentences in (296) present an apparent problem.

(296) a. Situationen var under kontrol.
Situation_the was under control

b. *Kontrol var over situationen.
Control was over situation_the

If both *situationen under kontrol* and *kontrol over situationen* are saturated PPs, why is it possible for *være* to raise the subject in the first case, but not in the latter?

It turns out to be a question of definiteness of the subject. Danish has a strong tendency towards disallowing indefinite subjects in subject position, that is, in the socalled foundation field (Diderichsen, 1957), the position in front of the finite verb, or in a position immediately after it. Instead the indefinite subject is positioned after possible central adverbials and non-finite verbs in the 'object' position, and the expletive *der* occupies the 'normal' subject position. (297a) has a definite subject and (297b) is the corresponding sentence with indefinite subject.

(297) a. Manden har ligget på sofaen.
Man_the has lied on sofa_the

b. Der har ligget en mand på sofaen.
There has lied a man on sofa_the

The problem with (296b) is that the subject *kontrol* is indefinite and therefore cannot occur in subject position. The corresponding sentence with *der* in subject position and *kontrol* in object position is fine:

(298) Der var kontrol over situationen.
There was control over situation_the

And of course there is no well-formed sentence with *der* corresponding to (296a):

(299) *Der var situationen under kontrol.
There was situation_the under control

4.1.4 Other durative support verbs

A number of *Verbs of Spatial Configuration* (Levin, 1993) may also be used as support verbs with a durative meaning.

(300) a. ligge i forhandlinger (med nogen)
lie in negotiations (with somebody)

b. ligge i skilsmisse (med nogen)
lie in divorce (with somebody)

c. stå til rådighed (for nogen)
stand to disposal (for somebody)

d. stå til ansvar for noget
stand to responsibility for something

In such cases the verb loses some of its specific meaning. The two verbs *ligge*, 'lie', and *stå*, 'stand', have approximately the same syntax and semantics as *være*. One may have the intuition that *ligge* is used to denote situations of longer duration than *stå*, but it is not clear whether this is more than just a loose tendency.

Cases where the verb retains its basic positional meaning should be kept apart from the cases above. Thus in (301) we are not dealing with SVCs.

(301) a. Skibet lå for anker.
Ship_the lay at anchor

b. Han sad til doms over them
He sat to judgement+GEN over them
'He sat in judgement over them'

c. De sad til bords med familien Jensen.
They sat to table+GEN with family_the Jensen
'They were the Jensens's dinner partners'

4.2 Inchoative

Support verb constructions denoting transitions are invariably achievements, that is, the support verb has an underspecified subevent$_1$. In most cases the support verb is itself an achievement verb, e.g. *fik*, 'got', *bragte*, 'brought', *kom*, 'came'. In other cases the SV is a verb of motion that loses its specific relation when used as SV, e.g. *gå i stå*, litt: 'go to stand', 'stop', [3].

In both sentences in (302) *kom* is underspecified for subevent$_1$, the process leading to the result state.

(302) a. Hunden kom ud i haven.
Dog_the came out into garden_the

b. Situationen kom under kontrol.
Situation_the came under control

In (302a) the dog may run, walk, be carried etc. and in (302b) the description covers any process that can be construed as the cause for the situation being under control. In both cases the result state is denoted by the PP, the co-predicate.

The lexical entry for *komme*, 'come' can be limited to information of morphology/phonology, the fact that it is a support verb, i.e. takes a co-predicate, and its content type, *inchoative*, with a *locative relation* as subevent$_2$. The locative relation may be literal as in (302a) or metaphorical as in (302b).

When combined with its co-predicate, *komme* like *være* raises the non-realized subject of the co-predicate *under (kontrol)* realizing it as subject. Subevent$_2$ is specified by the co-predicate.

Komme is the central member of a small class of SVs with locational subevent$_2$ and may be used in any context. Other verbs in this class (*gå*, 'go', *nå*, 'reach' etc.) all have restricted use compared to that of *komme*.

(303) show examples of another support verb with inchoative meaning, *blive*$_2$, 'become'.

(303) a. Himlen blev rød.
Sky_the became red

[3]Languages differ considerably in the extent to which they make use of derived verbs of motion in support verb constructions. Dutch, for instance, seems to do so a lot more than English or Danish (cf. examples in Hoekstra (1988))

b. Peter blev politibetjent.
Peter became policeman

c. Maden blev spist.
Food_the was eaten

The only difference between *komme* and *blive*$_2$ is that while the former has locative subevent$_2$-value, the latter has a non-locative subevent$_2$ resulting in a difference in what kind of co-predicate they combine with.

Blive$_2$ is the only inchoative support verb with a non-locational subevent$_2$.

4.3 Terminative

Terminative is the term often used for the semantic structure in sentences like (304).

(304) Situationen kom ud af kontrol.
Situation_the came out of control

The term is not normally used about non-metaphorical sentences like (305), though the semantic structure is identical.

(305) Manden kom ud af huset.
Man_the came out of house_the

In both cases the contribution of *komme* is exactly the same as in the inchoative (302): it denotes a situation in which some process leads to the coming about of a state denoted by the PP. In terminative structures this state is described in negative terms, thus in (304) the result state is *not under control* and in (305) it is *not in the house*. The situation is presupposed to have been under control, and the man is presupposed to have been in the house.

4.4 Causative

Two subtypes of causative support verb construction are exemplified in (306) and (307).

(306) Bo bragte situationen under kontrol.
Bo brought situation_the under control

(307) a. Bo fik Peter til at grine.
Bo got Peter to to laugh
b. Bo fik Peter til at gå hjem.
Bo got Peter to to walk home

What they have in common is that the first argument of the causative support verb is the ACTOR of some underspecified process or the process itself. The difference lies in the caused situation. In (306) the caused situation is a state. With lexical causatives (*dræbe* 'kill', *vælte* 'overturn' etc.) this semantic structure is the only possibility. In (307a) the caused situation is a process, in (307b) this embedded process is followed by a state.

In addition to being the actor of an underspecified process the first argument of the support verb may also be an argument of the co-predicate as exemplified in (308).

(308) Peter bragte situationen under kontrol.
Peter brought situation_the under kontrol

Situationen is the subject of *under (kontrol)* while *Peter* is the ACTOR of some process leading to the situation being under control but at the same time the one controlling the situation, the BEARER of the control-relation.

For all causative support verbs the lexically underspecified subevent_2-value of the support verb is specified by the co-predicate.

4.4.1 Support verbs with caused states

A central member of the class of support verbs with caused states is *gøre*, 'make', exemplified in (309) and (310).

(309) a. Anne gjorde ham rasende.
Anne made him furious
b. Solen gjorde himlen rød.
Sun_the made sky_the red

(310) a. Den megen træning gjorde ham til en stor fodboldspiller.
The much training made him to a great football player

b. Støjen gjorde hesten bange.
Noise_the made horse_the scared

In (309) the subject denotes the actor of the underspecified causing subevent$_1$, while in (310) the subject denotes the causing process itself. *Gjorde* combines with non-locative co-predicates only.

The verb *bringe*, 'bring', combines with locative co-predicates both metaphorical and non-metaphorical, as exemplified in (311).

(311) Ole bragte bordet ud i haven.
Ole brought table_the out in garden_the

Bo bragte situationen under kontrol.
Bo brought situation_the under control

Verbs of Putting in a Spatial Configuration (Levin, 1993), *sætte, stille, lægge* etc., the causative counterpart of *Verbs of Spatial Configuration* used in durative support verb constructions, also combine with locative co-predicates. However, these verbs have uses without a co-predicate and must therefore in these uses be considered full verbs. (312) gives an example.

(312) a. Per stillede vasen ude i køkkekenet.
Per placed/stood vase_the outSTAT i kitchen_the

b. Per stillede vasen.
Per placed/stood vase_the

Here *stille* is a lexical causative with the meaning 'place in an upright position,' and *ude i køkkenet* is a stative adverbial, not a co-predicate. Consequently, the combination of this type of verb and a locative co-predicate as in (313) must be a resultative, cf. chapter 5.

(313) Per stillede vasen ud i køkkenet.
Per put vase_the outDIR in kitchen_the

In other cases this type of verb behaves like a support verb. An example is given in (314).

(314) a. Man stillede sagen i bero.
They stood matter_the in abeyance

b. * Man stillede sagen.
They stood matter_the

(315) Han satte den nye medarbejder ind i forretningsgangen.
He sat the new employee into procedure_the

In some contexts these verbs are interchangeable, in others they are idiomatically determined.

A particularly interesting causative support verb is *få*, 'get, have'. It may be used with locative co-predicates as in (316), and with non-locative co-predicates, either adjectives (317b) or past participles (317c):

(316) a. Jørgen fik hesten ind i stalden.
Jørgen got horse_the in in stable_the

b. Ole fik hænderne op af lommen.
Ole got hands_the up of pocket_the

c. Pia fik situationen under kontrol.
Pia got situation_the under control

(317) a. Lone fik sovet.
Lone got slept

b. Lise fik bilen klar.
Lise got car_the ready

c. Søren fik bilen repareret.
Søren got car_the repaired

While in (316b) and (316c) the subject of *få* is the one directly causing the situation denoted by the co-predicate, this need not be the case for (316a) and (317). Thus (317c) may mean that Søren (eventually) repaired the car, or it may mean that Søren made someone else repair it.

As shown in (318) the subject of *få* may also not be an actor in any sense but merely a kind of 'receiver' of some (unwanted) event.

(318) Viggo fik en rude smadret (af en tagsten).
Viggo had a window smashed (by a tile)

4.4.2 Support verbs with caused processes

Danish only has two verbs that combine with co-predicates denoting processes, *få*, 'get, have', and the permissive *lade* 'let'.

Få combines with a PP either headed by *til*, (319), or *fra*, (320).

(319) Moren fik børnene til at gå ud.
Mother_the got children_the to to go out

(320) Moren fik børnene fra at gå ud.
Mother_the got children_the from to go out

In the situation denoted by (319) the mother does something that makes the children walk out, while in (320) the mother does something which makes the children abstain from walking out. On the face of it, it may seem that abstaining from something cannot be a process, but it has been argued that it can be construed on a par with normal processes:

(321) ... DO does not necessarily connote action in the usual sense, because of examples like *John is being quiet, John is ignoring Mary, What John did was not eat anything for 3 days* (Cruse, 1973) which seem to entail merely deliberate avoidance of action of a certain kind (Dowty, 1979, p. 117)

With regard to (320) this means that the children intended to go out and would have done so, had it not been for the mother intervening. I suggest that we must acknowledge the existence of an *abstain-relation* as a subtype of process relation.

Permissives The abstain-relation is also relevant for *permissives* as (322).

(322) Moren lod børnene gå ud.
Mother_the let children_the go out

Here the mother does not actively do anything. Instead she deliberately abstains from doing something that might have prevented the children from going out, see also Jackendoff (1990, pp. 134-135).

Continuatives Support verb constructions like the one in (323) is called *continuatives*.

(323) Peter holdt situationen under kontrol.
Peter kept situation_the under control

Jackendoff (1983, p. 172) gives the representation in (324).

(324) $[_{Event}$ STAY $([_{Thing}\ X],[_{Place}\ Y])]$

He does not explain why STAY is an event-function while BE is a state-function:

(325) $[_{State}$ BE $([_{Thing}\ X],[_{Place}\ Y])]$

except for the comment 'STAY is likely composite, perhaps some sort of durational form of BE.' Jackendoff (1990, pp. 43-44).

Verspoor (1997, p. 37) suggests that 'the sentence *Bill stayed in the kitchen* can simply be represented by a subsort of *loc-rel* which adds the entailment of stasis.'

Krenn and Erbach (1994, p. 373) say that continuatives denote 'the uninterrupted continuation of a process' (or state, TB).

If this was true, continuatives would present a problem to the set-up I propose. In the event structure advocated in this thesis, there is no such thing as a complex situation consisting of two identical subevents, nor is it possible for subevent_1 in a complex situation to be a state.

Instead I suggest another approach to theses structures. Consider the sentence in (326).

(326) Peter havde situationen under kontrol.
Peter had situation_the under control

(326) has a durative structure. It denotes a state that, if uninterrupted, may last indefinitely. The difference between (326) and (323) can therefore not be just a question of duration. (327) shows two possible paraphrases of (323).

(327) a. Peter forhindrede at situationen kom ud af kontrol.
Peter prevented that situation_the came out of control

b. Peter lod ikke situationen komme ud af kontrol.
Peter let not situation_the come out of control

If these are reasonable paraphrases, it should be clear that (323) denotes a complex situation in which the referent of the subject is not just the one controlling the situation, but is actually doing something to prevent the state from changing. I suggest that (323) as well as the sentences in (327) can be paraphrased: *Peter did something (subevent$_1$) as a result of which it was not the case that the situation was out of (=not under) control (subevent$_2$).* This may seem overly complicated, but it is needed in order to retain the generalization that in *complex situations* subevent$_1$ is always a *process relation*, and I see some corroboration in the fact that (327b) which both contain overt negations and negative resultant states, are near synonyms of (323).

In fact, as may be seen from the paraphrase in (328b) of the *continuative* in (328a), *continuatives* can be viewed as the combination of a negative *permissive* and a *terminative*.

(328) a. Hegnet holdt hestene inde.
Fence_the kept horses_the inside

b. Hegnet lod ikke hestene løbe ud.
Fence_the let not horses_the run out

(329) gives an overview of the system of Danish support verbs arranged by the expressed event structure and the relation expressed by the co-predicate.

(329)

	Durative	Inchoative (+Term)	Causative		
			state	process	continuative
Locative	*være* *ligge, stå*	*komme*	*bringe, få* *sætte, stille*	*få*	*holde*
Non Locative	*være* *have*	*blive*	*få* *gøre*	*lade*	

4.5 Formalization

Support verbs are characterized by their need to combine with another predicative element. This is represented by the feature CO-PRED taking as value a list of maximally one *synsem* object. Support verbs have a non-empty CO-PRED list, while full verbs have an empty CO-PRED list.

The combination of a support verb with its co-predicate is termed a *svc-pred* constrained as shown in (330).

(330)

$$\textit{svc-pred} \longrightarrow \left[\begin{array}{l} \text{PHON } \langle \boxed{1} \mid \boxed{2} \rangle \\ \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{l} \text{CO-PRED } \langle\rangle \\ \text{SYN-ARGS } \boxed{3} \end{array}\right] \\ \text{CONT } \boxed{4} \end{array}\right] \\ \text{H-DTR} \left[\begin{array}{l} \text{PHON } \langle \boxed{1} \rangle \\ \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{l} \text{CO-PRED } \langle \boxed{5} \rangle \\ \text{SYN-ARGS } \boxed{3} \end{array}\right] \\ \text{CONT } \boxed{4} \end{array}\right] \end{array}\right] \\ \text{CO-PRED-DTR} \left[\begin{array}{l} \text{PHON } \boxed{2} \\ \text{SS } \boxed{5} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED } \langle\rangle \end{array}\right] \end{array}\right]$$

Some of this information is inherited from *complex-pred*, *verbal-pred* and *two-pred*, see page 55. Specific to *svc-pred* is that head-daughter has an element on its CO-PRED list corresponding to the SYNSEM-value of the co-pred-daughter, that the SYN-ARGS list of the mother is identical to the SYN-ARGS list of the head-daughter and that the CONT-value of the mother is structure-shared with the CONT-value of the head-daughter.

4.5.1 Stative constructions

Danish has three support verbs with stative meaning *have*, 'have', *være*, 'be', and *blive*, 'be(come)'. They have a durative event structure with a CONT-value of type *simple-psoa*. The E1-value is lexically underspecified and structure-shared with the CONT-value of the co-predicate.

As argued above the difference between *have* and *være* is that the former takes a co-predicate with an empty SUBJ list and raises a possible element from the SYN-ARGS list to its own SYN-ARGS list. The lexical entry for *have* is shown in (331).

(331)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{ha}, \_ \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{ll} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle \left[\text{LOC} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{l} \text{SUBJ} \langle\rangle \\ \text{SYN-ARGS} \langle \boxed{1} \rangle \end{array} \right] \\ \text{CONT} \boxed{2} \end{array} \right] \right] \right\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{array} \right] \\ \text{CONT} \left[\begin{array}{l} \textit{simple-psoa} \\ \text{E1} \ \boxed{2} \end{array} \right] \end{array} \right] \end{bmatrix}$$

Have takes a co-predicate with an empty SUBJ list and one element on the SYN-ARGS list which is raised to the SYN-ARGS list of *have*.

Være, on the other hand, takes a co-predicate with an element on the SUBJ list which is raised to be the first element on the SYN-ARGS list of *være*.

The lexical entry for *være* is shown in (332).

(332)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{vær}, \_ \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{ll} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle \left[\text{LOC} \left[\begin{array}{l} \text{CAT} \mid \text{SUBJ} \langle \boxed{1} \rangle \\ \text{CONT} \boxed{2} \end{array} \right] \right] \right\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{array} \right] \\ \text{CONT} \left[\begin{array}{l} \textit{simple-psoa} \\ \text{E1} \ \boxed{2} \end{array} \right] \end{array} \right] \end{bmatrix}$$

Være takes a co-predicate with an element on the SUBJ list which is raised to the SYN-ARGS list of *være*.

The lexical entry for $\textit{blive}_1$ taking a participle as co-predicate is shown in (333).

(333)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{blive}_1, \_ \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{ll} \text{CO-PRED} & \left\langle \left[\text{LOC} \left[\begin{array}{l} \text{CAT} \mid \text{SYN-ARGS} \left\langle [\ ] \mid \boxed{1} \right\rangle \\ \text{CONT} \mid \text{PRESIT} \ \boxed{2} \end{array} \right] \right] \right\rangle \\ \text{SYN-ARGS} & \boxed{1} \end{array} \right] \\ \text{CONT} \ \boxed{2} \end{array} \right] \end{bmatrix}$$

It says that *blive*$_1$ raises the SYN-ARGS list of the co-predicate minus the first element. This means that either the co-predicate is transitive, and the second argument is realized as subject, or the co-predicate is intransitive giving an empty SYN-ARGS list of *blive*$_1$ in which case *der* is inserted as dummy subject. The feature PRESIT is explained below.

To rule out among other things inchoative participles as co-predicate for *blive* I introduce the general constraint on syntactically complex predicates, *complex-pred*, shown in (334).

(334) $$\textit{complex-pred} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{SYN-ARGS} \langle \boxed{1} \rangle \vee \left\langle [\ ], \boxed{1} \right\rangle \\ \text{CO-PRED-DTR} \mid \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{SUBJ} \langle \boxed{1} \rangle \vee \langle\rangle \end{bmatrix}$$

It says that the co-predicate must either have an empty SUBJ list, or else the element on the SUBJ list must be raised to be the last element on the SYN-ARGS list of the *complex-pred*. An inchoative participle like *forsvundet*, 'disappeared', which has the valence shown in (335) (as described in the following section) can therefore not be the co-predicate of *blive* because the element on the SUBJ list is the first element on the SYN-ARGS list and therefore not raised to the SYN-ARGS list of *blive*.

(335) *forsvundet*
$$\begin{bmatrix} \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix}$$

4.5.1.1 Auxiliaries and Past Participles

It is possible to express the relationship between active verbs and past participles in a lexical rule. One problem in doing so is that because the semantics of active verbs and past participles differ – the former having a CONT-value of type *psoa* and the latter a CONT-value of type *relation* – it would be necessary to double all constraints on verbal complex predicates and on achievement verbs.

I therefore avoid the use of lexical rules and instead employ underspecification. I introduce a new feature, CORE-SEM, taking *cont* as value which must be structure shared with various parts of the semantics of a verb depending on type (*vform*). Active verbs have the CONT-value structure shared with their CORE-SEM value, while past participles structure share their PRESIT value (see below) with their CORE-SEM value.

Constraints on properties that are common to all verbs are expressed in terms of CORE-SEM instead of CONT. An example of this is the constraint in (142) on page 53 which is changed to (336) so as to apply to participles also.

(336) $$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{CO-PRED} \langle\rangle \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{SYN-ARGS} \boxed{1} \\ \text{CORE-SEM} \mid \text{SEM-ARGS} \boxed{1} \end{bmatrix} \end{bmatrix}$$

Lexical entries are thus underspecified for morphological ending, VFORM- and CONT-value. (337) shows the lexical entry for *løbe*,'run'.

(337) $$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{løb, -string} \rangle \right\rangle \\ \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \mid \text{HEAD } \textit{verb} \\ \text{CORE-SEM} \begin{bmatrix} \textit{simple-psoa} \\ \text{E1 } \textit{run-rel} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Various constraints may apply to this entry specifying the underspecified values. The constraint shown in (154) on page 58 specifies the VFORM value and the morphological ending, and the constraint in (338) ensures that verbs which are not participles structure share their CORE-SEM value with their CONT value.

(338) $$\left[\text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \mid \text{HEAD} \mid \text{VFORM } \textit{finite} \vee \textit{infinitive}\right] \longrightarrow$$

$$\begin{bmatrix} \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CORE-SEM} \boxed{1} \\ \text{CONT} \boxed{1} \end{bmatrix} \end{bmatrix}$$

Past participles are specified by the constraint in (339).

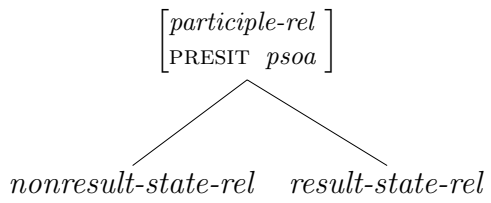
(339) $$\left[\text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \mid \text{HEAD} \mid \text{VFORM } \textit{pastp}\right] \longrightarrow$$

$$\begin{bmatrix} \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CORE-SEM} \boxed{1} \\ \text{CONT} \begin{bmatrix} \textit{participle-rel} \\ \text{PRESIT} \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(339) says that past participles have a CONT-value of type *participle-rel* and that their CORE-SEM value is structure shared with their CONT|PRESIT-value.

To model the two types of past participle *participle-rel* is split into a *nonresult-state-rel* and a *result-state-rel*.

(340)



(341) shows a constraint on *non-result* participles.

(341)

$$\begin{bmatrix} \textit{predicate} \\ \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM } \textit{pastpart} \\ \text{CO-PRED } \langle\rangle \end{bmatrix} \\ \text{CONT } \textit{nonresult-state-rel} \end{bmatrix} \end{bmatrix}$$

$$\longrightarrow$$

$$\begin{bmatrix} \text{SYNSEM} \mid \text{LOCAL} \mid \text{CAT} \begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \boxed{1} \\ \text{SYN-ARGS} & \left\langle [\ ] \mid \boxed{1} \right\rangle \end{bmatrix} \end{bmatrix}$$

It says that a past participle predicate with an empty CO-PRED list and a *nonresult-state-rel* has an empty SUBJ list and a COMPS list which contains all elements from the SYN-ARGS list except for the first.

Participle predicates with an empty CO-PRED list and a *simple-psoa* as CORE-SEM-value can only be non-result participles as stated in (342).

(342)

$$\begin{bmatrix} \textit{predicate} \\ \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM } \textit{pastpart} \\ \text{CO-PRED } \langle\rangle \end{bmatrix} \\ \text{CORE-SEM } \textit{simple-psoa} \end{bmatrix} \end{bmatrix}$$

$$\longrightarrow$$

$$\left[\text{SYNSEM} \mid \text{LOCAL} \mid \text{CONT } \textit{nonresult-state-rel}\right]$$

(343) shows a constraint on participle predicates with an empty CO-PRED list and a *complex-psoa* as CORE-SEM-value.

(343)
$$\left[\begin{array}{l}\textit{predicate}\\ \textsc{synsem} \mid \textsc{local}\left[\begin{array}{l}\textsc{cat}\left[\begin{array}{l}\textsc{head} \mid \textsc{vform}\ \textit{pastpart}\\ \textsc{co-pred}\ \langle\rangle\end{array}\right]\\ \textsc{core-sem}\ \textit{complex-psoa}\end{array}\right]\end{array}\right]$$
$$\longrightarrow$$
$$\left[\textsc{synsem} \mid \textsc{local}\left[\begin{array}{l}\textsc{cat} \mid \textsc{syn-args}\left\langle[\ ],[\ ]\right\rangle\\ \textsc{cont}\ \textit{nonresult-state-rel}\end{array}\right]\right]$$
$$\vee$$
$$\left[\textsc{synsem} \mid \textsc{local}\left[\begin{array}{l}\textsc{cat}\left[\begin{array}{ll}\textsc{subj} & \langle\boxed{1}\rangle\\ \textsc{comps} & \langle\rangle\\ \textsc{syn-args} & \langle\boxed{1}\rangle \vee \left\langle[\ ],\boxed{1}\right\rangle\end{array}\right]\\ \textsc{cont}\ \textit{result-state-rel}\end{array}\right]\right]$$

The first disjunct says that a nonresult participle of this kind must have two elements on its SYN-ARGS list. This rules out inchoatives like *forsvundet*, 'disappeared', as well as complex predicates like *gået ud i haven*, 'walked out in the garden', both of which have only one element on the SYN-ARGS list. Nonresult participles may combine with *have* and *blive*, but not with *være*. (344) show some examples.

(344)
$$\begin{array}{ll}\textit{sovet} & \textit{spist}\\ \left[\begin{array}{ll}\textsc{subj} & \langle\rangle\\ \textsc{comps} & \langle\rangle\\ \textsc{syn-args} & \langle\boxed{1}\rangle\end{array}\right] & \left[\begin{array}{ll}\textsc{subj} & \langle\rangle\\ \textsc{comps} & \langle\boxed{2}\rangle\\ \textsc{syn-args} & \langle\boxed{1},\boxed{2}\rangle\end{array}\right]\end{array}$$

Sovet meets the requirements *have* place on the valence of its co-predicate, while *spist* will have to first combine with a complement[4].

The second disjunct in (343) says that a result participle has an empty COMPS list and an element on the SUBJ list corresponding to the only element on the SYN-ARGS list or the second of two on this list. This means that all predicates with a *complex-psoa* as CORE-SEM-value may form result participles. This kind of participle may combine with *være*, transitive participles of this kind may combine with *blive*, but none of them with *have*. (345) show some examples.

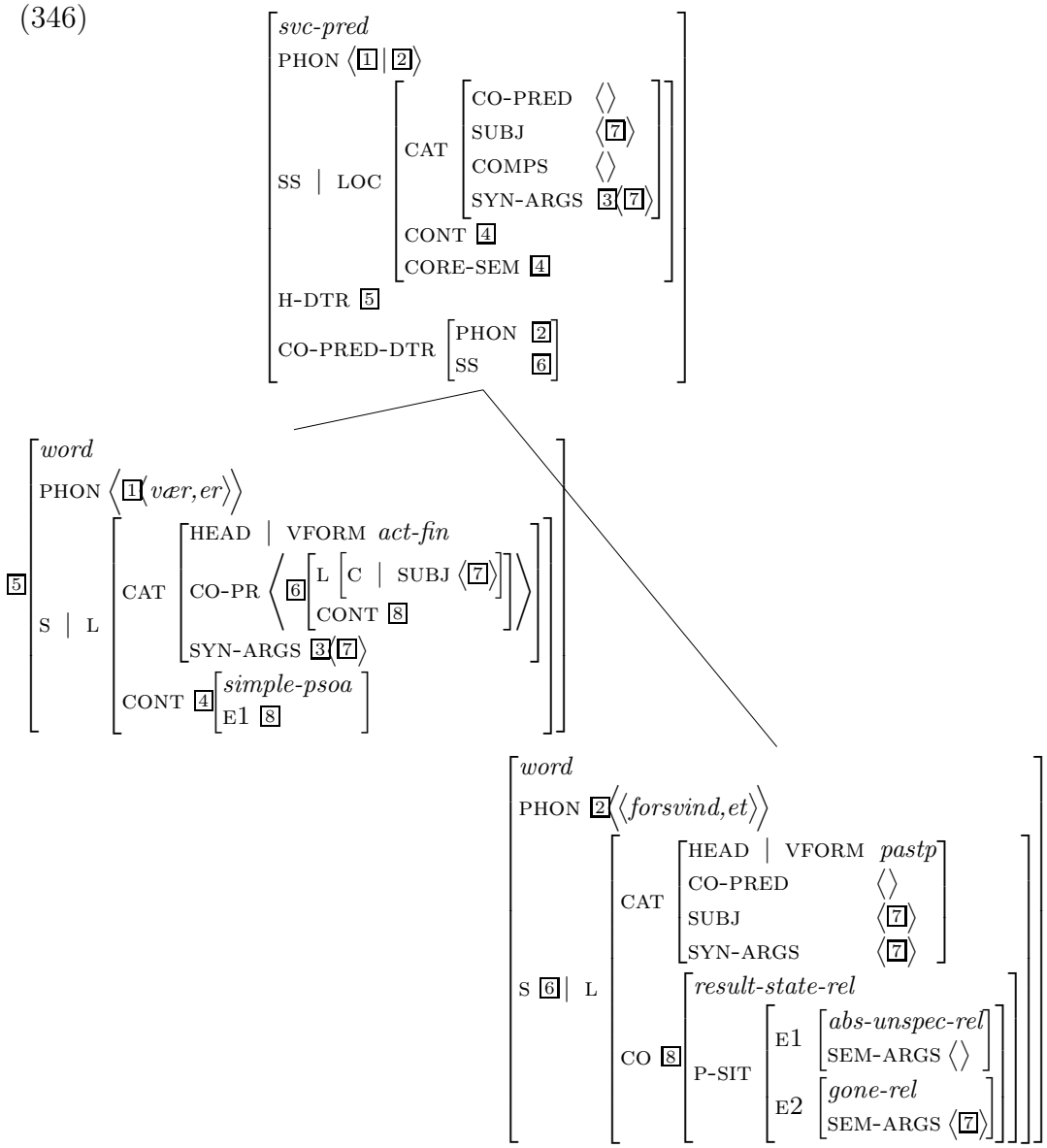
[4]Of course, the version of *spist* which does not take an object may combine with *have* directly. However, I will not formalize unspecified object deletion here.

(345)

forsvundet	*gået ud i haven*	*spist*
SUBJ ⟨1⟩	SUBJ ⟨1⟩	SUBJ ⟨2⟩
COMPS ⟨⟩	COMPS ⟨⟩	COMPS ⟨⟩
SYN-ARGS ⟨1⟩	SYN-ARGS ⟨1⟩	SYN-ARGS ⟨1,2⟩

(346) shows the complex predicate *er forsvundet*, 'is disappeared'.

(346)



The *svc-pred* in (346) has as its head-daughter the word *er*, 'is', with a non-empty CO-PRED list. The co-predicate has an element on its SUBJ list, which

is raised to the SYN-ARGS list of *er* and this list is structure-shared with the SYN-ARGS list of the *svc-pred*. The CONTENT-value of *er*, structure-shared with the CONTENT value of the *svc-pred*, is of type *simple-psoa* and the E1-value is structure-shared with the CONTENT value of the co-predicate, in this case *result-state-rel*.

The composition of the past participle version *været forsvundet*, 'been disappeared', is identical to that in (346). (347) shows part of the mother node.

(347)
$$\left[\begin{array}{l} \textit{svc-pred} \\ \text{PHON} \left\langle \langle \textit{vær}, \textit{et} \rangle, \langle \textit{forsvund}, \textit{et} \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{ll} \text{HEAD} \mid \text{VFORM} & \textit{pastp} \\ \text{CO-PRED} & \langle\rangle \\ \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \left\langle [\ ] \right\rangle \end{array}\right] \\ \text{CONT} \left[\begin{array}{l} \textit{nonresult-state-rel} \\ \text{PRESIT } \boxed{1} \end{array}\right] \\ \text{CORE-SEM } \boxed{1} \left[\begin{array}{l} \textit{simple-psoa} \\ \text{E1 } \textit{result-state-rel} \end{array}\right] \end{array}\right] \end{array}\right]$$

The CORE-SEM-value is structure shared with the PRESIT-value, and because this is a *simple-psoa* the CONT-value must be *nonresult-state-rel* and the SUBJ list empty. This means that the *svc-pred* in (347) may be the co-predicate of *have*, 'have', *har været forsvundet*, but not of *være*, 'be', **er været forsvundet*.

4.5.1.2 Prepositional co-predicates

In this section I treat co-predicates consisting of a preposition in combination with a predicative noun as in (348).

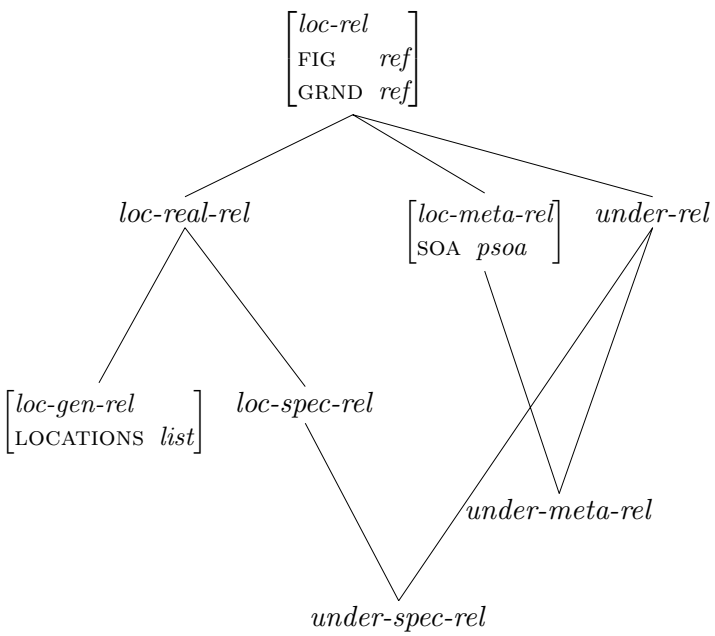
(348) a. Bo havde situationen **under kontrol**.
Bo had situation_the under control

b. Festen var **i gang**.
Party_the was in going
'The party had started'

These prepositions are metaphorically locative, and I therefore let *loc-rel* split into the subtypes *loc-real-rel* subsuming non-metaphorical locative relations

and *loc-meta-rel* subsuming metaphorical locative relations. Part of this hierarchy is shown in (349).

(349)



As exemplified with *under-rel* the specific locative relations expressed by prepositions come in two subsorts, a metaphorical and a non-metaphorical one.

I thus assume a relationship between the metaphorical and non-metaphorical use of a preposition, but the exploration of the nature of this relationship is outside the scope of this thesis.

(350) shows the lexical entry for the metaphorical preposition *under*.

(350)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon} \left\langle \left\langle \textit{under} \right\rangle \right\rangle \\ \textsc{ss} \mid \textsc{loc} \begin{bmatrix} \textsc{cat} \mid \textsc{head} \ \textit{prep-lex} \\ \textsc{cont} \ \textit{under-meta-rel} \end{bmatrix} \end{bmatrix}$$

(351) shows the constraint on this type of preposition.

(351)

$$\begin{bmatrix} \textit{word} \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cont} \ \textit{loc-meta-rel} \end{bmatrix} \longrightarrow$$

$$\left[\text{SS}\,|\,\text{LOC}\left[\begin{array}{l}\text{CAT}\,|\,\text{SYN-A}\ \boxed{1}\oplus\left(\left\langle\left[\text{L}\,|\,\text{S}\,|\,\text{C}\,|\,\text{S-A}\ \boxed{1}\oplus\langle\boxed{2}\rangle\right],\boxed{2}\right\rangle\vee\left\langle\boxed{2},\left[\text{L}\,|\,\text{S}\,|\,\text{C}\,|\,\text{S-A}\ \boxed{1}\oplus\langle\boxed{2}\rangle\right]\right\rangle\right)\\ \text{CONT}\ \mid\ \text{SOA}\ \boxed{3}\end{array}\right]\right]$$

The SOA-feature takes the *psoa* on the RESTRICTION list of the predicative noun as value. For lack of space, this is not indicated in (351). The SYN-ARGS list holds the predicative noun plus the element(s) from the SYN-ARGS list of the predicative noun. The last raised element is either the last or the second-last element on the list. This means that if the predicative noun has a unary relation the SYN-ARGS list of the metaphorical preposition will have two elements ($\boxed{1}$ is the empty list), and if the predicative noun has a binary relation it will have three elements, the first of which will be the first argument from the co-predicate. In both cases the two last elements are the co-predicate itself and the last argument of the co-predicate in any order. According to the constraint in (124) on page 46 the last element has the role *ground* and the second-last element the role *figure*.

The representation of the predicative noun *kontrol*, 'control' in (165) is repeated here as (352).

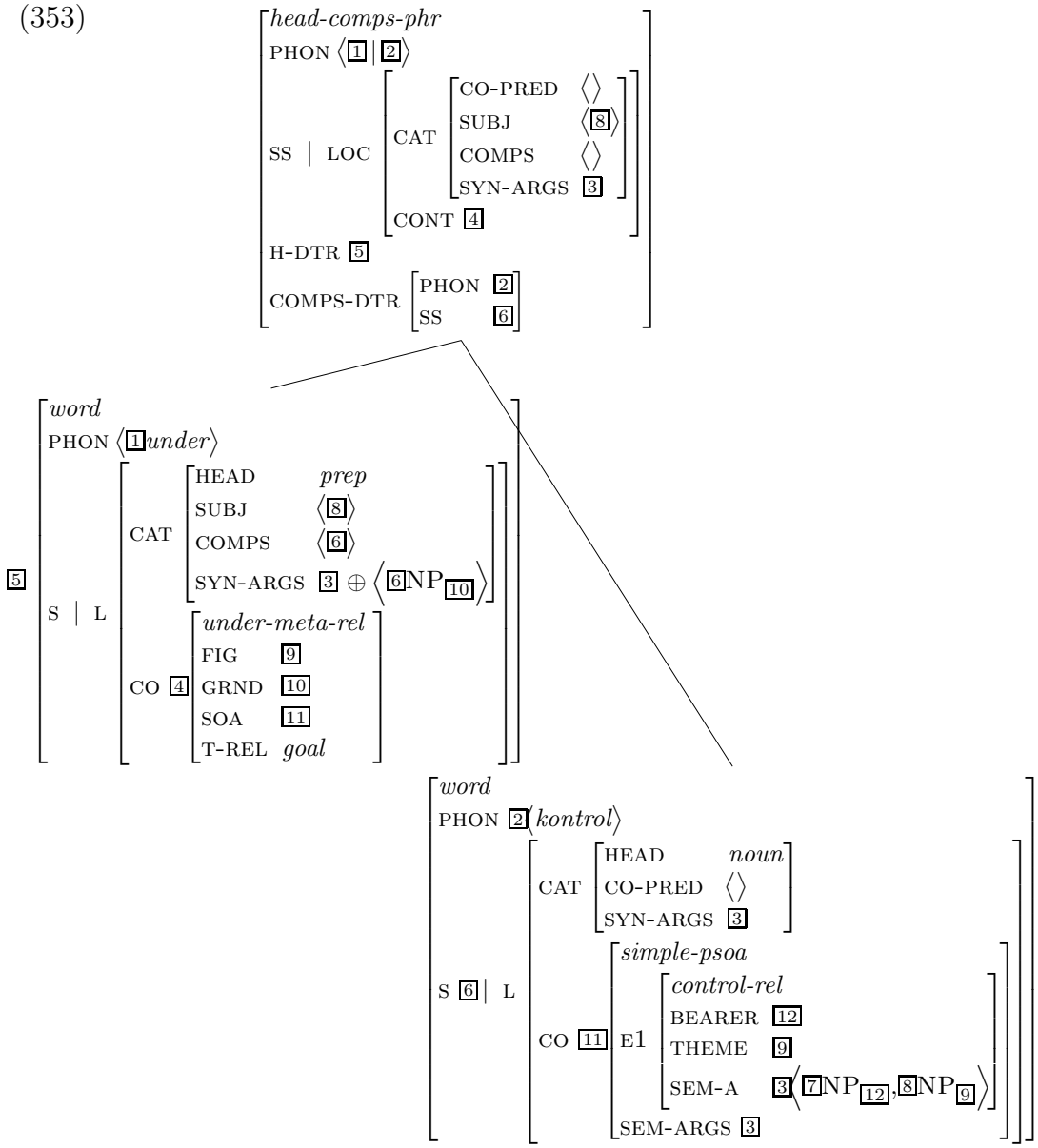
(352)
$$\left[\begin{array}{ll}\textit{word}&\\ \text{PHON}&\langle\textit{kontrol}\rangle\\ \text{SS}\ \mid\ \text{LOC}&\left[\begin{array}{ll}\text{CAT}&\left[\begin{array}{ll}\text{HEAD}&\textit{noun}\\ \text{SUBJ}&\langle\rangle\\ \text{COMPS}&\langle\rangle\\ \text{SYN-ARGS}&\boxed{3}\end{array}\right]\\ \text{CONT}&\left[\begin{array}{ll}\textit{nom-obj}&\\ \text{RESTRICT}&\left\{\left[\begin{array}{ll}\textit{simple-psoa}&\\ \text{E1}&\left[\begin{array}{ll}\textit{control-rel}&\\ \text{SEM-ARGS}&\boxed{3}\left\langle\text{NP}_{\boxed{1}},\text{NP}_{\boxed{2}}\right\rangle\\ \text{BEARER}&\boxed{1}\\ \text{THEME}&\boxed{2}\end{array}\right]\\ \text{SEM-ARGS}&\boxed{3}\end{array}\right]\right\}\\ \text{SEM-ARGS}&\boxed{3}\end{array}\right]\end{array}\right]\end{array}\right]$$

It shows that *kontrol* is a noun with a *simple-psoa* on its restriction-list, that is, it denotes a simple situation where a *control relation* obtains. *Control-rel* is a subtype of *state-rel* with two semantic roles, a *bearer* and a *theme*, so the SEM-ARG list contains two elements and hence so does the SYN-ARGS list. However, nouns are unable to realize arguments directly, and so the SUBJ-

and COMPS lists are empty. To realize its arguments, a predicative noun must combine with predicative words like verbs and prepositions.

(353) shows *under kontrol*, a *head-comps-phr* .

(353)



(353) shows that the metaphorical preposition *under* may take the predicative noun *kontrol* as it complement raising the two arguments of *kontrol* to its SYN-ARGS list which has as its last element the noun *kontrol* itself. *kontrol* has the *ground*-role in the *under-meta-relation* and the *theme* of the *control-*

relation is also the *figure* of the *under-meta-relation*. The *psoa* expressed by the predicative noun is the value for the feature SOA in the CONTENT of the preposition.

The *head-comps-phr* in (353) may be the co-predicate of *være*, 'be', in which case the element on the SUBJ list, the *theme* of the *control-rel*, is raised, or it may the the head-daughter in a *head-subj-phr*, which then may be the co-predicate of *have*, 'have', raising the last element on the SYN-ARGS list, the *bearer* of the *control-rel*. According to the constraint in (351) the order of the two last arguments of metaphorical prepositions like *under* may be reversed so that *kontrol* is realized as subject instead of object but with identical syntactic and semantic structure apart from that.

4.5.2 Achievement support verbs

Verbs with a non-empty CO-PRED list (support verbs) and an E1-value of type *unspec-rel* (inchoatives and causatives) are subject to the constraint in (354).

(354)
$$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \langle [\,] \rangle \end{bmatrix} \\ \text{CONT} \mid \text{E1} \ \textit{unspec-rel} \end{bmatrix} \end{bmatrix} \longrightarrow$$
$$\begin{bmatrix} \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{CO-PRED} \left\langle \begin{bmatrix} \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{SUBJ} \langle \boxed{1} \rangle \\ \text{CONT} \ \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SYN-ARGS} \ \boxed{3} \oplus \langle \boxed{1} \rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{E1} \mid \text{SEM-ARGS} \ \boxed{3} \\ \text{E2} \ \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

It says that these verbs take a co-predicate with an element on its SUBJ list which is raised to be the last element on the SYN-ARGS list of the verb. It is preceded on this list by the elements from the E1 | SEM-ARGS list (the arguments of subevent$_1$). This list is empty in the case of inchoatives which have an *abs-unspec-rel* as E1-value, and contains one element, an actor, in the case of causatives which have an *unspec-act-rel*.

4.5.2.1 Inchoative support verbs

The lexical entry for *komme*, 'come', is given in (355)

(355)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \left\langle \textit{kom}, \_ \right\rangle \right\rangle \\ \\ \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle [\ ] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{E1} & \textit{abs-unspec-rel} \\ \text{E2} & \textit{loc-rel} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Note that the E2-value, which is structure-shared with the CONTENT-value of the co-predicate, is a *loc-rel* limiting the range of possible co-predicates with prepositional heads. *Loc-rel* is the supertype of both *real-loc-rel* and *meta-loc-rel* thus allowing both non-metaphorical co-predicates as in *kom ud i haven*, 'came out into the garden', and metaphorical co-predicates as in *kom under kontrol*, 'came under control'.

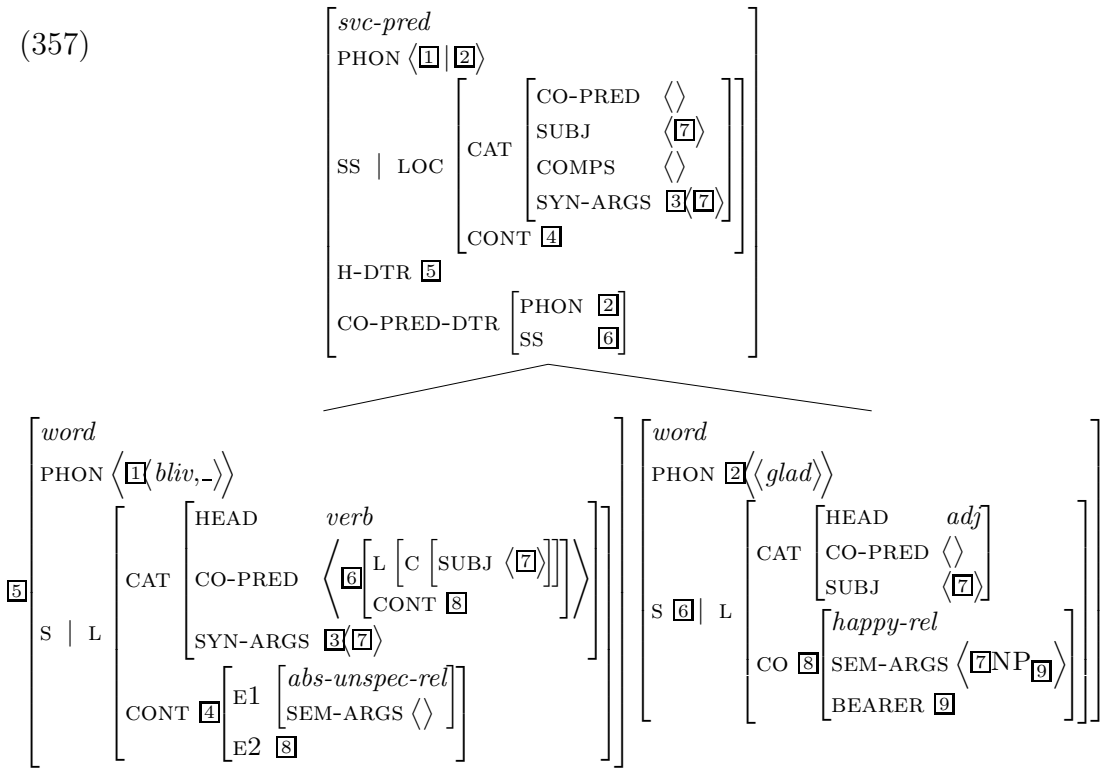
The lexical entry for *blive*$_2$, 'become', the other inchoative support verb, is shown in (356).

(356)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \left\langle \textit{bliv}_2, \_ \right\rangle \right\rangle \\ \\ \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle [\ ] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{E1} & \textit{abs-unspec-rel} \\ \text{E2} & \textit{non-loc-rel} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The difference between *komme* and *blive*$_2$ is that *blive*$_2$ has *non-loc-rel* as its E2-value.

(357) shows the compositon of the complex predicate *bliver glad*, 'become happy'.

(357)



Blive is an inchoative with an *abs-unspec-rel* with no arguments as E1-value. The E2-value is structure-shared with the CONTENT-value of the co-predicate and the subject of *glad*, the *bearer* of the *happy-rel* is the only syntactic argument of the complex predicate.

4.5.2.2 Causative support verbs

Two subtypes of causative support verb are exemplified in (358) and (359)

(358) Peter bragte stolene ud i haven.
Peter brought chairs_the out in garden_the

(359) a. Bo fik Peter til at grine.
Bo got Peter to to laugh
b. Bo fik Peter til at gå hjem.
Bo got Peter to to walk home

What they have in common is that the first argument of the causative support verb is the ACTOR of some underspecified process.

The difference lies in the caused situation. In (358) the caused situation is a state. This is the content type that lexical causatives (*vælte*, 'turn over', *vække*, 'wake up' tr. etc.) invariably have. (360) shows the representation of the semantics of (358).

(360)
$$\begin{bmatrix} \textit{complex-psoa} \\ \text{E1} & \begin{bmatrix} \textit{unspec-act-rel} \\ \text{ACTOR} \;\; \textit{ref(peter)} \end{bmatrix} \\ \text{E2} & \begin{bmatrix} \textit{in-rel} \\ \text{FIG} \;\; \textit{ref(chairs)} \\ \text{GRND} \;\; \textit{ref(garden)} \end{bmatrix} \\ \text{RESTR} \;\; \textit{goal} \end{bmatrix}$$

In (359) the caused situation is a process, possibly plus a state caused by this lower process as in (359b). (361) shows the representation of (359b).

(361)
$$\begin{bmatrix} \textit{complex-psoa} \\ \text{E1} & \begin{bmatrix} \textit{unspec-act-rel} \\ \text{ACTOR} \;\; \textit{ref(bo)} \end{bmatrix} \\ \text{E2} & \begin{bmatrix} \textit{complex-psoa} \\ \text{E1} & \begin{bmatrix} \textit{walk-rel} \\ \text{ACT} \;\; \boxed{1}\textit{peter} \end{bmatrix} \\ \text{E2} & \begin{bmatrix} \textit{loc-rel} \\ \text{FIG} \;\; \boxed{1} \\ \text{GRND} \;\; \textit{ref(home)} \\ \text{T-REL} \;\; \textit{goal} \end{bmatrix} \\ \text{T-REL} \;\; \textit{goal} \end{bmatrix} \end{bmatrix}$$

4.5.2.2.1 Causatives with caused state One support verb of this type is *gøre* exemplified in (362).

(362) a. Peter gjorde arbejdet færdigt.
Peter made work_the finish
'Peter finished the job.'

b. Solen gjorde himlen rød.
Sun_the made sky_the red

c. Den megen træning gjorde ham til en stor fodboldspiller.
The much training made him to a great football player

The subject denotes the actor, which may or may not be volitionally involved in the E1-process, as demonstrated in (362a) and (362b), respectively, or the

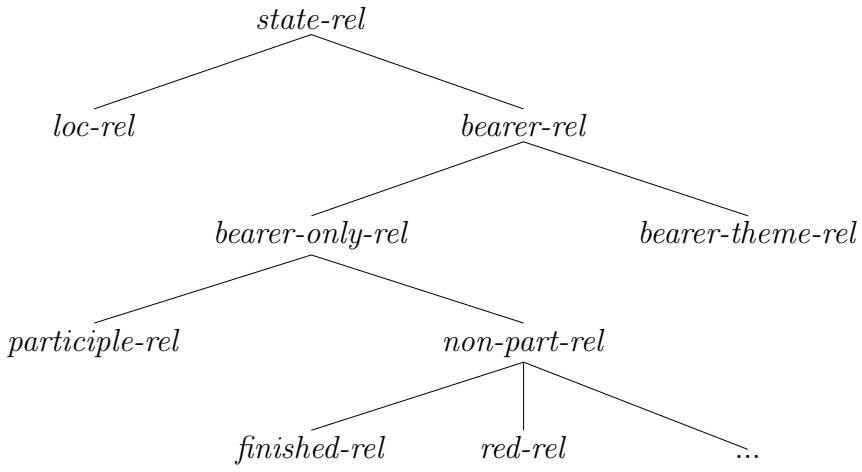
subject may denote the process itself, (362c). The latter option will not be formalized here.

The lexical entry for *gøre*, 'do', 'make', is shown in (363).

(363)
$$\left[\begin{array}{l} \textit{word} \\ \textsc{phon} \left\langle \left\langle \textit{gør}, \_ \right\rangle \right\rangle \\ \textsc{synsem} \mid \textsc{local} \left[\begin{array}{l} \textsc{cat} \left[\begin{array}{ll} \textsc{head} & \textit{verb} \\ \textsc{co-pred} & \left\langle [\ ] \right\rangle \end{array}\right] \\ \textsc{cont} \left[\begin{array}{ll} & \textit{complex-psoa} \\ \textsc{e1} & \textit{unspec-act-rel} \\ \textsc{e2} & \textit{non-part-rel} \end{array}\right] \end{array}\right] \end{array}\right]$$

Gøre is specified as having an E2-value of type *non-part-rel* restricting the CONT-value of the co-predicate to be of this type. (364) shows the relevant part of the type hierarchy.

(364)



Another causative support verb, *bringe*, 'bring', is exemplified in (365).

(365) a. Ane bragte bordet ud i haven.
Ane brought table_the out in garden_the

b. Mikkel bragte situationen under kontrol.
Mikkel brought situation_the under control

As shown in (366) *bringe* has an E2-value of type *loc-rel* allowing to combine with locative as well as metaphorically locative co-predicates.

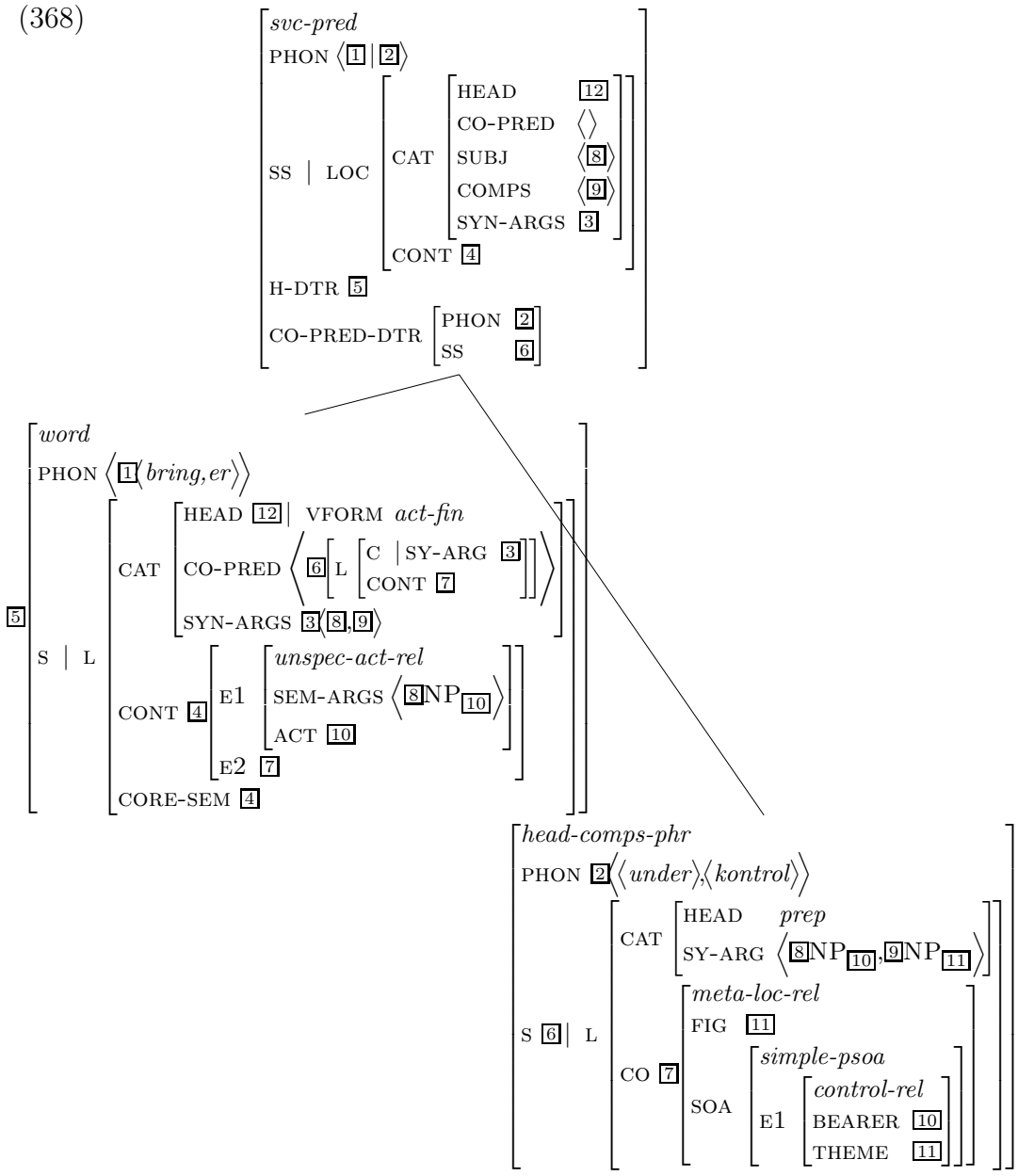
(366)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon} \left\langle \langle \textit{bring}, \_ \rangle \right\rangle \\ \textsc{synsem} \mid \textsc{local} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{head} \ \textit{verb} \\ \textsc{co-pred} \left\langle [\ ] \right\rangle \end{bmatrix} \\ \textsc{cont} \begin{bmatrix} \textit{complex-psoa} \\ \textsc{e}1 \ \ \textit{unspec-act-rel} \\ \textsc{e}2 \ \ \textit{loc-rel} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

In addition to the constraint in (354) saying that the element on the SUBJ list is also the last element on the SYN-ARGS list of the support verb, in those cases where the co-predicate has two elements on its SYN-ARGS list, we must raise the entire SYN-ARGS list of the co-predicate as stated in (367).

(367)
$$\begin{bmatrix} \textit{word} \\ \textsc{ss} \mid \textsc{loc} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{head} \quad \textit{verb} \\ \textsc{co-pred} \left\langle \left[\textsc{loc} \mid \textsc{cat} \mid \textsc{syn-args} \left\langle [\ ], [\ ] \right\rangle \right] \right\rangle \end{bmatrix} \\ \textsc{cont} \mid \textsc{e}1 \ \textit{unspec-act-rel} \end{bmatrix} \end{bmatrix} \longrightarrow$$
$$\left[\textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \begin{bmatrix} \textsc{co-pred} \left\langle \left[\textsc{loc} \mid \textsc{cat} \mid \textsc{syn-args} \ \boxed{1} \right] \right\rangle \\ \textsc{syn-args} \ \boxed{1} \end{bmatrix} \right]$$

Part of the representation of the complex predicate *bringe under kontrol*, 'bring under control', is shown in (368).

(368)



In (368) the co-predicate is a *head-comps-phr* consisting of the metaphorical preposition *under* and the predicative noun *kontrol* described in more detail in (353). The E1-value of *bringe* is an *unspec-act-rel* with one argument, an *actor*, the E2-value is the *meta-loc-rel* of the co-predicate. *Bringe* raises the two arguments of the co-predicate and identifies the first of these with its own argument. This entity thus has the role of actor in subevent$_1$ and bearer in subevent$_2$.

There are two corresponding past participle predicates. (369) shows part of the representation of the *nonresult* version.

(369)
$$\begin{bmatrix} \textit{svc-pred} \\ \text{PHON} \left\langle \langle \textit{bring,et} \rangle, \langle \textit{under} \rangle, \langle \textit{kontrol} \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM } \textit{pastp} \\ \text{CO-PRED } \langle\,\rangle \\ \text{SUBJ } \langle\,\rangle \\ \text{COMPS } \langle \boxed{9} \rangle \\ \text{SYN-ARGS } \boxed{3} \langle \boxed{8}, \boxed{9} \rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{nonresult-state-rel} \\ \text{PRESIT } \boxed{4} \begin{bmatrix} \text{E1} & \begin{bmatrix} \textit{unspec-act-rel} \\ \text{SEM-ARGS } \left\langle \boxed{8} \text{NP}_{\boxed{10}} \right\rangle \\ \text{ACT } \boxed{10} \end{bmatrix} \\ \text{E2} & \textit{meta-under-rel} \end{bmatrix} \end{bmatrix} \\ \text{CORE-SEM } \boxed{4} \end{bmatrix} \end{bmatrix}$$

This *svc-pred* may first combine with its object in a *head-comps-phr* which may then be the co-predicate of *have*.

(370) shows part of the representation of the *result* version.

(370)
$$\begin{bmatrix} \textit{svc-pred} \\ \text{PHON} \left\langle \langle \textit{bring,et} \rangle, \langle \textit{under} \rangle, \langle \textit{kontrol} \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM } \textit{pastp} \\ \text{CO-PRED } \langle\,\rangle \\ \text{SUBJ } \langle \boxed{9} \rangle \\ \text{COMPS } \langle\,\rangle \\ \text{SYN-ARGS } \boxed{3} \langle \boxed{8}, \boxed{9} \rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{result-state-rel} \\ \text{PRESIT } \boxed{4} \begin{bmatrix} \text{E1} & \begin{bmatrix} \textit{unspec-act-rel} \\ \text{SEM-ARGS } \left\langle \boxed{8} \text{NP}_{\boxed{10}} \right\rangle \\ \text{ACT } \boxed{10} \end{bmatrix} \\ \text{E2} & \textit{meta-under-rel} \end{bmatrix} \end{bmatrix} \\ \text{CORE-SEM } \boxed{4} \end{bmatrix} \end{bmatrix}$$

This *svc-pred* may be the co-predicate of *være*.

As discussed above Verbs of Putting in a Spatial Configuration come in a full verb version (371) and a support verb version (372).

(371) Ane satte bordet ud i haven.
Ane sat table_the out in garden_the

(372) a. Lønnen satte ham i stand til at købe nyt hus.
Pay_the sat him in ableness to to buy a new house
'The pay made it possible for him to buy a new house'

b. Han satte den nye medarbejder ind i forretningsgangen.
He sat the new colleague into procedure_the

In the latter case they have a lexical entry similar to that of *bringe*.

(373)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \left\langle \textit{sæt}, \_ \right\rangle \right\rangle \\ \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle [\ ] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{complex-psoa} \\ \text{E1} \quad \textit{unspec-act-rel} \\ \text{E2} \quad \textit{meta-loc-rel} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The only difference is that the E2-value is *meta-loc-rel*.

Få, 'get' may be used with a variety of co-predicates:

(374) a. Jørgen fik hesten ind i stalden.
Jørgen got horse_the into in stable_the

b. Pia fik situationen under kontrol.
Pia got situation_the under control

(375) a. Lise fik bilen klar.
Lise got car_the ready

b. Søren fik repareret bilen.
Søren got repaired car_the

c. Søren fik bilen repareret.
Søren got car_the repaired

(376) shows the lexical entry for *få*, 'get'.

(376)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{få}_1, \_ \rangle \right\rangle \\ \text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle [\ ] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{complex-psoa} \\ \text{E1} \quad \textit{unspec-act-rel} \\ \text{E2} \quad \textit{state-rel} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

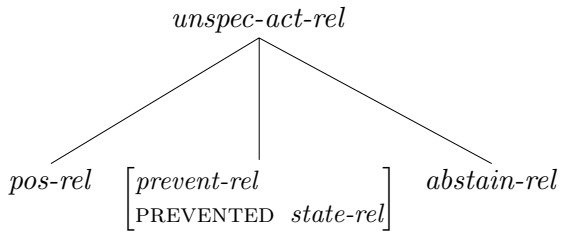
4.5.2.2.2 Continuative should be viewed as a kind of *causative* and not as a kind of *durative* I argued above.

Danish has one support verb, *holde*, 'keep', with this meaning, and I suggest the lexical entry in (377) for it.

(377)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \langle \textit{hold}, \_ \rangle \right\rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle [\ ] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{E1} & \begin{bmatrix} \textit{prevent-rel} \\ \text{PREVENTED} \ \neg\boxed{1} \end{bmatrix} \\ \text{E2} & \boxed{1} \\ \text{T-REL} & \textit{path} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Prevent-rel is a subsort of *unspec-act-rel* as shown in (378).

(378)



The intended interpretation of the CONTENT-value in (377) is that the first argument is an actor in a process preventing the negation of the state denoted by the co-predicate, the E2-value, from coming about.

4.5.2.2.3 Support verbs with caused process Two Danish support verbs have a caused process in their semantics, *få*$_2$, 'get', and *lade*, 'let'.

(379) shows examples with *få*.

(379) a. Moren fik børnene til at gå ud.
Mother_the got children_the to to go out
b. Moren fik børnene fra at gå ud.
Mother_the got children_the from to go out
c. Moren fik børnene til ikke at gå ud.
Mother_the got children_the to not go out

The lexical entry for $få_2$ is shown in (380).

(380)
$$\begin{bmatrix} word \\ \textsc{phon} \left\langle \left\langle få_2, \_ \right\rangle \right\rangle \\ \textsc{synsem} \mid \textsc{local} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{head} & verb \\ \textsc{co-pred} & \left\langle [\ ] \right\rangle \end{bmatrix} \\ \textsc{cont} \begin{bmatrix} complex\text{-}psoa \\ \textsc{e1} & unspec\text{-}act\text{-}rel \\ \textsc{e2} & psoa \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The E2-value is of type *psoa* which means that the co-predicate must have a CONTENT-value of type *psoa* with an E1-value and possibly an E2-value.

(381) gives an example with *lade*.

(381) Moren lod børnene gå ud.
Mother_the let children_the go out

The lexical entry for *lade* is shown in (382) differing from *få* only in that the E1-value in this case is *abstain-rel*.

(382)
$$\begin{bmatrix} word \\ \textsc{phon} \left\langle \left\langle lad, \_ \right\rangle \right\rangle \\ \textsc{synsem} \mid \textsc{local} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{head} & verb \\ \textsc{co-pred} & \left\langle [\ ] \right\rangle \end{bmatrix} \\ \textsc{cont} \begin{bmatrix} complex\text{-}psoa \\ \textsc{e1} & abstain\text{-}rel \\ \textsc{e2} & psoa \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The semantics of these structures was treated in more detail on page 51.

4.6 Summary

This chapter dealt with Danish support verbs, that is verbs that obligatorily combine with co-predicates including the auxiliaries *have*, *være* and *blive*.

I first gave an account of perfect and passive constructions with the auxiliaries *have, være* and *blive* suggesting that 'auxiliary selection' is a question of the auxiliaries selecting co-predicates with differing valence structure, and the valence structure of participles being the result of their semantics.

Have selects a co-predicate with an empty SUBJ list and a remaining element on the SYN-ARGS list which is raised to the SYN-ARGS list of *have*:

(383) *have*

$$\begin{bmatrix} \text{CO-PRED} & \left\langle \left[\text{LOC} \mid \text{CAT} \begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix} \right] \right\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix}$$

Være selects a co-predicate with an element on its SUBJ list which is raised:

(384) *være*

$$\begin{bmatrix} \text{CO-PRED} & \left\langle \left[\text{LOC} \mid \text{CAT} \mid \text{SUBJ} \langle \boxed{1} \rangle \right] \right\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix}$$

Blive raises the SYN-ARGS list of its co-predicate minus the first element:

(385) *blive*

$$\begin{bmatrix} \text{CO-PRED} & \left\langle \left[\text{LOC} \mid \text{CAT} \mid \text{SYN-ARGS} \left\langle [\ ] \mid \boxed{1} \right\rangle \right] \right\rangle \\ \text{SYN-ARGS} & \boxed{1} \end{bmatrix}$$

Participles come in two sorts, *non-result* participles which may combine with *have* and *blive* but not with *være*:

(386) *sovet*

$$\begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle \end{bmatrix}$$

spist

$$\begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle \boxed{2} \rangle \\ \text{SYN-ARGS} & \langle \boxed{1}, \boxed{2} \rangle \end{bmatrix}$$

and *result* participles which may combine with *være*, the transitive ones also with *blive*, but not with *have*:

(387) *forsvundet* *gået ud i haven* *spist*

$$\begin{bmatrix}\text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle\end{bmatrix} \quad \begin{bmatrix}\text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \langle \boxed{1} \rangle\end{bmatrix} \quad \begin{bmatrix}\text{SUBJ} & \langle \boxed{2} \rangle \\ \text{COMPS} & \langle\rangle \\ \text{SYN-ARGS} & \langle \boxed{1}, \boxed{2} \rangle\end{bmatrix}$$

It was shown that this description of *have* and *være* extends to their use with other co-predicates as in (388).

(388) a. Situationen var under kontrol.
Situation_the was under control

b. Bo havde situationen under kontrol.
Bo had situation_the under control

c. Bo havde kontrol over situationen.
Bo had control over situation_the

Co-predicates like those in (388) was described as metaphorical prepositions taking a predicative noun as either subject or complement raising its arguments. When the predicative noun has two arguments this means that the metaphorical preposition has three arguments, of which it can only realize two, a subject and a complement, leaving one argument to be realized as subject of *have* as in (388).

All other support verbs than the above mentioned three statives are inchoatives or causatives, subject to the constraint in (389).

(389)
$$\begin{bmatrix}\textit{word} \\ \text{SS} \mid \text{LOC} \begin{bmatrix}\text{CAT} \begin{bmatrix}\text{HEAD} & \textit{verb} \\ \text{CO-PRED} & \left\langle [\ ] \right\rangle\end{bmatrix} \\ \text{CONT} \mid \text{E1} \ \textit{unspec-rel}\end{bmatrix}\end{bmatrix} \longrightarrow$$

$$\begin{bmatrix} \\ \text{SS} \mid \text{LOC} \begin{bmatrix}\text{CAT} \begin{bmatrix}\text{CO-PRED} \left\langle \begin{bmatrix}\text{LOC} \begin{bmatrix}\text{CAT} \mid \text{SUBJ} \langle \boxed{1} \rangle \\ \text{CONT} \ \boxed{2}\end{bmatrix}\end{bmatrix} \right\rangle \\ \text{SYN-ARGS} \ \boxed{3} \oplus \langle \boxed{1} \rangle\end{bmatrix} \\ \text{CONT} \begin{bmatrix}\text{E1} \mid \text{SEM-ARGS} \ \boxed{3} \\ \text{E2} \ \boxed{2}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

It says that they have an *unspec-rel* (either an *abs-unspec-rel* in the case of inchoatives or an *unspec-act-rel* for causatives) as E1-value, and that the co-predicate supplies the E2-value. The SYN-ARGS list consists of the arguments from subevent$_1$ (zero in the case of inchoatives, one in the case of causatives) and one argument raised from the SUBJ list of the co-predicate.

Among the questions that I have not been able to deal with here are what determines the choice of prepositions in SVCs. Why is it ***under*** *kontrol* 'under control' but ***i*** *tvivl* 'in doubt'? Is it possible to group process- and state-relations in this respect on semantic criteria, or are the groupings arbitrary (even so, they can still be expressed in the type hierarchy). And similarly, what determines the choice of SVs, e.g. *komme under kontrol* vs. *gå i stå*?

Chapter 5

Resultatives

A certain type of construction has been much discussed in later years under the name of *The Resultative Construction*. (390) shows some examples:

(390) a. Børnene legede sig trætte.
Children_the played themselves tired

b. Hanne talte Else til fornuft.
Hanne talked Else to sense

c. Du spiser din mor ud af huset.
You eat your mother out of house_the

d. Hunden løb ud i haven.
Dog_the ran out in garden_the

A Resultative consists of NP_1 V (NP_2) AP/PP and has the meaning: *NP_1 does V as a result of which NP_2 is AP/PP*. NP_2 may be coreferential with NP_1 in which case it is realized as a reflexive pronoun, in some cases it is omitted (390d).

Below I review two accounts of the resultative construction, one based on unaccusativity (Levin and Hovav, 1995), and one explicitly denying unaccusativity as explanation for the construction (Wechsler, 1997). I then present my own proposal within the theory developed in previous chapters building on Wechsler's ideas.

5.1 The Unaccusative Analysis

Simpson (1983), Hoekstra (1988), Levin and Hovav (1995) and others explain the peculiarities of resultatives in terms of unaccusativity (Perlmutter, 1978). The claim is that intransitive verbs split into *unergatives* which have an external argument but no direct internal argument, and *unaccusatives* which have a direct internal argument but no external argument as shown in (391)

(391) a. Unergative verbs (*dance, laugh, work*):
NP [$_{VP}$ V]
b. Unaccusative verbs (*freeze, melt, break*):
___ [$_{VP}$ V NP/CP]

The generalization wrt. resultatives is claimed to be that they are predicated of objects, not of subjects as stated in (392).

(392) **Direct Object Restriction** (DOR)

> ... a resultative phrase may be predicated of the immediately postverbal NP, but may not be predicated of a subject or of an oblique complement. (Levin and Hovav, 1995, p. 34)

To predicate a resultant state of the subject of unergative verbs it is necessary to insert a 'fake reflexive' (Simpson, 1983, p. 145) as in (393).

(393) a. I danced myself tired.
b. I shouted myself hoarse.

The behaviour of verbs of motion is problematic for this view. While these verbs are, according to the proposed tests, clearly *unergatives*, and as such in some cases (e.g. (393a)) combine with 'fake reflexives', when combined with (resultative) directional PPs they behave like *unaccusatives* and no 'fake reflexives' are needed or indeed possible.

(394) a. She danced into the room.
b. The dog ran away.

To handle these cases, Levin and Hovav (1995) suggest a lexical rule for verbs of manner of motion and verbs of sound emission which turns these verbs into unaccusatives and adds a directional phrase requirement.

While this analysis may account for the data, there is no independent evidence of manner of motion verbs being unaccusatives. A theory which can explain the data without such a lexical rule should be preferred.

5.2 Wechsler 1997

Wechsler argues against DOR and unaccusativity and shows that the resultative construction may be explained without it.

Wechsler distinguishes between two types of resultative, a *Control Resultative* and an *ECM (Exceptional Casemarking) Resultative*:

(395) Control Resultative: resultative phrase whose predication subject is a semantic argument of the matrix verb.
   a. John hammered the metal flat.
   b. The water froze solid.

(396) ECM Resultative: resultative phrase whose predication subject is NOT a semantic argument of the matrix verb.
   a. The dog barked itself hoarse.
   b. Mary ran the soles off her shoes.

Further he suggests that in the case of Control Resultatives the resultative must represent a 'canonical' result of an event of the type denoted by the verb, this generalization is dubbed the *Canonical Result Restriction*.

(397) Canonical Result Restriction (CRR): a *control resultative* must represent a 'canonical' or 'normal' result state of an action of the type denoted by the verb.

This explains why Control Resultatives are much more restrictive in what resultative phrases they allow than ECM resultatives are.

In ECM resultatives an extra argument is added to the verb which is why (398) is ungrammatical.

(398) * The dog barked hoarse.

Wechsler gives the lexical entry for *run* shown in (399)

(399)
$$\begin{bmatrix} \text{CATEGORY} \mid \text{ARG-S} \langle \text{NP}_i \rangle \oplus \langle \text{PP:}\boxed{1}* \rangle \\ \text{CONTENT } \boxed{1} \begin{bmatrix} \text{RELATION} \begin{bmatrix} \textit{run-rel} \\ \text{RUNNER} \quad i \end{bmatrix} \\ \text{BECOME} \left(\begin{bmatrix} \textit{location-rel} \\ \text{LOCATUM} \quad i \end{bmatrix} \right) \end{bmatrix} \end{bmatrix}$$

In this theory optional PPs such as benefactives, instrumentals and resultatives and also AP resultatives are treated as dependents, and any number of these (indicated by the Kleene star, *) may be appended at the end of the verb's ARG-S list. Bad cases are ruled out on semantic grounds. The value for the attribute BECOME expresses the canonical result state, in this case a *location-rel*. The locatum argument is co-indexed with the runner argument.

Wechsler's lexical entry for *into* is given in (400).

(400)
$$\begin{bmatrix} \text{CATEGORY} \mid \text{ARG-S} \langle \text{NP}_i, \text{NP}_j \rangle \\ \text{CONTENT} \mid \text{BECOME} \begin{bmatrix} \textit{location-rel} \\ \text{LOCATUM} \quad i \\ \text{LOCATION} \quad \begin{bmatrix} \textit{in-rel} \\ \text{REF.PT} \quad j \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Into first combine with its complement (NP_j), then with *run* to form a control resultative, unifying its CONTENT value[1] with the CONTENT value of *run*.

To account for ECM resultatives, among other things, Wechsler formulates the Raising Principle in (401).

(401) If V's ARG-S list item XP[SUBJ <$\boxed{1}$NP>], X $\neq$ V, lacks a local controller, then add the phrase $\boxed{1}$NP to XP's left on V's ARG-S list, immediately following any other NP's on that list

Now, *run* may also have an underspecified BECOME value, indicated by the parentheses in (399). This allows *run* to combine with any resultative phrase the subject of which will be inserted on the ARG-S list as indicated in (401) thus forming an ECM resultative. (402) gives an example.

[1]Or perhaps only its BECOME value, this is unclear in Wechsler's account

(402) We ran our Nikes threadbare.

I find this proposal appealing and make use of Wechsler's basic ideas in my proposal below. There are various problems, though, in Wechsler's formalization. Firstly, I do not see what prevents resultative phrases denoting the canonical state of the verb to appear in ECM resultatives resulting in ill-formed sentences like (403).

(403) *John ran himself into a tavern.

Secondly, it would seem that *run* even without combining with a resultative phrase will be telic since according to (399) whether underspecified or not it must have a value for the feature BECOME expressing the result state.

5.3 Proposal

In line with the theory developed in the previous chapters my proposal is to consider the adjective/preposition in the resultative phrase a co-predicate which together with the verb form a complex predicate. Thus in (404) the predicate is *løb træt*, 'ran tired', taking two arguments, in (404a) *Peter* and *Ole*, while in (404b) the two arguments are coreferential, *Peter* and *sig*. In (405) the predicate is *talte til fornuft*, 'talked to sense', again with two arguments, *Hanne* and *Else*.

(404) a. Peter løb Ole træt.
Peter ran Ole tired

b. Peter løb sig træt.
Peter ran himself tired

(405) Hanne talte Else til fornuft.
Hanne talked Else to sense

Resultatives are in most cases *accomplishments*, i.e. they have a specified subevent$_1$-value, a process, denoted by the verb, and a subevent$_2$-value denoted by the adjective/preposition, a state resulting from the subevent$_1$-process. In (405) *talte* has one argument and *til fornuft* has one argument, and they are both realized as arguments of the complex predicate. Passivization where the argument of the state becomes the subject of the sentence as in (406) is therefore no problem on this analysis. Note that the possibility

of passivization does not imply that the second argument (the subject in passive) is an argument of the verb.

(406) a. Else blev talt til fornuft.
Else was talked to sense

b. Moren blev spist ud af huset.
Mother_the was eaten out of house_the

Tale, 'speak', in (406a) is normally intransitive, and though *spise*, 'eat', is transitive, in (406b) the mother is obviously not the thing being eaten. The idea is that while in (406b) *the mother* is not an argument of the *eating* situation itself, she is an argument of the *out-of-the-house* situation and, as a consequence, of the *eating-out-of-the-house* situation.

As we have seen above, it has often been noted in the literature that there seem to be two types of *resultative*. One type has an obligatory NP_2, in many cases a reflexive.

(407) a. * Hunden gøede hæs.
Dog_the barked hoarse.

b. Hunden gøede sig hæs.
Dog_the barked itself hoarse.

The other type cannot have an NP_2.

(408) a. Hunden løb ud i haven.
Dog_the ran out in garden_the

b. * Hunden løb sig ud i haven.
Dog_the ran itself out in garden_the

(409) a. Vandet frøs til is.
Water_the froze to ice.

b. * Vandet frøs sig til is.
Water_the froze itself to ice.

Whether or not the NP_2 is obligatory seems to be dependant not on the verb in isolation, but on the verb *and* the resultative phrase. Thus the verb *løbe* is on its own intransitive, (410):

(410) a. Hunden løb.
Dog_the ran

b. * Hunden løb sig/ham.
Dog_the ran itself/him

With *træt*, 'tired', as co-predicate the NP_2 is obligatory, (411):

(411) a. * Hunden løb træt.
Dog_the ran tired

b. Hunden løb sig træt.
Dog_the ran itself tired

But with *ud i haven*, 'out into the garden', the NP_2 is prohibited, (412):

(412) a. Hunden løb ud i haven.
Dog_the ran out in garden_the

b. * Hunden løb sig ud i haven.
Dog_the ran itself out in garden_the

I follow Wechsler (1997) in assuming that it is a question of whether the resulting state is the expected outcome ('canonical result state') of the process denoted by the verb or not. In (408) the result is what could be expected; it is part of understanding what a verb of motion like *løbe*, 'run', means, to know that the process will normally result in that the entity moving ends up in a new place. In (411) while being tired is an acceptable outcome of running, it is not the canonical result, and this is reflected in the obligatory 'object', in this case a reflexive. Likewise in (407), hoarseness is an acceptable outcome of the barking process, but not the canonical result, presumably *gø* does not have one at all.

Note that on this approach, the often noted constraint on resultatives that the verb be non-stative simply follows from the circumstance that resultatives normally denote accomplishments or else achievements, in both cases with a process subevent_1 (because, as I have argued, only processes can cause change).

Full verb achievements are to some extent possible in canonical resultatives.

(413) a. Barnet væltede flasken ned på gulvet.
Child overturned bottle_the down on floor_the

b. Peter satte bogen op på hylden.
Peter put book_the up onto shelf_the

As exemplified in (414), being obligatorily transitive these verbs may not form the type of resultative where the object is not an argument of the verb and the result state not the one denoted by the verb.

(414) a. * Barnet væltede flasken tom.
Child_the overturned bottle_the empty

b. * John vækkede Marie sur.
John awakened Mary sour

The causative verb *skræmme* seems to be an exception combining with a co-predicate that denotes a result state which does not seem to be the expected outcome, (415):

(415) Hunden skræmte katten op i træet.
Dog_the frightened cat_the up into tree_the

5.4 Formalization

Resultatives are licensed as *resultative-pred* constrained as shown in (416).

(416)

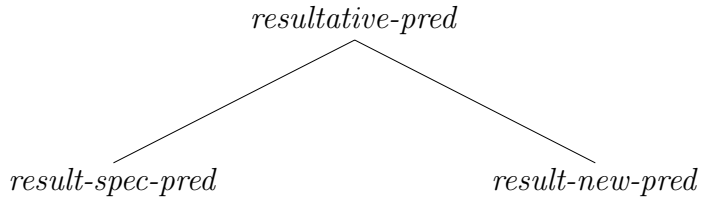
$$\textit{resultative-pred} \longrightarrow \begin{bmatrix} \text{PHON } \langle \boxed{1} \mid \boxed{2} \rangle \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \boxed{3} \\ \text{CO-PRED} & \langle\rangle \\ \text{SYN-ARGS} & \textit{list} \oplus \langle \boxed{4} \rangle \end{bmatrix} \\ \text{CORE-SEM} \begin{bmatrix} \textit{complex-psoa} \\ \text{E1 } \boxed{5} \\ \text{E2 } \boxed{6} \end{bmatrix} \end{bmatrix} \\ \text{H-DTR} \begin{bmatrix} \textit{word} \\ \text{PHON } \langle \boxed{1} \rangle \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{HEAD } \boxed{3} \textit{verb} \\ \text{CO-PRED } \langle\rangle \end{bmatrix} \end{bmatrix} \\ \text{CO-PRED-DTR} \begin{bmatrix} \text{PHON } \boxed{2} \\ \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{CO-PRED } \langle\rangle \\ \text{SUBJ } \langle \boxed{4} \rangle \end{bmatrix} \\ \text{CONT } \boxed{6} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Much of this information is inherited from the types *complex-pred*, *verbal-pred* and *one-pred*, see page 55. Specific to *resultative-pred* is that CO-PRED

list of the head-dtr is empty. The element on the SUBJ list of the co-predicate is raised to be the last element on the SYN-ARGS list of mother.

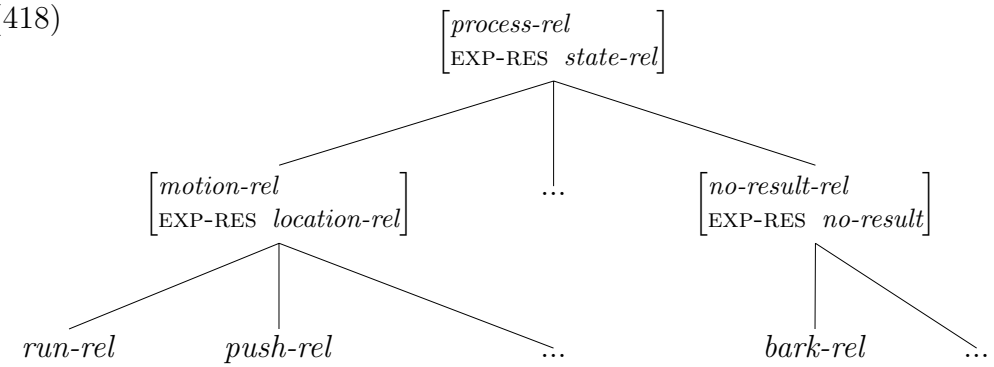
I have argued that there are two subtypes of resultative. I therefore introduce two subtypes of *resultative-pred*, see (417).

(417)



In a *result-spec-pred* the result state denoted by the co-predicate instantiates and possibly specifies the expected result of the verb, while in a *result-new-pred* the co-predicate denotes a result state which is not identical to the canonical state. The expected outcome of a process is expressed as the value for a feature EXP-RES on *process-rel* as sketched in (418).

(418)



It says that processes have a *state-rel* as the value for the feature EXP-RES expressing the expected (or canonical) outcome of that process. For *motion-rel* the expected outcome is a change in location and hence the value for EXP-RES is *location-rel*. Other processes may have other expected results, but some processes have no expected result, as e.g. *bark-rel*.

(419) shows the constraint on *result-spec-pred*.

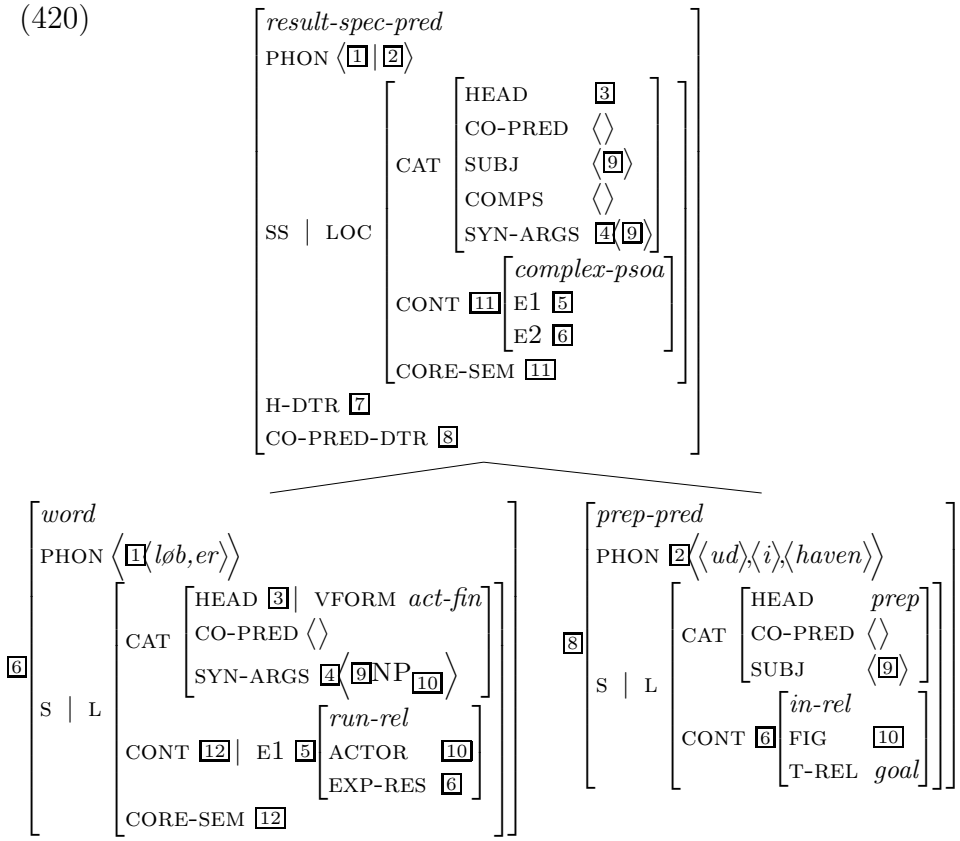
(419)

$$\textit{result-spec-pred} \longrightarrow \left[\begin{array}{l} \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{SYN-ARGS } \boxed{1} \\ \text{H-DTR} \mid \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \mid \text{SYN-ARGS } \boxed{1}\Big(\textit{list} \oplus \langle \boxed{2} \rangle\Big) \\ \text{CONT} \mid \text{E1} \mid \text{EXP-RES } \boxed{3} \end{array}\right] \\ \text{CO-PRED-DTR} \mid \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \mid \text{SUBJ } \langle \boxed{2} \rangle \\ \text{CONT } \boxed{3} \end{array}\right] \end{array}\right]$$

It states that the CONTENT-value of the co-predicate, the EXP-RES-value of the head-daughter are identical (and identical to the E2-value of the mother according to (416)). Furthermore, the element on the SUBJ list of the co-pred-dtr is the last element on the SYN-ARGS list of the head-dtr and of the *result-spec-pred*. If the verb is intransitive the list has one element, if it is transitive it has two.

(420) shows the representation of the *result-spec-pred løber ud i haven*.

(420)



This *result-spec-pred* has an element on the SUBJ list identical to the element on the SUBJ list of the co-predicate. The COMPS list is empty. The CONTENT-value is a *complex psoa* in which the E1-value is structure-shared with the E1-value of the head-daughter and the E2-value structure-shared with the CONTENT-value of the co-predicate and also with the EXP-RES-value of the head-daughter.

(421) shows part of the representation of the corresponding past participle version.

(421)
$$\begin{bmatrix} \textit{result-spec-pred} \\ \text{PHON} \left\langle \langle \textit{løb,et} \rangle, \langle \textit{ud} \rangle, \langle \textit{i} \rangle, \langle \textit{haven} \rangle \right\rangle \\ \text{S} \mid \text{L} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM } \textit{pastp} \\ \text{CO-PRED} \left\langle \right\rangle \\ \text{SUBJ} \left\langle \boxed{1} \right\rangle \\ \text{COMPS} \left\langle \right\rangle \\ \text{SYN-ARGS} \left\langle \boxed{1}\text{NP}_{\boxed{2}} \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{result-state-rel} \\ \text{PRESIT } \boxed{3} \end{bmatrix} \\ \text{CORE-SEM } \boxed{3} \begin{bmatrix} \text{E1} \begin{bmatrix} \textit{run-rel} \\ \text{ACTOR } \boxed{2} \end{bmatrix} \\ \text{E2} \begin{bmatrix} \textit{in-rel} \\ \text{FIG } \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The *result-spec-pred* in (421) has only one element on the SYN-ARGS list and must therefore according to the constraint in (343) an page 126 have a *result-state-rel* as CONTENT-value. The single argument is put on the SUBJ list while the COMPS list is empty. This predicate may function as co-predicate of *være*.

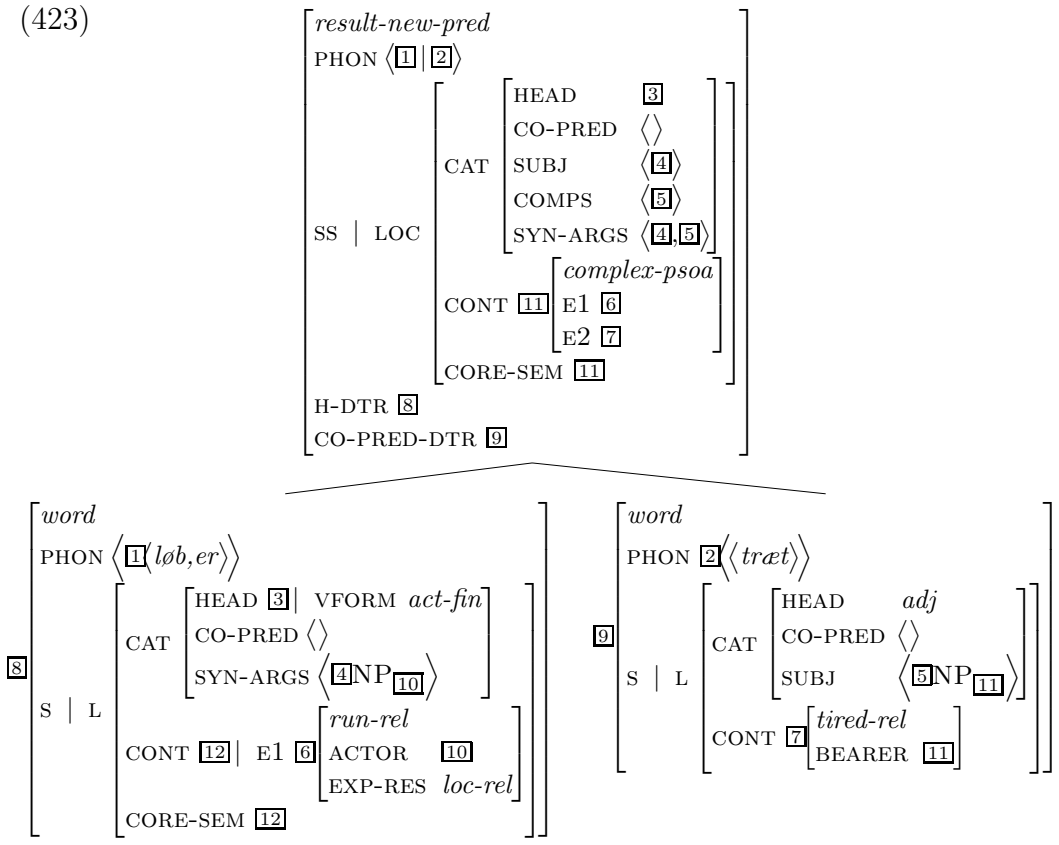
(422) shows the constraints on *result-new-pred*.

(422)
$$\textit{result-new-pred} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{SYN-ARGS} \left\langle \boxed{1}, \boxed{2} \right\rangle \\ \text{H-DTR} \mid \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{SYN-ARGS} \left\langle \boxed{1} \right\rangle \\ \text{CORE-SEM} \mid \text{E1} \mid \text{EXP-RES } \boxed{3} \end{bmatrix} \\ \text{CO-PRED-DTR} \mid \text{SS} \mid \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{SUBJ} \left\langle \boxed{2} \right\rangle \\ \text{CONT } \boxed{4} \end{bmatrix} \end{bmatrix}$$
$$\wedge \boxed{3} \not\supset \boxed{4}$$

In a *result-new-pred* the actual result, the E2-value, must differ from the expected result of the process. A *result-new-pred* has two elements on the SYN-ARGS list, the first the element on the SYN-ARGS list of the head-dtr and the second the element on the SUBJ list of the co-pred-dtr.

(423) shows the *result-new-pred løber træt*.

(423)



The *result-new-pred* in (423) has two syntactic arguments, the *actor* of the *run-relation* and the *bearer* of the *tired-relation*. The expected result of the *run-relation* is different from the E2-value structure-shared with the CONTENT-value of the co-predicate.

Because this *result-new-pred* has a CONTENT-value of type *complex-psoa* and two syntactic arguments there are two corresponding past participle versions.

(424) shows part of the non-result participle.

(424)
$$\begin{bmatrix} \textit{result-new-pred} \\ \text{PHON} \left\langle \langle \textit{løb,et} \rangle, \langle \textit{træt} \rangle \right\rangle \\ \text{S} \mid \text{L} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM } \textit{pastp} \\ \text{CO-PRED} \left\langle \right\rangle \\ \text{SUBJ} \left\langle \right\rangle \\ \text{COMPS} \left\langle \boxed{3} \right\rangle \\ \text{SYN-ARGS} \left\langle \boxed{1}\text{NP}_{\boxed{2}}, \boxed{3}\text{NP}_{\boxed{5}} \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{nonresult-state-rel} \\ \text{PRESIT } \boxed{4} \end{bmatrix} \\ \text{CORE-SEM } \boxed{4} \begin{bmatrix} \text{E1} \begin{bmatrix} \textit{run-rel} \\ \text{ACTOR } \boxed{2} \end{bmatrix} \\ \text{E2} \begin{bmatrix} \textit{tired-rel} \\ \text{BEARER } \boxed{5} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

In this case the SUBJ list is empty and the second argument is put on the COMPS list. This predicate may combine with its object in a *head-comps-phr* which may then be the co-predicate of *have*.

(425) shows the result participle.

(425)
$$\begin{bmatrix} \textit{result-new-pred} \\ \text{PHON} \left\langle \langle \textit{løb,et} \rangle, \langle \textit{træt} \rangle \right\rangle \\ \text{S} \mid \text{L} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \mid \text{VFORM } \textit{pastp} \\ \text{CO-PRED} \left\langle \right\rangle \\ \text{SUBJ} \left\langle \boxed{3} \right\rangle \\ \text{COMPS} \left\langle \right\rangle \\ \text{SYN-ARGS} \left\langle \boxed{1}\text{NP}_{\boxed{2}}, \boxed{3}\text{NP}_{\boxed{5}} \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \textit{result-state-rel} \\ \text{PRESIT } \boxed{4} \end{bmatrix} \\ \text{CORE-SEM } \boxed{4} \begin{bmatrix} \text{E1} \begin{bmatrix} \textit{run-rel} \\ \text{ACTOR } \boxed{2} \end{bmatrix} \\ \text{E2} \begin{bmatrix} \textit{tired-rel} \\ \text{BEARER } \boxed{5} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

This predicate may function as co-predicate for *være*.

5.5 Summary

In this chapter I have shown that resultatives fit in nicely in the overall theory presented in this dissertation. The construction is licensed as a subtype of *phrasal predicate*, the verb denotes a process (subevent_1) which causes the coming about of the state (subevent_2) denoted by the adjective or preposition, the co-predicate. The two subtypes of *resultative* are argued to be a question not of unaccusative, but of whether or not the result phrase denotes the expected outcome of the process denoted by the verb.

Chapter 6

Conclusion and further research

6.1 Conclusion

This thesis has argued that valence is predictable from semantics. The proposed theory has two basic ingredients, an event structure and a theory of complex predicates.

It is argued that predicates denote situations, that these situations may be simple or complex, and that complex situations are composed of simple situations.

I have shown that a limited number of constraints on descriptions of simple situations, relations, specifying the number and order of arguments, and a few constraints on the combination of relations in descriptions of complex situations can account for the valence of words with lexically specified semantics without any information on valence in lexical entries.

It is further argued that a group of words have a lexically underspecified semantics and therefore must combine with at co-predicate to form a complex predicate. It is shown how this combination of predicates is licensed and how the valence of the complex predicate is predictable from the valence of the parts.

The theory is succesfully applied to three types of complex predicate, complex prepositions, support verb constructions and resultative constructions, resulting in detailed descriptions of the Danish inventory of prepositions and support verbs.

The thesis uses HPSG as its theoretical framework and is a contribution in

the areas of complex predicates and the semantics-syntax interface in HPSG theory.

6.2 Further research

Because of the broad coverage of this dissertation a number of issues were mentioned only in passing or left untouched altogether. It would therefore be of interest to broaden the coverage e.g. wrt. verb classes and to look deeper into the many intricacies exhibited by prepositions.

Two new areas that I think could benefit from an analysis within the theory proposed here are socalled 'case-marking' prepositions and idioms.

Casemarking prepositions could be treated as co-predicates not present on the CO-PRED list of the verb, but allowed to combine with any verb with a matching CONTENT-value.

(426) Peter taler / skriver / synger **om** Pia.
Peter talks writes sings about Pia.

Idioms could be treated as complex predicates where the head-daughter has on its CO-PRED list an object of type *sign* instead of *synsem*. (427) gives an example.

(427) Peter stillede træskoene.
Peter put clogs_the
'Peter kicked the bucket'

One entry for *stille* would then have the NP *træskoene* specified to be *plural* and *definite* on its CO-PRED-list neatly modeling the fact that the verb may be conjugated while the form of the NP is fixed.

Chapter 7

Implementation

In this chapter I show the implementation of the proposed theory on the Controll platform. I first briefly describe the syntax of the Controll system and address some points of discrepancy between theory and implementation. In 7.2 I show the result of a test suite, 7.3 present snapshots of the Controll output to some of the test queries and in 7.4 the Controll files are given.

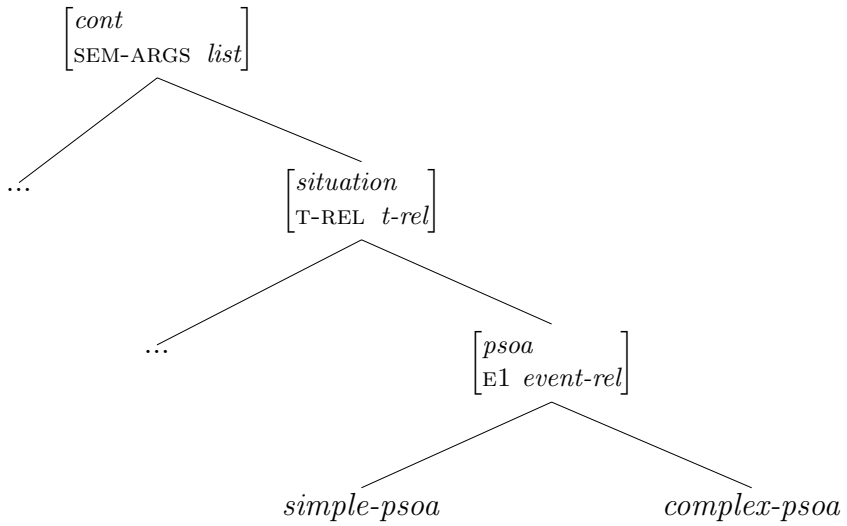
7.1 The syntax of Controll

7.1.1 Types

The type hierarchy is given in the *signature* file. The most general type is *bot*, and subtyping is indicated by indentation. Attributes and appropriate values appear to the right of the type in question seperated by a colon. (428) is thus the Controll version of (429).

(428)
```
cont sem_args:list
   situation t_rel:t_rel
      psoa e1:event_rel
         simple_psoa
         complex_psoa
      ...
   ...
```

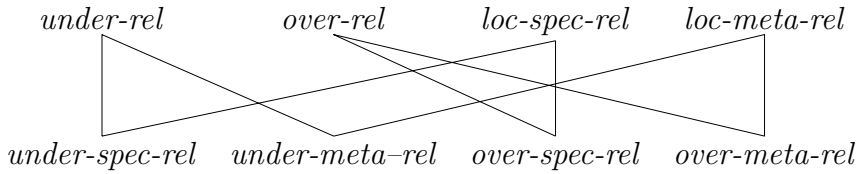
(429)



Multiple inheritance is indicated by an ampersand preceding types that inherit from more than one supertype. Multiply inheriting types are specified under each type from which they inherit. (430) is the Controll equivalent of (431).

(430)
```
under_rel
   &under_spec_rel
   &under_meta_rel
over_rel
   &over_spec_rel
   &over_meta_rel
loc_spec_rel
   &under_spec_rel
   &over_spec_rel
loc_meta_rel
   &under_meta_rel
   &over_meta_rel
```

(431)



7.1.2 Constraints

The Controll version of the constraint in (432) is given in (433).

(432)
$$\left[\begin{array}{l} \textit{predicate} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \left[\begin{array}{ll} \text{HEAD} \mid \text{VFORM} & \textit{active} \\ \text{CO-PRED} & \langle\rangle \end{array}\right] \end{array}\right] \longrightarrow$$

$$\left[\begin{array}{l} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \left[\begin{array}{ll} \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \boxed{2} \\ \text{SYN-ARGS} & \langle \boxed{1} \mid \boxed{2} \rangle \end{array}\right] \end{array}\right]$$

(433)
```
vac
===
predicate,
synsem : local : cat : (head : vform : active,
                        co_pred : [])  ==>
synsem : local : cat : (subj : [A],
                        comps : B,
                        syn_args : [A|B])).
```

The first part of this,

```
vac
===
```

names the is the name of the implication making it possible to refer to it individually e.g. for purposes of debugging or delay statements, (Götz et al., 1997, pp. 50-52), (Götz et al., 1999).

Capital letters are variables corresponding to tags in HPSG. Lists are indicated by square brackets, and the notation [A|B] in a Prolog fashion divides the list into a first element, A, and the rest of the list, B, which is also a list.

7.1.3 Lexicon

Two statements specify the notation of lexical entries. The first statement, shown in (434), says that lexical entries are of type *word*.

(434) `lexicon_type(word).`

The second statement, shown in (435), tells the system how to interpret lexical entries notated as exemplified in (436) with the phonology to the left of $---->$ and the rest of the entry to the right.

(435) `lexicon_style(X,Y,(phon:[[X]],Y)).`

(436)
```
loeb --->
synsem : local : (cat : (head : verb,
                         co_pred : []),
                  cont : (simple_psoa,
                          e1 : run_rel)).
```

7.1.4 Discrepancies between Theory and Implementation

Part of the constraint in (422) repeated here as (437) is not implemented.

(437)
$$\textit{result-new-pred} \longrightarrow \left[\begin{array}{l} \text{SS} \mid \text{LOC} \mid \text{CAT} \mid \text{SYN-ARGS} \langle \boxed{1}, \boxed{2} \rangle \\ \text{H-DTR} \mid \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \mid \text{SYN-ARGS} \langle \boxed{1} \rangle \\ \text{CONT} \mid \text{E1} \mid \text{EXP-RES} \ \boxed{3} \end{array}\right] \\ \text{CO-PRED-DTR} \mid \text{SS} \mid \text{LOC} \left[\begin{array}{l} \text{CAT} \mid \text{SUBJ} \langle \boxed{2} \rangle \\ \text{CONT} \ \boxed{4} \end{array}\right] \end{array}\right] \wedge \boxed{3} \not\bowtie \boxed{4}$$

The problem is the last part, $\boxed{3} \not\bowtie \boxed{4}$, ensuring that the result state of a *result-new-pred* is different from the expected result cannot be implemented.

Minor discrepancies are the Danish characters ø and å are notated oe and aa respectively, and that the value of RESTRICT feature is a list, not a set. (438) shows the Controll-version of (439).

(438)
```
bogen --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [book_rel]).
```

(439)
$$\begin{bmatrix} \textit{word} & \\ \textsc{phon} & \langle \textit{bog} \rangle \\ \textsc{ss} \mid \textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \textit{noun} \\ \textsc{co-pred} & \langle\rangle \end{bmatrix} \\ \textsc{cont} \mid \textsc{restrict} & \{\textit{book-rel}\} \end{bmatrix} \end{bmatrix}$$

7.2 Test suite

```
| ?- testt_all.
-- Test 1: phon:[[ole],[spis,er],[kagen]],head_subj_phr
                % Ole eats the the cake
     1) 1.2 sec
    --> 1.2 sec
        1 Solution (ok)

-- Test 2: phon:[[kagen],[spis,es]],head_subj_phr
                % The cake eat_PASS
     1) 0.0 sec
    --> 0.0 sec
        1 Solution (ok)

-- Test 3: phon:[[bo],[loeb,er]],head_subj_phr
                % Bo runs
     1) 0.0 sec
    --> 0.0 sec
        1 Solution (ok)

-- Test 4: phon:[[bo],[loeb,es]],head_subj_phr
                % *Bo run_PASS
    --> 0.0 sec
        No Solution (ok)

-- Test 5: phon:[[ole],[forsvind,er]],head_subj_phr
                % Ole disappear
     1) 0.0 sec
    --> 0.0 sec
        1 Solution (ok)

-- Test 6: phon:[[ole],[forsvind,es]],head_subj_phr
                % *Ole disappear_PASS
    --> 0.0 sec
        No Solution (ok)

-- Test 7: phon:[[ole],[vaek,er],[bo]],head_subj_phr
                % Ole wakes up bo
```

```
     1) 1.2 sec
    --> 1.2 sec
        1 Solution (ok)

-- Test 8: phon:[[bo],[vaek,es]],head_subj_phr
                % Bo is woken
     1) 0.0 sec
    --> 0.0 sec
        1 Solution (ok)

-- Test 9: phon:[[ud,zero],[i],[haven]],prep_pred
                % out in the garden
     1) 14.5 sec
    --> 17.8 sec
        1 Solution (ok)

-- Test 10: phon:[[ud,zero],[paa],[taget]],prep_pred
                 % out on the roof
     1) 15.5 sec
    --> 17.7 sec
        1 Solution (ok)

-- Test 11: phon:[[ud,zero],[til],[havet]],prep_pred
                 % out to the sea
     1) 14.1 sec
    --> 17.8 sec
        1 Solution (ok)

-- Test 12: phon:[[ud,ad],[mod],[havet]],prep_pred
                 % outwards towards the sea
     1) 14.1 sec
    --> 17.8 sec
        1 Solution (ok)

-- Test 13: phon:[[ud,ad],[til],[havet]],prep_pred
                 % *outwards to the sea
    --> 17.7 sec
        No Solution (ok)

-- Test 14: phon:[[kontrol],[over],[bo]],head_subj_phr
                 % control over Bo
```

```
     1) 0.6 sec
    --> 1.2 sec
        1 Solution (ok)

-- Test 15: phon:[[bo],[under],[kontrol]],head_subj_phr
                % Bo under control
     1) 0.6 sec
    --> 1.2 sec
        1 Solution (ok)

-- Test 16: phon:[[bo],[vaer,er],[under],[kontrol]],head_subj_phr
                % Bo is under control
     1) 20.2 sec
    --> 21.2 sec
        1 Solution (ok)

-- Test 17: phon:[[bo],[vaer,er],[bring,et],[under],[kontrol]],head_subj_phr
                % Bo is brought under control
     1) 25.4 sec
    --> 26.3 sec
        1 Solution (ok)

-- Test 18: phon:[[vaer,er],[loeb,et],[ud,zero],[i],[haven]],svc_pred,co_pred
                % Ole is run out in the garden
     1) 2.7 sec
    --> 8.0 sec
        1 Solution (ok)

-- Test 19: phon:[[ole],[vaer,er],[loeb,et],[ud,zero],[i],[haven]],head_subj_
                % Ole is run out in the garden
     1) 2.7 sec
    --> 8.8 sec
        1 Solution (ok)

-- Test 20: phon:[[kagen],[vaer,er],[spis,et]],head_subj_phr
                % The cake is eaten
     1) 1.1 sec
    --> 1.2 sec
        1 Solution (ok)

-- Test 21: phon:[[ole],[vaer,er],[glad]],head_subj_phr
```

```
                % Ole is happy
     1) 1.1 sec
    --> 1.2 sec
        1 Solution (ok)

-- Test 22: phon:[[ole],[vaer,er],[sov,et]],head_subj_phr
                % *Ole is slept
    --> 1.2 sec
        No Solution (ok)

-- Test 23: phon:[[ole],[vaer,er],[forsvind,et]],head_subj_phr
                % Ole is disappeared
     1) 1.1 sec
    --> 1.2 sec
        1 Solution (ok)

-- Test 24: phon:[[ole],[ha,er],[kontrol],[over],[bo]],head_subj_phr
                % Ole has control over bo
     1) 21.5 sec
    --> 22.4 sec
        1 Solution (ok)

-- Test 25: phon:[[ole],[ha,er],[bo],[under],[kontrol]],head_subj_phr
                % Ole has bo under control
     1) 21.5 sec
    --> 22.4 sec
        1 Solution (ok)

-- Test 26: phon:[[ole],[ha,er],[bring,et],[bo],[under],[kontrol]],head_subj_phr
     1) 20.5 sec
    --> 23.0 sec
        1 Solution (ok)

-- Test 27: phon:[[ole],[ha,er],[glad]],head_subj_phr
                % *Ole has glad
    --> 1.2 sec
        No Solution (ok)

-- Test 28: phon:[[ole],[ha,er],[sov,et]],head_subj_phr
                % Ole has slept
     1) 1.1 sec
```

```
    --> 1.2 sec
        1 Solution (ok)

-- Test 29: phon:[[ole],[ha,er],[forsvind,et]],head_subj_phr
                % *Ole has disappeared
    --> 1.2 sec
        No Solution (ok)

-- Test 30: phon:[[ole],[ha,er],[loeb,et],[ud,zero]],head_subj_phr
                % Ole has run out
    --> 21.1 sec
        No Solution (ok)

-- Test 31: phon:[[ole],[ha,er],[spis,et],[kagen]],head_subj_phr
                % Ole has eaten the cake
     1) 20.3 sec
    --> 21.2 sec
        1 Solution (ok)

-- Test 32: phon:[[kagen],[bliv,er],[spis,et]],head_subj_phr
                % The cake becomes eaten
     1) 1.0 sec
    --> 1.3 sec
        1 Solution (ok)

-- Test 33: phon:[[ole],[bliv,er],[glad]],head_subj_phr
                % Ole becomes happy
     1) 1.0 sec
    --> 1.3 sec
        1 Solution (ok)

-- Test 34: phon:[[ole],[bliv,er],[sov,et]],head_subj_phr
                % *Ole becomes slept
    --> 1.3 sec
        No Solution (ok)

-- Test 35: phon:[[ole],[bliv,er],[forsvind,et]],head_subj_phr
                % Ole becomes disappeared
    --> 1.3 sec
        No Solution (ok)
```

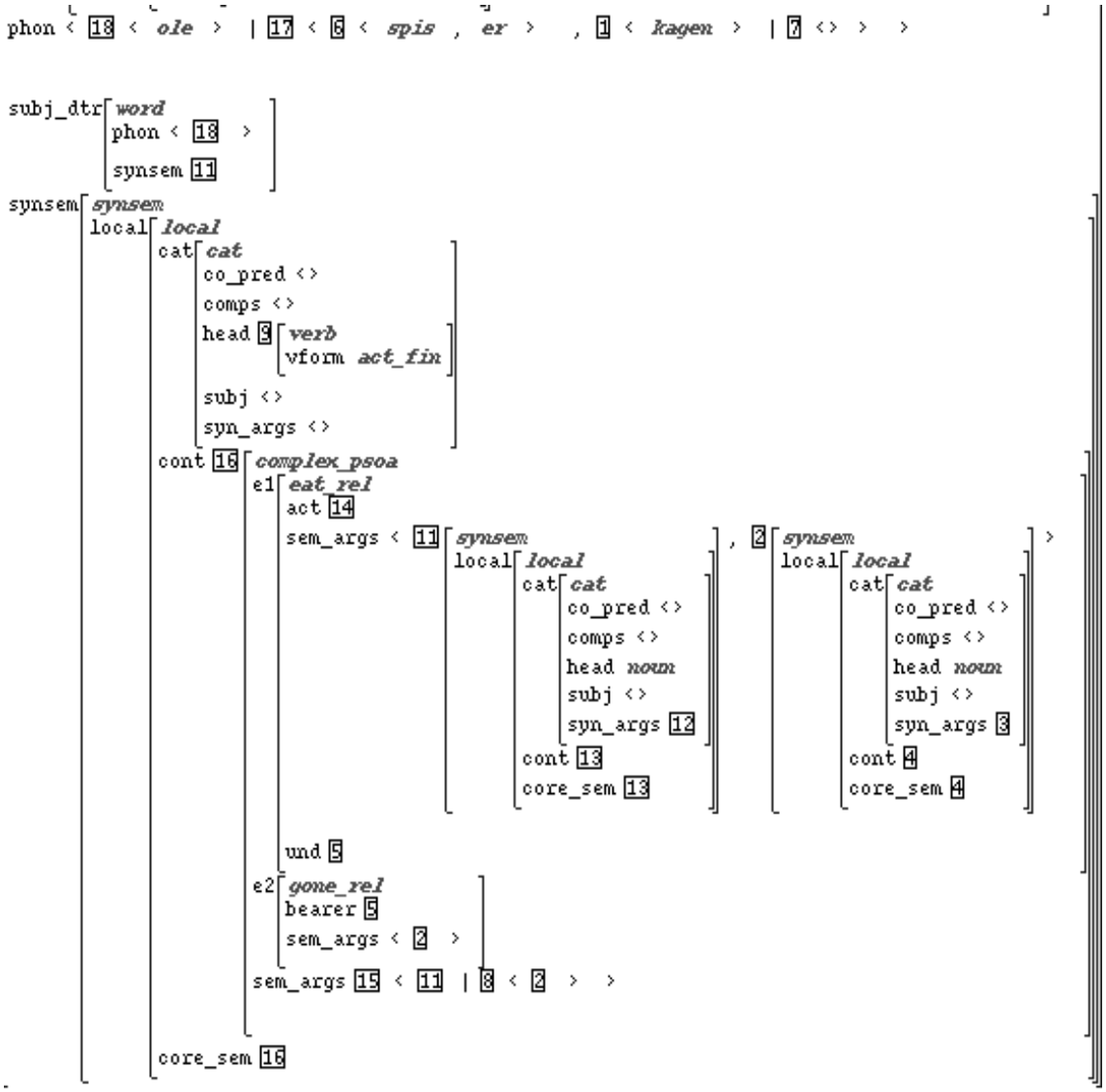
```
-- Test 36: phon:[[ole],[bliv,er],[loeb,et]],head_subj_phr
                % *Ole becomes run
    --> 1.3 sec
        No Solution (ok)

-- Test 37: phon:[[ole],[kom,er],[ud,zero],[i],[haven]],head_subj_phr
                % Ole comes out in garden
     1) 21.4 sec
    --> 26.2 sec
        1 Solution (ok)

-- Test 38: phon:[[ole],[bring,er],[bo],[under],[kontrol]],head_subj_phr
                % Ole brings bo under control
     1) 20.7 sec
    --> 20.9 sec
        1 Solution (ok)

-- Test 39: phon:[[bo],[bring,es],[under],[kontrol]],head_subj_phr
                % Bo bring_PASS  under control
     1) 20.0 sec
    --> 20.8 sec
        1 Solution (ok)

-- Test 40: phon:[[ole],[goer,er],[bo],[glad]],head_subj_phr
                % Ole makes bo happy
     1) 20.5 sec
    --> 20.6 sec
        1 Solution (ok)

-- Test 41: phon:[[ole],[hold,er],[bo],[glad]],head_subj_phr
                % Ole keeps bo happy
     1) 20.4 sec
    --> 20.6 sec
        1 Solution (ok)

-- Test 42: phon:[[kagen],[bring,es],[ud,zero],[i],[haven]],head_subj_phr
                % The cake bring_PASS out in garden
     1) 21.3 sec
    --> 26.5 sec
        1 Solution (ok)
```

```
-- Test 43: phon:[[ole],[loeb,er],[ud,zero],[i],[haven]],head_subj_phr
                % Ole runs out in the garden
     1) 21.6 sec
    --> 27.3 sec
        1 Solution (ok)

-- Test 44: phon:[[loeb,et],[ud,zero],[i],[haven]],result_spec_pred
                % runPASTP out in the garden
     1) 1.2 sec
    --> 6.1 sec
        1 Solution (ok)

-- Test 45: phon:[[ole],[loeb,er],[bo],[traet]],head_subj_phr
                % Ole runs bo tired
     1) 20.6 sec
    --> 21.0 sec
        1 Solution (ok)

-- Test 46: phon:[[bo],[loeb,er],[ole],[traet]],head_subj_phr,h_dtr:h_dtr:res
                % Bo runs Ole tired
    --> 0.1 sec
        No Solution (ok)

-- Test 47: phon:[[bo],[loeb,er],[hjem,zero],[til],[ole]],head_subj_phr
                % Bo runs home to Ole
     1) 21.2 sec
    --> 27.3 sec
        1 Solution (ok)

-- Test 48: phon:[[bo],[loeb,er],[ole],[traet]],head_subj_phr,h_dtr:h_dtr:res
                % Bo runs Ole tired
     1) 0.1 sec
    --> 0.1 sec
        1 Solution (ok)

==> 8 min, 22.1 sec


yes
| ?-
```

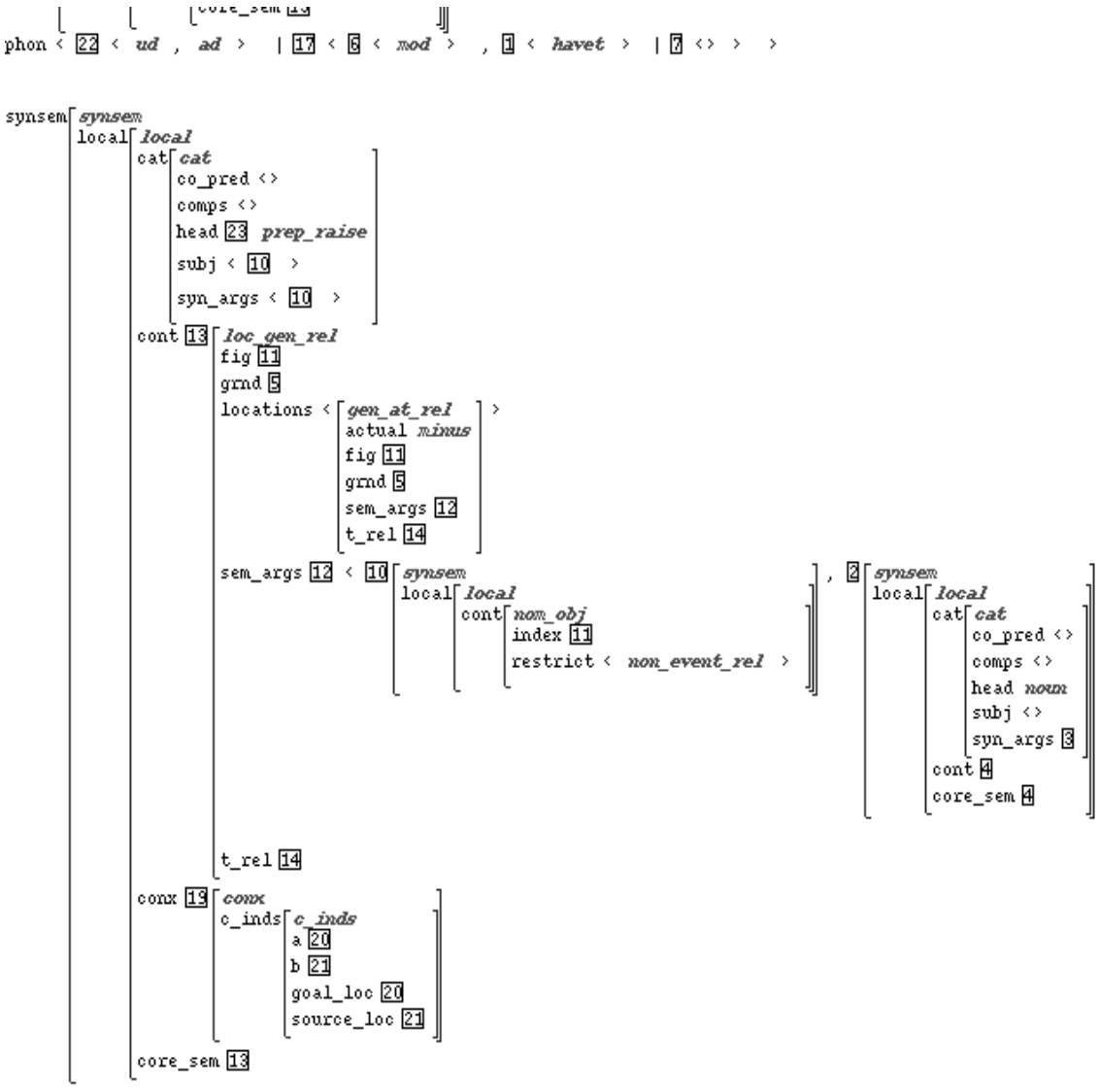
7.3 Controll output AVMs

Below I show a few samples of snapshots of the Controll output to some of the test queries. For lack of space only part of the output is shown and the snapshots therefore serve illustrative purposes rather than ...

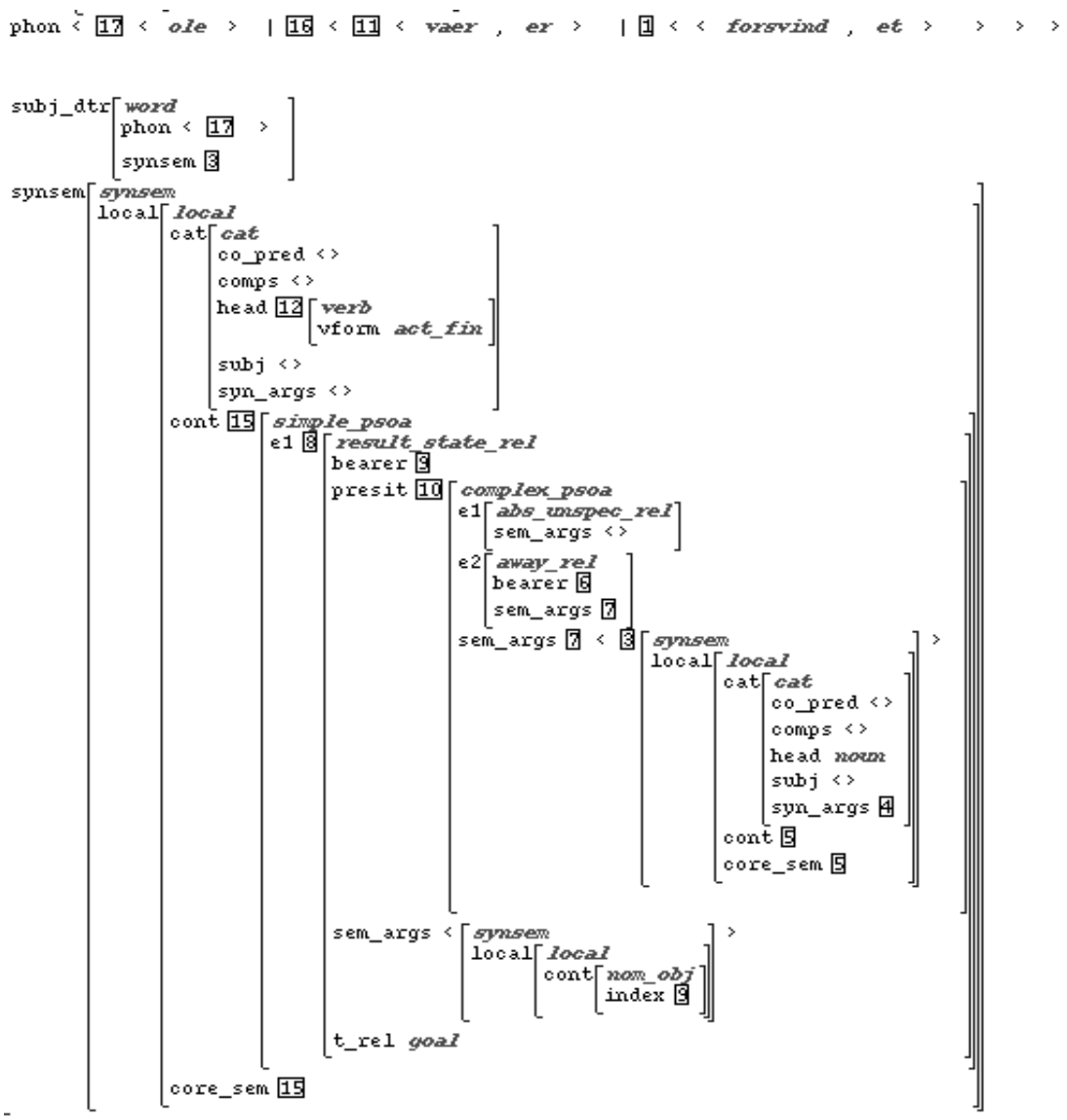
(440) Test 1: Ole spiser kagen, 'Ole eats the cake'



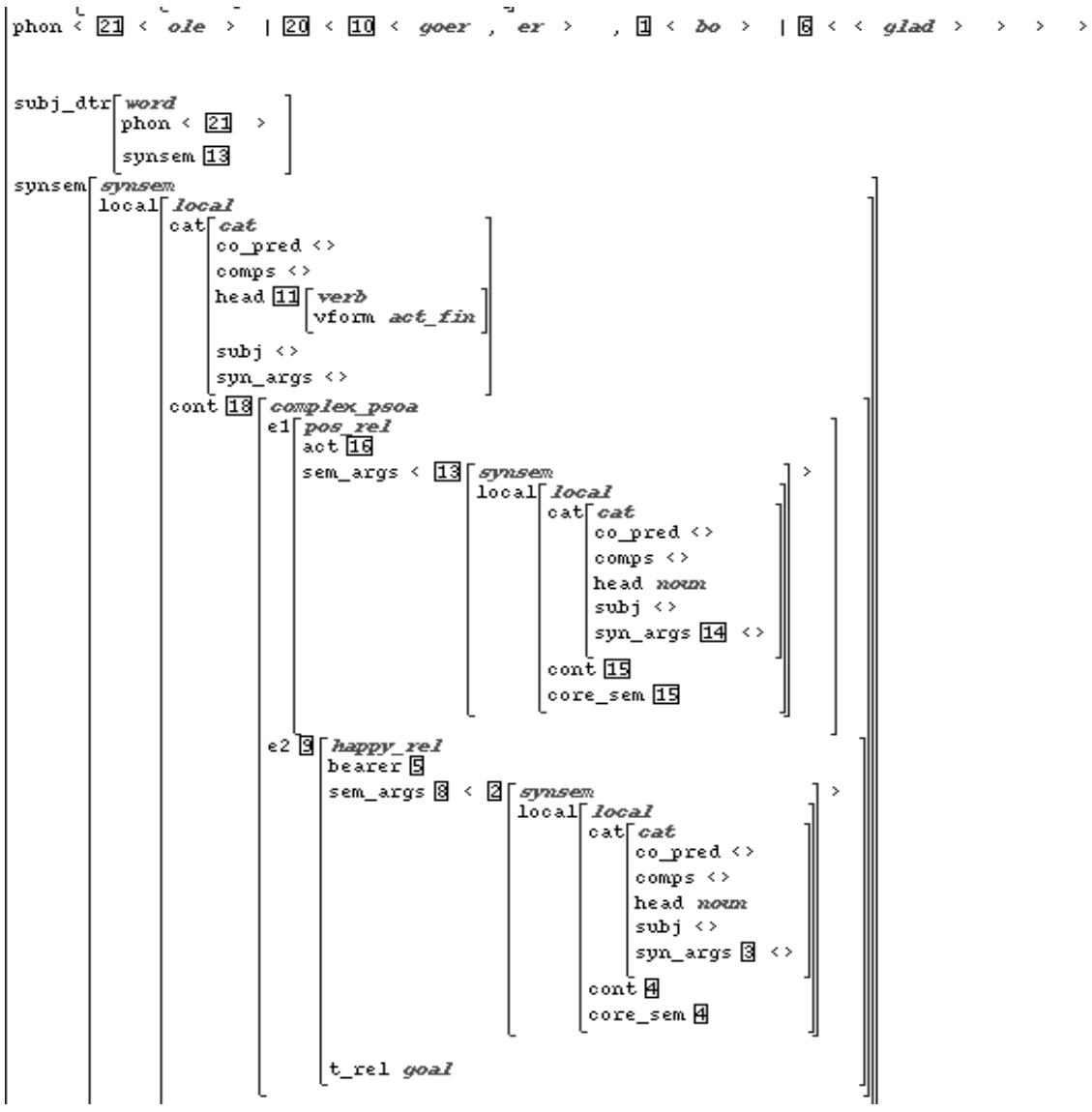
(441) Test 12: Udad mod havet, 'Outwards toward the sea'



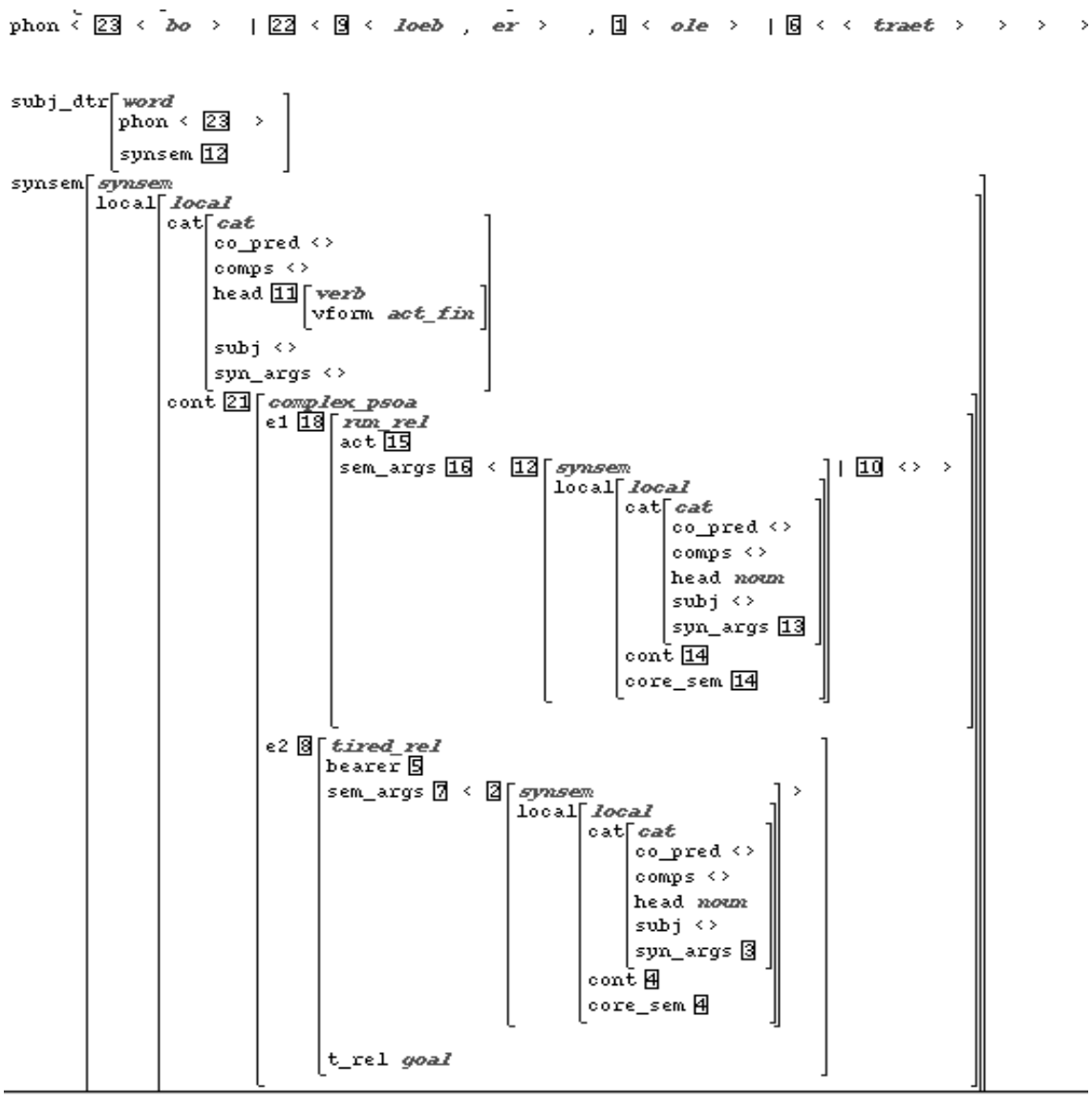
(442) Test 23: Ole er forsvundet, 'Ole is disapeared'



(443) Test 40: Ole gør Bo glad, 'Ole makes Bo happy'



(444) Test 49: Bo løber Ole træt, 'Bo runs Ole tired'



7.4 Controll Files

7.4.1 Signature

```
type_hierarchy

bot
   sign phon:list synsem:synsem
      phrase
         headed_phr h_dtr:sign
            &complex_pred h_dtr:word co_pred_dtr:sign
               verb_pred
                  resultative_pred
                     result_spec_pred
                     result_new_pred
                  &svc_pred
               obli_pred
                  &svc_pred
                  prep_pred
            head_val_phr
               head_subj_phr subj_dtr:word
               head_comps_phr comps_dtr:word
      predicate
         word
         &complex_pred
   synsem local:local
   local cat:cat cont:cont conx:conx core_sem:cont
   cat head:head subj:list comps:list syn_args:list co_pred:list
   cont sem_args:list
      situation t_rel:t_rel
         psoa e1:event_rel
            simple_psoa
            complex_psoa e1:process_rel e2:situation
         relation
            no_args_rel
               non_event_rel instance:ref
                  cake_rel
                  name_rel
```

```
            garden_rel
            book_rel
            roof_rel
            sea_rel
         &abs_unspec_rel
         &no_result
      event_rel
         state_rel actual:boolean
            &no_result
            loc_rel fig:ref grnd:ref
               under_rel
                  &under_spec_rel
                  &under_meta_rel
               over_rel
                  &over_spec_rel
                  &over_meta_rel
               loc_meta_rel soa:psoa
                  &under_meta_rel
                  &over_meta_rel
               loc_real_rel
                  loc_gen_rel locations:list
                  loc_spec_rel
                     in_rel
                     on_rel
                     at_rel
                        gen_at_rel
                        spec_at_rel
                           vertical_rel
                              &over_spec_rel
                              &under_spec_rel
                           between_rel
                           horizontal
                              in_fr_of_rel
                              behind_rel
            bearer_rel bearer:ref
               bearer_only_rel
                  participle_rel presit:psoa
                     result_state_rel
                     nonresult_state_rel
                  non_part_rel
                     awake_rel
```

```
                        exist_rel
                        gone_rel
                        happy_rel
                        big_rel
                        red_rel
                        tired_rel
                        away_rel
                     bearer_theme_rel theme:ref
                        know_rel
                        control_rel
               process_rel
                  spec_rel exp_res:state_rel
                     &spec_act_rel
                     &act_und_rel
                  unspec_rel
                     &abs_unspec_rel
                     &unspec_act_rel
                        pos_rel
                        abstain_rel
                        prevent_rel prevented:state_rel
                  act_rel act:ref
                     act_only_rel
                        &unspec_act_rel
                        &spec_act_rel
                           &run_rel
                           work_rel
                           sleep_rel
                     &act_und_rel und:ref
                        &push_rel
                        &carry_rel
                        eat_rel
                        drink_rel
                  motion_rel exp_res:loc_gen_rel
                     &run_rel
                     &push_rel
                     &carry_rel
   nom_obj index:index restrict:list
t_rel
   stative
   directional
      goal
```

```
      path
      source
int_rel
   henne
   in_out
      in
      out
   over
   home
   up_down
      up
      down
   away
   fremme_omme
      fremme
      omme
   back
index person:person
   ref
   it
   there
person
   first
   second
   third
conx c_inds:c_inds
c_inds a:int_rel b:int_rel source_loc:int_rel goal_loc:int_rel occ_loc:int_rel ut
head
   noun
   adjective
   verb vform:vform
   prep
      prep_lex
      prep_raise
vform
   active
      &act_fin
      &act_inf
   passive
      &pas_fin
      &pas_inf
```

```
      finite
         imperative
         &act_fin
         &pas_fin
      nonfinite
         infinitive
            &act_inf
            &pas_inf
         participle
            presp
            pastp
   boolean
      plus
      minus
   string
.
```

7.4.2 Theory

```
lexicon_type(word).
lexicon_style(X,Y,(phon:[X],Y)).

gen
===
word ==>
synsem : local : cat : co_pred : ([] ; [synsem]).

lex
===
word,
synsem : local : cat : co_pred : [synsem] ==>
synsem : local : cat : (subj : [],
                        comps : []).


append(list,list) **> list.

append([],L) := L.
append([X],L) := [X|L].
append([X,Y],L) := [X,Y|L].
append([X,Y,Z],L) := [X,Y,Z|L].




%% Linking
no_args
===
no_args_rel ==> sem_args : [].


act_process
===
act_rel ==> sem_args : [local : cont : index : A |_],
                act : A.
```

```
act_only
===
act_only_rel ==> sem_args : [_].

act_und
===
act_und_rel ==> sem_args : [_,local : cont : index : A],
                und : A.


loc
===
loc_rel ==>
 sem_args : append(_,[local : cont : index : A,local : cont : index :B]),
 fig : A,
 grnd : B.


loc_spec
===
loc_spec_rel ==> sem_args : [local : cont : restrict : [non_event_rel],
                             local : cont : restrict : [non_event_rel]].



bearer
===
bearer_rel ==> sem_args : [local : cont : index : A |_],
                bearer : A.

bearer_only
===
bearer_only_rel ==> sem_args : [_].

bearer_theme
===
bearer_theme_rel ==> sem_args : [_,local : cont : index : A],
                theme : A.
```

```
lex_simple
===
word,
synsem : local : (cat : co_pred : [],
                  core_sem : simple_psoa) ==>
synsem : local : core_sem : (sem_args : A,
                             e1 : sem_args : A).


lex_cmpl
===
word,
synsem : local : (cat : co_pred : [],
                  core_sem : complex_psoa) ==>
(
(synsem : local : core_sem : (sem_args : B,
                              e1 : sem_args : [],
                              e2 : sem_args : B))  ;
(synsem : local : core_sem : (sem_args : [A,B],
                              e1 : sem_args : [A],
                              e2 : sem_args : [B]))  ;
(synsem : local : core_sem : (sem_args : [A,B],
                               e1 : sem_args : [A,B],
                               e2 : sem_args : [B]))
).


lex_link_one
===
word,
synsem : local : cat : (head : noun,
                        co_pred : []) ==>
synsem : local : (cat : syn_args : A,
                  core_sem : (nom_obj,
                              sem_args : A)).

lex_link_two
===
word,
synsem : local : cat : (head : verb,
                        co_pred : []) ==>
```

```
synsem : local : (cat : syn_args : A,
                  core_sem : (psoa,
                              sem_args : A)).

lex_link_three
===
word,
synsem : local : cat : (head: (adjective;prep),
                        co_pred : []) ==>
synsem : local : (cat : syn_args : A,
                  core_sem : (relation,
                              sem_args : A)).



complex
===
complex_pred ==>
phon : [A|B],
synsem : local : cat : (co_pred : [],
                        syn_args : ([C] ;[_,C])),
h_dtr : (word,
         phon : [A]),
co_pred_dtr : (phon : B,
               synsem : local : cat : (co_pred : [],
                                       comps : [],
                                       subj : ([C];[]))).


two
===
obli_pred ==> h_dtr : synsem : local : cat : co_pred : [A],
              co_pred_dtr : synsem : A.



verbal_p
===
verb_pred ==>
synsem : local : core_sem : e1 : A,
h_dtr : synsem : local : (cat : head : verb,
```

```
                          core_sem : e1 : A),
co_pred_dtr : synsem : local : cont : t_rel : goal.


svc
===
svc_pred ==>
synsem : local : (cat : (co_pred : [],
                         syn_args : E),
                  cont : C),
h_dtr : synsem : local : (cat : (co_pred : [D],
                                 syn_args : E),
                          cont : C),
co_pred_dtr : ((phrase ; word),
               synsem : (D, local : cat : co_pred : [])).


result
===
resultative_pred ==>
synsem : local : (cat : co_pred : [],
                  core_sem : e2 : A),
h_dtr : synsem : local : cat : (head : verb,
                                co_pred : []),
co_pred_dtr : ((word ; prep_pred),
               synsem : local : cont : A).

res_spec
===
result_spec_pred ==>
synsem : local : cat : syn_args : B,
h_dtr : synsem : local : (cat : syn_args : B,
                          core_sem : (simple_psoa,
                                      e1 : exp_res : A)),
co_pred_dtr : synsem : local : (cat : subj : [_],
                                cont : A).


res_new
===
result_new_pred ==>
```

```
synsem : local : cat : syn_args : [C,D],
h_dtr : synsem : local : (cat : syn_args : [C],
                          core_sem : (simple_psoa,
                                      e1 : exp_res : B)),
co_pred_dtr : synsem : local : (cat : subj : [D],
                                cont : A).

%%forskellig(A,B)

phr
===
phrase ==>
phon : [_,_|_].

w
===
word ==>
phon : [_].



headed
===
headed_phr ==>
synsem : local : cat : head : A,
h_dtr : synsem : local : cat : head : A.


val
===
head_val_phr ==>
synsem : local : (cat : co_pred : [],
                  cont : A),
h_dtr : ((predicate;head_comps_phr),synsem : local : (cat : co_pred : [],
                                    cont : A)).


comps
===
head_comps_phr ==>
phon : [A,B|C],
```

```
synsem : local : cat : (subj : D,
                        comps : E,
                        syn_args : F),
h_dtr : (predicate,
         phon : [A|C],
         synsem : local : cat : (subj : D,
                                 comps : append(E,[G]),
                                 syn_args : append(F,[G]))),
comps_dtr : (phon : [B],
             synsem : G).


subj
===
head_subj_phr ==>
phon : [A|B],
synsem : local : cat : (subj : [],
                        comps : [],
                        syn_args : C),
h_dtr : (phon : B,
         synsem : local : cat : (subj : [D],
                                 comps : [],
                                 syn_args : append(C,[D]))),
subj_dtr : (word,
            phon : [A],
            synsem : D).
```

7.4.3 Verbs

```
verbform
===
word,
synsem : local : cat : head : verb ==>
(synsem : local : cat : head : vform : act_fin,
 phon : [[_,er]])
;
(synsem : local : cat : head : vform : act_inf,
 phon : [[_,e]])
;
(synsem : local : cat : head : vform : passive,
 phon : [[_,es]])
;
(synsem : local : cat : head : vform : imperative,
 phon : [[_,zero]])
;
(synsem : local : cat : head : vform : pastp,
 phon : [[_,et]])
;
(synsem : local : cat : head : vform : presp,
 phon : [[_,ende]]).


vnonpart
===
synsem : local : cat : head : vform : (finite ; infinitive) ==>
synsem : local : (core_sem : A,
                  cont : A).

vpart
===
synsem : local : cat : head : vform : participle ==>
synsem : local : (core_sem : A,
                  cont : presit : A).

vac
===
```

```
predicate,
synsem : local : cat : (head : vform : active,
                        co_pred : []) ==>
synsem : local : cat : (subj : [A],
                        comps : B,
                        syn_args : [A|B]).

vimp
===
predicate,
synsem : local : cat : (head : vform : imperative,
                        co_pred : []) ==>
synsem : local : cat : (subj : [A];[],
                        comps : B,
                        syn_args : [(A,loc : cont : index : person : second)|B]).



pass
===
predicate,
synsem : local : cat : (head : vform : passive,
                        co_pred : []) ==>
synsem : local : cat : (subj : [B],
                        comps : [],
                        syn_args : [_,B]).



part_one
===
word,
synsem : local : cat : head : vform : pastp ==>
synsem : local : cont : participle_rel.


part_two
===
```

```
predicate,
synsem : local : (cat : (head : vform : pastp,
                         co_pred : []),
                  cont : nonresult_state_rel) ==>
synsem : local : cat : (subj : [],
                        comps : B,
                        syn_args : [_|B]).

part_three
===
predicate,
synsem : local : (cat : (head : vform : pastp,
                         co_pred : []),
                  core_sem : simple_psoa) ==>
synsem : local : cont : nonresult_state_rel.



part_four
===
predicate,
synsem : local : (cat : (head : vform : pastp,
                         co_pred : []),
                  core_sem : complex_psoa) ==>
(
(synsem : local :(cat : syn_args : [_,_],
                  cont : nonresult_state_rel))
;
(synsem : local : (cat : (subj : [A],
                          comps : [],
                          syn_args : ([A];[_,A])),
                   cont : result_state_rel))
).




achieve
===
word,
```

```
synsem : local : (cat : (head : verb,
                         co_pred : [synsem]),
                  core_sem : e1 : unspec_rel) ==>
synsem : local : (cat : (co_pred : [local : (cat : subj : [A],
                                              cont : B)],
                         syn_args : append(C,[A])),
                  core_sem : (e1 : sem_args : C,
                          e2 : B)).



achieve_two
===
word,
synsem : local : (cat : (head : verb,
                         co_pred : [synsem]),
                  core_sem : e1 : unspec_rel) ==>
synsem : local : cat : (co_pred : [local : cat : syn_args : (A,[_,_])],
                        syn_args : A)
;
synsem : local : cat : co_pred : [local : cat : syn_args : [_]].



[loeb,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : []),
                  core_sem : (simple_psoa,
                          e1 : run_rel)).


[spis,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : []),
                   core_sem : (e1 : eat_rel,
                               e2 : gone_rel)).


[sov,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : []),
```

```
                  core_sem : (simple_psoa,
                              e1:  sleep_rel)).

[forsvind,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : []),
                  core_sem : (e1 : abs_unspec_rel,
                              e2 : away_rel)).
[vaagn,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : []),
                  core_sem : (e1 : abs_unspec_rel,
                              e2 : awake_rel)).

[vaek,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : []),
                  core_sem : (e1 : pos_rel,
                              e2 : awake_rel)).

[kontroller,_] --->
synsem : local :  (cat : (head : verb,
                          co_pred : []),
                  core_sem : (simple_psoa,
                              e1 : control_rel)).

%% Support verbs

[vaer,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : [local : (cat : subj : [A],
                                             cont : B)],
                         syn_args : [A]),
                   core_sem : (simple_psoa,
                               e1 : B)).



[ha,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : [local : (cat : (subj : [],
```

```
                                                    syn_args : [A]),
                                              cont : B)],

                        syn_args : [A]),
                  core_sem : (simple_psoa,
                              e1 : B)).


[bliv,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : [local : (cat : syn_args : [_|A],
                                             cont : presit : B)],
                         syn_args : A),
                  core_sem : B).


[bliv,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : [_]),
                  core_sem : (e1 : abs_unspec_rel,
                              e2 : non_part_rel)).


[kom,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : [_]),
                  core_sem : (e1 : abs_unspec_rel,
                              e2 : loc_rel)).


[goer,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : [_]),
                  core_sem : (e1 : pos_rel,
                              e2 : non_part_rel)).


[bring,_] --->
synsem : local : (cat : (head : verb,
                         co_pred : [_]),
```

```
                core_sem : (e1 : pos_rel,
                        e2 : loc_rel)).

[saett,_] --->
synsem : local : (cat : (head : verb,
                        co_pred : [_]),
                core_sem : (e1 : pos_rel,
                        e2 : loc_rel)).

[faa,_] --->
synsem : local : (cat : (head : verb,
                        co_pred : [_]),
                core_sem : (e1 : pos_rel,
                        e2 : state_rel)).

[hold,_] --->
synsem : local : (cat : (head : verb,
                        co_pred : [_]),
                core_sem : (e1 : prevent_rel,
                        e2 : state_rel)).

[faa,_] --->
synsem : local : (cat : (head : verb,
                        co_pred : [_]),
                core_sem : (e1 : unspec_act_rel,
                        e2 : psoa)).

[lad,_] --->
synsem : local : (cat : (head : verb,
                        co_pred : [_]),
                core_sem : (e1 : abstain_rel,
                        e2 : psoa)).
```

7.4.4 Prepositions

```
prep_g
===
synsem : local : cat : head : prep ==>
synsem : local : (cont : A,
                  core_sem : A).

prep_gen
===
word,
synsem : local : cat : (head : prep,
                        co_pred : []) ==>
synsem : local : cat : (subj : [B],
                        comps : ([C];[]),
                        syn_args : append(_,[B,C])).


p_lex
===
word,
synsem : local : cat : head : prep_lex ==>
synsem : local : cat : (co_pred : [],
                        comps : [_]).

p_raise_one
===
predicate,
synsem : local : cat : head : prep_raise ==>
synsem : local : cat : comps : [].




meta
===
word,
synsem : local : cont : loc_meta_rel ==>
synsem : local : (cont : soa : A,
```

```
                cat : syn_args :
      ( [B,local:(cat:syn_args: [B,D],
                cont : restrict : [A]),D];
        [B,D,local:(cat:syn_args:[B,D],
                  cont : restrict : [A])])).


p_loc
===
word,
synsem : local : (cat : head : prep,
                  cont : loc_gen_rel) ==>
synsem : local : cont : (locations : [(loc_rel,
                                       sem_args : B,
                                       t_rel : C)|_],
                         sem_args : B,
                         t_rel: C).



p_raise_two
===
word,
synsem : local : cat : head : prep_raise ==>
(phon : [[_,ad]],
 synsem : local : cont : locations : [(actual : minus,
                                       t_rel : goal)|_]
)
;
(phon : [[_,zero]],
(
(synsem : local : (cat : co_pred : [_],
                   cont : locations : [t_rel : (goal ; path)|_])
);
(synsem : local : (cat : co_pred : [],
                   cont : locations : [(actual : plus,
                                        t_rel : goal)|_])
))
;
(phon : [[_,e]],
(
```

```
(synsem : local : (cat : co_pred : [_],
                   cont : locations : [t_rel : (source ; stative)|_])
);
(synsem : local : (cat : co_pred : [],
                   cont : locations : [t_rel : stative|_])
)))).



prep_pred_
===
prep_pred ==>
synsem : local : (cat : (subj : [A],
                         syn_args : [A]),
                   cont: B,
                   conx : C),
h_dtr : synsem : local : (cat : (head : prep,
                                 syn_args : [A]),
                           cont : B,
                           conx : C),
co_pred_dtr : (head_comps_phr,
               synsem : local : (cat : syn_args : [A],
                                 cont : B,
                                 conx : C)).




prep_cx
===
predicate, synsem : local : cont : locations : [t_rel : (goal ; path)] ==>
synsem : local : conx : c_inds : (a : A,
                                  b : B,
                                  source_loc : B,
                                  goal_loc : A).


prep_cx_s
===
predicate, synsem : local : cont : locations : [t_rel : source] ==>
```

```
synsem : local : conx : c_inds : (a : A,
                                  b : B,
                                  source_loc : A,
                                  goal_loc : B).

prep_cx_st
===
predicate, synsem : local : cont : locations : [t_rel : stative] ==>
synsem : local : conx : c_inds : ((a : A,
                                   occ_loc : A),
                                  (b : B,
                                   (( utt_loc : B) ;
                                    (addr_loc : B) ;
                                    (ref_loc : B)))).




%% Raising Prepositions

raise_prep
===
word, synsem : local : cat : head : prep_raise ==>
synsem : local : cont : loc_gen_rel.


[ind,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : (a : in,
                                   b : out)).

[ud,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : (a : out,
                                   b : in)).

[op,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : (a : up,
                                   b : down)).
```

```
[ned,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : (a : down,
                                   b : up)).

[frem,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : (a : fremme,
                                   b : omme)).

[om,_] --->
synsem : local : (cat : (head : prep_raise,
                         co_pred : [_]),
                  conx : c_inds : (a : omme,
                                   b : fremme)).

[over,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : a : over).

[hjem,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : a : home).

[hen,_] --->
synsem : local : cat : (head : prep_raise,
                        co_pred : [_]).


[bort,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : a : away).

[tilbage,_] --->
synsem : local : (cat : head : prep_raise,
                  conx : c_inds : a : back).



%%% Lexical Prepositions
```

```
lex_prep
===
word, synsem : local : cat : head : prep_lex ==>
synsem : local : cat : co_pred : [].



[fra1] --->
synsem : local : (cat : head : prep_lex,
                  cont : locations : [(loc_spec_rel,
                                       t_rel : source)]).

[af] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(loc_spec_rel,
                                        t_rel:goal),
                                       (in_rel,
                                        t_rel : source)
                                       ]).

[fra2] --->
synsem : local : (cat : head : prep_lex,
                  cont : locations : [(loc_spec_rel,
                                        t_rel:goal),
                                      ((on_rel;at_rel),
                                        t_rel : source)
                                      ]).



[via] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(in_rel,
                                        t_rel:path)]).

[ad1] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(on_rel,
                                        t_rel:path)]).
```

```
[langs] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(gen_at_rel,
                                       t_rel:path)]).

[ad2] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(loc_spec_rel,
                                       t_rel : goal),
                                      (in_rel,
                                       t_rel:path)
                                      ]).

[gennem] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(loc_spec_rel,
                                       t_rel : goal),
                                      (in_rel,
                                       t_rel:path)
                                      ]).

[forbi] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(loc_spec_rel,
                                       t_rel : goal),
                                      (gen_at_rel,
                                       t_rel:path)
                                      ]).

[i] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(actual : plus,
                                       in_rel,
                                       t_rel:(goal;stative))]).



[paa] --->
synsem : local : (cat : head : prep_lex,
```

```
                  cont : locations : [(actual:plus,
                                       on_rel,
                                       t_rel:(goal;stative))]).


[mod] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(gen_at_rel,
                                       actual:minus,
                                       t_rel : goal)]).

[til] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(gen_at_rel,
                                       actual:plus,
                                       t_rel : goal)]).

[hos] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(gen_at_rel,
                                       t_rel:stative)]).

[ved] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(gen_at_rel,
                                       t_rel:stative)]).


[foran] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(in_fr_or_rel,
                                       t_rel:(path;goal;stative))]).

[bag] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(behind_rel,
                                       t_rel:(path;goal;stative))]).


[over] --->
```

```
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(over_spec_rel,
                                       t_rel:(path;goal;stative))]).

[over] --->
 synsem : local : (cat : head : prep_lex,
                   cont : (over_meta_rel,
                           t_rel:(path;goal;stative))).


[under] --->
 synsem : local : (cat : head : prep_lex,
                   cont : locations : [(under_spec_rel,
                                       t_rel:(path;goal;stative))]).

[under] --->
 synsem : local : (cat : head : prep_lex,
                   cont : (under_meta_rel,
                           t_rel:(path;goal;stative))).


[blandt] --->
synsem : local : (cat : head : prep_lex,
                   cont : locations : [(between_rel,
                                       t_rel:(path;goal;stative))]).

[mellem] --->
synsem : local : (cat : head : prep_lex,
                   cont : locations : [(between_rel,
                                       t_rel:(path;goal;stative))]).
```

7.4.5 Nouns

```
noun_g
===
synsem : local : cat : head : noun ==>
synsem : local : (cont : A,
                  core_sem : A).

noun_gen
===
word,
synsem : local : cat : head : noun ==>
synsem : local : (cat : (subj : [],
                         comps : []),
                  cont : (nom_obj,
                          restrict : [(non_event_rel ; psoa)])).

noun_non
===
word,
synsem : local : (cat : head : noun,
                  cont : restrict : [non_event_rel]) ==>
synsem : local : cont : (index : A,
                         restrict :[instance : A]).


noun_arg
===
word,
synsem : local : cat : head : noun ==>
synsem : local : cont : (sem_args : A,
                         restrict : [((non_event_rel,sem_args : A);
                                      (psoa,sem_args : A))]).


[bogen] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [book_rel]).
```

```
[haven] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [garden_rel]).

[havet] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [sea_rel]).

[kagen] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [cake_rel]).

[taget] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [roof_rel]).


[bo] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [name_rel]).


[ole] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [name_rel]).

[kontrol] --->
synsem : local : (cat : (head : noun,
                         co_pred : []),
                  cont : restrict : [(simple_psoa,
                                      e1 : (control_rel,
                                            sem_args : A),
                                      sem_args : A)]).
```

7.4.6 Adjectives

```
adj_gen
===
synsem : local : cat : head : adjective ==>
synsem : local : (cont : A,
                  core_sem : A).

adj_r
===
word,
synsem : local : cat : head : adjective ==>
synsem : local : cat : (subj : [D],
                        comps : [],
                        syn_args : [D|_]).

[roed] --->
synsem : local : (cat : (head : adjective,
                         co_pred : []),
                  cont : red_rel).

[stor] --->
synsem : local : (cat : (head : adjective,
                         co_pred : []),
                  cont : big_rel).

[glad] --->
synsem : local : (cat : (head : adjective,
                         co_pred : []),
                  cont : happy_rel).

[traet] --->
synsem : local : (cat : (head : adjective,
                         co_pred : []),
                  cont : tired_rel).
```

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