Boys buying two sausages each: On the syntax and semantics of distance-distributivity
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Citation for published version (APA):
Zimmermann, M. (2002). Boys buying two sausages each: On the syntax and semantics of distance-distributivity
Utrecht: LOT

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Chapter V   Adverbial readings with Adnominal Elements

In the course of this thesis, it was shown that there are two instances of jeweils, which give rise to different readings. Adverbial jeweils is adjoined to VP and distributes the elements of the VP-denotation (i.e. individual events) over an (implicit) set of events. Adnominal jeweils is located inside a complex DP and distributes sets of individuals over a plural-denoting expression in its clause. In this chapter, we turn to what looks like a borderline case between the two instances of jeweils, at least at first sight. It turns out that instances of adnominal jeweils sometimes give rise to – what looks like an - adverbial reading. This mostly happens when adnominal jeweils is in subject position, a case that has not been considered in detail so far (but see the data from German, Czech, Bulgarian in chapter II.4.4). The phenomenon is exemplified in (1).

(1)  Jeweils zwei Jungen standen Wache.
    each  two boys  stood  watch
    ‘Each time, two boys kept watch.’

At first sight, jeweils in (1) is interpreted adverbially. It seems to distribute individual events of two boys keeping watch over an implicit set of events. The adverbial interpretation is somewhat surprising, since jeweils in (1) seems to form part of the subject DP.

This chapter has two chief goals, then: First, the semantic analysis of adnominal jeweils from chapter IV is extended to instances of adnominal jeweils in subject position. In the process, it is shown that the analysis accounts for the existence of – what looks like – adverbial readings with adnominal jeweils, as in (1).

To this end, I first show that jeweils in (1) is really an instance of adnominal jeweils, not an adverbial adjoined to CP, or located in some other functional projection in the left periphery of the clause. This is done in section 1. In section 2, I demonstrate that and how adnominal jeweils can give rise to an adverbial reading when it occurs in sentence initial position. In the process, the semantic operation of ‘crosswise λ-abstraction’ is introduced. Notice that although the reading of (1) will be shown to derive from an adnominal instance of jeweils, I will go on to call it ‘adverbial’ because of its truth-conditional equivalence to genuine adverbial readings. In section 3, I show that the analysis accounts for the (im)possibility of d-distributive elements in embedded subject position (thus accounting for the last remaining problem from chapter III.5.5). It will become clear that the impossibility of d-distributive elements in embedded subject position is partly due to semantic, and partly due to syntactic reasons. The chapter concludes with a few (speculative) remarks concerning the applicability of crosswise λ-abstraction to other syntactic configurations. It is suggested that crosswise λ-abstraction may play a role in connection with variable binding from within ILCs, with variable binding out of possessive DPs, and withPP-pluractional quantifiers. The potential application of crosswise λ-abstraction in a wider range of constructions, if feasible, lends independent motivation to the process as a whole.
1 Adverbial Readings with Adnominal Jeweils

This section introduces the relevant facts concerning the adverbial interpretation of adnominal elements. Starting with jeweils, I present the arguments for its adnominal status in (1) in section 1.1. In 1.2, I show that analogous semantic effects arise with other jeweils-DPs that have moved overtly to sentence-initial position, e.g. by passivisation or topicalisation. The possibility of an adverbial interpretation is independent of the grammatical function of the raised jeweils-DP. In 1.3, I show that similar semantic effects occur with other adnominal elements, such as the s-expression wenigstens ‘at least’, the adjective gelegentlich ‘occasional’, or with numerals. The observed facts are summarised in 1.4 in form of a generalisation about the availability of adverbial readings with adnominal elements.

1.1 Jeweils in Subject Position

In chapter II.4.4, the possibility of backwards distribution with with adnominal jeweils in underlying subject position was introduced in passing. An example is given in (2).

(2) jeweils zwei Offiziere begleiteten die Ballerinen nach Haus.

On the backwards distributive reading in (3a), each ballerina was walked home by two officers. However, (2) has a second, more prominent reading according to which two officers walked home a group of ballerinas each time (cf.3b).

(3) a. ∀z [ballerina'(z)] → ∃X [2officers'(X) ∧ ∃e [*accompany'(X, z, e)]]

b. ∀z[∃x ∈ E → ∃X[2officers'(X) ∧ ∃e[*accompany'(X, [[the ball.s]],z) ∧ R(e,z)]]]

How to account for this additional adverbial reading? As a first guess, one could analyse the two readings in (3) as the result of structural ambiguity, similar to what was argued for ambiguities with jeweils in the middle field (see the discussion in chapter II.2 and IV.4.3.3). According to this view, reading (3b) would be derived from a structure as in (4):

(4) [XP jeweils [CP zwei Offiziere; [C: begleiten t; die Ballerinen nach Haus]]

The label XP leaves open the exact positioning of jeweils in the left periphery. jeweils could be adjoined to CP, or it could occupy the specifier of one of the functional projections that have been argued to make up the left periphery by Rizzi (1997). Note that the structure in (4) violates the V2-requirement which seems otherwise inviolable in German.2

However, even if the V2-requirement should prove violable in German, there are three arguments against (4) as the correct syntactic structure for (2). First, jeweils in (2) can be replaced by the short form je, which – as shown in chapter II.1.9 – is restricted to

1 The ‘adverbial’ reading can be suppressed by adding the imperfectivity marker gerade ‘just’.
2 But see the reference to Büring & Hartmann (2001) in chapter III.2.1.1, fn.9, who argue that the V2-requirement is violable by occurrences of the focus particle nur ‘only’ in the initial position of root clauses.
adnominal position. (5) shows that the adnominal form je can be interpreted adverbially in sentence-initial position.3

(5) Je zwei Offiziere begleiteten die Ballerinnen nach Haus.
   each two officers accompanied the ballerinas to home
   a. ‘Each of the ballerinas was accompanied home by two officers.’
   b. ‘Each time, two officers accompanied the ballerinas home.’

Second, jeweils in (2) has the selection properties of adnominal jeweils. It must occur with a predicate denoting DP as in (2). With proper names or specific DPs in SpecCP, jeweils cannot occur in sentence-initial position (cf.6ab).

(6) a. *Jeweils Leutnant Tarski begleitete die Ballerinnen nach Haus.
   each Lieutenant T. accompanied the ballerinas to home
   b. *Jeweils der Hauptmann begleitete die Ballerinnen nach Haus.
      each the captain accompanied the ballerinas to home

Third, other adverbial quantifiers cannot be substituted for jeweils in (2). Their insertion leads to ungrammaticality, as shown in (7).

(7) *Oft/ manchmal/ selten zwei Offiziere begleiteten die Ballerinnen nach Haus.
   often sometimes seldom two officers accompanied the ballerinas to home

Given that the syntactic distribution of adverbial jeweils parallels that of other adverbial quantifiers in all other syntactic contexts (see chapter III.1), (7) suggests that jeweils in (2) is not an instance of adverbial jeweils.

Summing up, this section has shown that jeweils gives rise to ‘adverbial’ readings when it occurs in subject position together with an indefinite expression serving as the DistShare. The selection properties of jeweils, the impossibility of other adverbial quantifiers in this position, and the fact that jeweils can be replaced by the short form je combine to show that we deal with an instance of adnominal jeweils in (2). I therefore assume that the structure of (2) is as in (8), with adnominal jeweils forming part of the subject DP.

(8) [CP [DP [jeweils₁ [ zwei Männer t₁]₂ [C begleiteten t₂ die Ballerinnen nach Haus]]]]
   each two men accompanied the ballerinas to home

I conclude that instances of adnominal jeweils are sometimes interpreted adverbially.

1.2  Adverbial Readings with Fronted Jeweils-DPs
The ability of jeweils to be interpreted adverbially does not depend on the subject status of its embedding DP, but on its being in sentence-initial position. An adverbial reading is possible for jeweils-DPs of all grammatical functions as long as they have moved to an ‘initial position’ at surface structure. The term initial position must here be understood as a position outside the VP, usually a position in sentence- or middle field-initial position.

3 See also example (i) from Link (1987):
   (i) Je drei Äpfel waren faul.
      each two apples were rotten ‘Each time / in each basket, two apples were rotten.’
(9a) illustrates the adverbial reading for an object jeweils-DP after passivisation, and (9b) for an indirect object jeweils-DP after topicalisation.

(9)  a. Jeweils zwei Schönheitsköniginnen wurden gewählt.
    each two beauty queen was chosen
    ‘Each time, two beauty queens were chosen.’

  b. Jeweils drei Kandidaten haben wir einen Preis überreicht.
    each three candidates have we a price handed over
    ‘Each time, we handed over a price to three candidates.’

The adverbial reading is the only reading for the sentences in (9), for they contain no plural DistKey expression that jeweils could quantify over.

So far, we have seen that adverbial readings are possible with jeweils-DPs in SpecCP. The examples in (10) show that the possibility of adverbial readings is not dependent on the CP-position (or any other projection in the left periphery). In the embedded clause in (10a), the subject jeweils-DP occupies the initial position in the middle field. In the embedded clause in (10b), the object jeweils-DP has scrambled across the subject to middle field initial position.

(10)  a. ..., weil [je(weils) zwei Jungen]1 Wache standen.
    because each two boys watch stood
    ‘...because two boys kept watch each time.’

  b. ..., weil [je(weils) zwei Gästen]1 einen Preis überreicht wurde.
    because each two guests a price handed over was
    ‘...because each time two guests were handed over a price.’

Notice immediately that jeweils in (10ab) must be an instance of adnominal jeweils since the adverbial reading is also possible with the short form je in the same position (as indicated by the brackets). Again, distributive je is a short form of adnominal jeweils only.

(10ab) show, then, that an adverbial reading is possible with a jeweils-DP if the jeweils-DP is located outside the VP. This is the case for subject DPs on the normal word order, or for DPs of other grammatical functions that have undergone passivisation, topicalisation, or scrambling out of the VP. Based on (9) and (10), I conclude that jeweils-DPs can be interpreted adverbially if they are in a VP-external position.

Summing up, it was shown that the possibility of an adverbial interpretation is not restricted to instances of adnominal jeweils inside subject DPs. Instances of jeweils in other DPs can also be interpreted adverbially, given that the DP has overtly moved to a VP-external position. In the following subsection, it is shown that adverbial readings are possible with other adnominal expressions besides jeweils.

1.3  Adverbial Readings with other Adnominal Elements

In this section, I show that German jeweils is not the only adnominal element allowing for an adverbial reading. Indeed, the phenomenon seems to be quite pervasive. It occurs with a number of other expressions, among them s-expressions such as wenigstens ‘at least’, adjectival constructions such as d- gelegentliche ‘the occasional’, and numeral expressions.

As shown in chapter II.3, the focus particle wenigstens can occur both adverbially and adnominally. The adnominal case is illustrated in (11a), the adverbial case in (11b). The two instances of wenigstens are distinguished by their relative position to the exhaustivity
marker *alle* ‘all’ and the adverbial quantifier *immer* ‘always’. Being a (speaker-oriented) sentence adverbia1, adverbial *wenigstens* must precede the adverbial quantifier. This makes it a little easier to tell apart instances of adnominal and adverbial *wenigstens*.

(11) a. Die Jungen haben immer alle *wenigstens* zwei Bücher gelesen.
    the boys have always all at least two books read
    ‘The boys have always all read at least two books.’
    b. Die Jungen haben *wenigstens* immer alle zwei Bücher gelesen.
       at least always all two books read
    ‘At least, the boys have always read two books.’

In (11a), presence of *wenigstens* indicates that the set denoted by the object NP *zwei Bücher* ‘two books’ contains two books or more. In other words, *wenigstens* indicates the lower margin of the set denoted by the NP. In (11b), *wenigstens* functions as a speaker-oriented adverb. It compares the proposition expressed by the clause with a set of alternative propositions which might also have been the case. It indicates that the state of affairs expressed by the proposition was the least what one could have expected, or what would have been appropriate according to the speaker’s evaluation.

Interestingly, an adverbial reading is available for adnominal *wenigstens*, once the object DP in (11a) has raised out of the VP, e.g. by topicalisation (cf.12a). Similarly, the adverbial reading is possible for adnominal *wenigstens* inside subject DPs (12b).

(12) a. [Wenigstens zwei Bücher] haben die Jungen immer alle *t₁* gelesen.
    at least two books have the boys always all read
    i. ‘The boys have always all read at least two books.’
    ii. ‘At least, the boys have always all read two books.’

b. [Wenigstens zwei Studenten] haben *t₁* zugeschaut.
    at least two students have watched
    i. ‘At least two students have watched.’
    ii. ‘At least, two students have watched.’

Informally, the reason for the ambiguity of (12ab) is clear. *Wenigstens* is a focus particle which takes its focus to the right at surface structure. For this reason, the entire proposition can be in the focus of *wenigstens* and be positioned on the speaker’s scale of evaluation, while the same is impossible for (11a).

Adverbial readings can also be found with adnominal elements without a formally identical adverbial counterpart. A well documented case (cf. Bolinger 1967, Stump 1985, Larson 1999, Zimmermann 2000) are the adverbial readings observed with the adjective *occasional*. (13a) has a reading synonymous to the adverbial (13b).

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4 For a precise formal account of the semantics of *wenigstens*, see Krifka (1999).
5 The two readings come along with two different intonations. I assume that the differences in intonation are due to the different focus structures imposed, depending on whether the whole proposition (adverbial reading) or only the fronted numeral NP (adnominal reading) is the focus of the expression.
6 As pointed out in chapter III.4.4, this condition can be overruled in particular (discourse) contexts. In (i), *wenigstens* occurs to the left of the contrastive topic *mir* ‘meDAT’:

(i) *Mir wenigstens ist das zu viel.*
   me at least is that too much
   ‘For me at least, this is too much.’
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(13)  a.  [DP An/ the occasional sailor] walked by.
  b.  Occasionally, a sailor walked by.

The same holds for German, as shown in (14ab):

(14)  a.  [DP Der gelegentliche Seemann] spazierte vorüber.

the occasional sailor walked by

i.  ‘Occasionally, a sailor walked by.’ (adverbial reading)
ii.  ‘Somebody who sails occasionally walked by.’ (adnominal reading)

b.  Gelegentlich spazierte ein Seemann vorüber.

occasionally walked a sailor by

‘Occasionally, a sailor walked by.’

In (13a) and (14a), the adjective is clearly inside the DP at surface structure. Despite this, an adverbial reading is available.

In German, the adverbial reading is impossible for the adjective gelegentlich ‘occasional’, if it occurs inside an object DP, unless this DP has been fronted to a position outside the VP. This is illustrated in (15ab).


we have also the occasional burglar arrested

‘We have also arrested the hobby burglar.’

‘Occasionally, we have also arrested a burglar.’

b.  [Den gelegentlichen Einbrecher] haben wir auch t1 verhaftet.

the occasional burglar have we also arrested

‘Occasionally, we have also arrested a burglar.’

Again, we see that the possibility of an adverbial reading for an adnominal element depends on the syntactic position of the embedding DP. It must be outside the VP, fronted to a sentence- or middle field initial position. Presumably, the DP must occur in VP-external position for semantic reasons. On the adverbial reading of (13a), the sequence the occasional seems to form a complex quantifier over pairs of individuals and events (see section 2.3.2 and Zimmermann (2000) for more discussion). As a quantifier over events, it is expected to occur in a position above the event argument of the verb, i.e. outside the VP (see chapters IV.1 and IV.2).

A further case of an adnominal element giving rise to an adverbial reading is discussed in Krifka (1990) and Doetjes & Honcoop (1997). It is instantiated by adnominal numeral expressions, which can be used to quantify existentially over events. In this case, they take on the reading of the adverbial event quantifier n times, as shown in (16).

(16)  4000 ships passed through the lock.

i.  ‘4000 times, there was a ship passing through the lock.’
ii.  ‘4000 different ships passed through the lock.’

1In English, the adverbial reading is possible for occasional inside an object DP, as witnessed by (i):

(i)  We met the occasional sailor. = ‘Occasionally, we met a sailor.’

Zimmermann (2000) puts this difference down to an independent syntactic factor: The availability of LF-movement for semantic reasons in English. LF-movement can raise the object DP in (i) to a position outside the VP, where it can be interpreted adverbially.'
On the adverbial reading, there need not be 4000 different ships. 1000 ships would suffice given that each ship passed through the lock 4 times.\(^8\) In contrast, on the adnominal reading there have to be 4000 different individual ships.

Again, it turns out that this adverbial reading is not so readily available with the numeral DP in VP-internal object position. This is shown for English in (17), and for German in (18a).\(^9\) The adverbial reading is easily available again if the object DP has been raised outside the VP to an initial-position (cf.18b).

(17)  The coast guard examined 4000 ships.
     ʼ4000 times, the coast guard examined a ship.ʼ

(18)  a. Die Küstenwache untersuchte 4000 Schiffe.
     the coastguard examined 4000 ships
     ʼ4000 times, the coastguard examined a ship.ʼ

   b. 4000 Schiffe wurden untersucht.
     4000 ships were examined
     i. ʼ4000 times, a ship was examined.ʼ  (adverbial reading)
     ii. ʼ4000 different ships were examined.ʼ  (adnominal reading)

As in the case of the occasional, the VP-external position of the numeral DP in (18b) seems to follow from semantic requirements. Doetjes & Honcoop (1997) argue that numerals can (optionally) denote quantifiers over pairs of individuals and events. As an event quantifier, the numeral – or the DP containing it – must be in a position above the VP in order to take scope over the verbʼs event argument.

Summing up, this section has shown that the possibility of adverbial readings with adnominal elements is not restricted to the case of jeweils. Parallel facts are observed with s-expressions, determiner-adjectival constructions, and numeral expressions. It was shown that the possibility of an adverbial reading depends on structural factors. The embedding DP must be in a VP-external position in all cases. Tentatively, it was suggested that the VP-external position follows from a semantic requirement, namely the need for the adnominal element to take either the entire proposition (in the case of s-expressions), or at least the event argument of the verb in its scope. In the next section, we will look at the structural conditions for adverbial readings with adnominal elements in more detail, arriving at some preliminary generalisations.

### 1.4 Structural Conditions on Adverbial Readings with Adnominal Elements

In this section, I present a few preliminary generalisations concerning the possibility of adverbial readings with adnominal elements. Since the matter is rather complex, I will not attempt to give a full-fledged explanation of all observable phenomena, rather limiting myself to a few remarks that may hint at a possible solution, and which may serve as the basis for future work. The general point will be that the possibility of an adverbial reading

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\(^8\) The adverbial reading is contingent on the numeral being relatively high and thus excluding the possibility of individual identification of the various ships. In contrast, (i) does not readily allow for the adverbial reading.

(i) Three ships passed through the lock.

\(^9\) I am not sure if the adverbial reading is entirely impossible for (17) and (18a). In any event, it is more easily available if the numeral DP occurs in initial position, as in (18b). A possible explanation for the availability of an adverbial reading for (17) and (18a) could be the application of vacuous scrambling in German and LF-movement in English, which would move the numeral object out of the VP. Outside VP, it would be in a position from where it could quantify over the event argument of the verb.
depends both on structural and on morphosyntactic factors, namely on the syntactic position of the adnominal element and on its feature content.

In the preceding section, adverbial readings in German (and to a certain extent in English) were shown to be possible with the following adnominal elements:

(19) i. *s-expressions: wenigstens ‘at least’
   ii. numerals: 4000
   iii. sequences of determiner and adjective: d-gelegentliche ‘the occasional’

It was also pointed out that the possibility of an adverbial reading is subject to a structural condition, as formulated in (20).

(20) *1st Structural Constraint on Adverbial Readings with Adnominal Elements:
The embedding DP must occur in a position (at least) above VP.

(20) is satisfied by underlying subjects in SpecIP or SpecCP, as well as by objects which have overtly moved outside the VP through scrambling, topicalisation, or passivisation. Above, it was argued that (20) is motivated semantically. The DP containing the adnominal element must be in the right scopal position. In the case of wenigstens ‘at least’, it must take scope over the entire proposition expressed (including potential adverbial quantifiers). With those elements (including jeweils) which give rise to adverbial quantification over events, it must be in a position where it can take scope over the external event argument of the verb. From this, it follows that the embedding DP must be at least adjoined to VP.10

Apart from (20), there is a second structural constraint that refers to the position of the adnominal element inside its embedding DP. (21a-d) show that the adnominal element must occur at the left edge of the DP in order to give rise to an adverbial reading. If the adnominal element is preceded by other DP-internal material, an adverbial interpretation is impossible. For jeweils, this case is illustrated by means of a jeweils-DPs that is embedded inside another DP.

(21) a. Die wenigstens 500 Demonstranten marschierten zum Rathaus.  (cf.12b)
   i. ‘The at least 500 protesters marched to the townhall.’
   ii. *‘At least, 500 protesters marched to the townhall.’

b. Der gutgekleidete gelegentliche Seemann spazierte vorüber.’  (cf.13a/14a)
   The well-dressed occasional sailor walked by
   *Occasionally, a well-dressed sailor walked by.’

c. Die 4000 Schiffe fuhren durch die Schleuse.  (cf.16/18b)
   The 4000 boats passed through the lock.
   *‘4000 times, the boats passed through the lock.’

10 In section 2.3.1, it will be shown for adnominal jeweils that the semantic derivation cannot proceed if the embedding DP has not left the VP.
d. Mütter von jeweils zwei Soldaten wurden ausgezeichnet.
   mothers of each two soldiers were decorated
   ‘Each time, mothers of two soldiers were decorated.’

The data in (23a-d) suggest the second generalisation in (22):

(22) 2nd Structural Constraint on Adverbial Readings with Adnominal Elements:
The adnominal element must occur at the left edge of DP.

The generalisations in (20) and (22) account for all the data discussed so far. However, (20) and (22) are at best necessary, but not sufficient conditions for the availability of adverbial readings with adnominal elements. Consider (23).

(23) Jeder Student hat ein Buch gelesen.
   each student has a book read
   i. ‘Each student has read a book.’
   ii. ‘A/the student has always read a book.’

The universal D-quantifier jeder ‘each’ in (23) does not allow for a universal adverbial reading, although the two structural conditions in (20) and (22) are met. The DP is in a position above VP, and jeder is at the left edge of this DP. Hence, there must be a third licensing condition that would correctly exclude an adverbial reading for (23).

I would like to argue that the third licensing condition concerns the feature content of the adnominal element in question. The intuitive idea is that the specific feature content of some adnominal elements blocks them from being interpreted adverbially. This qualification is reminiscent of the discussion of the possibility or impossibility for d-distributive elements to select a non-DP as DistKey. In chapters II.4 and III.5, it was shown that there is a correlation between this property and the morphological shape of the d-distributive element. D-distributive elements which are formally identical to the respective D-quantifiers cannot distribute over the denotations of non-DPs. D-distributive elements which differ in form usually can do so. Representative examples from German and English are repeated as (24ab).

(24) a. Peter kritisierte und lobte Maria aus jeweils zwei Gründen.
   Peter criticised and praised Maria for each two reasons
   ‘Peter criticised and praised Maria for two reasons respectively.’
   b. *Peter criticised and praised Maria for two reasons each.

In chapter III.5.4.1, it was argued that the D-features of each block it from distributing over the set of events denoted by the verb conjunction in (24b). By the same token, the D-quantifier jeder in (23) cannot have an adverbial reading on which it would quantify over events. Recall that jeder overtly encodes typical D-features such as gender, number, and person. The third condition on adverbial readings with adnominal elements is given in (25).

(25) Morphosyntactic Condition on Adverbial Readings with Adnominal Elements:
The adnominal element must not contain (overtly expressed) D-features.
In contrast to jeder in (23), the expressions in (19) do not encode D-features overtly. From this, I conclude that they do not contain D-features in their lexical entry. In III.4.4, it was argued that adnominal s-expressions – among them adnominal jeweils - are postnominal PPs underlyingly and raise to SpecDP overtly. Numerals were argued to be adjectival underlyingly, and as such they are base-generated adjoined to NP. Possibly, the adverbial reading is the result of head movement of the adjectival numeral to an empty D-head. In a similar vein, Zimmermann (2000) argues that the sequence a/the occasional forms a complex quantifier after (A-to-D) head movement of the adjective occasional. Note that the choice of overt determiner (definite or indefinite) makes no difference in (13a). This suggests that – after A-to-D incorporation - the presence of D-features is not discernible any longer. It follows that quantification over events becomes possible.\footnote{An alternative way to account for adverbial readings with complex quantifiers such as the/an occasional would be to deny the indefinite and definite article a quantifier status altogether, in line with Kamp (1981) and Heim (1982).}

To conclude these somewhat speculative remarks, I have proposed that an adnominal element must meet the following three licensing conditions in order to be interpreted adverbially.

(26) \textbf{Licensing Conditions on Adverbial Readings with Adnominal Elements}

i. The embedding DP must occur in a position (at least) above the VP.

ii. The adnominal element must occur at the left edge of the DP.

iii. The adnominal element must not have (semantically visible) D-features in its feature content.

(26i) and (26iii) where shown to follow from semantic factors. The adnominal element’s DP must be in the right scopal position, and the adnominal element must be capable to quantify over, or modify the denotations of non-DP-constituents. The following section shows how adverbial readings are derived with adnominal jeweils in subject position. In section 2.3, it will be shown that the licensing conditions in (26) fall out automatically for jeweils from the semantic analysis proposed.

1.5 \textbf{Summary}

In this section, it was shown that adnominal jeweils can be interpreted adverbially under certain conditions. Adverbial readings are also possible with other adnominal elements. Finally, it was shown that the possibility of an adverbial reading with an adnominal element depends on certain, partly structural licensing conditions. In particular, the DP containing the adnominal element has to be located outside the VP.

2 \textbf{The Semantics of Adnominal Jeweils in Subject Position}

This section presents the semantic analysis of sentences with adnominal jeweils in subject position. 2.1 establishes the syntactic surface structure of such sentences, which serves as the input for semantic interpretation. 2.2 shows how the adverbial reading is derived. To this end, it is necessary to introduce a semantic mechanism, which I refer to as ‘crosswise λ-abstraction’. Section 2.3 shows how the licensing conditions for adverbial readings with adnominal elements follow from semantic factors. Finally, section 2.4 shows that the mechanism of crosswise λ-abstraction allows for a correct interpretation of all instances of
adnominal *jeweils* that were left unaccounted for in chapter IV (see the examples in (168a-d) in chapter IV.4.3). These include backwards distribution with a *jeweils*-DP in subject position over a DistKey in object position, and the distribution with *jeweils*-DPs in direct object position over a DistKey in indirect object position. In all constructions, the *jeweils*-DP is analysed as having moved overtly, leaving behind an indexed trace. The existence of this trace is important for the semantic derivation to proceed. The present discussion completes the semantic analysis of adnominal *jeweils*. At the end of this section, all syntactic occurrences of adnominal *jeweils* that were presented in IV.4.3 will have received a formal semantic account.

### 2.1 The Syntactic Structure

Since the interpretive component takes syntactic (surface) structures as its input, we have to be clear about the syntactic structure of sentences such as (1), which has been slightly altered to an embedded structure in (27).\(^\text{12}\)

(27) ..., weil jeweils zwei Jungen Wache gestanden haben.  
‘...because each time, two boys have kept watch.’

(27) is taken to be derived by standard assumptions. The *jeweils*-DP is base-generated in VP-internal subject position and raises to SpecIP, where it receives case. The surface structure is given in (28), irrelevant details aside.

(28) \[
\begin{align*}
\text{(CP weil) } & [\text{(DP jeweils zwei Jungen)}, \text{VP stehen Wache haben}].
\end{align*}
\]

The question is how the structure in (28) can give rise to an adverbial reading.

### 2.2 Crosswise λ-Abstraction

Attempting to derive the meaning of (28) in compositional fashion, one encounters the following problem. The derivation proceeds smoothly up to the point where the denotations of DP and I’ combine. The interpretation of the *jeweils*-DP should be standard by now. Recall that the constituent \([P^0 \text{jeweils}]\) carries two indices, one shared with the DistKey, the other with a relation-denoting expression.

(29) \[
[[ \text{DP jeweils zwei Jungen} ]] = \forall z \in Z_i \exists X [2\text{boys}(X) \land *R_j(X)(z)]
\]

The I’-denotation is derived by functionally applying the verb denotation to a variable co-indexed with the moved subject, followed by existential closure over the event variable (I ignore the contribution of I\(^0\), if any).

(30) \[
[[ \text{VP stehen Wache} ]] = \exists e' [\text{*kept\_watch'}(x_1,e')]
\]

The problem is that (29) and (30) are both saturated expressions of semantic type \(<\ell>\), i.e. none of the denotations can functionally apply to the other. Nor can they be combined by predicate modification. Being of type \(<\ell>\), they could combine by boolean conjunction.

\(^{12}\)The embedded structure in (27) was chosen in order to keep the syntactic structure as minimal as possible, thus avoiding unnecessary intermediate steps in the semantic derivation. The semantic derivation works the same way for *jeweils*-DPs in SpecCP.
However, the result of boolean conjunction in (31) shows that this operation does not apply in the case at hand either.

(31) $\exists e \left[ *\text{kept\_watch}'(x_1,e) \right] \land \forall z \left[ z \in Z_i \Rightarrow \exists X \left[ 2\text{boys}'(X) \land *R_j(X)(z) \right] \right]$

After boolean conjunction, the variable ‘$x_1$’ in the first conjunct is not in the scope of the existential quantifier ‘$\exists x$’ in the second conjunct. According to (31), it is not necessary that the agent of the watch keeping (i.e. the value of ‘$x_1$’) be a set of two boys, contrary to fact.

I propose to mend the problem regarding the composition of (29) and (30) in the following way. First, I assume that the verb denotation contains an optional modifier which expresses a relation of the event predicated by the verb to an event in the preceding discourse. In IV.1.3, it was shown that such optional, event-relating modifiers are required independently in order to ensure discourse coherence. With this assumption, the $I'$-denotation is as follows.

(32) $[[ \text{I' \ t\ st\ Wache} ]] = \exists e' \left[ *\text{kept\_watch}'(x_1,e') \land R(e', e_i) \right]$

(32) contains two free variables, ‘$e_i$’ and ‘$x_1$’ which could be $\lambda$-abstracted over in principle. The question is what could be the trigger for such $\lambda$-abstraction. In my view, $\lambda$-abstraction is triggered by the presence of the indices ‘$i$’ and ‘$1$’ on the syntactic sister of $I'$, which is the jeweils-DP. Index ‘$1$’ is added to the subject DP as a result of movement from its VP-internal base position. In 2.3.1, I discuss how the index ‘$i$’ on jeweils can be visible to $I'$. For now, let us assume that the jeweils-DP as a whole carries the two indices ‘$i$’ and ‘$1$’. If so, $\lambda$-abstraction is licensed by the index-triggered $\lambda$-abstraction rule from chapter IV.4.2.1, which is repeated as (33).

(33) **Index-Triggered $\lambda$-Abstraction:**

If the semantic types of a proposition-denoting expression $\alpha$ and its syntactic sister $\beta$ do not match, and if $[[\alpha]]$ contains a free variable $u_i$ which shares an index ‘$i$’ with $\beta$, $\lambda$-abstraction in $[[\alpha]]$ over index ‘$i$’ is licensed, and $\lambda u_i[[\alpha]]$ is a value for $\alpha$.

After $\lambda$-abstraction over index ‘$i$’ and then over index ‘$1$’ in this order, we get (34), which expresses a relation of type <$e,e_i$>.

(34) $\lambda x\lambda e. \exists e' \left[ *\text{kept\_watch}'(x, e') \land R(e', e) \right]$

At this point, we are left with the relation in (34), the denotation of $I'$ after $\lambda$-abstraction, and an expression that contains a free relation variable, the denotation of the jeweils-DP. Given the discussion of the conditions on $\lambda$-abstraction from chapter IV.4.2.1, a possibility to resolve this type-mismatch lies at hand. The rule of type-triggered $\lambda$-abstraction rule, repeated as (35), allows for type-triggered $\lambda$-abstraction over a free variable if the result is of a suitable type to combine with the denotation of the sister node.
(35) Type-Triggered \( \lambda \)-Abstraction:
If the semantic types of a proposition-denoting expression \( \alpha \) and its syntactic sister \( \beta \) do not match, and if \([[\alpha]]\) contains a free variable \( u_i \) which shares an index ‘i’ with \( \beta \), \( \lambda \)-abstraction in \([[\alpha]]\) over index ‘i’ is licensed, and \( \lambda u_i[[\alpha]] \) is a value for \( \alpha \).

Applying (35) to the denotation of the jeweils-DP in (29), \( \lambda \)-abstraction over ‘R’ yields (36).

\[
[[\text{DP}_{i,j}, \text{jeweils}_{i,j} \text{zwei Jungen }]] = \lambda R. \forall z [z \in Z_i \Rightarrow \exists X [2\text{boys}'(X) \land R(X)(z)]]
\]

Function application of (36) to (34) yields (37a), with truth conditions as specified in (37b).

(37) a. \[
[[\text{DP}_{i,j}, \text{jeweils}_{i,j} \text{zwei Jungen Wache gestanden haben}]] = [[\lambda R. \forall z [z \in Z_i \Rightarrow \exists X [2\text{boys}'(X) \land R(X)(z)]]]]
\]
\[
(\lambda x \lambda e. [\exists e' (*\text{kept watch}'(x,e') \land R(e',e))] \iff \forall z [z \in Z_i \Rightarrow \exists X [2\text{boys}'(X) \land \exists e' (*\text{kept watch}'(X,e') \land R(e',z))]] = 1 \text{ iff}
\]

b. for all elements \( z \) of a contextually salient set (of events) \( Z_s \), there is a set of two boys \( X \), and an event \( e' \), such that the elements of \( X \) kept watch in \( e' \), and event \( e' \) is related to event \( z \) by a temporal, causal, subpart, or other contextual relation.

The reader may convince herself that the truth conditions in (37b) are the same as those found with adverbial jeweils. Hence, the semantic derivation proposed here gives the correct results. Observe that the universal quantifier binds an event variable \( z \) both in its restriction and in its nuclear scope in (37a). In chapter IV.1.3, this was argued to be a characteristic property of adverbial quantification over events. This shows, then, that the label ‘adverbial reading’ for the interpretation of (27) is justified.

The derivation of the adverbial interpretation of jeweils-DPs in subject position differs from that of jeweils-DPs in other syntactic positions in two respects. The first difference pertains to the role of the index ‘i’ on jeweils, which it shares with the DistKey. In all cases studied in chapter IV, the index on jeweils only indicated the presence of a free set variable which could be \( \lambda \)-abstracted over triggered by an identical index on the DistKey. In the case of jeweils-DPs in subject position, the index on jeweils triggers \( \lambda \)-abstraction over a co-indexed variable inside the denotation of the sister of the jeweils-DP. This suggests that identical indices always have the same semantic capacity, no matter where they appear syntactically.

The second difference pertains to the mechanism of \( \lambda \)-abstraction. In all the cases discussed so far, \( \lambda \)-abstraction was employed in order to resolve type-mismatches. At each syntactic node, \( \lambda \)-abstraction applied to the denotation of only one daughter. In the course of the discussion, we have encountered \( \lambda \)-abstraction over a relation variable, \( \lambda \)-abstraction over a plural individual variable, and \( \lambda \)-abstraction over an event variable in the following syntactic configurations.
(38) a. VP
   jeweils-DP
   V individuall-level

λ-abstraction applies here, yielding an expression of type \(<e,et>,t>\)

b. I'
   DistKey\(_i\)
   VP

λ-abstraction applies here, yielding an expression of type \(<et>\)

(39) a. VP
   PP\(_{adv}\)
   VP
   ...jeweils-DP...

λ-abstraction applies here, yielding an expression of type \(<vt>\)

b. VP
   PP\(_{adv}\)
   VP
   ...jeweils-DP...

λ-abstraction applies here, yielding an expression of type \(<vt>\)

(38a) models the semantic composition of a jeweils-DP in object position with an individual-level verb. (38b) models the ‘factoring in’ of the DistKey denotation. Both λ-abstractions are triggered by an index on the sister constituent according to the λ-abstraction rule in (33). (39a) models the semantic composition of an (event modifying) adverbial PP and a VP. (39b) models the composition of a VP and an (event-modifying) adverbial that contains a jeweils-DP. In chapter IV.4.3.2, the latter compositions were argued to be mirror images of the same semantic process.

The composition of jeweils-DPs in subject position with the remainder of the clause is different in nature. The crucial difference lies in the fact that λ-abstraction must apply to both daughters of the IP-node. This is illustrated schematically in (40).

(40) IP
   jeweils-DP\(_{i,1}\)

λ-abstraction applies here, yielding \(<e,et>,t>\)

If the composition to proceed, it is important that λ-abstraction applies first to the denotation of the right-hand daughter, which is triggered by the two indices on the subject DP. Without this process, λ-abstraction over the left hand daughter’s denotation for type reasons could not apply. This shows, once again, the prominent role played by index-triggered λ-abstraction in the semantic system sketched here. In what follows, I will refer to the double operation of λ-abstraction first to the right-hand daughter, and then to the left-hand daughter of a syntactic node as ‘crosswise λ-abstraction’. In section 4, I suggests
that this process possibly plays a role in the semantic interpretation of other syntactic configurations besides d-distributive constructions.

One may wonder what fixes the order of $\lambda$-abstraction on the right-hand daughter in (40). In other words, how do we know that $\lambda$-abstraction is first applied to index ‘i’ (the index on jeweils) and then over index ‘1’ (the index of the moved DP)? In my view, the two rules are intrinsically ordered. An argument for this is the fact that application of the rules in the reverse order yields a reading which is not attested. Consider what happens if we apply $\lambda$-abstraction in the reverse order. Instead of (34), we get (41).

\[
(41) \quad \lambda e \lambda x. \exists e'[\text{kept}_\text{watch}'(x, e') \land R(e', e)]
\]

And applying (36) to (41), we get (42):

\[
(42) \forall z [z \in Z, \exists X [\exists e'[\text{kept}_\text{watch}'(z, e') \land R(e', e)] (X)(z)]
\]

(42) states that each element $z$ of a contextually given set of individuals kept watch, and in addition for each $z$ there is a set of two boys which stands in some relation to the watching event. This is not a possible reading for (27), where the two boys must be the agent of the watch keeping. Based on this empirical evidence, I conclude that there is only one order in which $\lambda$-abstraction can apply to the configuration in (40).

In conclusion, it was shown that application of the two $\lambda$-abstraction rules from chapter IV.4.2.1 allows for a correct derivation of the adverbial reading of adnominal jeweils. The only additional assumption was that $\lambda$-abstraction can apply crosswise to both daughters of a syntactic node.

2.3 Deriving the Licensing Conditions on Adverbial Readings

In this section, I show how the empirical generalisations at the end of 1.4 follow from a semantic analysis of adnominal jeweils in subject position. The three licensing conditions for adverbial readings with adnominal jeweils were the following: (i.) jeweils must be able to quantify over non-DP denotations, i.e. it must not contain D-features; (ii.) the embedding DP must be outside the VP; and (iii.) jeweils must be located at the left edge of DP. Section 2.3.1 shows how the last two licensing conditions follow from the mechanism of crosswise $\lambda$-abstraction. Having done this, I show that the licensing conditions for adverbial readings with other adnominal elements – though on the face of it identical – may be conditioned by other factors, I will do this in exemplary fashion for the pluractional quantifier the/an occasional in section 2.3.2.

2.3.1 Deriving the Conditions for Adnominal jeweils

The first licensing condition for adverbial readings with adnominal jeweils was discussed at length in chapter III.5.4. Since jeweils does not have D-features, it can freely quantify over non-DP denotations, for instance binding an event variable introduced by the verb.

The reason for the second generalisation becomes clearer by looking at how the adverbial reading is derived when adnominal jeweils is inside a fronted object DP. Consider (43).
(43) [Jeweils zwei Schönheitsköniginnen]$_2$ haben wir t$_2$ gewählt.
   each two beauty queens$_{MCC}$ have we chosen
   i. ‘Each of us has chosen two beauty queens.’
   ii. ‘Each time, we have chosen two beauty queens.’

(43) is ambiguous between the ‘regular’ adnominal reading (43i), and the preferred
adverbial reading (43ii). I assume that the regular reading arises when the fronted DP is
reconstructed to its base position at LF (in line with Burzio 1986). After reconstruction,
the standard semantic procedure for object jeweils-DPs with transitive stage-level verbs
from chapter IV.4.2.4 applies.

In contrast, the adverbial reading is derived from the surface structure of (43) in (44)
by application of crosswise λ-abstraction.

(44) [CP [DP jeweils zwei Schönheitsköniginnen]$_2$ [C- haben [IP wir$_1$ [VP t$_1$ t$_2$ gewählt]]]].
   each two beauty queens have we chosen

Crosswise λ-abstraction applies at the CP-node, where the denotations of jeweils- DP
and C’ combine. The denotations of the jeweils- DP and C’ are given in (45ab).

(45) a. [[DP$_{jeweils}$ zwei Schönheitsköniginnen]]
    = ∀z [z ∈ Z$_i$ → ∃X [2beautyqueens’(X) ∧ *R(X)(z)]]
    b. [[C- haben wir$_1$ t$_1$ t$_2$ gewählt]] = ∃e’[*choose'(we’,y$_2$, e’) ∧ R(e’,e)]

Crosswise λ-abstraction over ‘i’ and ‘2’ in C’ and over ‘j’ in the denotation of the jeweils-
DP, followed by functional application yields (46a), which has the truth conditions in
(46b).

(46) a. [[jeweils zwei Schönheitsköniginnen$_2$ haben wir$_1$ t$_2$ gewählt]]
    = [λR. ∀z [z ∈ Z$_i$ → ∃X [2beautyqueens’(X) ∧ *R(X)(z)]]
        (λyλe.∃e’[*choose’(we,y,e’) ∧ R(e’,e)])]
    ⇔ ∀z [z ∈ Z$_i$ → ∃X [2beautyqueens’(X) ∧
        (λyλe.∃e’[*choose’(we,y,e’) ∧ R(e’,e)]) (X)(z)]
    ⇔ ∀z [z ∈ Z$_i$ → ∃X [2beautyqueens’(X) ∧ ∃e’[*choose’(we,X,e’) ∧ R(e’,z)]]] = 1

b. iff for each event z of a contextually salient set of events Z$_i$, there is a set X of
two beauty queens, and an event e’, such that we have chosen X in e’, and e’
stands in some temporal, causal, subpart, or other relation to z.’

The derivation shows that – as was the case with jeweils in subject DPs – the semantic
derivation is contingent on the index (here ‘2’) introduced by movement. Without this
index on the fronted DP (and without the co-indexed variable left behind), the denotation
of C’ could not be turned into a relation by λ-abstraction, and the denotations of fronted
jeweils- DP and C’ could not be composed. In other words, the derivation of adverbial
readings with adnominal jeweils is contingent on movement of the jeweils- DP out of its
VP-internal base position. This way, we have arrived at a formal explanation for the fact
that adverbially interpreted instances of adnominal jeweils must be embedded inside DPs
that are located outside the VP.
We turn now to the third condition, which states that *jeweils* must be located at the left edge of its embedding DP for an adverbial reading to be possible. In my view, this requirement follows from the fact that the index ‘i’ on *jeweils* must be visible to the syntactic sister of the fronted DP. If the index is invisible, λ-abstraction cannot apply, thus blocking crosswise λ-abstraction. This gives rise to a slight problem that was glossed over in connection with the interpretation of (27) in 2.2. There, I have simply assumed that the *jeweils*-DP as a whole carries the index ‘i’. Looking at (44) in more detail, in particular at the structure of the fronted *jeweils*-DP, we see that visibility of ‘i’ is not automatically guaranteed by the syntactic structure.

(47)

\[
\text{C} \quad \text{P} \\
\text{D} \quad \text{P}_2 \\
\text{C'} \\
\text{jeweils}_{5,3} \quad \text{haben} \quad \text{wir} \quad \text{t}_2 \quad \text{gewählt} \\
\text{zwei Schönheitsköniginnen} \quad \text{t}_3 \\
\text{two beauty queens}
\]

The rule of index-triggered λ-abstraction in (33) states that λ-abstraction over an indexed free variable is possible in the denotation of C’ iff the syntactic sister of C’ carries an identical index. However, (47) shows that the index ‘i’ is not on the sister of C’, but on the specifier of this sister. There are at least two possible ways to approach this problem. The first would be to stick to the rule of λ-abstraction in (33) in its strong form and make sure that the index ‘i’ on the specifier of DP somehow gets copied onto the DP. It seems to be a plausible assumption that the index is copied onto the D-head of the DP under Spec-Head-agreement. From the D-head, it could percolate to the maximal projection, DP. This percolation process is illustrated schematically in (48).

(48)

\[
\text{D} \quad \text{P}_1 \\
\text{SpecDP}_1 \\
\text{D'} \quad \text{percolation} \\
\text{D}_1 \quad \text{NP} \\
\text{agreement}
\]

In contrast, there is no way for the index on *jeweils* to percolate to the upper DP in (49a), given the DP-structure in (49b).

(49)

a. [DP Listen mit [DP jeweils drei Namen]] [C were herumgereicht].

   lists with each three names were passed.around

   ‘Each time, listst with three names were passed around.’

   ‘Lists, each with three names on it, were passed around.’
As a result, an adverbial reading is impossible for (49a). Hence, the obligation for adnominal jeweils to occur at the left edge of DP seems to follow from the need for the index ‘i’ to percolate up to DP. This is possible from the specifier position of DP.

An alternative approach to the index problem would be to weaken the definition of index-triggered λ-abstraction so that it could also apply to the structure in (47). For instance, the definition could be changed in such a way that λ-abstraction over an indexed free variable is possible in α iff an identical index is carried by the sister of α, or by the specifier of α’s sister. With the changed definition, the index ‘i’ on jeweils is visible to C’ in (47), but invisible in (49).

A third strategy would be to adopt Kayne’s (1994) analysis of specifiers as adjuncts and redefine the definition of index-triggered λ-abstraction negatively. According to this negative definition, an index on a sister constituent is visible to α if it is carried by an element not included within its sister constituent. According to Chomsky & Lasnik (1991), elements adjoined to a maximal projection are not included within this maximal projection because they are not dominated by all its segments. This means that an index is visible to α if it is carried by α’s sister, or by an element adjoined to α’s sister. If adnominal jeweils is analysed as adjoined to the DP, as in (50), it follows that its index is visible to the sister of DP.

\[(50)\]

\[
\text{XP} \\
\text{DP} \\
\alpha \\
\uparrow \\
\text{jeweils, drei Namen} \\
\uparrow \\
\text{not contained within DP = contained within DP} = \\
\text{visible to } \alpha = \text{invisible to } \alpha
\]

13 The weakened version is reminiscent of the definition of ‘government’ in the GB-framework where a lexical element governs its syntactic sister and the specifier of this sister (Chomsky 1986b:162).

14 This formulation is reminiscent of Kayne’s (1994) notion of adjoined elements c-commanding out of the maximal projection they are adjoined to. The notion of ‘c-commanding out’ was necessitated by structures as (i) in which a DP-external pronoun is bound by a possessor QP in the specifier position of a DP.

(i) [Everybodyi’s dog] follows himi obediently.

In section V.4, it will be shown that there may be a deeper connection between the interpretation of jeweils-DPs and the interpretation of binding from within possessive DPs in (i).
(50) also shows that an adverbial reading for (49a) is excluded, in line with the facts.

All three approaches to the index problem have shown that adnominal jeweils must be in a left-peripheral position (either in SpecDP or adjoined to DP) in order for its index to be visible to the sister constituent of the DP, and in order for crosswise \( \lambda \)-abstraction to apply. The left-peripheral position of adnominal jeweils inside the DP thus seems to be determined by semantic factors. It provides a suitable configuration for crosswise \( \lambda \)-abstraction to apply. The discussion has also shown that the semantic mechanism of crosswise \( \lambda \)-abstraction is compatible – in principle – with a syntactic analysis of adnominal jeweils as specifier of DP, or as adjoined to DP. The semantics are of no help to us, then, in deciding whether jeweils should be analysed as being in the specifier position of DP, or as being adjoined to DP. I will stick to the specifier analysis of jeweils (assuming percolation of the index to DP) because it is the only analysis compatible with the strong definition of index-triggered \( \lambda \)-abstraction, according to which the triggering index must be located on the sister constituent.

In conclusion, it was shown that the assumption of crosswise \( \lambda \)-abstraction accounts for two empirical generalisations concerning the availability of adverbial readings with adnominal jeweils. The embedding DP must have moved outside the VP because the index introduced by movement is vital for the semantic derivation to proceed. At the same time, jeweils must be located in the specifier of DP in order for its index to be visible to the sister constituent, and in order for the semantic derivation to proceed.

2.3.2 Deriving the Conditions for the/a+occasional

The unified empirical generalisation about the possibility of adverbial readings with adnominal elements at the end of section 1.4 incorrectly suggests that the observed restrictions are due to the same factors in all cases. That this is not the case is illustrated in exemplary fashion for the so-called occasional-construction in (13), repeated as (51):

\[
(51) \ [DP \ An/ the \ occasional \ sailor] \ walked \ by. \\
\text{Occasionally, a sailor walked by.}
\]

Here, I will base myself on the analysis of occasional-constructions in Zimmermann (2000). There, the sequence of determiner and adjective in (51) is analysed as a complex existential quantifier over pairs of individuals and events. The complex quantifier the/an+occasional is formed by syntactic incorporation of the adjective into the determiner. It is a pluractional quantifier, with ‘pluractionality’ defined as in Lasersohn (1995). Presence of the/an+occasional not only asserts the taking place of a number of events of a given kind with given individuals. It also distributes these events in a special way so that the events in question are distributed over a given stretch of time. Their times of occurrence must not overlap. E.g., (51) would not be a felicitous description of a complex event in which three sailors walked by at the same time, or immediately after one another, even though the condition that there are some sailor-event-pairs such that the sailors are walking by is satisfied. The meaning of the complex quantifier is given in (53).

\[
(52) \ \left[ \left[ Q_{a/\text{the occasional}} \right] = \lambda Q_{a/\text{the occasional}} \lambda S_{a/\text{occidental}} \exists <e,x> \ [ e \in E \ & Q(x)] : (S(x,e) \ & \forall <e',x',<e'',x''>|S(e',x') \ & S(e'',x'') \ & Q(x')) : ((e' = e'') \ \lor \ (e' \neq e'' \ \land \ \neg (\tau(e') \ o \ \tau(e'')))) \right] \\
\text{(with } \tau = \text{ time of occurrence, } o = \text{ overlap-relation)}
\]
The truth-conditions of (52) read as ‘There are some pairs \(<e,x>\), with e an element of a contextually given set E & x having a particular property Q, such that e is an event S involving x, AND all pairs \(<e',x'>, <e'',x''>\) of events S involving an x having Q are such that the events do not overlap in time.

The complex quantifier the/an+occasional in (51) takes two arguments and maps them onto a truth value. The first argument is a set of individuals (here the set of sailors) denoted by the NP-complement of the quantifier. The second argument is a relation between individuals and events (here a set of events of walking by). It is provided by the VP-denotation after \(\lambda\)-abstraction over the index of the subject trace has applied. Functional application of (52) to the two arguments yields (53a), with the truth conditions in (53b).

\[
(53)\quad a. \exists\langle e,x\rangle [e \in E \land \text{sailor}'(x)] : \text{walk by}'(x,e) \land \forall\langle e',x'\rangle, \langle e'',x''\rangle \text{[walk by}'(e',x') \land \text{walk by}'(e'',x'') \land \text{sailor}'(x') \land \text{sailor}'(x'')] : ((e'=e'') \lor (e' \neq e'' \land \neg (\tau(e') \circ \tau(e'')))) = 1 \text{ iff }
\]

b. There are some pairs of individuals x and events e, with e element of a contextually given set E and x a sailor, such that x walks by in e and no two walking by events by a sailor overlap in time.

The semantic representation in (52) gives us the clue for the VP-external occurrence of DPs containing the complex quantifier the/an+occasional. Since the second argument of the complex quantifier in (52) must be of type \(<e,<v,t>\), and since transitive (stage-level) verbs are of type \(<e,<v,t,t>\), it follows that the/an+occasional in object DPs cannot directly combine with the verb denotation because of type mismatch. It follows that the/an+occasional in object DPs can only be interpreted adverbially if the embedding DP has left the VP either overtly (in German) or covertly (in English). In this case, then, the VP-external position of the embedding DP is necessary in order to avoid type mismatch. It is not conditioned by the need to introduce an index (through movement), as was the case with jeweils. Of course, subject DPs containing the pluractional quantifier the/an+occasional give rise to adverbial readings because they are located outside the VP anyway.

What about the left-peripheral occurrence of the adjective occasional in (51)? In (21b), it was shown that occasional must occur adjacent to the determiner for an adverbial reading to be possible. The adverbial reading is impossible in (54), where another adjective intervenes.

\[
(54)\quad \text{The well-dressed occasional sailor walked by.}
\]

\* ‘Occasionally, a well-dressed occasional sailor walked by.’

Its semantics in (52) require the complex quantifier the/an+occasional to be in a position from where it can take first an NP- and then a VP-argument, i.e. in the left-peripheral D-position. (54) does not allow for the formation of such a complex quantifier over pairs of events and individuals in D. The intervening adjective blocks head-movement of occasional to the determiner, thus also blocking complex quantifier formation. The left-peripheral position of the adnominal element occasional therefore follows from a syntactic restriction on movement, and not from a visibility condition on indices, as was the case with adnominal jeweils.

The aim of this comparison of the adnominal elements jeweils and occasional was to show that the observed correlation between syntactic position (DP-peripheral, VP-
external) and semantic interpretation (adverbial quantification over events), is motivated by different factors in each case. In the case of jeweils, the syntactic restrictions follow from factors governing the presence or visibility of indices that are crucial for the semantic interpretation. In the case of the/an+occasional, the syntactic restrictions follow in part from semantic requirements (type mismatch), and in part from syntactic requirements (no movement of an adjective over an intervening adjective).

The point of this section was to show that a parallel syntactic and semantic behaviour of related elements may still be due to different syntactic and semantic factors, depending on the exact nature of these elements. Clearly, more research regarding the licensing conditions on adverbial readings with adnominal elements is necessary.

2.4 Further Applications of Crosswise λ-Abstraction with jeweils

The semantic mechanism of crosswise λ-abstraction accounts for the interpretation of two other constructions with adnominal jeweils that have not yet been analysed. In (55a), jeweils in direct object position distributes over the denotation of an indirect object. In (55b), jeweils in subject position distributes backwards over the denotation of a direct object.

(55) a. Peter hat den Mädchen jeweils eine Rose gegeben.  
   'Peter gave the girls one rose each.'
   b. Jeweils zwei Offiziere begleiteten die Ballerinen nach Haus.  
   'Each ballerina was accompanied home by two officers.'

The semantic analysis of (55ab) was postponed in chapter IV.4.3 because back then we did not have the mechanism of crosswise λ-abstraction at our disposal. In this section, I first discuss the semantics of (55a) in 2.4.1. In 2.4.2, I present the analysis of backwards distribution with jeweils in subject position in (55b). (55b) will turn out to be the only instance of jeweils-DPs that involves LF-movement. The vital role that crosswise λ-abstraction plays in the interpretation of these constructions shows that it is not restricted to deriving adverbial readings with adnominal jeweils. The section concludes the discussion of the semantics of adnominal jeweils. At its end, all relevant cases will have been accounted for.

2.4.1 Distribution over Indirect Objects

The semantic interpretation of (55a) is straightforward, given crosswise λ-abstraction and one additional assumption. The assumption concerns the surface position of the jeweils-DP in (55a). I assume that the jeweils-DP has vacuously moved and that the surface structure of (55a) is the one in (56).

(56) Peter hat t2 [den Mädchen, [[jeweils, eine Rose]], [VP t2 t1 gegeben]]].

There are two semantic reasons for vacuous movement of the jeweils-DP in (56). First, the jeweils-DP cannot be interpreted in its base position. This is because the ditransitive verb geben ‘to give’ is a 4-nary predicate $\lambda y\lambda z\lambda x\lambda e. \text{give}(x,z,y,e)$. In chapter IV.4.2.4, it was shown that jeweils-DPs can combine with ternary predicates (denoted by stage-level transitive verbs) once the ‘superfluous’ event variable has been bound by existential
The same strategy is not applicable to the combination of jeweils and stage-level ditransitive verbs because here the ‘superfluous’ subject variable must later be bound by an overt argument, the subject Peter. The problem disappears if the jeweils-DP has moved vacuously from its base position to a position above or adjoined to VP.

The second motivation for movement of the jeweils-DP is that it creates an index on the moved constituent. The presence of this index (here: ‘1’) triggers λ-abstraction in the VP-denotation, and is a precondition for crosswise λ-abstraction.15

Taking the syntactic structure in (56) as input, the semantic derivation proceeds as follows. The VP-denotation after existential closure over the event argument is shown in (57a). The denotation of the scrambled jeweils-DP is shown in (57b). Both denotations are propositions.

(57)

a. \[ [[\text{VP}_{2_1}, t_1, t_1, \text{geben}] ] = \exists e [\text{give}'(x_2, z_1, y_1, e)] \]

b. \[ [[\text{DP}_{2,1}, \text{jeweils, eine Rose}]] = \forall z [z \in Z \rightarrow \exists y [\text{one_rose}'(y) \land R(y)(z)]] \]

In a next step, the denotations in (57ab) must be combined. The situation is reminiscent of that encountered with adnominal jeweils in subject position in section 2.2. There, we were also confronted with two proposition-denoting syntactic sisters. The remedy for the type mismatch there was crosswise λ-abstraction, first over the two indices of the jeweils-DP, and then over the index of the relation variable ‘R’. The same remedy will be used in the case at hand. Recall from the discussion in section 2.3.1 that the jeweils-DP carries two indices, namely ‘1’ (introduced by movement) and ‘i’ (by inheritance from its specifier jeweils). These indices trigger λ-abstraction in the VP-denotation, first over index ‘i’, and then over index ‘1’. The result is shown in (58a). After double application of λ-abstraction in the VP-denotation, type-triggered λ-abstraction over index ‘j’ applies in the denotation of the jeweils-DP in order to avoid type-mismatch (cf.58b). Functional application of (58b) to (58a) yields (58c).

(58)

a. \[ [[\text{VP}_{2_1}, t_1, t_1, \text{geben}] ] = \lambda y_1 \lambda z_2. \exists e [\text{give}'(x_2, z_2, y_1, e)] \]

b. \[ [[\text{DP}_{2,1}, \text{jeweils, eine Rose}]] = \lambda R. \forall z [z \in Z \rightarrow \exists y [\text{one_rose}'(y) \land R(y)(z)]] \]

c. \[ [[\text{DP}_{2,1}, \text{jeweils, eine Rose}, t_2, t_1, t_1, \text{geben}] ] = \lambda y_1 \lambda z_2. \exists e [\text{give}'(x_2, z_2, y_1, e)] \]

\[ \Rightarrow \forall z [z \in Z \rightarrow \exists y [\text{one_rose}'(y) \land \exists e [\text{give}'(x_2, z_2, y_1, e)]] \]

λ-abstraction over the indices ‘i’ and ‘2’ followed by functional application to the denotations of indirect object ([[the girls]]) and subject (Peter’) respectively, yields the expression in (59a), which specifies the correct truth conditions for (55a) (cf.59b). Functional application of (59b) to (59a) yields (59c).

(59)

a. \[ [[\text{VP}_{2_1}, \text{hat den Mädchen, jeweils, eine Rose}], t_1, t_1, t_1, \text{geben}] ] = \forall z [\text{girl}'(z) \rightarrow \exists y [\text{one_rose}'(y) \land \exists e [\text{give}'(\text{Peter}', z, y, e)]] = 1 \text{ iff} \]

b. For each girl z there is one rose y and an event e such that Peter gave y to z in e.

(59b) shows that crosswise λ-abstraction allows for a correct interpretation of (55a).16

15 It seems difficult to verify the assumption of vacuous movement in (56) syntactically. Standard tests like the impossibility of extraction from moved constituents (in adjoined position), or the position relative to left edge markers of VP (adverbial quantifiers, ja…doch-particles) seem to fail. I leave this problem open.
2.4.2 Backwards Distribution from Subject Position

Backwards distribution with adnominal *jeweils* in subject position is the final case that still needs accounting for. Again, crosswise $\lambda$-abstraction is the solution to the problem, but again, we need one additional syntactic assumption in order to get correct results.

The problem becomes clear if we look at the surface structure of (55b) in (60):

(60) \[CP[jeweils, zwei Offiziere],,1[c-begleiteten [\_t1 [VP t dieBallerinen, nach Haus]]].\]

Simply speaking, the problem lies in the fact that the denotation of the *jeweils* DP in (61) requires a relation-denoting expression as argument after $\lambda$-abstraction over index ‘j’ has taken place.

(61) \[[DP, jeweils, zwei Offiziere]] = \forall z [z \in Z \rightarrow \exists X [\text{officers'} (X) \land R_j(x(z))]]

The denotation of C’, on the other hand, contains only one free variable with index ‘1’. Therefore, $\lambda$-abstraction over C’s denotation will at best result in a property-denoting expression, which is of the wrong semantic type. In addition, it is not clear how the variable $Z_i$ can be bound by the denotation of the object *die Ballerinen* ‘the ballerinas’ in (60).

In view of these problems, we are forced to assume LF-movement of the object DP *die Ballerinen* to sentence-initial position.\(^{17}\) Note that it is not the *jeweils*-DP, nor *jeweils* in isolation, which move, but the specific DistKey expression. The resulting LF-structure that is the input to semantic interpretation is given in (62).

---

\(^{16}\) A similar derivation derives the meaning of (i), where adnominal *jeweils* in object position distributes over the plural event modifier *in zwei Läden* ‘in two shops’. Again, the *jeweils*-DP must have raised and adjoined to VP at surface structure (cf.lfb).

(i) a. Peter hat [in zwei Läden], jeweils eine Rose gekauft.'
   Peter has in two shops each a rose bought
   ‘In two shops, Peter has bought one rose each.’

b. Peter₂ hat [in zwei Läden [jeweils eine Rose], [VP t2 t1 gekauft]]

The DistKey expression is a plural event modifier with a meaning as given in (iia). The derivation proceeds parallel to that in (58) and (59), except that the denotations of VP and the adjoined DistKey combine by predicate modification, and not by functional application:

(ii) a. \[[in zwei Läden]] = \lambda E. \exists e_1,e_2[E={e_1,e_2} \land \exists x_1,x_2 [\text{shop'}(x_1) \land \text{shop'}(x_2) \land \text{in'}(x_1,e_1) \land \text{in'}(x_2,e_2)]]

b. \[[VP t2 t1 gekauft]] = \lambda y_1,\lambda e. \text{bought'}(x_2, y_1, e) \text{ by index-triggered } \lambda\text{-abstraction over ‘1’}

c. \[[jeweils eine Rose]] = \lambda R_j. \forall z [z \in Z_i \rightarrow \exists y [\text{rose'}(y) \land R_j(y)(z)]] \text{ by type-triggered } \lambda\text{-abstraction}

d. \[[jeweils eine Rose t2 t1 gekauft]] = \forall z [z \in E \rightarrow \exists y [\text{bought'}(x_2,y,z)]]

\(^{17}\) If adjunction to root CPs is banned, one could also assume adjunction of the object DP to IP with parallel reconstruction of the *jeweils*-DP in SpecCP to SpecIP.
The LF-moved object leaves behind a variable \( t_i \), which is co-indexed with the jeweils-DP. With this, the derivation is fairly standard. The denotation of \( C' \) is shown in (63a). \( \lambda \)-abstraction over indices ‘i’ and ‘1’ in this order yields (63b). \( \lambda \)-abstraction in (61) over index ‘j’ gives (63c). (65c) functionally applies to (65b), yielding (65d).

\[
\begin{align*}
(63) \quad & a. \quad \left[ [c \text{-begleiteten } t_1 t_i] \right] = \exists e \left(*\text{accompany}'(x_1,y_i,e)\right) \\
& b. \quad \left[ [c \text{-begleiteten } t_1 t_i] \right] = \lambda x_1 \lambda y_i \exists e \left(*\text{accompany}'(x_1,y_i,e)\right) \\
& c. \quad \left[ [\text{die Ballerinen, zwei Offizieren}] \right] = \lambda R. \forall z \left[z \in Z_i \rightarrow \exists X \left[2\text{officers}'(X) \land R(X)(z)\right]\right] \\
& d. \quad \left[ [c \text{-begleiteten, zwei Offiziere begeleiteten } t_1 t_i] \right]
\end{align*}
\]

\[
\left(\lambda x_1 \lambda y_i \exists e \left(*\text{accompany}'(x_1,y_i,e)\right)\right) \equiv \forall z \left[z \in Z_i \rightarrow \exists X \left[2\text{officers}'(X) \land \exists e \left(*\text{accompany}'(X,z,e)\right)\right]\right]
\]

\[
\left(\lambda x_1 \lambda y_i \exists e \left(*\text{accompany}'(x_1,y_i,e)\right)\right)
\]

(63d) contains a free variable \( Z_i \), which is co-indexed with the DistKey \textit{die Ballerinen} ‘the ballerinas’. The denotation of the DistKey is factored in by \( \lambda \)-abstraction over index ‘i’in (63d), followed by functional application of the result to the DistKey denotation. The final result is given in (64a). The truth-conditions in (64b) match those of (55b).

\[
\begin{align*}
(64) \quad & a. \quad \left[ [\text{die Ballerinen, jeweils, Offiziere, z begleiteten } t_1 t_i] \right] \\
& \quad = \forall z \left[\text{ballerina}'(z) \rightarrow \exists X \left[2\text{officers}'(X) \land \exists e \left(*\text{accompany}'(X,z,e)\right)\right]\right] = 1 \iff \\
& \quad b. \quad \text{for each ballerina } z \text{ of a given set, there is a group of two officers } X \text{ and } \text{an event } e \text{ such that } X \text{ accompanies } z \text{ in } e.
\end{align*}
\]

Hence, the proposed semantic system accounts for instances of backwards distribution from subject position.

It is a nice property of the instrument of crosswise \( \lambda \)-abstraction that it is entirely index-and type-driven. The grammatical funtions of DistKey, DistShare, and relation-denoting expression play no role as long as the indices are distibuted correctly. This makes crosswise \( \lambda \)-abstraction a very flexible instrument which can apply to a range of constructions. It allows adnominal \textit{jeweils} to establish distributive relations between events (DistShare) and events (DistKey), as in the case of adverbial readings with fronted \textit{jeweils}-DP; between direct objects (DistShare) and indirect objects (DistKey); and even between subjects (DistShare) and objects (DistKey). The semantics used in all three cases are the same. Differences in interpretation are due to differences in indexation and differences in syntactic structure (which seem to follow in part from semantic requirements). The picture of the interpretation of adnominal \textit{jeweils} that emerges is therefore a very homogenous one, even in cases that appear problematic at first sight. LF-movement of the \textit{jeweils}-DP, or of \textit{jeweils}, for interpretive reasons has proven unnecessary, making the semantic analysis very surfacy in nature. As pointed out in chapter I, the development of such a surface analysis was one of the objectives of this thesis.

---

18 I leave out the contribution of \textit{nach Haus} ‘home’ and the intermediate subject trace in SpecIP for reasons of transparency.
2.4.3 The Costliness of LF-Movement

In the previous section, I have argued that LF-movement of the DistKey object across the jeweils-DP is a precondition for the backwards distributive reading. It was shown that LF-movement must apply for semantic reasons. Without LF-movement, no indexed variable (the trace of the moved constituent) would be introduced. Without this variable, crosswise $\lambda$-abstraction could not apply. And without crosswise $\lambda$-abstraction, sentence (55b) would not have a backwards distributive reading, but only the adverbial reading (over an implicit set of events). I conclude that LF-movement applies in order to give rise to a new interpretation that would be impossible without application of LF-movement. This state of affairs fits in nicely with Fox’s (2000) semantic licensing condition on LF-movement, which demands that LF-movement can apply if and only if it gives rise to a new interpretation. This makes syntax appear to be sensitive to semantic factors at least in the LF-component, the basic idea being that LF-movement is costly and should be dispreferred unless it “pays off” by allowing for a new interpretation. The costliness of the LF-movement operation in (62) is adequately reflected by the fact that the backwards distributive reading of (60) is harder to get than the adverbial reading. 19

In light of the costliness of LF-movement, it is a welcome result that all other readings with adnominal jeweils can be derived from surface structure and do not involve LF-movement. Observe finally, that LF-movement in the case of backwards distributive readings is triggered by the need to create an indexed variable and not by scope considerations. The fronted specific DP always takes wide scope with respect to other quantificational elements in the clause. Therefore, LF-movement of the DP does not give rise to a new scopal reading. This fact allows for maintaining the restriction that German does not allow for scope-driven LF-movement, a claim which was relevant for the revised analysis of ILCs in chapter III.3, and more or less tacitly assumed in the rest of the thesis. 20

2.5 Summary

This section discussed the interpretation of adnominal jeweils in subject position. The possibility of adverbial readings with adnominal jeweils was attributed to application of crosswise $\lambda$-abstraction. Then, it was shown that the assumption of crosswise $\lambda$-abstraction allows for deriving the structural licensing conditions on adverbial readings with adnominal jeweils from section 1.4. Finally, it was shown that the assumption of crosswise $\lambda$-abstraction accounts for distribution with direct object jeweils over indirect objects, and backwards distribution with subject jeweils over direct objects. The variability in the application of crosswise $\lambda$-abstraction follows from the fact that this semantic process is only sensitive to the presence of indices and type requirements. In section 4, it is argued that the semantic operation of crosswise $\lambda$-abstraction may have an even wider range of applications, independent of the presence of adnominal jeweils. This suggests that we deal with a more general semantic process here.

19 The same can be observed for Korean. In Korean, the d-distributive element –ssik- in subject position is also preferably interpreted adverbially as quantifying over an implicit set of events. The backwards distributive reading of subject denotation over object denotation is possible, but dispreferred (cf. Choe 1987:50, fn.9)

20 I will leave it open why some semantic requirements (presence of a trace for the backwards distributive reading) can trigger LF-movement in German, while others (relative scope) do not.
3 Cross-Linguistic Considerations

The discussion of the semantics of subject *jeweils* puts us in the position to widen the scope of the analysis once again, and to look at the wider cross-linguistic picture. In this section, we investigate the question of whether distance-distributive elements (DDs) in other languages can also be interpreted by crosswise $\lambda$-abstraction when occurring in underlying subject position. We will look at three phenomena in particular. Section 3.1 shows that subject DDs can be interpreted adverbially in those languages that allow for DDs in this syntactic position. On the null hypothesis, the adverbial interpretation is derived by the same semantic mechanism as in German, namely by crosswise $\lambda$-abstraction. Section 3.2 discusses the origin of backwards distributive readings with subject DDs in other languages. Finally, section 3.3 discusses the general impossibility of DDs in subject position of embedded clauses, as in (65).

(65) *The storeclerks said that one boy each had laughed.*

(65) is of particular interest because it underlines the need for an integrated syntactic and semantic analysis of distance-distributivity. First, (65) is not ruled out for purely syntactic reasons, since there is a potential DistKey antecedent (*the storeclerks*) which c-commands each in (65) (see III.5.5 for discussion). Second, structures like (65) are as ungrammatical (on the intended reading) in German as they are in English. The latter fact suggests that the ungrammaticality of (65) is semantic in nature, since German *jeweils* need not be syntactically licensed anyway. I take this as an argument in favour of an integrated syntactic and semantic account.

### 3.1 Adverbial readings with DDs in Subject Position

The discussion in chapter III.5 has shown that d-distributive elements which are formally identical to the D-quantifier in their language must take a c-commanding DP as their DistKey expression. This correctly excludes the possibility of adverbial readings for the d-distributive element in these languages. On its adverbial reading, the DD distributes over an implicit set of events which is not expressed as an overt DP in c-commanding position. It follows that no D-features can be copied onto the NP-proform which provides the restriction for the DD, and the DD finds no matching D-features to check its own against. As a result, the sentences in (66) are ungrammatical with or without an adverbial reading.

(66) a. *One boy each came in.*
   b. *Elk een jonge kwam binnen.* \[Dutch\]
   c. *Un garçon chac-un(e) est entré.* \[French\]
   d. *E’ entrato un ragazzo ciascuno.* \[Italian\]

In contrast, DDs which do not require licensing by a c-commanding element allow for adverbial readings, when in subject position. Apart from German *jeweils*, this is the case for Korean –*ssik*, Czech and Bulgarian *po*, and Japanese *zutu*. The relevant examples are repeated in (67).

(67) a. [hyengsa-tw-ssik]-i [yonguicha-tul]-ul ccoch-ko-iss-ta. \[Korean\]
   ‘The detectives are chasing a group of suspects in pairs of two.’
   (Choe 1987:50, ex.15)
b. Po edna yabulka beshe izgnila. [Bulgarian]  
     each one apple was rotten  
     ‘(Each time / in each basket), one apple was rotten.’ (Petrova, p.c.)

c. Po třech ženách vstupovalo³ do místnosti. [Czech]  
     each threeLOC womenLOC entered3sg into room  
     ‘(Each time / each ten minutes), three women entered the room.’ (Filip, p.c.)

d. Taroo-wa i-ssatu-zutu hon-o ka-tta. [Japanese]  
     Taroo- TOP one- CL-each book- ACC buy- PAST  
     ‘Taroo bought one book on each occasion.’ (Sakaguchi 1998:115, fn.1)

The availability of adverbial readings with d-distributive elements in other languages  
suggests that the semantic process of crosswise λ-abstraction is universally available. On  
the null assumption, the sentences in (67) are derived in parallel fashion to the case of jeweils discussed in section 2.2. The availability of an adverbial reading seems to depend  
solely on the insensitivity of an d-distributive element to the presence of a DP as DistKey  
(at least in the languages under discussion) plus the two additional structural conditions  
from (26) in section 1.4.

3.2 Backwards Distribution from Subject Position

In this section, we look at the possibility of backwards distributive readings with subject  
DDs in other languages. Of course, such readings are only attested in languages that allow  
for DDs in subject position independently (for syntactic reasons).

In section 2.4.2, it was argued that backwards distributive readings are the result of  
covert LF-movement of the object DistKey across the DD in subject position. Since such  
movement results in a weak crossover configuration, we expect languages that allow for  
backwards distributive readings to be insensitive to WCO-effects on the null assumption  
that backwards distributive readings are derived by the same semantic mechanism cross-  
linguistically.

Apart from German, backwards distribution with a subject DD over an object DistKey  
is possible with Korean –ssik-, Japanese zutu, and Bulgarian po. The sentences in (68)  
allow for a backwards distributive reading.

(68) a. [hyengsa-twu-myeng-ssik]-i[yonguicha-tul]-ul ccoch-ko-iss-ta. [Korean]  
     detective-two-CL -each-NOM suspect- pl- ACC chase-PROG  
     ‘Each suspect is chased by two policemen.’ (Choe 1987:50, ex.15)

     b. Shinbunkisyga futari-zutu sorera-no seizika-o sirabeta.  
        news-paper journalist- NOM 2-cl-each those- GEN politician- ACC investigated  
        ‘Those politicians were investigated by two newspaper journalists each.’ [Jap.]

     c. Po edin student pomogna na vseki profesor. [Bulgarian]  
        each one student helped to every professor  
        ‘The professors were helped by one student each.’ (Petrova 2000, ex.6b)
The DDs in (68) contain no D-features. Hence, they can occur in underlying subject position, a precondition for a backwards distributive reading. (69) shows that Korean allows for weak crossover configurations as the result of overt scrambling (Kim, p.c.).

    which child-ACC self-GEN mother- NOM abandon- PAST-Q
    ‘Which child, was abandoned by his, mother?’

Based on (69), I conclude that the object DistKey in (68a) can rise across the distributing subject at LF.\(^{21}\) The resulting structure is then interpreted by application of crosswise \(\lambda\)-abstraction.

The Bulgarian facts do not present us with a clear picture. At first sight, Bulgarian does not seem to allow for weak crossover configurations (70a). However, in certain configurations weak crossover effects seem to be absent. There is no weak crossover with a clitic double of the possessive in (70b) (Petrova, p.c.).

(70) a. *Kogo obicha negovata maika? [Bulgarian]
    who loves his mother
    *‘Who does his mother love?’

b. Kogo go obicha maika mu?
    who him loves mother his?
    ‘Who does his mother love?’

In light of the contradictory evidence, it seems difficult to account for the backwards-distributive reading in (68c). I see two options. Either, (68c) is a configuration in which LF-movement does not result in ungrammaticality, similar to what we find with (70b). Or, LF-movement in (68c) would result in ungrammaticality were it not for the fact that the NP-proform that was argued to be cross-linguistically present in d-distributive constructions in chapter III.5.1 is covert. In both cases, LF-movement could apply, and the resulting structure could be interpreted by crosswise \(\lambda\)-abstraction. In the absence of further evidence, I will leave it at these sketchy remarks.

In conclusion, the evidence for the assumption that LF-movement of the object DistKey across the co-indexed DD is possible in the languages in (68) is far from overwhelming. Korean seems to allow for such movement (but see fn.21). Bulgarian provides contradictory evidence in the overt component. Furthermore, I was unable to retrieve any relevant data concerning Japanese. Therefore, the claim that all backwards distributive readings are derived by application of crosswise \(\lambda\)-abstraction after LF-movement of the DistKey remains a mere hypothesis, pending further decisive evidence in its favour or against it.

\(^{21}\) This assumption appears problematic when confronted with the ill-formedness of (i), which seems to show that Korean is sensitive to weak crossover at the level of LF. Apparently, LF-movement of the \(n\)-constituent enu ai-lul ‘which child’ over the subject is impossible.

(i) ??caki-uy emeni-ka enu ai-lul naydapeli-ess-upnika?
    self-GEN mother-NOM which child-ACC abandon-PAST-Q
    ‘Which child, did his, mother abandon?’

In order to maintain the analysis in the main text, the reason for the ungrammaticality of (i) must lie elsewhere, e.g. in the need for the pronoun caki ‘self’ to be licensed at surface structure. In the absence of further evidence, I will leave the matter unresolved.
On DDs in Embedded Subject Position

We now take up the discussion of ADs in embedded subject position that was postponed in chapter III.5.5. There, it was mentioned that the ungrammaticality of (65), repeated as (71), does not follow from a violation of the c-command requirement.

(71) *The storeclerks, said that one boy each, had laughed.

Interestingly, the German counterpart of (71) is equally ungrammatical on the intended reading.

(22) *Die Verkäufer, sagten, dass jeweils ein Junge gelacht hatte.

The store clerks said that each one boy laughed had

The fact that jeweils does not need to be licensed under c-command suggests that c-command, or lack thereof is not the decisive factor for the ungrammaticality of (71) and (72). The parallel behaviour of English and German rather suggests that the sentences are out (on the intended reading) for semantic reasons. In what follows, the structures in (71) and (72) are argued to be semantically ill-formed. They cannot be interpreted in a meaningful way. This conclusion underlines the importance of semantic considerations for an adequate analysis of d-distributive constructions.

Observe that (71) and (72) cannot be saved by raising the embedded subject (or the DD in isolation) into the matrix clause. Extraction of or subextraction from subjects is generally bad in English and German, as shown in (73ab).

(73) a. *Who, did Peter say that t had laughed.
    b. *Wer, hat Peter gesagt, dass t gelacht hat.

Who has Peter said that laughed has

I conclude that no raising of (part of) the subject DP has taken place in (71) and (72).

This being so, we have to determine why the DDs in (71) and (72) cannot be interpreted in situ. In my view, the non-interpretable (71) and (72) follows directly from applying the semantic analysis for jeweils in subject position. In other words, the semantic analysis of DDs in subject position rules out the sentences in (71) and (72) as ungrammatical.

Consider the semantics at the point in the derivation where the denotations of the embedded subject DP and I’ combine. The relevant subtree is given in (74). The embedded subject has moved overtly to SpecIP, leaving behind a trace inside the VP. The denotations of subject DP and I’ are given in (75ab).

(74)

---

(72) has an adverbal reading on which jeweils distributes over an implicit set of events: The store clerks said that one boy laughed each time.

(75) a. *Who did Peter say that t had laughed.
    b. *Wer hat Peter gesagt, dass t gelacht hat.

Who has Peter said that laughed has
\[(75)\] a. \[[\text{jeweils} \text{ein Junge}] = \forall z \in Z_i \rightarrow \exists X [\text{one}_\text{boy}'(X) \land \ast R_j(X)(z)] \]

b. \[[t_i \text{ gelacht hatte}] = \exists e [\text{laughed}'(x_i, e)] \]

\[(75b)\] contains only one free variable, but we can add a second by introducing an optional relational modifier. This optional modifier establishes discourse coherence by relating a discourse-old event with the event introduced by the existential quantifier (see chapters IV.1.3, and V.2.2 for discussion of this point). The denotation of \(I'\) will then be as in (76a). Since both indices ‘1’ and ‘i’ are visible to \(I'\) (see 2.3.1), crosswise \(\lambda\)-abstraction can apply. First, \(\lambda\)-abstraction applies to the free variables \(e_i\) and \(x_1\) in (76a), yielding (76b). Then, \(\lambda\)-abstraction applies to \(R_j\) in (75a), yielding (76c). Finally, (76d) combine by functional application, giving (76d).

\[(76)\] a. \[[t_i \text{ gelacht hatte}] = \exists e [\text{laughed}'(x_i, e) \land R(e, e_i)] \]

b. \[[t_i \text{ gelacht hatte}] = \lambda x_i \lambda e_i \exists e [\text{laughed}'(x_i, e) \land R(e, e_i)] \]

c. \[[\text{dp jeweils ein Junge}] = \lambda R_j \lambda z \in Z_i \rightarrow \exists X [\text{one}_\text{boy}'(X) \land \ast R_j(X)(z)] \]

d. \[[\text{dp jeweils ein Junge t}_i \text{ gelacht hatte}] = \forall z \in Z_i \rightarrow \exists X [\text{one}_\text{boy}'(X) \land \exists e [\ast \text{laughed}'(X, e) \land R(e, z)]] \]

So far, the derivation is well-formed. The matrix verb \textit{sagten} ‘said’ selects the proposition in (76d) as one of its arguments, together with the trace of the subject \textit{die Verkäufer} ‘the storeclerks’. The moved subject in SpecIP can semantically bind both its trace and the index of the variable \(Z_i\) on \textit{jeweils} in (76d). This is shown schematically in (77).

\[(77)\]

```
IP
  die Verkäufer
  the store clerks
  VP
    \(t_i\)
    \(V'\)
    \(V\)
    \(C\)
    \(P\)
    \text{said}
  \(\forall z [z \in Z_i \rightarrow \exists X [\text{one}_\text{boy}'(X) \land \exists e [\ast \text{laughed}'(X, e) \land R(e, z)]]]\)
```

However, this binding would lead to disastrous results. For consider what happens if we \(\lambda\)-abstract over index ‘i’ in the denotation of the matrix \(V\) (cf.78a), and functionally apply the result to the denotation of \textit{die Verkäufer} (cf.78b):

\[(78)\] a. \(\lambda Z_i \exists e'' [\text{said}'(Z_i, e''), \forall z [z \in Z_i \rightarrow \exists X [\text{one}_\text{boy}'(X) \land \exists e [\ast \text{laughed}'(X, e) \land R(e, z)]]]]\)

b. \(\exists e'' [\text{said}'([\text{the storeclerks}], e''), \forall z [z \in [\text{the storeclerks}] \rightarrow \exists X [\text{one}_\text{boy}'(X) \land \exists e [\ast \text{laughed}'(X, e) \land R(e, z)]]]]\)

\[(78b)\] is semantically ill-formed. It would be true if there were an event of the storeclerks saying that for each of the storeclerks \(z\) there are a boy \(x\) and an event \(e\) such that \(x\) laughs in \(e\) and such that \(e\) is related to \(z\). The last condition in italics is in contradiction to the sortal restriction on \(R\) in (78b). \(R\) was introduced as a sorted relation between two atomic events, one of them discourse-old, the other introduced by the existential quantifier. This
being so, \( R \) cannot establish a relation between an event and an individual, as demanded by (78b).

This point becomes clearer still if we assume that existential closure over the embedded VP (optionally) does not apply. Without existential closure, the embedded I’ would denote the expression in (79)

\[
[[\varepsilon_1 \text{ gelacht hatte}]] = \lambda e_i \text{ [laughed'}(x_i,e_i)]
\]

(79)

Applying all the steps in (76b-d) and in (78a), we get the following expression for the meaning of the entire clause:

\[
\exists e'' \text{ [said'([the_storeclerks]), e'']}, \forall z [z \in [[\text{the_storeclerks}]] \rightarrow \\
\exists X [\text{one_boy}'(X) \land *\text{laughed'}(X,z)]]
\]

(80)

(80) could only receive an interpretation if the intransitive verb lachen ‘to laugh’ was able to establish a relation between two individuals. However, lachen is sortally restricted to take one event argument \( e \) and one individual argument \( x \) that laughs in \( e \). For this reason, (80) cannot be a well-formed expression from a semantic point of view. The last condition \(*\text{laughed'}(X,z)\) cannot be interpreted in a meaningful way, as long as \( z \) stands for a storeclerk.

In German, jeweils can alternatively select for an implicit set of events as DistKey. On this reading the sentence is grammatical (see fn.22). For English each, this alternative strategy is not available because it requires a DistKey in form of a DP. As seen, the denotation of the only potential DistKey DP is of the wrong sort to lead to a meaningful interpretation.

The above considerations show that a combination of syntactic and semantic factors excludes distributive each from the subject position of the embedded clause in (71). Semantically, each requires a set of events as DistKey and cannot distribute over the DP-subject the storeclerks. Syntactically, each requires a c-commanding DP as DistKey in order to check its D-features (after feature copying onto the covert proform). The ensuing conflict results in ungrammaticality.

Finally observe that the present analysis predicts that the conflict between semantic and syntactic requirements in English can be circumvented if the DP-antecedent in the matrix clause does not denote a set of individuals, but a set of events. In this case, there is a DP antecedent that can check the D-features of each, and that satisfies the semantic requirement of denoting a set of events. Indeed, it seems that each is not altogether impossible in embedded subject position in (81a) (Since a set of events cannot be the subject of a propositional verb (such as say), I have inserted a verb of causation instead). The German counterpart of (81a) is also grammatical.

(81)  a. ?The protest rallies, had the effect that one politician each, stepped down.

\[ \text{Die Proteste, bewirkten, dass jeweils, ein Politiker zurücktrat.} \]

b. Die Proteste, bewirkten, dass jeweils, ein Politiker zurücktrat.

If correct, the grammaticality of (81) follows directly on the analysis presented here.\(^{23}\) In (81), each in embedded subject position can be interpreted by means of crosswise \( \lambda - \)

\(^{23}\) The grammaticality of (81b) also shows that there is no clausemate condition in the strict sense, at least in German. The apparent clausalmate effect comes about through the choice of an unsuitable, individual-denoting
abstraction because the matrix DP provides a plurality of the appropriate sort. This shows that crosswise \( \lambda \)-abstraction is operative in English, and presumably cross-linguistically. It also shows that semantic factors are important in the analysis of d-distributive elements.

### 3.4 Summary

In this section, I have argued that the semantic process of crosswise \( \lambda \)-abstraction is operative cross-linguistically. It was argued that crosswise \( \lambda \)-abstraction applies in the derivation of adverbial and backwards distributive readings in those languages that syntactically license a DD in subject position. Furthermore, it was argued that the assumption of crosswise \( \lambda \)-abstraction accounts for the general ungrammaticality of DDs in embedded subject position. This provides indirect evidence for the operativeness of crosswise \( \lambda \)-abstraction even in English, which otherwise does not show much overt evidence for it, at least with d-distributive constructions. The indirect evidence seems confirmed by the relative acceptability of (81a).

In the next section, I argue that crosswise \( \lambda \)-abstraction is not only relevant for the semantic analysis of DDs in subject position (cross-linguistically). It also seems to play a role in the semantic analysis of other syntactic constructions.

### 4 Crosswise \( \lambda \)-Abstraction in other Syntactic Constructions

In this final section of the thesis, I show that the mechanism of crosswise \( \lambda \)-abstraction possibly applies to a range of phenomena which are – at first sight - unrelated to d-distributive constructions. In 4.1, I show how crosswise \( \lambda \)-abstraction may account for variable binding out of ILCs (cf.82a). In 4.2, I show how crosswise \( \lambda \)-abstraction may account for variable binding out of possessive DPs (cf.82b). In 4.3, I show how crosswise \( \lambda \)-abstraction may account for the working of pluractionally quantifying PPs, as in (82c), which are discussed by Stockall (2001).

(82)\[\begin{align*}
a &. \text{Some man from every city loves it.} \\
b &. \text{Every lady’s dog adores her.} \\
c &. \text{Girl after girl arrived.}
\end{align*}\]

The semantic mechanism in all three cases is argued to be identical. In each construction, one or two indices on the subject DP trigger \( \lambda \)-abstraction in the denotation of the subject’s sister. This \( \lambda \)-abstraction is followed by \( \lambda \)-abstraction over a free relation variable in the subject denotation. The use of crosswise \( \lambda \)-abstraction in all three cases points out a semantic (and a syntactic) parallel between at first sight unrelated constructions, thus achieving a high degree of generality. Although the discussion is admittedly sketchy and in need of further elaboration, it serves to highlight the potential use of the mechanism of crosswise \( \lambda \)-abstraction in the semantic analysis of natural language expressions. This last section of the dissertation can therefore be considered the starting point for further research into the nature of crosswise \( \lambda \)-abstraction and its application in natural language semantics.

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DP as potential DistKey in the matrix clause. If an event-denoting DP is chosen as DistKey, the clausemate effect disappears.
4.1 Binding from within ILCs

The discussion of ILCs in chapter III.3 and in IV.7 has not answered the question of how bound variable readings with ILCs come about. (82a) from May (1985) is a classical instance of such readings. As pointed out in chapter III.3.1, fn.33, bound variable readings with ILCs are not accepted by all speakers of English, but there needs to be an explanation for the subgroup of speakers that finds them acceptable.

To begin with, recall that the bound variable reading only shows up together with the “inverse” reading. This indicates that the structure of (82a) should be as in (83) (cf. III.3.4.2).

\[(83) \[\text{IP} [\text{DP} \ \text{NP} \ [\text{Some man} \ [\text{QPP from every city}]_i]_t, t_i \text{loves it}]].\]

Also recall that the right-adjunction structure in (83) is the result of re-interpreting the PP from every city as a generalised quantifier. Its meaning is given in (84a), the meaning of the entire ILC in (84b):

\[(84) \begin{align*}
\text{a. } \lambda P. \forall z [\text{city}'(z) \rightarrow \exists x [P(x) \land \text{from}'(x,z)]] \\
\text{b. } \lambda x [\text{man}'(x) \land \text{*from}'(x,z)]
\end{align*}\]

(84b) is a closed proposition with no free variables. For this reason, it should not be an appropriate target for \(\lambda\)-abstraction. The denotation of I’ is an open proposition with the two free variables \(x_i\), the value of the VP-internal subject trace, and \(y_i\), the value of the object pronoun it. Therefore, \(\lambda\)-abstraction could in principle apply over both indices, resulting in a relation-denoting expression of type \(<e<et>\). This in itself is to no avail because the ILC-denotation in (84b) is of the wrong type (type \(<e>\) to serve as an argument for the relation.

In my view, the problem can be mended by means of one additional stipulation. Say, that it is possible to introduce an additional optional relation variable into the nuclear scope of (84a), along the lines in (85).

\[(85) \lambda P. \forall z [\text{city}'(z) \rightarrow \exists x [P(x) \land \text{from}'(z)(x) \land R_j(z)(x)]]\]

The relation variable establishes an additional relation between the two variables bound by universal and existential quantifier respectively. It seems that such a step is semantically harmless because it does not introduce truth-conditions that are too strong. This is because we can always fill in the non-identity relation in cases where an additional relation variable is unnecessary, i.e. in all cases with no variable binding from within the ILC. In other words, it will always be possible to find a relation that makes (85) true, given that the other conditions are satisfied.

Granted that the optional addition of a relational modifier is permitted in general (compare also the optional addition of relational event-modifiers in the verbal domain), applying crosswise \(\lambda\)-abstraction will derive the bound variable reading for (83). The relevant point in the derivation is shown in (86).\(^\text{24}\)

\(\text{For the derivation to proceed, it is necessary that the index ‘i’ of the QP be visible on the subject DP. I will return to this point shortly.}\)
The denotation of the right-hand daughter I’ before \( \lambda \)-abstraction is given in (87a). The indices ‘i’ and ‘1’ trigger \( \lambda \)-abstraction in (87a), in this order. The result is the relation-denoting expression in (87b). In a second step, \( \lambda \)-abstraction over index ‘j’ applies to the left-hand daughter, the ILC-denotation. The result in (87c) functionally applies to (87b), yielding the correct (87d) as the meaning for (83).

\[
\text{(87) } \begin{align*}
\text{a. } & \left[ \left[ I' \text{ t}\_1 \text{ loves it}_2 \right] \right] = \exists e \left[ \text{love}'(x, y) \right] \\
\text{b. } & \left[ \left[ I' \text{ t}\_1 \text{ loves it}_2 \right] \right] = \lambda y \lambda x_1 . \exists e \left[ \text{love}'(x_1, y) \right] \\
\text{c. } & \left[ \left[ \text{ DP}_{i,1} \text{ some man from every city} \right] \right] = \lambda R_\_j . \forall z \left[ \text{city}'(z) \rightarrow \exists x \left[ \text{man}'(x) \land \text{from}'(z)(x) \land R_\_j(z)(x) \right] \right] \\
\text{d. } & \left[ \left[ \text{ some man from every city t}_1 \text{ loves it}_2 \right] \right] = \\
& \forall z \left[ \text{city}'(z) \rightarrow \exists x \left[ \text{man}'(x) \land \text{from}'(z)(x) \land \exists e \left[ \text{love}'(x, z) \right] \right] \right] = 1 \text{ iff} \\
\text{e. } & \text{ for every city } z, \text{ there is a man } x \text{ from } z \text{ and there is an event } e \text{ such that } x \text{ loves } z.
\end{align*}
\]

The derivation in (87) is structurally analogous to the semantic analysis of adnominal jeweils-DPs in subject position. This is a welcome result, since ILCs and jeweils-DPs were argued to be structurally parallel in chapter III. Given their structural parallelism, a similar semantic derivation is to be expected. The price to pay in order to achieve this parallelism is the introduction of an extra relational modifier. As argued above, I do not conceive of such an introduction as dangerous. It does not lead to truth-conditions that are too strong, for it can always be trivially satisfied by the non-identity relation. In addition, it is in line with compositionality, since its introduction seems to be necessitated by the parts of the whole expression (the clause) and the way they are combined. Finally, the fact that an extra relational modifier must be introduced may account for the marginality of the construction, and to its rebuttal by many speakers.

A more serious problem was raised in footnote 24. It regards the position of the index ‘i’. In section 2.3.1, I have argued that the index-bearing expression must be at the left periphery of the DP in order for its index to be visible to DP’s sister, thus triggering \( \lambda \)-abstraction. Visibility could be attributed to percolation of the index to DP, or to the fact that expressions in SpecDP (or adjoined to DP) are visible to the sister of DP. However, the index-bearing expression in (86), the QPP, is not at the left-periphery of the DP, but right-adjointed to NP. So how can the index be visible to I’, triggering \( \lambda \)-abstraction? I can see at least two possible answers to this problem. First, one could assume that the postnominal QPP is right-adjointed to DP, instead of NP. Being not included inside the DP, the index ‘i’ of QPP should be visible to I’, triggering \( \lambda \)-abstraction. The second solution is that the postnominal QPP can undergo LF-movement to SpecDP after all, contrary to what was argued in chapter III.3. In this case, the LF-structure of the ILC in (83) would be identical to the surface structure of jeweils-DPs, and the index could get to DP from SpecDP. Since movement would be necessitated by the need to get the index to the DP-level, such LF-movement would be licensed by Fox’s (2000) requirement that LF-
movement can apply only if it gives rise to a new reading. In this case, the new reading is
the bound variable reading. On this view, there would be two syntactic structures for the
“inverse” readings of ILCs. On the regular “inverse” reading, the postnominal QPP can be
interpreted in situ, in its postnominal base position. On the bound variable “inverse”
reading, the postnominal QPP must be interpreted in SpecDP after LF-movement has
taken place.

The second solution has the advantage that it also gives an account for the marginality
of bound variable readings with ILCs. Additional LF-movement for semantic reasons is
costly, and generally dispreferred by speakers. On the other hand, the assumption of two
different LF-structures for the two “inverse” readings of ILCs makes the analysis testable
in principle. We would expect to find empirical differences in connection with the two
“inverse” readings if their LF-structures differ. At present, I am not aware of such
differences. Also, a mixed syntactic account of the two inverse readings takes away a lot
of the appeal of the surface analysis of ILCs proposed in chapter III.3. I leave the matter
open for further research, simply assuming that the index ‘i’ is visible to I’ one way or
another.

4.2 Binding from within Possessive DPs
Crosswise λ-abstraction may also be of use in the analysis of variable binding from within
possessive DPs (Reinhart 1976). In (88), the universal QP *every lady* in SpecDP can bind
a pronoun inside the VP.

(88) *Every lady*’s dog adores her.

Since Abney (1987), prenominal genitive DPs are standardly analysed as being located in
the specifier of DP. I will adopt Abney’s analysis without further comment. The structure
of (88) is given in (89).

(89) [IP [DP *every lady*’s [NP dog]] [t: t; adores her]]

The question is how the QP can bind the pronoun from SpecDP? Kayne (1994) gives a
syntactic answer to the problem. On his analysis, all specifiers are adjuncts, and all
adjuncts can c-command out of the structure they are adjoined to because they are not
dominated by it. It follows that *every lady*’s c-commands *her* in (89). If syntactic c-
command is a precondition for semantic binding, such binding should be licensed.

The syntactic solution does not solve the semantic problem with (88), though. The
problem lies in the fact that DPs with a genitive QP in prenominal position are usually
analysed as generalised quantifiers (type <et,t>) (cf. Keenan & Stavi 1986). In the
ordinary case, this GQ would take a property-denoting expression as its semantic
argument. However, the sister of DP in (89) appears to be relation-denoting. It contains
two free variables which must be bound by the DP or material therein. The type mismatch
is illustrated in (90).

(90) [Every lady*’s dog]* (λx,λy*, xᵢ adores yᵢ)
    <et,t>     <e<et>>

In other words, the DP-denotation should be able to take a relation as argument if it were
to bind the two variables in one go. A potential solution to this problem is to raise the QP
(or the Q-head in isolation) out of the DP, and adjoin it to IP, as in (91).
In (91), binding proceeds in two steps. In a first step, the moved DP binds its trace $t_1$. In a second step, the raised QP binds both its trace inside the DP and the pronoun inside the VP. The syntactic structure in (91) therefore receives a correct interpretation. The obvious disadvantage of this approach is that it involves extraction out of a specific DP. Such extraction is not attested otherwise in English. In addition, the structure in (91) does not account for why (92) is ungrammatical.25 Given the structure in (91), the QP *every lady* should bind the reflexive pronoun inside its minimal governing category.

(92)  *Every lady’s dog adores herself.*

In answer to this problem, I would like to propose an account that does not involve LF-extraction. Instead, the alternative analysis makes use of the mechanism of crosswise \( \lambda \)-abstraction. The starting point is den Dikken’s (1998) claim that prenominal genitive expressions start out as underlying PPs in postnominal position. On this analysis, the DP in (88) has the underlying structure in (93a). The surface structure in (93b) is derived through movement of the preposition into the functional head \( F^0 \), followed by predicate inversion of the headless PP to the specifier of this functional projection. The complex head \( [F^0 + P] \) is spelt out as genitive –s.

(93)  a. \( [FP[F_0[NP\{dog [PP\{of\} every lady\}]]]] \)
    b. \( [FP[t_{FP every lady}, [F^0 + P\{NP\{dog t_1\}]]]] \)

Even though the analyses differ in details, the structural similarity between (93a) and the underlying structure of ILCs should be obvious. Here as there, a PP which is generated in postnominal base position moves overtly to a DP-initial position. The structural similarity of the two constructions plus the fact that variable binding is possible from within ILCs as well suggests an analysis for (88) along the lines discussed for ILCs in the previous subsection.

Turning to the semantics of prenominal genitive constructions, Partee (1983/97) and Partee & Borshev (1998) argue that these contain a free relation variable in their denotation. An example is given in (94).

(94)  \([\{Sarah’s team\}] = \iota x[team’(x) \land R(x, sarah’)]\)

The relation variable \( R \) in (94) is free and receives its value from the context. This explains why prenominal genitive constructions can vary in interpretation. The genitive construction in (94) could refer to the team Sarah owns, the team she plays in, the team she supports etc. depending on the context. What is interesting is that a prenominal genitive construction can express different relations simultaneously. *Sarah’s team* can also refer to the team which Sarah owns and in which she plays. One way to implement this formally, would be to introduce a second relation variable in the denotation of the genitive construction.

25 In response to this problem, Reinhart (1983:81) suggests a strengthening of the licensing conditions on syntactic anaphors according to which anaphors and their antecedents must be dominated by the same minimal governing category, i.e. the same minimal IP or DP. This condition is violated in (92).
With (95), we are in a position to account for the bound variable reading with (88). I take the genitive construction in (88) to be proposition denoting, just like ILCs or jeweils-DPs. The semantic content of the genitive expression can be paraphrased as ‘every lady stands in some relation to a unique dog’. Its semantic representation is given in (96).

\[
[\text{every lady,‘s dog}] = \forall z [\text{lady}(z) \rightarrow \exists x [\text{dog}(x) \land R_k(x, z) \land R_l(x, z)]]
\]

With (96) in place, the derivation is straightforward. The indices ‘1’ and ‘i’ on the DP are visible to its syntactic sister, ‘I’. This triggers λ-abstraction over the co-indexed variables in the denotation of ‘I’. The result is the relation-denoting expression in (97).

\[
[\text{‘I, i adores her,1’}] = \lambda y_1 \lambda x_i. \text{adore}(x_i, y_1)
\]

Now the road is paved for λ-abstraction over the index of one of the relation variables in (96), the denotation of the left-hand sister, yielding (98).

\[
[\text{every lady,‘s dog}] = \lambda R_j. \forall z [\text{lady}(z) \rightarrow \exists x [\text{dog}(x) \land R_k(x, z) \land R_j(x, z)]]
\]

In a last step, (98) functionally applies to (97), yielding (99a).

\[
\text{(99)} \quad \begin{align*}
\text{a. } & [\text{every lady,‘s dog,1,1 adores her,1}] = \quad \forall z [\text{lady}(z) \rightarrow \exists x [\text{dog}(x) \land R_k(x, z) \land \text{adore}(x, z)]] \iff \\
\text{b. } & \text{for every lady } z, \text{ there is a dog } x \text{ such that } x \text{ stands in a relation of possession, ownership etc. to } z \text{ and } x \text{ adores } z.
\end{align*}
\]

The foregoing remarks are admittedly sketchy and need to be worked out in further detail. In particular, the interpretation of the universally quantified genitive construction in (96) deserves further comment. Nonetheless, the present analysis points out an interesting parallelism in the behaviour of possessive DPs and ILCs (and jeweils-DPs). This parallelism may have its origin in a shared underlying structure syntactically, and in the shared application of crosswise λ-abstraction semantically.

### 4.3 Pluractional Quantifiers

The final case that I would like to discuss is the case of - on the face of it - PP-modifiers that show the semantic behaviour of pluractional quantifiers (see Lasersohn 1995, Matthewson 2000, Zimmermann 2000). Two examples are given in (100ab).

\[
\text{(100)} \quad \begin{align*}
\text{a. } & \text{[Girl after girl] arrived.} \\
\text{b. } & \text{John washed [dog after dog].}
\end{align*}
\]

The analysis of (101ab) as involving pluractional quantification is due to Stockall (2001), where an insightful account of the phenomenon is given. I will quickly summarise her
analysis, and then go on to show why (100ab) may have a bearing on the present discussion.

Stockall analyses the bracketed constituents in (100) as PPs with the structure in (101).

\[(101)\]

\[
\text{RED} \quad P' \quad \text{after} \quad \text{girl}
\]

The NP girl is the complement of the PP headed by after. The preposition after does not have its basic lexical meaning. In addition to two individuals x,y, after takes a relation f (the value of which will be that of the intransitive verb arrive, type \(<e,vt>>\)) and a complex event as arguments. It specifies that the complex event consists of two events of x arriving in e’, and of y arriving in e”’, such that e’ occurs after e”’. The last clause of this condition contains the original meaning of after. SpecPP is occupied by an operator RED, which phonemically reduplicates the NP girl.\(^{27}\) Semantically, RED quantifies over the set of girls. RED is defined in such a way that it takes a set g, with a large subset Cov (here: a large set of girls), a relation, and an event as argument (i.e. it is of type \(<et,<eet,vt>>\)), specifying that any two elements x, y of Cov and the event e stand in a particular relation to each other (in the course of the derivation this relation will turn out to be the relation of x arriving after y in e).

Stockall assumes that RED must LF-raise and adjoin to IP because it is quantificational, and because it does not stand in sister position to the expression denoting its first semantic argument, the NP girl. This movement is followed by LF-movement of the NP girl to a position adjoined to RED, so that the LF-structure is as given in (102).\(^{28}\)

\(^{27}\) The analysis of reduplication as a process of copying phonemic material from a base form to an operator-element is reminiscent of Marantz’ (1982:437) definition of movement. The suggested process of reduplication differs from the ones discussed in Marantz in that it seems to apply in the syntactic component, and therefore cannot be a pure morphological process.

\(^{28}\) The formal denotations for the elements in (101) are given in (ia-c):

\begin{enumerate}
  \item a. \([[\text{girl}]] = \lambda x. x \text{ is a girl}
  \item b. \([[\text{after}]] = \lambda x \lambda y \lambda f_{e,vt}. \lambda e. \exists e'. e' \in e, e' \in e \land f(e') = 1 \land f(y)(e) = 1 \land e' \text{ occurs after } e''$
  \item c. \([[\text{RED}]] = \lambda g \lambda f_{e,vt}. \lambda e. \text{ Cov} = \text{ a large subset of } g \land \forall x,y: (x \in \text{ Cov} \land y \in \text{ Cov}) \rightarrow f(x)(y)(e) \lor f(y)(x)(e) = 1$
\end{enumerate}

The denotation of the verb arrive is found in (ii):

\begin{enumerate}
  \item (ii) \([[\text{arrive}]] = \lambda x \lambda e. x \text{ arrives in } e
\end{enumerate}

\(^{29}\) The movement is Heim & Kratzer (1998)-style in that it leads to insertion of indexical nodes in the syntactic structure.
With the denotations from fn.28, (102) can be correctly interpreted. Stockall’s analysis is a major step forward towards an analysis of the hitherto quite mysterious constructions in (100). In particular, the analysis in terms of pluractionality is insightful and deserves merit. Nonetheless, the analysis raises a number of syntactic problems. The first problem concerns the movement of the bare noun girl to its adjunction site in (102). As Stockall observes, this movement looks rather like head movement. But if this is the case, the N-head girl must be assumed to skip the prepositional head after in violation of Travis’ (1984) ‘Head Movement Constraint’. The second problem concerns the fact that the preposition after selects a bare singular count NP. In chapter III.4.1.1, it was pointed out that prepositions typically do not select bare count nouns, as witnessed by (103).

(103) *John went after girl.

The question arises why the selectional restrictions on P should be different in (100). The final problem seems to be the most serious. The maximal projection headed by the preposition after occurs in subject position. As an argument position, this position is reserved for DPs.

(104) *With the men arrived.

In response to these problems, I would like to suggest an alternative analysis which retains the pluractionally quantifying nature of the construction, but which faces fewer syntactic problems. Not surprisingly, perhaps, I propose to analyse the bracketed constituents in (100) as DPs with an empty D-head that selects for the bare NP. A PP consisting of the preposition after and the operator element RED is right-adjointed to NP.
In other words, the underlying structure of the pluractional constructions in (100) is identical to that of jeweils-DPs, of ILCs (on their “inverse” reading), and possibly of possessive DPs as well. The structure in (105) maintains the DP-status of the subject constituent, the preposition selects a full QP (as it should), and the entire structure can be interpreted without LF-movement, given an appropriate semantic value for RED.

Semantically, RED takes two arguments, a relation expressed by the preposition, and a property expressed by the bare NP, mapping these into a truth-value. In addition, I assume that RED contains a free relation variable that will be assigned the semantic value of the verb in the course of the derivation. As a result, the semantic analysis of (105) is very close to that of jeweils-DPs. The interpretation of (105) is illustrated in (106).

(106) a. \([\text{RED}_i] = \lambda W_{\prec v, \prec t} \lambda P_{\prec e} \exists Q = \text{a large subset of } P, \exists E = \text{a set of events} \chi((x,y) \in Q \land e', e'' \in E \land R_j(x,e') \land R_j(y,e'')) \rightarrow (W(e', e'') \lor W(e'', e'))\]
b. \([\text{after}] = \lambda x \lambda y. \text{after}'(x,y)\]
c. \([\text{girl}] = \lambda x. \text{girl}'(x)\]
\[\Downarrow \quad \text{FA of (106c) to (106b)}\]
d. \([\text{DP after RED}_i] = \lambda P_{\prec e} \exists Q \subseteq P, \exists E [\forall x,y, \forall e', e'' ((x,y) \in Q \land e', e'' \in E \land R_j(x,e') \land R_j(y,e'')) \rightarrow (\text{after}'(e', e'') \lor \text{after}'(e'', e'))]\]
\[\Downarrow \quad \text{FA of (106d) to (106c)}\]
e. \([\text{DP girl after RED}_i] = \exists Q \subseteq [\text{girl}], \exists E [\forall x,y, \forall e', e'' ((x,y) \in Q \land e', e'' \in E \land R_j(x,e') \land R_j(y,e'')) \rightarrow (\text{after}'(e', e'') \lor \text{after}'(e'', e'))]\]

(106c) gives the semantic value for the entire DP. Hence, the subject DP in (100a) denotes a proposition like jeweils-DPs. Syntactically, the subject DP has moved out of its base position to SpecIP, leaving behind a co-indexed trace.

(107) \([IP \quad \text{[Girl after girl]}], [VP \quad t_1 \text{ arrived}].\]

The index ‘1’ on the moved subject now triggers crosswise λ-abstraction. In a first step, index-triggered λ-abstraction applies to index ‘1’ in the VP-denotation, yielding (108a). In a second step, type-triggered λ-abstraction applies to index ‘j’ in the denotation of the subject DP, yielding (108b). (108b) then functionally applies to (108a), yielding (108c).

(108) a. \([t_1 \text{ arrived}] = \lambda y, \lambda e. \text{arrive}'(y, e)\]
b. \([\text{DP girl after RED}_i] = \lambda R_j \exists Q \subseteq [\text{girl}], \exists E [\forall x,y, \forall e', e'' ((x,y) \in Q \land e', e'' \in E \land R_j(x,e') \land R_j(y,e'')) \rightarrow (\text{after}'(e', e'') \lor \text{after}'(e'', e'))]\]
c. \([\text{DP girl after RED}_i t_1 \text{ arrived}] = \exists Q \subseteq [\text{girl}], \exists E [\forall x,y, \forall e', e'' ((x,y) \in Q \land e', e'' \in E \land \text{arrive}'(x,e') \land \text{arrive}'(y,e'')) \rightarrow (\text{after}'(e', e'') \lor \text{after}'(e'', e'))]\]
\[= 1 \text{ iff } \]
d. \text{there is a large group of girls } Q \text{ and a complex event } E, \text{ such that for any two girls } x, y \text{ in } P \text{ and for any two events } e', e'' \text{ in } E \text{ such that } x \text{ arrives in } e' \text{ and } y \text{ arrives in } e'', \text{ either } e' \text{ occurs after } e'' \text{ or } e'' \text{ occurs after } e'.\]

(108d) adequately captures the truth-conditions of (100a). The correct semantic interpretation is arrived at by applying crosswise λ-abstraction at the cost of postulating a free relation variable R in the denotation of RED. In this connection, observe that Stockall
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(2001) must also posit a relation variable (bound by a \( \lambda \)-operator) in the lexical entry of the preposition after. So, the two analyses fare equally good or bad in this respect. In contrast, the merits of the present analysis are fourfold: (i.) the denotation of after is the normal one; (ii.) no LF-movement is required; (iii.) the syntactic problems concerning the selectional properties of Ps and the obligatory DP-status of subjects do not arise; and (iv.) the syntactic and semantic analysis of (100ab) is analogous to that proposed for several other constructions. The applicability of crosswise \( \lambda \)-abstraction to the range of syntactic constructions discussed in this and the preceding sections is a strong argument in its favour.

4.4 A Perspective for Reduplicating Languages

The previous sections have shown that a unified semantic analysis of a number of (at first sight) unrelated constructions is feasible. The role played by crosswise \( \lambda \)-abstraction in the semantic derivation of binding from ILCs, binding from possessive DPs, and in the interpretation of pluractional DPs assigns it a prominent role in the semantic analysis of natural language expressions. It provides a flexible tool for the analysis of a variety of constructions in a variety of languages. From a universalist perspective, this is a welcome result.

In addition, the discussion of pluractional \( N \)-after-\( N \) constructions in section 4.3 opens an unexpected window to the analysis of languages that express adnominal d-distributivity by reduplication of the numeral. Examples from Hungarian and Georgian from chapter II.4.1 are repeated as (109ab).

(109) a. A gyerekek hoztak egy-egy könyvet.  [Hungarian]  
    the children bought a-a book  
    ‘The children bought a book each.’ (Farkas 1997:260,ex.36)

b. Orma k’acma sam-sami čanta c’aiyo.  [Georgian]  
    two\_ERG man\_ERG three-three\_NOM suitcase\_NOM carried  
    ‘Two men carried three suitcases each.’ (Gil 1982:18, ex.1c)

The discussion of \( N \)-after-\( N \) constructions in section 4.3 was based on the assumption that the reduplicated expression is an operator element that receives its phonological feature value through feature copying from an overt lexical element at PF. On the plausible assumption that a similar process applies with reduplicated numerals, the object DP in (109a) could be analysed as in (110).

(110)    \[
    \text{[DP RED [NP egy könyvet]]} \\
    \text{one book}
    \]

(110) resembles the surface structure of German jeweils-DPs to a certain extent. Furthermore, Hungarian exhibits overt DP-internal fronting, as witnessed by (111b) which is derived from (111a) (Szabolcsi 1994:180f.):

(111) a. (a) Mari kalap-ja-i  
    the Mari(-NOM) hat-POSS-PL  
    Mari’s hats

b. Mari-nak a t1 kalap-ja-i  
    Mari-DAT the hat-POSS-PL  
    ‘Mari’s hats’
This means that the underlying structure of (110) could – in principle – be as in (112).

\[(112) \ [DP \ [NP \ [NP \text{ egy könyvet}] \ \text{RED}]] \]

This structure closely resembles the cross-linguistic structure of adnominal d-distributive constructions from chapter III.5.1. It is relatively simple to write a lexical entry for RED in (112) that is parallel to that of adnominal jeweils, and that would allow for a correct interpretation of (109a).^30

\[(113) \ [[\text{RED}]] = \lambda P. \exists z [z \in Z \rightarrow \exists x [P(x) \land R_j(x)(z)]] \]

I do not want to go further into the details of Hungarian here. Farkas (1997) shows that reduplication is a more general process in Hungarian which also applies with verbs, resulting in an iterative reading. So quite possibly, we need an eventivised version of (112) as well. The point of the foregoing remarks is merely that a unified analysis of languages that mark adnominal d-distributivity by means of a proper DD, and languages that mark d-distributivity by means of reduplication may not be as hopeless an enterprise as previously thought.

These concluding remarks are therefore intended to pave the way for further research into the universal nature of adnominal d-distributivity. Ideally, the result of such a research program would be (i.) that languages do not differ widely concerning the way they express adnominal d-distributivity, and (ii.) that the observable differences can be reduced to general syntactic differences between languages.

5 Conclusion

In this chapter, I have argued for the following:

\[(114) \]

i. A subset of adnominal elements can be interpreted adverbially if two structural conditions are satisfied: (i.) The adnominal element must be at the left edge of its embedding DP; (ii.) The embedding DP must be located outside VP.

ii. The semantic operation of crosswise \(\lambda\)-abstraction lies at the heart of adverbial readings with adnominal jeweils in sentence-initial position. Crosswise \(\lambda\)-abstraction involves \(\lambda\)-abstraction on both daughters of a syntactic node so that the first application of \(\lambda\)-abstraction creates the precondition for the second application of \(\lambda\)-abstraction.

iii. Crosswise \(\lambda\)-abstraction may play a role in a number of at first sight unrelated constructions, involving binding from within inverse linking constructions, binding from within possessive DPs, and pluractional quantification with NP-P-NP-constructions.

^30 See Farkas (1997) for an alternative semantic account of (109a) in terms of dependent variables.