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Chapter IV  Interpreting Jeweils

In chapters II and III, I have isolated and analysed two instances of the distributive element jeweils in German. Adverbial jeweils ‘each’ occurs in the position of adverbial quantifiers. This position was analysed as being a VP-adjoined position. Adnominal jeweils ‘each’ was shown to form part of a postnominal PP underlyingly. In languages like German, which exhibit overt DP-internal fronting for discourse reasons, this PP normally moves to the specifier of DP overtly.

The presence of two homophonous elements in different syntactic positions presents us with a classical instance of the problem of ambiguity. The question is whether the two instances of jeweils have the same meaning, or not. In the first case, the homophony is expected. In the second case, it will be accidental. The question also pertains to the syntax-semantics interface. In the first case, the difference in sentence meaning will be the result of a difference in syntactic structure. In the second case, the difference in the meaning of jeweils will lead to a difference in syntactic position.

In this section, I adopt the first view and assume that the two instances of jeweils have only one underlying meaning. Differences in meaning are – on this view – the result of jeweils occurring in different syntactic positions. In chapter III.1, it was shown that adverbial jeweils does not differ from other adverbial quantifiers syntactically, and that it should therefore be treated as such. Adverbial quantifiers denote generalised quantifiers over events. If adverbial and adnominal jeweils have the same meaning, the null assumption is that adnominal jeweils also denotes a generalised quantifier, albeit in a different ontological domain. The nature of this domain will be shown to depend on the nature of the (DistKey) co-referent of the proform –weil–, which restricts the universal quantifier.

In chapter I.4, I have adopted a surface compositional view on the syntax-semantics interface. In this spirit, the semantic analysis of jeweils will demonstrate that both instances of jeweils are compositionally interpretable in their surface position, and that we do not have to fall back on LF-movement for interpretive reasons. The syntactic evidence against LF-movement that was presented in chapter III.4.3 backs up this result.

The semantic analysis to be presented is based on the internal structure of jeweils-DPs that was developed in chapter III.4. The analysis is similar in spirit to von Stechow’s (1996) account of the ambiguity of wieder ‘again’. There, as here, the semantic analysis takes as input a syntactic structure that is more complex than what appears on first sight. The difference between the two analyses lies in the fact that von Stechow’s analysis relies on lexical decomposition of the verb, while the present analysis involves analysing the free form jeweils as a PP. Since the presence of a prepositional head is morphosyntactically licensed through genitive case on jeweil–, the ‘decomposition’ of jeweils into P0 and NP appears to be well motivated.

The structure of the chapter is as follows. In section 1, I give a general introduction into the semantics of events. This discussion is indispensable for the analysis of adverbial jeweils and – to a certain extent – adnominal jeweils. In section 2, adverbial jeweils is analysed as an adverbial quantifier over events. In section 3, I present a few desiderata for the semantic analysis of adnominal jeweils. The section also gives an overview over
earlier semantic treatments of distance-distributivity in the literature. Section 4 presents the analysis of adnominal jeweils. It is shown that adnominal jeweils does not differ in meaning from its adverbial counterpart and that a (surface) compositional analysis of adnominal jeweils is possible. Section 5 shows how some of the properties of adnominal jeweils (as discussed in chapter II.1) follow on the analysis proposed here. In section 6, I adopt a wider cross-linguistic perspective again. The difference between English and German concerning the possibility of distance-distributive elements in the subject position of small clauses (see chapter III.5.5) is shown to derive from a combination of semantic factors and a syntactic difference between the two languages. Finally, I show in section 7 that the semantic analysis of jeweils-DPs can be extended to the interpretation of inverse linking constructions (ILCs). Given that ILCs and jeweils-DPs have the same underlying structure, this is a welcome result.

1 Event Semantics

Drawing on Reichenbach (1947), Davidson (1967) introduces events as ontological primitives into the analysis of natural language, namely as arguments of verbal predicates. Since natural language expressions often make implicit or explicit reference to events (cf. Link 1987, Parsons 1990:17-19), this move should hardly be surprising (even though Davidson’s reasons for doing so were of a different nature). Natural language expressions can refer directly to events (1a). Events are countable by means of adverbial modifiers (1b). Quantifiers can range over events (1c). Events can anaphorically bind pronouns (1c). And event-denoting antecedents can be picked up anaphorically across sentence boundaries (1d).

(1) a. The fall of the Berlin Wall
    b. Germany attacked Russia twice.
    c. Every traffic accident will leave its witnesses traumatized.
    d. The fall of the Berlin wall was unexpected. It came as a complete surprise.

The data in (1) justify the assumption that events are linguistically real entities. Unlike proper individuals, which in general are more stable over time, events are usually perceived as more fleeting, more transient, spatio-temporally occurring objects. Nevertheless, they are ontological entities, albeit of a different sort (cf. Eckardt 2002:91). In general, events are characterised and identifiable by their spatio-temporal location, i.e. by the space and time of their occurrence (Link 1998:236). It is the time of occurrence that helps to distinguish a visit by Schröder now from a visit by Schröder then. And it is the place of occurrence that helps to distinguish a thunderstorm here from a thunderstorm there (if the two events occur simultaneously).

Davidson’s idea was taken up by a lot of researchers both in natural language philosophy (Link 1987, 1998, Bennett 1988, Parsons 1990, among others) and in linguistic semantics. In the latter field, the notion of ‘event’ proved particularly useful in the analysis of two grammatical phenomena, namely of aspect (e.g. Bach 1986, Krifka, 1989, 1992, Kiparsky 1998, and others) and adverbial quantification (cf. Berman 1987,
Heim 1990, De Swart 1991, von Fintel 1994). In what follows, I will focus on the following aspects of events.

(2) i. Events as semantic entities (in section 1.1)
ii. The internal structure of events (in section 1.2)
iii. Adverbial quantification over events (in section 1.3)
iv. Stage and individual level predicates (in section 1.4)
v. The argument status of events (in section 1.5)

The ensuing discussion of events and their properties will serve two purposes: First, it provides a useful background for the semantic analysis of adverbial and adnominal jeweils. Second, it introduces the necessary tools required for a formal semantic analysis based on events. At the same time, some aspects of (the semantics of) events are illustrated by way of looking at adverbial jeweils. Therefore, the section can also be understood as a first step towards the semantic analysis of adverbial jeweils, which will be presented in section 2. The section as a whole is mainly intended for the more syntactically minded among the readership. Readers with a proficient background in event semantics and adverbial quantification are invited to skip the chapter, perhaps browsing through sections 1.2.3 and 1.4 that have a direct bearing on the semantics of adverbial jeweils.

1.1 Events

We begin with motivating the existence of events in the logical representation of sentences. Events are semantic arguments of predicates and enter the logical representation of sentences in form of an ‘event variable’. Because they are variables, it is to be expected that events can be bound, or quantified over by quantificational elements such as adverbial quantifiers. We will focus on the motivation for introducing events into the logical structure of sentences in section 1.1.1. In 1.1.2, we will point out the difference between particular events and event types. Drawing this distinction is important for a proper treatment of events, and neglecting it often leads into problems. In 1.1.3, I show that there is no real empirical difference between the ‘traditional’ Davidsonian analysis and so-called Neo-Davidsonian (Parsons 1990) analyses. As a result, I will go on to use the Davidsonian format.

1.1.1 Events as Semantic Entities

An argument in favour of events comes from the observation that declarative sentences, such as (3), can be used to make statements about a number of different occasions, or events, depending on when and where they are used.

(3) Brutus kisses Caesar.

To avoid confusion from the beginning, it is clear that (3) can mean two different things. On the one hand, (3) is an existential statement about an individual event that is usually identifiable through its context of utterance. At the same time, (3) describes a set of events which can occur at different times (and places), but which have the same property. In the case of (3), this property is the property of being an event of Brutus kissing Caesar. A set

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1 But see Lewis (1975), Kamp (1981), and Heim (1982) for a different view on which adverbial quantification involves unselective quantification over ‘cases’, i.e. n-tuples of individuals that do not contain events.
of events with the same property constitutes an event class, or an event type.\(^2\) We can say, then, that sentences always specify an event type.\(^3\) These event types are predicated of particular events. Below, it is argued that its VP denotes the event type of a sentence. The concrete utterance of a sentence, on the other hand, is always about individual events. The situation is reminiscent of that found in the nominal domain. There, the NP denotes a set of entities with a certain property, whereas the DP denotes either a concrete individual, or it gives rise to a quantified statement about a (group of) individual(s). The difference between particular events and their event types will play an important role in the discussion of the internal structure of events in section 1.2.

Formally, Davidson captures the intuition that sentences are about event types by saying that verbal predicates have an obligatory argument position for events, just as they do for internal and external arguments. This event argument position is filled by an event variable which stands for an individual event, and which - in the default case - is bound by existential closure. The logical entry of the verb *kiss* is given in (4a). Repeated functional application (henceforth: ‘FA’) of (4a) to the object denotation *caesar* (4b), and to the subject denotation *brutus* yields (4c). (4c) denotes a set of events, the event type of Brutus kissing Caesar. Existential closure of the event variable in (4d) turns the event type into the proposition expressed by (3). The truth conditions are spelt out in (4e).

\[(4) \begin{align*}
\text{a. } & \lambda y \lambda x \lambda e. \text{kiss}'(x, y, e) \\
\text{b. } & \lambda x \lambda e. \text{kiss}'(x, \text{caesar}, e) \\
\text{c. } & \lambda e. \text{kiss}'(\text{brutus}, \text{caesar}, e) \\
\text{d. } & \exists e \text{kiss}'(\text{brutus}, \text{caesar}, e) \\
\text{e. } & \text{There is an event } e \text{ such that } e \text{ consists of a kissing of Caesar by Brutus.}
\end{align*}\]

An alternative, though equivalent way of formalising (4d) is (5), which brings out more clearly the fact that sentences contain event types (i.e. sets of events) as part of their meaning.

\[(5) \exists e \in \{e | \text{kiss}'(\text{brutus}, \text{caesar}, e)\}\]

Davidson’s analysis in terms of events allows for an elegant account of sentences with adverbial modifiers, which are problematic otherwise. Consider (6).

\[(6) \text{Brutus killed Caesar [with the dagger] [in Rome] [on the ides of March].}\]

The instrument, place, and time adverbials in (6) do not denote properties of Brutus or Caesar. Instead, Davidson (1967) construes the additional time, place and instrumental adverbials as modifying predicates over events, i.e. as predicates of type \(<v,t>\) (with \(v\) the logical type of events). Like adnominal modifiers (adjectivals, PP-modifiers, restrictive relative clauses), which restrict the NP-denotation, event predicates restrict the VP-denotation, or the class of events in question. The VP [[Brutus kiss- Caesar]] denotes the

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\(^2\) Event types can also be conceived of as (characteristic) functions from events to truth-values, their logical type being \(<v,t>\) (with \(v\) the logical type of events).

\(^3\) This claim is more general than Davidson’s claim that is restricted to ‘action sentences’, sentences with an intentionally acting agent. We will replace this vague restriction shortly with Kratzer’s (1995) claim that only sentences with stage-level predicates contain an event in their semantic structure. This does not obviate, but it confirms Davidson’s general point (1967:93): “Some predicates have an event place, some do not.”
set of all Brutus-kissing-Caesar-events. The modified VP \([Brutus \text{ kiss-}\ Caesar \text{ on Monday}]\) only denotes the subset of those Brutus-kissing-Caesar-events that occur on Mondays.\(^4\) And, as with adnominal modifiers, it is possible to compose the semantic values of VP and the adverbial phrase by predicate modification (henceforth: ‘PM’) (cf. Heim & Kratzer 1998:65).\(^5\)

For a concrete example, consider the interpretation of the modified VP in (7). Since I am not concerned with the precise syntactic location of time, place, and instrument adverbials, I will simply treat them as being right-adjoined to VP, as in (7).\(^6\) For simplicity, the subject Brutus is interpreted in its base position inside VP. The semantic types of the syntactic constituents are shown as subscripts on the respective syntactic nodes. The individual steps of the semantic derivation are listed in (8a-f).

\[
(7) \quad \text{VP}_{\nu, t} \rightarrow \text{VP} \rightarrow \text{AdvP}_{\nu, t} \rightarrow \text{on the ides of March} \rightarrow \text{VP} \rightarrow \text{AdvP}_{\nu, t} \rightarrow \text{in Rome} \\
\text{VP} \rightarrow \text{AdvP}_{\nu, t} \rightarrow \text{with the dagger} \rightarrow \text{DP} \rightarrow \text{Brutus} \rightarrow \text{V} \rightarrow \text{DP} \rightarrow \text{with the dagger} \rightarrow \text{Brutus} \rightarrow \text{V} \rightarrow \text{DP} \rightarrow \text{killed} \rightarrow \text{Caesar}
\]

\[
(8) \quad \begin{align*}
\text{a. } & \quad [[\text{killed}]] = \lambda y \lambda x \lambda e. \text{killed}'(x, y, e) \\
\text{b. } & \quad [[\text{killed Caesar}]] = \lambda x \lambda e. \text{killed}'(x, \text{caesar}, e) \quad \text{[FA]} \\
\text{c. } & \quad [[\text{Brutus killed Caesar}]] = \lambda e. \text{killed}'(\text{brutus}, \text{caesar}, e) \quad \text{[FA]} \\
\text{d. } & \quad [[\text{Brutus killed Caesar with the dagger}]] = \lambda e. \text{killed}'(\text{brutus}, \text{caesar}, e) \land \text{with}'(\text{\(\iota\)x.dagger}'(x), e) \quad \text{[PM]} \\
\text{e. } & \quad [[\text{Brutus killed Caesar with the dagger in Rome}]] = \lambda e. \text{killed}'(\text{brutus}, \text{caesar}, e) \land \text{with}'(\text{\(\iota\)x.dagger}'(x), e) \land \text{in}'(\text{rome}, e) \quad \text{[PM]}
\end{align*}
\]

\(^4\) Recall that the VP-internal subject hypothesis is assumed throughout.

\(^5\) Of course, it is also possible to combine the two semantic values by functional application if one treats adverbial phrases as denoting functions of the type \(<<\nu, t>,<\nu, t>>\). On this analysis, the adverbial expression takes a VP-denotation as its input and yields an expression of the same type as its output. Analogous analyses of modifiers as functors have been put forward for the semantics of attributive adjectives. The argument for such a functor analysis is based on the existence of non-intersective adjectives that receive no straightforward account in terms of predicate modification (cf. Hamann 1991).

\(^6\) See also Cinque (1999:29) and the discussion there. A potential problem for the structure in (7) arises in connection with the fact that pronouns inside the adverbials can be bound from direct object position.

(i) We interviewed everybodyi / nobodyi in hisi office / on hisi birthday.

Since semantic binding of pronouns is usually taken to be contingent on c-command (cf. Reinhart 1976; Heim & Kratzer 1998), the direct object in (i) must be structurally higher than the adverbial expression.

There are at least two ways to uphold the right-adjunction analysis of adverbs in the light of the binding facts (and leaving aside theoretical consideration like the ban on right-adjunction (Kayne 1994), or on adjunction in general (Chomsky 1995)): The first option is to define binding in terms of linear precedence (cf. Jackendoff 1990). The second option is to assume that direct objects move to a structurally higher position at LF in order to check case, as in Chomsky (1995). In both cases, the object will be able to bind into an adverbial that is right-adjoined to VP.
CHAPTER IV

f. \[([\text{Brutus killed Caesar with the dagger in Rome on the ides of March}]) \text{ [PM]} \]
\[
= \lambda e. \text{killed'(brutus, caesar, e)} \land \text{with'(ix, dagger'(x), e)} \land \text{in'(rome, e)} \land \text{on'(the-ides-of-march’, e)}
\]

(8f) denotes the set of all events e such that e is killing event of Caesar by Brutus that is brought about with the help of a previously mentioned dagger, that took place in Rome, and that took place on the Ides of March. The expression in (8f) is eventually turned into a proposition by ‘existential closure’ (EC) over the event variable. Application of existential closure yields (9).

\[
(9) \exists e [\text{killed'(brutus, caesar, e)} \land \text{with'(the-dagger’, e)} \land \text{in'(rome, e)} \land \text{on'(the-ides-of-march’, e)}]
\]

In the default case, existential closure applies at the outermost VP-level (Kratzer 1995), i.e. after all event modifiers have been adjoined. This situation mirrors the situation found in the adnominal domain. There, the NP first combines with modifying material (adjectivals, RCs, PPs), and then with an adnominal quantifier (see also the discussion in chapter III.3.4.2).

(10) a. Peter has [[always [[lived happily] [in Rome]]].
b. [every [[8-legged [animal] [in Africa]]]]

(6) contains several optional event modifiers, which refer to the event’s time, place, and instrument respectively. Eckardt (2002:107-109) shows that events can be modified (optionally) along other dimensions: ‘Volitional participant’, ‘Moved-Object’, ‘Resulting-State’, and ‘Degree’. All these modifiers take the form of a relation between the event and some other entity. In 1.3, I will argue that events can come with another implicit modifier that relates them to an event in the preceding discourse. As will be argued, this relational modifier is responsible for discourse coherence phenomena and adverbial quantification.

To conclude, VPs denote sets of events, irrespective of the aktionsart of their verbs. This means that states and processes (both telic and atelic) must be subsumed under the general notion of ‘event’, or ‘eventuality’. However, in fn. 3 it has already been pointed out that not every verbal predicate introduces an event argument into the semantic representation. Kratzer (1995) shows that this holds only for so-called ‘stage-level’ predicates, while it is not true of so-called ‘individual-level’ predicates. ‘Individual-level’ predicates such as intelligent or altruistic hold of individuals over time. Therefore, it should not come as a surprise that they do not single out particular classes of events that hold at some points of time, but not at others. Unfortunately, Kratzer’s argument relies on a better understanding of adverbial quantification. For this reason, the discussion of Kratzer (1995) will be postponed to 1.4, after adverbial quantification has been discussed in more detail. For the time being, it is sufficient to bear in mind that a subset of the stative verbs does not introduce an event argument into the logical structure of sentences. Before we go on, it is necessary to dwell on the distinction between concrete events and event types a little longer. The term ‘event’ is often applied indiscriminately to both concepts even though they apply to different entities. I argue that a clear distinction between both in the sense of Link (1998) will help to avoid unclarities. It will also prove useful in the discussion of event complexity in section 1.2.
1.1.2 Individual Events and Event Types

The discussion of (3), repeated as (11), showed that there are two notions of ‘event’.

(11) Brutus kisses Caesar.

On its first use, ‘event’ refers to a particular occasion, an individual event that is localised in time and space, which has the property of being a Brutus-kissing-Caesar event. On its second use, ‘event’ refers to this very event property, or event type. In what follows, I will reserve the notion ‘event’ for the first use, and the notion ‘Event’ for the second. This is a notational variant of Link (1998:299), who proposes a distinction between abstract events types and concrete processes which instantiate these events. For Link (ibid.:298), these processes are the ‘stuff’ events are made of. For me, events are the “stuff” Events are made of.

As concrete instantiations of abstract Events, individual events are localised in time and space. While an event e can have at most one time and place of occurrence (and possibly one possible world of occurrence), it can instantiate different Events. It can be a member of different sets of events. For instance, an event e₁ of stretching out one’s arm on a bike instantiates both the Event (type) of stretching out one’s arm on a bike, and the Event of indicating the direction. Formally, this is captured by (12):

\[
\begin{align*}
e_1 \in E_{\text{stretch out one’s arm}} &= \{e_1, e_2, e_3, \ldots\} \land e_1 \in E_{\text{indicate-direction}} &= \{e_1, e_4, e_5, \ldots\}
\end{align*}
\]

The events e₄, and e₅ in (13) do not have to be events where an arm is stretched out. They could also be events of switching on the indicator, or pointing a finger, etc. Alternative ways to capture the relation between events and Events are to say that an event can have different properties (like individuals), or that an event can satisfy different event predications.

A finite sentence without an explicit adverbial quantifier such as often expresses an existential statement about an individual event e. As argued above, this is the semantic result of existential closure over the event variable. This suggests that event quantification ranges over individual events, not Events. Section 1.2 will provide more evidence for this claim.

Finally, observe that there is no biunique relation between Events and sets of events. All Events are sets of events, but not vice versa. There are many disparate events which do not form an Event. Nevertheless, just like other entities of the same kind, disparate events can be combined in a set by set union. A linguistic application of this process is found in (13):

(13) The frog hopped into the pond, and a satellite was launched.

7 The assumption that an ordinary declarative clause denotes a general existential statement of the kind ‘the set of events of such and such a kind is not empty’ seems to be at odds with the intuitive feeling that such sentences are usually about particular events (with accordingly stronger truth-conditions). Translating the semantic representation from a static into a dynamic framework where the event is introduced dynamically as a discourse referent ameliorates the problem. Below, it is shown that certain phenomena in connection with events and event quantification need to be captured in a dynamic framework anyway. The resulting dynamic semantic representation is still not a statement about a particular event, but its truth-conditions are stronger than those of existential statements (see Dekker 2002).
(13) is a statement about two concrete events: the frog hopping into the pond constitutes \( e_1 \); a Russian satellite being launched constitutes \( e_2 \). The meaning of the entire conjunct can be formally represented as (14a), which is set-theoretically equivalent to (14b):

\[
\begin{align*}
(14) & \quad a. \exists e_1 \in \{\text{the frog hopped into the pond}\} \land \exists e_2 \in \{\text{a satellite was launched}\} \\
& \quad b. \exists E \{e_1, e_2\}: e_1 \in \{\text{the frog hopped into the pond}\} \land e_2 \in \{\text{a satellite was launched}\}
\end{align*}
\]

(14b) shows that the conjunction in (13) is equivalent to a statement about a set of events. We will see below that sets of events that are derived through sentence coordination are linguistically relevant. They provide a domain of quantification for adverbial *jeweils*. Nevertheless, there does not seem to be a natural event type corresponding to \( E \) in (14b).

1.1.3. Davidson (1967) vs. Parsons (1990)

Before we go on to discuss the structure of complex events, let us look briefly at Parsons’ (1990) reanalysis of Davidson (1967), if only because Parsons-style, ‘Neo-Davidsonian’ analyses are widespread in contemporary event semantics (cf. e.g. Laserson 1995, Landman 1996, Brisson 1998). Parsons (1990) criticises Davidson’s analysis of verbs as obligatorily taking an external and/or an internal argument, apart from the event argument. Instead, he suggests a reanalysis on which the verb takes a single argument only, namely the event argument. External and internal arguments are linked to the event variable through thematic relations, as are all other optional modifiers. Consequently, sentences (3) and (6), repeated as (15ab), receive the logical representation in (16ab) respectively.

\[
\begin{align*}
(15) & \quad a. \text{Brutus kisses Caesar.} \\
& \quad b. \text{Brutus killed Caesar with the dagger in Rome on the ides of March.}
\end{align*}
\]

\[
\begin{align*}
(16) & \quad a. \exists e \{kiss'(e) \land AG(\text{brutus, } e) \land TH(\text{caesar, } e)\} \\
& \quad b. \exists e \{killed'(e) \land AG(\text{brutus, } e) \land TH(\text{caesar, } e) \land INST(\text{ix.dagger(x), } e) \land \text{PLACE(rome, } e) \land \text{TIME(ides_of_March, } e)\}
\end{align*}
\]

I will try to recapitulate Parsons argument, as I understand it. First, Parsons (1990:97) concedes that Davidson’s and his analyses do not differ very much concerning their empirical coverage, but only regarding the status of the internal and external argument as obligatory or not. Parsons (ibid.:97-99) claims that Davidson’s analysis runs into problems with passive constructions such as (17a), where one of the obligatory arguments, here the external one, is not expressed overtly. In such a case, the external argument variable, which stands for the stabber, would have to be bound by existential closure on Davidson’s analysis, yielding (17b). In contrast, the external argument (the agent) is not represented in logical form at all in Parsons’ analysis in (17c).

\[
\begin{align*}
(17) & \quad a. \text{I was stabbed.} \\
& \quad b. \exists e \exists x \{\text{stabbed'}(x, I, e)\} \\
& \quad c. \exists e \{\text{stabbed'}(e) \& \text{TH(I,e)}\}
\end{align*}
\]

Parsons (1990:98) argues that the Davidsonian analysis in (17b) makes a wrong prediction in the following scenario. Assume that somebody utters (18), referring to a dream that is about the unrealistic situation of having been stabbed without a stabber.

---

8 Of course, the two events instantiate very general Event types such as ‘being an event’. But it would seem rather odd if we wanted to refer to these Event types by using (13).
I had a dream last night. I was stabbed, although in fact nobody had stabbed me, and I was not stabbed with anything.

According to Parsons, an analysis of the highlighted passage in (18) in terms of (17b) will lead to the contradiction in (19).

\[
\exists e [\exists x \text{[stabbed'(x, I, e)] } \& \neg \exists y \text{[stabbed'(y, I, e)]}]
\]

Nonetheless, we can utter sequences like (18) without being self-contradictory. Because of this, Parsons concludes that the Davidsonian analysis in (17b) must be false and should be replaced by (17c).

Is this reasoning sound? I think not. Parsons’ argument rests on the assumption that the argument structures of active verbs and their passive counterparts are necessarily identical. This is not necessarily the case, though. It seems to me that the passive form was stabbed in (18) is an instance of what Williams (1981:93, see also references there) calls ‘adjectival passive’, in contrast to the ordinary ‘verbal passive’. Languages like German or Dutch, in which the two passives differ not only semantically, but also syntactically, support the parallel existence of two passive forms. Adjectival passives do not denote an action (by somebody), but a property of the subject. No agens argument is present in argument structure, which is reflected by the fact that adding a by-phrase is impossible (20a). In contrast, verbal passives denote a process or activity that necessarily involves an agens which is expressed (optionally) by a by-phrase (20b). The examples are from German.

\[
\begin{align*}
\text{(20)} & \quad \text{a. Ich war (*von Peter) geschlagen.} & \text{b. Ich wurde (von Peter) geschlagen.} \\
& \quad \text{‘I was by Peter beaten} & \text{‘I became by Peter beaten} \\
& \quad \text{‘I was beaten.’} & \text{‘I was beaten by Peter.’}
\end{align*}
\]

It seems reasonable to assume that the syntactic difference derives from an underlying difference in argument structure. If this assumption were correct, a Davidsonian analysis would assign the following logical representations to (20ab).

\[
\begin{align*}
\text{(21)} & \quad \text{a. } \exists e \text{[beaten}_{1}'(I, e)]} & \text{b. } \exists e \exists x \text{[beaten}_{2}'(x, I, e) \& Ag(peter, e)]}
\end{align*}
\]

In analogy, since was stabbed in (18) has the semantics of an adjectival passive (it denotes the property of having been stabbed), it should get the logical representation in (22a). The corresponding paraphrase of (18) in (22b) is not a contradiction. End of argument.

\[
\begin{align*}
\text{(22)} & \quad \text{a. } \exists e \text{[stabbed}_{1}'(I, e)]} & \text{b. } \exists e \text{[stabbed}_{1}'(I, e)] \& \neg \exists x \text{[stabbed}_{2}'(x, I, e)]}
\end{align*}
\]

That this analysis is correct receives further support from the fact that the German translation of (18) only forms a coherent (non-contradictory) discourse if the adjectival

---

9 The assumption of a difference in argument structure is supported by the existence of languages that never allow for the expression of an external argument with passive verbs. Finnish is a language in question. (i) cannot contain a modifying phrase which indicates who does the eating:

\[
\begin{align*}
(i) & \quad \text{Omena syödään (*Ainolla).} \\
& \quad \text{the apple is eaten by Aino.}
\end{align*}
\]

It seems that Finnish passive forms generally lack an external argument in their argument structure.
passive is used, as in (23a). Use of the verbal passive (which introduces an external argument variable) makes the discourse incoherent (23b), as expected.10

(23)  a. Ich war gestochen, aber niemand hatte mich gestochen. [German]
I was stabbed but nobody had me stabbed
b. Ich wurde gestochen, aber niemand stach mich.
I became stabbed but nobody stabbed me

Summing up, Parsons’ counterargument to Davidson’s analysis rests on the problematic assumption that passive verbs in English have the same lexical entry as their active counterparts on all their uses. We have seen that there is empirical evidence from other languages which casts doubt this assumption. If Parsons’ counterargument is invalid, the two analyses seem equivalent in terms of descriptive adequacy. However, Parsons’ analysis fails to account for the special status of internal and external argument as obligatory. It treats these on a par with optional modifiers, such as adverbials of time, place and instrument. In contrast, Davidson’s analysis captures the prominent status of external and internal arguments, which has played and continues to play an important role in generative grammar. Since the concept of thematic roles (which - according to Eckardt (2002:106) - is used by Parsons in a circular fashion anyway) plays no relevant role in this thesis, and since I want to hold on to the prominent status of external and internal arguments (as opposed to modifiers), I will go on using the original Davidsonian analysis. This being said, I assume that the analysis is translatable into a Neo-Davidsonian format in a straightforward manner.

It seems, then, that events are necessary for a proper account of natural language. Events are semantic arguments of verbal predicates. Events can be referred to by natural language expressions. Events allow for a neat account of adverbial modification with manner, place, and time adverbials, and – as we shall see – events allow for a neat account of adverbial quantification, also in the case of adverbial jeweils. If no overt quantifier element is present, binding of the event argument is achieved through existential closure, usually at the level of VP as in (9).

1.2 The Structure of Events and the Domain of Adverbial Jeweils
In this subsection, I show that events can be complex in different ways. This is important because jeweils will be shown to operate on parts of complex events semantically. The following discussion of event complexity forms the second step towards a proper semantic analysis of the adverbial quantifier jeweils. In particular, it will help to determine the domain of quantification of adverbial jeweils. It will be shown that adverbial jeweils ranges over pluralities of atomic events, not over their parts.

Most researchers who assume events as semantic primitives (e.g. Link 1987, Krifka 1992, Lasersohn 1995, Landman 1996, Moltmann 1997, Brisson 1998, and many others) seem to agree on the fact that events (or Events) can be complex in some way or other.

10 Even though the regular passive in English is ambiguous between adjectival and verbal passive, there is an alternative passive form that must be interpreted as a verbal passive. The form in question is the get-passive, illustrated in (i):

(i) I got stabbed (by Brutus).
Interestingly, substitution of the get-passive into the discourse in (18) leads to a contradiction:
(ii) #I got stabbed. Although nobody stabbed me.
On the analysis sketched above, this is expected. Get-passive forms always have an external argument variable in their argument structure. This variable must be existentially bound, leading to the contradiction observed.
However, often a clear distinction between individual events and pluralities of events (i.e. either Event types or, more generally, sets of events) is lacking, leading to confusion in the best case. For the following, the distinction between individual events and sets of events is crucial. It is argued that the structures of both entities differ in nature. In particular, complex individual events consist of material parts, while Events, and other random sets of events are pluralities consisting of individual (atomic) events.

At first sight, events appear to be complex in three different dimensions: the temporal dimension, the material, or ‘stuff’ dimension, and the participant dimension. The three different kinds of complexity are exemplified in (24a-c):

(24)  a. Bill slept.             temporally complex
     b. Bill ate dinner.           stuff complex
     c. Bill and Suzie sneezed.         participant complex

In (24a), the complex event of Bill sleeping consists of a (potentially) infinite number of minimal sleeping events, which add up to make up the overall sleeping event. In (24b), the stuff complex event of Bill eating dinner consists of all the smaller subevents that form part of eating dinner, i.e. pouring wine, cutting the meat, lifting the fork (the example is inspired by Brisson 1998). In (24c), the participant complex sneezing event of Bill and Suzie consists of two subevents, Bill’s sneezing and Suzie’s sneezing. As a defining characteristic, participant complex events always involve plural participants.

In each case, the subevents stand in a part-whole relation to the complex superevent. In what follows, I would like to argue that there are only two different part-whole relations involved in (24a-c). In particular, I would like to argue that temporally and stuff complex events involve the same part-whole relation. Temporal and material subevents stand in a material-whole relation to a singular superevent that could not exist without them. This relation is best illustrated with an example from the nominal domain. There, it obtains, say, between a chair and its various parts (its legs, back, seat). The parts are linked to the whole (the chair) not by virtue of having the same property, but by contributing to the material stuff (i.e. a quantity of wood, steel, etc.) that the chair consists of.

In contrast to the first two, participant subevents form the atomic parts of a pluralic superevent. In the nominal domain, this corresponds to plural formation, as in the boys, books, Peter and Mary. The crucial difference between the two kinds of complexity is that the subevents of participant complex events are atomic events themselves. As a result, we expect these atomic events, which form part of a plural structure, to be accessible to semantic processes like (adverbial) quantification. This is precisely what I will argue below. In contrast, subevents of the first kind are only relevant in terms of the material stuff they contribute to the superevent. They are not represented as independent, atomic wholes, but as parts of one singular event. Therefore, we do not expect them to be accessible to semantic processes like quantification. Drawing on our example from the nominal domain again, a numeral like six cannot combine felicitously with the singular NP chair, even though the chair in question may consist of six parts (four legs, a seat, a back).

In the next section, I look at the substructure of atomic events in more detail. In section 1.2.2, I turn to the structure of plural events.
1.2.1 Temporal and Stuff Complexity: Material Parts of Individual Events

In this section, I discuss the material part-whole relation between events. As argued in connection with (24ab), this relation holds between temporally and stuff complex events and their material parts. The smaller subevents constitute, so to speak, the event stuff of which a singular concrete event consists. The subevents form the necessary parts of that event. In the case of temporal complexity, they do so by constituting the minimal parts of an event that goes on over time. In the case of stuff complexity, they do so by constituting the smaller (event) parts of a complex event without which the event would not come into being. For instance, the specific dinner eating of Bill in the example above involves a lifting of the fork.

The temporal complexity of events has attracted considerable attention in the literature because it is the temporal substructure of an event which determines the aspect of a VP as atelic (imperfective) or telic (perfective) (e.g. Bach 1986, Krifka 1989, 1992, Verkuyl 1993). More to the point, the temporal structure of an event is determined by the temporal structure of its time of occurrence, its running time. From this, it follows that temporal complexity must be a property of concrete events, for only these are localised in time. The running time of an event and its temporal substructure are related by a homomorphism (Eckardt 2002: 112). Just like the (possibly infinitely many) individual points of time combine to make up the running time of an event, say a particular sleeping of Bill, (possibly infinitely) many individual subevents combine to make up a temporally complex event.

Of course, not every Event characterises a set of temporally complex events. For instance, it is hard to imagine that instantiations of the Event of Peter waking up at five o’clock sharp have a temporal substructure, simply because they occur in an instance and have no temporal extension. Similarly, events of the type Bill-eat-two-sausages do not consist of temporal subevents that are also of the Bill-eat-two-sausages type (although they clearly seem to consist of subevents of Bill eating, but this is a case of stuff complexity). Whether or not an event is temporally complex, depends on the aspectual properties of its Event (type), i.e. its telicity or atelicity. Krifka (1989, 1992) shows that the binary aspectual distinction into telic and atelic Events can be reduced to the following three properties of Events: Divisibility (DIV), Summativity (SUM), and being quantised (QUANT). (25) gives the definitions of DIV, SUM, and QUANT:

\[
\begin{align*}
(25) \quad & a. \text{DIV}(E) \leftrightarrow \forall e \forall e' (E(e) & \land e' \subset e \implies E(e')) \\
& b. \text{SUM}(E) \leftrightarrow \forall e \forall e' (E(e) & \land E(e') \implies E(e \oplus e')) \\
& c. \text{QUANT}(E) \leftrightarrow \forall e \forall e' (E(e) & \land e' \subset e \implies \neg E(e'))
\end{align*}
\]

An Event is divisible iff it holds for all events of that type that their (temporal) subparts are events of the same type. E.g., if we divide a sleeping event (which goes on over time) in two, the resulting two events are sleeping events as well.\(^{11}\) In the nominal domain, this corresponds to the properties of mass noun denotations: the many parts that make up a body of water, are themselves water (at least, if we neglect the submolecular level). An Event is summative iff all events of that type form a complex event of the same type when

\(^{11}\) The property of (non-)divisibility lies at the heart of Dowty’s (1979) ‘imperfective paradox’. While divisible events allow for the inference in (iia), the same inference is not valid for the non-divisible, measured out event in (iib):

\[
\begin{align*}
(i) \quad & a. \text{Peter is running} \implies \text{Peter has run.} \\
& b. \text{Peter is running for an hour.} \implies \text{Peter has run for an hour.}
\end{align*}
\]
combined with one another by summation (indicated by ‘⊕’). For instance, many small sleeping events can combine to make up an extended (complex) sleeping event. In the nominal domain, this corresponds again to the denotation of mass nouns. Two bodies of water are still water. An Event is quantised iff, for all events of that type, any subpart of them is not of the original type.

How does the aspect of an Event derive from these three properties? An Event is atelic iff it is divisive and summative. An Event is telic iff it is quantised. There are two kinds of quantised Events: (i.) Events that typically occur in a single instance, as in (26a); and (ii.) originally non-quantised Events that are measured out by a definite or quantised NP-argument or by an adverbial modifier, as in (26b).

(26) Quantised Events:
   a. Bill waking up / finding the treasure.  
   b. Bill eating two sausages / sleeping for an hour.

It is clear that the Events in (26ab) do not satisfy both SUM and DIV. The momentary Events in (26a) fail SUM, the measured out Events in (26b) fail both SUM and DIV. A subpart of the event of Bill sleeping for an hour is not a sleep-for-an-hour event by Bill. And two events of Bill sleeping for an hour taken together do not form a sleep-for-an-hour event, but e.g. a sleep-for-two-hour event. From (25c), it follows that the Events in (26ab) are quantised, hence telic.

In contrast, the Event types of events which occur over intervals of time, and which are not measured out satisfy both SUM and DIV. They are non-quantised, hence atelic. To these belong all states and activities (or atelic processes). Examples are given in (27).

(27) Bill sleeping / singing/ running / sitting on the oven.

It is easily verified that the atelic events in (27) satisfy both DIV and SUM.

A result of the foregoing considerations is that only events of atelic Event types can be temporally complex. They inherit their complexity from the running time of the event, an interval, simply because the event in question occurs over time and is not measured out. This gives us the correspondence in (28) (with \(e\) a concrete event, and \(E\) its Event type):

(28) \[ \text{temporally complex (e) \& E(e)} \iff \text{atelic (E)} \iff \text{DIV(E) \& SUM(E)} \iff \text{E(e) \& e extends over time and is not measured out} \]

According to (28) an event \(e\) of type \(E\) is temporally complex iff \(E\) is atelic iff \(E\) satisfies both DIV and SUM iff \(e\) (of type \(E\)) extends over time and is not measured out. The examples in (27) are cases at hand.

As for stuff complexity, I have claimed above that this type of complexity reduces to the same material-whole relation as temporal complexity. This implies that the various subevents of Bill cutting meat, pouring wine, chewing, etc. constitute necessary subparts of a particular complex event of Bill eating dinner (depending on Bill’s eating habits they could also be the subparts of other complex events, such as Bill eating breakfast). Unlike with temporal complexity, however, the subparts of stuff complex events are not smaller events of the same kind, but they are smaller events of a different kind. The subevent of Bill cutting the meat is clearly not a Bill-eating-diner event (it is too small), nor are the other subevents. Only by combining forces, can the various subevents constitute a complex event. Looking at the chair example from above, we see that an analogous
situation obtains in the nominal domain. Parts of a chair (a leg, the back, the seat) do not constitute a chair all by themselves, but only when combined in a particular way.

Summing up, we have seen that there are two ways for an event \( e \) to form a material part of a larger event \( e' \). The first possibility is that both events are of the same type, but the running time of the larger event \( e' \) includes the running time of \( e \). This situation holds for events of atelic Event types only. The second possibility is that the two events are of different types, but the smaller event \( e \) is somehow a precondition for the coming about of the larger event \( e' \). This situation holds for events \( e' \) which are complex in the sense that they involve a variety of events of different kinds in order to come about. In both cases, the subevents are not represented as independent atomic entities, but only as material parts of a larger whole. Their status as parts of a larger whole accounts for the fact that natural language semantic processes (including adverbial quantification) are blind to temporal and stuff subevents. This is illustrated shortly in section 1.2.3.

1.2.2 Participant Complexity: Atomic Parts of Plural Events

In the previous section, I have argued that events can form the material part of complex singular events. In this section, I investigate the nature of participant complexity, which was illustrated in (24c), repeated as (29).

(29) Bill and Suzie sneezed.

I will argue that participant complex events involve a different part-of relation, namely an element-of relation between atomic events and pluralities of atomic events. The existence of plural events was argued for by e.g. Bach (1986). In other words, atomic events can combine into pluralic entities, just like individual books can combine into pluralities of books, or just like the atomic individuals Peter and Lucky can combine into the plurality of Peter and Lucky. Given this analogy, it should hardly come as a surprise that examples like (29), which are arguably statements about a plurality of events, display a plural nominal expression in argument position. In a way, the plurality of an event seems to be inherited from the plurality of the nominal argument, or vice versa. In any event, the correspondence does not seem to be a mere accident.

The assumption of a different internal structure for participant complex events (as opposed to temporal and stuff complex events) is based on their different behaviour regarding adverbial quantification with jeweils. The data in (30) and (31) suggest that participant complexity does not involve a material-whole relation between events, but rather a relation between atomic events and a plural event.

(30) a. #Bill schlief. Er hatte jeweils süsse Träume. (temporally complex)
   Bill slept. He had each.time sweet dreams
   #‘Bill slept. Each time, he had sweet dreams.’
   intended: ‘Bill slept, and at each moment of his sleep he had sweet dreams.’

b. #Bill aß Abendbrot. Er genoss es jeweils . (stuff complex)
   Bill ate dinner. He enjoyed it each.time
   #‘Bill ate dinner. Each time, he enjoyed it.’
   intended: ‘Bill ate dinner, and at all subevents (of cutting meet,…) he enjoyed it.’

(31) Bill und Suzie niesten. Die Gäste sagten jeweils ‘Gesundheit’. (part.complex)
   Bill and Suzie sneezed. The guests said each.time ‘Bless you’
   ‘Bill and Suzie sneezed. Each time, the bystanders said “Bless you”.’
The ill-formedness of the mini-discourses in (30ab) shows that adverbial jeweils cannot distribute over the material parts of temporally and stuff complex events. Jeweils appears to be blind to the fine structure of events along the material-whole dimension. In contrast, jeweils is able to identify and distribute over the minimal subevents of the participant complex event in (31), indicating that jeweils is sensitive to the structure of participant complex events. It is reasonable to assume that the reason for this lies in a structural difference between participant complex events on the one hand, and temporally and stuff complex events on the other.

I assume that the presence of the plural subject in (31) leads to the construal of a plural event.\(^\text{12}\) Given this, and given the plausible assumption that the adverbial quantifier jeweils operates over the atomic elements of a plural event, just like adnominal quantifiers operate over the atomic subparts of pluralities of individuals,\(^\text{13}\) the well-formedness of (31) is accounted for. Jeweils distributes over a plurality of events consisting of the atomic subevents of Bill sneezing and Suzie sneezing. The semantic representation of (29) after the construal of the plural event should be along the lines in (32).

\[(32)\] 
\[
\exists E \left[ \forall x \left[ x \in \{b, s\} \rightarrow \exists e \in E \wedge \text{sneezed}'(x, e) \right] \right]
\]

As desired, the expression on the right-hand side in (32) is an existential statement about a set of events.\(^\text{14}\)

\(\text{12}\) The same effect is observable with other plural arguments, e.g. with the plural direct object in (i).

(i) Die Polizei spürte die Ganoven auf. Jeweils half die Bevölkerung mit Hinweisen.

The police tracked the gangsters down each time helped the population with hints.

\(\text{13}\) On most accounts in the Generalised Quantifier tradition (Barwise & Cooper 1981), this plural entity is taken to be a set. For a different view see Matthewson (2001). Based on evidence from Straits Salish and English partitive constructions, Matthewson argues that natural language quantifiers universally range over parts of plural individuals. See the discussion in 1.2.4 below.

\(\text{14}\) I remain deliberately vague here as to the question where plural event formation takes place in the semantic derivation of (32). One possibility is that the presence of the set of events \(E\) in (32) follows directly from the compositional interpretation of the clause, along the lines in (i) (simplified).

\[(i)\]
\[
\begin{align*}
&\text{a. } \left[ [\forall t; \text{sneezed}] = \lambda e. \text{sneezed}'(z_t, e) \right] \\
&\text{b. } \left[ [\forall t; \text{sneezed}] = \exists e \in E[\text{sneezed}'(z_t, e)] \right] \quad \text{(existential closure of }\exists) \\
&\text{c. } \left[ [\forall \text{DIST}; t; \text{sneezed}] = \forall X, \exists e \in E \left[ \text{sneezed}'(x,e) \right] \right] \quad \text{(FA of DIST to } (i)) \\
&\text{d. } \left[ [\forall \text{DIST}; t; \text{sneezed}] = \lambda X, \forall X, \exists e \in E \left[ \text{sneezed}'(x,e) \right] \right] \quad \text{ (}\lambda\text{-abstraction over }'i'\text{)} \\
&\text{e. } \left[ [\forall \text{BILL and Suzie DIST}; t; \text{sneezed}] = \forall X, \exists e \in E \left[ \text{sneezed}'(z_t, e) \right] \right] \\
\end{align*}
\]

In (ic), the application of the Dist-operator to the distributive predicate sneezed may be forced by the need to avoid a representation as sneezed'(X,e), according to which a plurality of people has sneezed collectively, a state of affairs excluded by the lexical semantics of the predicate sneezed. Notice that existential quantification over the atomic sneezing events in (i) is restricted by a set of events \(E\) that can either be contextually bound, or (existentially) quantified over. We will encounter the restriction \(e \in E\) again below, where it is shown to play a role in multiple adverbial quantification over different event layers.

A potential problem with (ie) and (32) is that the set of events \(E\) may be too big because it is underspecified. All that is required is that \(E\) must contain the individual events of Bill sneezing and Suzie sneezing. Apart from these two events, \(E\) can contain all sorts of other events, without making (32) false. In the case of quantification with adverbial jeweils in (31), jeweils would therefore have to quantify over these other elements as well, possibly leading to wrong results.

In order to prevent \(E\) from becoming too big, one could locate the construal of the set of events \(E\) at the level of discourse representation (cf. fn.7). Kamp & Reyle (1993:309ff.) argue that a semantic operation of ‘abstraction’ collects individuals in the scope of a (universal) quantifier, turning these into a set that can be anaphorically referred to in later discourse. Sentence (ii) gives an example for the application of abstraction in the nominal domain.

(ii) Every ambassador brought one secretary along. None of them embarrassed his boss.
The analysis of participant complex events as pluralities of atomic events is in line with the well-known observation that participant complex sentences such as (29) are logically equivalent to conjunctions of their parts. This is shown in (33).

(33)  
\[ \text{a. Bill and Suzie sneezed. } \iff \text{b. Bill sneezed, and Suzie sneezed.} \]

Recall the assumption from section 1.1 that each atomic sentence (after existential closure) is an existential statement about an individual event. Now, we have already seen in connection with (13), repeated as (34), that arbitrary statements about individual events can be coordinated with and, no matter how disparate the events are.

(34) The frog hopped into the pond, and a satellite was launched.

Unless we subscribe to a fatalist view of the world (in which the flap of a butterfly’s wings can cause a rainstorm somewhere else), we would not want to treat the two separate events in (34) as (material) subparts of one complex event. Instead, the coordinated structure in (34) is better viewed as an existential statement about a set of two different (and mutually independent) events, which are conjoined by set union. Generalising this reasoning, (33b) should also be about a set of two events. And by extension (because of the logical equivalence), (33a) should be about a set of two events as well.

The possibility of adverbial quantification with jeweils over participant complex events, and the equivalence in (33) thus argue for treating participant complex events as pluralities of atomic events. The idea that the respective subevents combine to form a plural event in (33a), (33b), and (34) is further supported by the fact that the German translations of (33b) and (34) are possible antecedents for adverbial jeweils.

(35)  
\[ \text{a. Bill nieste und Sue nieste. Die Gäste sagten jeweils ‘Gesundheit’}. \]
\[ \text{‘Bill sneezed and Sue sneezed. Each time, the guests said “Bless you”.’} \]
\[ \text{b. Der Frosch hüpfte in den Teich und ein Satellit wurde gestartet.} \]
\[ \text{Die Sonne strahlte jeweils vom Himmel.} \]
\[ \text{‘The frog hopped into the pond and a satellite was launched.} \]
\[ \text{‘Each time, the sun was shining bright in the sky.’} \]

Notice finally that the treatment of participant complex events as pluralities of atomic events retains the spirit of Landman’s (1996:438) ‘unique role requirement’ (URR), which states roughly that each individual event has at most one individual satisfying each thematic role associated with it. Since participant complex events are not individual

In (ii), the plural pronoun them is most naturally construed as referring to the set of secretaries. Along the same lines, abstraction could apply to the separate events found in (id), and turn the expression into (iii).

(iii) \[ \exists E \subseteq \{e_1, e_2\} \land \text{sneeze}'(\text{bill}, e_1) \land \text{sneeze}'(\text{suzie}, e_2) \].

Since adverbial jeweils usually picks up its restriction across sentence boundaries, the recourse to the dynamic process of abstraction seems warranted. In section 2.3, this issue is taken up again. In any event, both (i) and (iii) are statements about a set of individual events and provide an appropriate restriction for adverbial jeweils.

15 To quote Link (1998:240): “But not every such collection [of events, MZ] can in a significant sense be considered a coherent part of the world: for that to be the case it is necessary that a sum of events be closed or saturated with respect to all lawful constraints that organize reality and hold it together.”

16 Recall that sets of events need not have a “natural” event type. They can be random collections of temporally and spatially disparate processes of different kinds with different participants.
events, but pluralities of events, they may involve more than one participant as long as the
atomic subevents involve at most one individual per argument position. The present
analysis therefore disagrees with approaches that take individual events to have more than
one participant (e.g. Schein 1993, Moltmann 1997).17 We will come back to Moltmann’s
analysis in section 3.2.5.

1.2.3 The Quantificational Domain of Adverbial jeweils
The previous section has brought to light that adverbial jeweils cannot quantify over just
any complex event. I have shown that adverbial jeweils is insensitive to subevent
structures imposed by material-whole relations. Instead, the adverbial quantifier jeweils
was argued to quantify over pluralic entities with atomic substructure. Since adverbial
jeweils normally distributes over an implicit plurality of events that is not overtly
expressed in the clause, the plurality must be recoverable from the linguistic context. So
far, we have encountered two ways for the linguistic context to provide a plurality of
events over which jeweils could quantify: (i.) by conjunction of two or more atomic
sentences as in (35ab); or (ii.) by means of an atomic sentence with plural participants as
in (31).
Quantification with adverbial jeweils is also possible following an adverbially
quantified sentence, as in (36).18

\begin{equation}
\text{(36) John schlief \textit{fünfmal/ oft / selten}. Er hatte jeweils süße Träume.}
\end{equation}

John slept five times often seldom He had each time sweet dreams

This means that we have to include adverbial quantification in our list of linguistic
contexts that create pluralities of events.

The distinction between atomic events and pluralities of atomic events also helps to
argues that (37a), with the logical representation in (37b), can be made true by many
different events.

\begin{equation}
\text{(37) a. John ate beans.}
\end{equation}

\begin{equation}
\text{b. } \exists e [\exists y \text{beans}'(y) \& \text{ate}'(john, y, e)]
\end{equation}

According to Brisson, (37b) is made true not only by the event of John eating beans, but
also by the (materially) complex event (in her terminology a ‘plural event’) of John eating
beans and the Yankees’ winning the World Series in 1996. Another complex event that
makes (37b) true is – according to Brisson - the event consisting of John eating the beans,
of the Yankees winning the World Series, and of Nixon’s visit to China. Nevertheless,

\begin{footnotes}
17 The present analysis requires us to treat plural arguments of collective predicates as plural or group
individuals. This leads to the analysis in (ib) for (ia).

(i) a. The boys gathered in the hallway. b. \(\exists e [\text{gathered}'(\text{the}_\text{boys}', e) \& \text{IN}(x, \text{hallway}'(x), e)]\)

18 Again, I assume that the plural set of events E that serves as the restriction for jeweils is formed by the
operation of abstraction (cf. fn.14). The value for E’ in (ib) is determined on the base of the flattened discourse
representation structure in (ia):

(i) a. \([e \text{ element } E] : <5e>[\text{John slept in } e]\)

b. \(E’= \sum e [e \text{ element } E, \text{John slept in } e]\)

The restricting set E must be contextually given. The semantics of \textit{fünfmal ‘five times’} ensure that only maximal
temporally complex sleeping events are counted.
\end{footnotes}
there is a clear feeling that (37a) is only a statement about the simple event of John eating beans. So how to prevent events from becoming too big? Brisson suggests to use Kratzer’s idea of an ‘event for a proposition’ in order to solve the problem of excluding events that are too big. I would like to suggest a different approach and argue that the problem of maximal events is only apparent. It arises because Brisson does not make a distinction between materially complex events (i.e. a dinner eating by Ede), which can consist of material subparts, and plural events, which are sets of individual (possibly materially complex) events. For her, all complex events are materially complex (and consequently mereologically structured) events, which she calls ‘plural events’. As a result, the disparate events of John eating beans, the Yankees winning the World Series, and Nixon visiting China can combine to form a rather unnatural materially complex event.

I do not subscribe to this view. Citing Link (1998:240), it was already pointed out in fn. 15 that “… not every such collection [of events, MZ] can in a significant sense be considered a coherent part of the world: for that to be the case it is necessary that a sum of events be closed or saturated with respect to all lawful constraints that organize reality and hold it together”. What this means is that random collections of disparate events cannot combine to form an individual (though complex) event if they share no relevant properties (causal connection, temporal inclusion/overlap of running time, homogenous subpart etc.) in common. It follows that (37a) is not a statement about a materially complex event, but only about the individual event of John eating beans. This statement will be true in a situation containing this event regardless of whether other disparate events such as the Yankees’ victory, and Nixon’s visit form a plurality of events with it. Regarding such a plurality of events E, (37a) will be either undefined (when interpreted distributively) false (for it is only a statement about an individual event). I conclude that the apparent puzzle of maximal events raised by (37a) disappears as soon as we discard the possibility that random collections of events can combine to form a materially complex event. Following Link, I take this to be a plausible assumption.

Observe finally, that (38) confirms the singular status of the event described by (37a). Adverbial jeweils cannot distribute over the denotation of (37a) because the latter does not introduce a plurality of events into the discourse.\(^{19}\)

(38) #John aß Bohnen. Jeweils schien die Sonne.
John ate beans each time shone the sun

Summing up, it has been shown that events can be complex in different ways and that it is important to be aware of these differences. Adverbial jeweils can only quantify over participant complex events. On the natural assumption that adverbial quantifiers range over pluralities of events – just as adnominal quantifiers range over pluralities of individuals – this difference argues for a treatment of participant complex events as pluralities of atomic events. It was also shown that the plurality of events that serves as the domain of quantification for jeweils must be introduced overtly in the preceding discourse, either by the presence of a plural argument, or by sentence conjunction, or by adverbial quantification. In the normal case, adverbial jeweils picks up its domain across a sentence boundary. This makes adverbial jeweils a discourse phenomenon that should be accounted for in a dynamic semantic framework such as DRT, or Groenendijk &

\(^{19}\) The only way to interpret (38), albeit marginally, is on an iterative reading, as in (i):

(i) John ate beans repeatedly/ several times. Each time, the sun was shining.
Stokhof’s (1990, 1991) dynamic semantics. The dynamic semantic behaviour of adverbial jeweils is discussed in section 2.3.

1.2.4 The Structure of Plural Events

In the previous section, we have motivated the inclusion of pluralities of events into our semantic model. Without plural events, it is difficult to account for the different kinds of event complexity, as well as for the possibility of quantification over events. However, I have remained deliberately vague as to the semantic representation of such plural events that consist of two or more atomic subparts or elements – apart from the sporadic use of set theoretic terminology. The semantic literature on plurals provides us with two alternatives: Plural events could be construed as algebraic sums (Link 1983, Bach 1986). Alternatively, they could be construed as sets of atomic elements.

On the set approach, two or more atomic elements can be organized in sets, which are unordered collections of these elements. For instance, the atomic events e₁, e₂, e₃ can form the four sets in (39) (disallowing for singleton sets which consist of one element only):

\[
\begin{align*}
\{e_1, e_2, e_3\} & \quad \text{set union} \\
\{e_1, e_2\} & \quad \{e_1, e_3\} \quad \{e_2, e_3\} & \quad \text{set formation}
\end{align*}
\]

‘Set formation’ combines the three atomic events into the three sets on the middle level. The atomic events are the members of these sets. In order to get from the middle to the upper level, we need another operation. ‘Set union’ takes the members of two sets and forms a new set with them. On the set view on plural entities, adverbial quantifiers such as jeweils quantify over the atomic elements of such sets of events.

On the algebraic sum approach, the operation which combines two or more atomic events into a plural event is not set formation, but (algebraic) sum formation, which is indicated by ‘⊕’. Sum formation combines the atomic events into a ‘plural individual’ that has the atomic events as its atomic parts. Such plural individuals are also referred to as ‘algebraic sums’, ‘plural sums’, or ‘groups’. The three events e₁, e₂, e₃ can be combined into the following plural individuals, forming the semi-lattice in (40):

\[
\begin{align*}
e_1 \oplus e_2 \oplus e_3 & \quad \text{sum formation} \\
e_1 \oplus e_2 & \quad e_1 \oplus e_3 & \quad e_2 \oplus e_3 & \quad \text{sum formation}
\end{align*}
\]

Sum formation can apply repeatedly, forming ever larger plural individuals. The smaller individuals stand in an individual part-of relation (i-part relation) to the larger ones. On
the algebraic view on plural events, adverbial quantification ranges over the i-parts of such plural individuals.

The two representations of plural entities – as presented here – are more or less equivalent. For the purpose at hand - to give an adequate semantic account of adverbial and adnominal jeweils - both approaches will do since both can model the existence of plural events. As seen, plural events seem to be the required semantic input for the adverbial quantifier jeweils.

A potential difference between the set approach and the sum approach lies in the fact that sum formation does not change the ontological or logical type of the input. Ontologically, plural individuals, are still individuals, albeit non-atomic ones. Type-logically, plural and atomic individuals are both of type <e>. In contrast to this, the sets formed by set formation differ from their members both ontologically, and type-logically. Ontologically, a set of events could e.g. be an Event type, i.e. a property of events. Type logically, sets are of type <e,t>. They are equivalent to characteristic functions from individuals into truth-values. Repeated application of set formation leads to the formation of ever more complex set structures (sets of sets of sets of…).

Summing up, there are two possible ways to represent pluralities of atomic events (and pluralities in general). They can be treated as sets with the atomic events as their members. Or, they can be treated as plural individuals with the atomic events as their i-parts. In the literature, we find a certain bias towards the algebraic sum approach to plural individuals (cf. Bach 1986, Junker 1995, Moltmann 1997). For our purposes, it is immaterial which representation we choose, and I will alternatively speak of ‘sets’ or ‘groups’ (= plural individuals). Nevertheless, I will mostly use set theoretic notation in formalising the semantics of jeweils. One reason for this is that accounts of (adverbial) quantification commonly involve sets. The second reason is practical in nature and based on the (perhaps unjustified) assumption that most readers will be more familiar with set notation than with algebraic sum notation. The decision in favour of set theory is therefore above all a decision in favour of legibility and clarity. Nevertheless, readers are free to translate the set theoretic formulas into algebraic formulas at their own will.

1.3 The Semantics of Adverbial Quantification

Above, it was argued that adverbial jeweils denotes an adverbial quantifier, and that this quantifier ranges over pluralities of events. On the null hypothesis, this is also the case for other adverbial quantifiers, e.g. always, sometimes, usually. There is a vast literature on the topic of adverbial quantification (cf. e.g. Lewis 1975, Kamp 1981, Heim 1982, Berman 1987, Heim 1990, deSwart 1991, von Fintel 1994, Percus 2000, among many others). A large part of the literature deals with adverbial quantification in connection with so-called donkey sentences of the form (Always), if a farmer owns a donkey, he beats it. Since donkey sentences are only of marginal interest for the current discussion, and since the issues involved are rather complex and not uncontested (cf. Heim 1990 for discussion), I will set aside a detailed discussion of them for now. Instead, I will argue in this section (i.) that adverbial quantifiers must be taken to quantify over events at least in some cases; (ii.) that adverbial quantification involves the introduction of a new dependent event into the semantic representation; (iii.) that a proper account of adverbial quantification necessitates the assumption that verbal predicates can optionally come along with two event variables. An obligatory one, which is indefinite and existentially closed, and an optional one, which is bound anaphorically to the event in the restriction of the quantifier.
It seems clear that adverbial quantifiers must range over something like sets of events at least in cases where no other free variables (expressed by indefinite NPs) are present (cf. Chierchia 1992:147, Dekker 1994:16f.). Consider (41).

(41)  Always/ usually/ often / sometimes when John takes a bath, he sings.

(41) is a statement about events of John taking a bath. It says that always / in most cases/ often / sometimes if there is a bath taking by John, there is also a singing by him. In other words, the adverbial quantifier takes the set of events expressed by the when-clause as its restriction, and the set of events expressed by the matrix clause as its ‘nuclear scope’ (Heim 1982). The structure of adverbial quantification is schematised in (42ab).

(42)  a. \( Q_{ab} \) (Restriction, Nuclear Scope)

b. \( Q_{ab} \left( \left[ \text{[John takes a bath]} \right], \left[ \text{[he sings]} \right] \right) \)

(42) shows that adverbial quantifiers relate two arguments. In this they do not differ from adnominal quantifiers. Adverbial quantifiers also behave like adnominal quantifiers in that their arguments denote sets, in this case sets of events.

What about the truth-conditions of the adverbial quantifiers in (42)? Is (41) a unifying statement about a single event, as indicated by the logical representation (for the case of always) in (43a)? Or is (41) a statement about two disparate events that stand in a particular relation to one another? The second option is formalised in (43b). The first position is found in Kratzer (1995). The second position is essentially that found in Berman (1987), Heim (1990), and Kamp & Reyle (1993). In what follows, I argue that the second option is correct both for theoretical, and for empirical reasons. In particular, adopting (43a) will have some unwelcome consequences concerning the nature of events.

(43)  a. \( \forall e \left[ \text{take_a_bath}'(\text{john, } e) \Rightarrow \text{sing}'(\text{john, } e) \right] \)

b. \( \forall e \left[ \text{take_a_bath}'(\text{john, } e) \Rightarrow \exists e' \left[ \text{R}_j(e', e) \land \text{sing}'(\text{john, } e') \right] \right] \)

(43a) reads as ‘Each event in which John takes a bath, is also an event in which he sings.’ In other words, two different (event) properties are ascribed to one and the same particular event \( e \). (43b) reads as ‘For each event \( e \) which consists of John taking a bath, there is an event \( e' \) of him singing and \( e' \) is related to \( e \) in a certain way’. Both structures have in common that the universal quantifier binds a variable \( e \) in the consequent of the material implication. I stress this fact here, because it will be relevant in connection with event-related readings of adnominal jeweils, to be discussed in chapter V. There, I argue that adnominal jeweils in subject position can also (under certain conditions) bind an event variable in the consequent, resulting in a reading that is truth-conditionally equivalent to an adverbial reading.

The difference between (43a) and (43b) is found in the consequent of the material implication. In (43a), there is only one event variable, which is bound by the universal quantifier. In (43b), an additional event variable \( e' \) is introduced. This additional variable \( e' \) is bound by an existential quantifier, and linked to the variable \( e \) by a relation variable

---

21 Kratzer’s examples are of the type in (i). It appears plausible to assume the existence of only one event for (i).

(i) Always, when Kemal speak s Turkish, he speaks it well.

22 Berman (1987), Heim (1990), and Kamp & Reyle (1993) coin their analyses in terms of (minimal) situations rather than events.
The existential operator in (43b) is introduced by existential closure, which applies to
the nuclear scope of the quantifier (Heim 1982, Kratzer 1995).

As mentioned above, I claim that (43b) is the correct semantic analysis of adverbial
quantification for theoretical and for empirical reasons. Theoretically, adopting (43b) is
more in line with the general quantificational scheme for donkey sentences. Consider (44).

(44) Always [if a farmer loves a donkey] [he builds it a stable].

Leaving events aside for the moment, the restriction in (44) contains two free variables
(introduced by the two indefinite NPs a farmer and a donkey), while the nuclear scope
contains three variables (introduced by he, it, and a stable). The adverbial quantifier binds
the first two of these, while the last one is bound by existential closure. On a Lewis-
Kamp-Heim-style analysis, this reads as follows:

(45) \[ \forall x,y \left[ \left( \text{farmer}'(x) \land \text{donkey}'(y) \land \text{love}'(x,y) \right) \land \exists z \left( \text{stable}'(z) \land \text{build}'(x,y,z) \right) \right] \]

Generally speaking, when the restriction of an adverbial quantifier contains n variables,
and when the nuclear scope contains more than n (i.e. n+m) variables, the additional
variables must be bound by existential closure. There is no way for them to be bound by
the adverbial quantifier, since they lack an adequate antecedent in the restriction. Notice
that the bold faced parts in (45) correspond to those in (43b). A universal quantifier binds
the two variables x and y in the restriction and in the nuclear scope. In addition, an
existential quantifier binds the variable z, which is introduced by the indefinite expression
stable. If we consider verbal predicates as indefinite expressions that introduce event
(variables), we expect these event variables to be bound by existential closure, in analogy
to z in (45). This gives us the expression in (43b). The event variable e' is related to the
event variable e, which is bound by the adverbial quantifier, by the relation R, just like z in
(45) is related to the anaphorically bound variables x and y by the relation build'. In other
words, adopting the quantificational scheme in (43b) allows us to treat donkey sentences
as a special instance of adverbial quantification without indefinite NPs, or vice versa. In
any event, one semantic mechanism accounts for all the observable cases. By adopting
(43b) as the semantic analysis of (41), we therefore achieve a maximum degree of
generality.

The second reason for adopting (43b) is empirical in nature and perhaps even more
compelling. As mentioned above, an adoption (43a) would imply that one particular event
is ascribed two event properties. In the terminology introduced above, one and the same
event belongs to two different Event types. This may be unproblematic in the case of (41),
but consider the examples in (46):

---

23 Relation variables that get their value from the context are found in analyses of pre- and postnominal genitives (cf. Partee 1983/97, Partee & Borshen 1999, Barker 1998, Storto 2000). Relation variables will play an important role in the analysis of adverbial and adnominal jereis to be presented below.

24 This holds even for the analysis of donkey sentences in Heim (1990), who treats in terms of quantification over situations plus an E-type strategy that resolves the anaphoricity of the pronouns in the nuclear scope by means of copying parts of the restriction into the nuclear scope. Without going into details, an analysis of (45) along the lines in Heim (1990) would run as follows:

(i) \[ \forall s \left[ \exists x \left( \text{man}'(s,x) \land \exists y \left( \text{donkey}'(s,y) \land \text{love}'(s,x,y) \right) \right) \Rightarrow \exists z \left( s \leq s' \land \exists x \left( \text{stable}'(s') \land \text{build}'(s',x) \land \text{man}'(s',x) \land \exists y \left( \text{donkey}'(s',y) \land \text{love}'(s',x,y) \right) \right) \right) \right] \]

The newly introduced variables s' and z are bound by an existential quantifier. In addition, the newly introduced situation variable s' is related to the anaphorically bound situation variable s by means of the subpart relation "≤".
(46)  a. Always/ usually/ often, when John sings, Mary leaves.
    b. Always/ usually/ often, when the wind blows, a window breaks.
    c. Always/ usually/ often, when Mary leaves, John leaves five minutes later.

On the analysis in (43a), (46a-c) receive the logical representations in (47a-c) (illustrated for always).

(47)  a. \( \forall e \left[ \text{sing}'(\text{john}, e) \Rightarrow \text{leave}'(\text{mary}, e) \right] \)

    ‘All events e that are singing events by John are also leaving events by Mary.’

b. \( \forall e \left[ \text{blow}'(\text{wind}'(x), e) \Rightarrow \exists y \left( \text{window}'(y) \land \text{break}'(y, e) \right) \right] \)

    ‘All events e that are wind blowing events are also window breaking events.’

c. *\( \forall e \left[ \text{leave}'(\text{mary}, e) \Rightarrow \text{leave}'(\text{john}, e) \land \text{later}'(e, e, 5\text{minutes}) \right] \)

    ‘All events e which are leaving events by Mary are also leaving events by John and take place five minutes later (than what?)’

But would we really want to say that a singing event by John is simultaneously a leaving event by Mary, or that a wind-blowing event is simultaneously a window-breaking event? I think not.

First, notice that the representations in (47) violate the restriction of non-collective events to one participant per argument. If we allow the atomic events in (47) to have more than one participant, we will lose our explanation for why jeweils can only quantify over participant complex events (see section 1.2).

Second, it can be shown that the event pairs in (46) behave differently regarding modification with a manner adverbial. Following Davidson (1969), Parsons (1990) and Eckardt (1998), this is a clear indication that the two events in question are distinct. Consider what happens if the second clause in (46a) contains an event-modifying manner adverb like secretly, as in (48a). Without going into the details of event modification with manner adverbs (cf. Eckardt 1998), (48a) will have a semantic representation along the lines of (48b).

(48)  a. Always when John sings, Mary leaves secretly.
    b. \( \forall e \left[ \text{sing}'(\text{john}, e) \Rightarrow \text{leave}'(\text{mary}', e) \land \text{MANNER}(\text{secretly}, e) \right] \)

But now we run into a problem. Since the two events of John singing and Mary leaving are taken to be identical in (47a) and (48b), we can infer that John’s singing must also occur in secret, unnoticed by Mary. After all, the individual event e is specified as occurring in a secret manner in (48b). But this is not how (48a) would normally be interpreted, if ever. Therefore, the two events in (48a), and also in (46a), must be distinct.

Finally, notice that the scheme in (43a) cannot be implemented in (47c) at all. (47c) contains a temporal adverbial later whose semantic function is to relate the occurrence times of two successive events. Since (47c) contains only one event variable, such a relation cannot be established.

In contrast, the scheme in (43b) accounts for (46a-c) in a straightforward manner. This is shown in (49a-c).

(49)  a. \( \forall e \left[ \left( \text{sing}'(\text{john}, e) \Rightarrow \exists e' \left( \tau(e') = \tau(e) \land \text{leave}'(\text{mary}, e') \right) \right] \right) \)

    ‘For each singing event by John e, there is a leaving event by Mary e’ that occurs at the same time as e.’
b. \( \forall e [\text{blow'(\text{wind'(x))} \rightarrow \exists \exists y [\text{window'(y) \land \text{CAUSE(e',e)}} \land \text{break'(y,e')}] \] \\
For each wind-blowing event e, there is a window-breaking e' caused by e.'

c. \( \forall e [\text{leave'(mary, e)} \rightarrow \exists e' [\text{later'(e', e, 5minutes)} \land \text{leave'(john, e')}] ) \\
For each leaving event by Mary e, there is a leaving event by John e' which occurs five minutes later than e.'

I conclude that adverbial quantification relates two events as in (43b). The bold-faced parts in (49a-c) fix the relation between the two events e and e'. It is obvious, that the abstract relation \( R \) in (43b) can take on a variety of values including identity of time of occurrence (49a), causation (49b), temporal succession (49c), but also temporal overlap, temporal inclusion, and others. I assume that \( R \) is a free variable over relations whose value is fixed pragmatically by the context, and by our knowledge of how two events can relate to one another in the world, as we know it.

There is still one loose end to tie up, namely the question of how the relation variable \( R \) enters the logical representation in (43b). I assume that \( R \) is an event modifier that combines optionally with the lexical 'core' entry of a verb, e.g. in the presence of an adverbial quantifier. This is similar to other optional modifying relations, such as Eckardt’s (2002) ‘Moved-Object’, ‘Resulting-State’, and ‘Degree’ from section 1.1.1. These enter the logical representation in the presence of additional lexical material, mostly adverbial modifiers. The representation of the (optionally) modified lexical entry of the verb \( \text{leave} \) in (46a) is found in (50). The relation variable \( R \) brings along an ‘old’ event variable \( e \) to which it relates the event predicated by the verb. The context dependency of \( R \) is indicated by the index \( j \).

\[
\lambda x \lambda e'.[ \text{leave'(x,e')} \land R_j(e',e)]
\]

The value of \( e \) in (50) can be fixed in two ways. In the presence of an adverbial quantifier, it is anaphorically related to the event expressed by the antecedent. In this case, the same adverbial quantifier binds both event variables after \( \lambda \)-abstraction over \( e \) has applied along the lines in (50a-c). In section 2, I show how this works for adverbial jeweils. The second way to fix a value for \( e \) is to assign it a value deictically. In my view, this possibility accounts for coherence phenomena across sentence boundaries. As with adverbial quantifiers, the value of \( R \) is fixed contextually in (51a-c). Likely candidate values for \( R \) are given in brackets.

\[
\begin{align*}
\text{(51) a. } & \text{The teacher came in. The children got up.} & \text{(temporal succession, causation)} \\
\text{b. } & \text{The sun is shining. The birds are singing.} & \text{(simultaneity)} \\
\text{c. } & \text{Bill yelled at Maria. She started to cry.} & \text{(causation)}
\end{align*}
\]

---

25 This scheme also holds for Kratzer’s (1995:129) sentence (ia), which seems to be about a single event, or a variation thereof in (ib):

\( \begin{align*}
\text{(ia) a. } & \text{When Mary speaks French, she speaks it well.} \\
\text{b. } & \text{When Mary speaks French, she speaks it at home.}
\end{align*} \)

(ia) can be subsumed under the general scheme in (43b) if we assume that the relation variable \( R \) can be assigned the value of the identity relation ‘\( = \)’ . The logical representation of (ia) is given in (ii):

\( \begin{align*}
\text{(ii) } & \forall e [\text{\text{\text{speak'(mary, french, e)}\rightarrow \exists e' [e' = e \land \text{\text{\text{speak_well'(mary, french, e')}]}]} })
\end{align*} \)

On this view, the sentences in (ia) are special instances of a more general scheme of adverbial quantification.
It is important that the event modifier $R(e,e')$ in (50) be optional. Otherwise, we could not account for the possibility of out-of-the-blue utterances, which stand in no relation to any preceding discourse whatsoever (simply because there is no preceding discourse).

(52) Maria has called.

However, since the majority of utterances form part of a larger discoursive whole, (50) can be taken to be the norm, rather than the exception. Presumably, the different coherence relations expressible by $R$ can be summarised under the term ‘discourse relation’ from Asher (2000).26

I conclude this section by summing up the semantic properties of adverbial quantification. Adverbial quantifiers take two arguments like adnominal quantifiers. Both arguments express event properties, or sets of events. Instead of ascribing two event properties to a single event, adverbial quantification relates two events $e$ and $e'$ by means of the following general scheme:

(53) General Scheme of Adverbial Quantification:

$$Q_{\lambda,\lambda'}(p)(r) = 1 \iff Q_{\lambda}(\lambda' e \exists\,(R(e,e') \land q(e'))(e)) = 1$$

(with $p,q,r$ variables over sets of events, and $R = \lambda e_1.\exists e'[R(e_1,e') \land q(e')]$)

The adverbial quantifier binds an event variable in the antecedent, and an anaphorically bound event variable in the consequent. Anaphoric binding is indicated by co-indexation. The additional event variable $e'$ in the consequent is bound by existential closure. For the sake of illustration, some values for $Q$ are given in (54).

(54) a. $Q = [[always]] = \lambda p.\lambda r. \forall e \ [p(e) \rightarrow r(e)]$

‘For all events $e$, if $p(e)$ then $r(e)$.’

b. $Q = [[usually]] = \lambda p.\lambda r. \ | \lambda e \ [p(e) \land r(e)] | > | \lambda e \ p(e) \land \neg r(e) |

‘The number of events that are $p$ and $r$ exceeds than that are $p$ and not $r$.’

= ‘Most events that are $p$, are also $r$.’

c. $Q = [[sometimes]] = \lambda p.\lambda r. \exists e \ [p(e) \land r(e)]$

‘There are some events which are both $p$ and $r$.’

Usually, the first argument $p$ is not explicitly stated, but restricts the quantifier implicitly in form of a ‘resource domain variable’ (von Fintel 1994). In such a case, $p$ simply stands for a plurality of events which is provided by the context, and which is picked up anaphorically by the adverbial quantifier. I will consequently replace the condition $p(e)$ with $e \in E$, where $E$ stands for the implicit plurality of events. The quantificational scheme illustrated in (53) and (54) will be applied to adverbial jeweils in section 2.

The quantifiers in (54) all take two sets of atomic events as semantic arguments. Under certain conditions, it looks as if adverbial quantifiers can also take sets of pluralities of events (i.e. sets of sets) as arguments. This happens in the case of iterated adverbial quantification, as illustrated in (55a). Sentences like (55a) involve a large amount of contextual information and interpretive effort for a felicitous interpretation. Presumably it

is for this reason that they often appear slightly strange. (55b) shows that the order of quantifiers can be reversed in many cases.

\[(55)\]
\[
a. \text{Peter hat always lost sometimes.} \\
b. \text{Peter has sometimes always lost.} \\
\]

The presence of two adverbial quantifiers leads to the conclusion of two event layers or event frames, one of which subsumes the other. A plausible scenario for (55a) would be one in which Peter went to the horse racing several times, and each time he placed a number of bets. The smaller event layer, quantified over by sometimes, is constituted by the number of bets that Peter places on a single racing day. The bigger event layer, quantified over by always, is constituted by the collection of Peter’s bettings on his separate visits to the racetrack. In this scenario, (55a) is true if Peter has lost a few bets on each of his visits to the racetrack. (55b) is true if Peter, on several unfortunate visits to the horse racing, has lost all of his bets.

The possibility of iterated adverbial quantification is theoretically interesting because the higher quantifier ranges over a complex event (e.g. the collection of all the bettings on an individual racetrack visit) which forms the restriction for the lower quantifier over the individual betting events. This naturally raises the question if the complex bigger event is a plurality (a set of events) as illustrated in (56a), or if it should rather be analyzed as a complex individual event, with the smaller events forming material parts of the superevent. The second option is illustrated in (56b). On the latter approach, the individual bettings stand in the same relation to the collection of bettings on a given racing day, as do the individual events of cutting the meat, raising the fork, and pouring the wine to the specific dinner-eating event by John from section 1.2.

\[(56)\]
\[
a. \forall E \in E’ [\exists e \in E \land \text{lost}'(\text{peter}', e)] \quad \text{(over plural events)} \\
b. \forall e’ \in E [\exists e \leq e’ \land \text{lost}'(\text{peter}', e)] \quad \text{(over a complex individual event)} \\
\]

‘For all sets of events E that are elements of a set of sets of events E’ there is at least one event e in E such that e is a losing by Peter.’

‘For all events e’ in E, there is at least one event e such that e is a part of e’ and e is a losing by Peter.’

Unlike the question whether pluralities should be represented as sets or as sums of events, the choice between (56a) and (56b) is not trivial, for it determines the internal structure of the complex events resulting from repeated adverbial quantification. Intuitively, this question is difficult to answer. Theoretically, however, there is an important difference between the two analyses.

Adopting (56a) with quantification over pluralities has the – at first sight - unwelcome consequence that it leads to a hierarchy of types in the representation of plural events. Additional event layers will be of ever higher semantic types, and – correspondingly – adverbial quantifiers over these higher types will have to be of a higher type, too.

In order to avoid the potential problems arising in connection with hierarchies of event types, Eckardt (1998) opts for the second strategy in (56b), which treats higher event layers as complex individual events consisting of material subparts. As a result, repeated adverbial application does not raise the semantic type of the (materially complex) events involved. For (55ab) with a singular participant, this approach gives the desired result and keeps the semantic event structure flat at the same time.
Despite this, there seems to be evidence that iterated adverbial quantification does quantify over pluralities (i.e. sets) of events, at least in some cases. Evidence for this claim comes in form of iterated adverbial quantification with plural participants, as illustrated in (57):

(57) The boys, always \(i\) \(sometimes\) slept.

In section 1.2.2, it was concluded that plural participants always induce a plurality of events (at least with inherently distributive predicates like sleep), based on the semantic behaviour of adverbial jeweils. It follows that sometimes in (57) should quantify over a set of events of individual boys sleeping, and always should quantify over a higher order set of events of individual boys sleeping sometimes.\(^{27}\) Without this assumption, we are forced to reconsider our assumptions about the nature of participant complex events from 1.2.2, and treat them not as pluralities of events, but as materially complex events. In light of the different semantic behaviour of participant complex events and materially complex events, such a move does not seem warranted. In the discussion of the semantics of adnominal jeweils in section 4, we will encounter more examples that plausibly involve adverbial quantification over pluralities of events. Given this, I tentatively conclude that adverbial quantification can range over pluralities of events, at least sometimes.\(^{28}\)

The treatment of iterated adverbial quantification concludes the discussion of adverbial quantification.

1.4 Stage-Level and Individual-Level Predicates and the Semantics of Jeweils

In this subsection, we turn back to the beginning and provide a refinement of the discussion of events from section 1.1. At the same time, the discussion is a further step towards the final semantic analysis of adverbial jeweils. Taking up remarks in fn.3 and at the end of section 1.1, it is shown that not every predicate introduces an event argument into the logical representation of a sentence. Based on this, adverbial quantifiers, and adverbial jeweils in particular, are shown to occur only with those predicates that introduce an event argument. This is as expected if adverbial quantifiers quantify over atomic events. Finally, the data from this section provide further support for the analysis of adverbial quantifiers as binding an event variable in their restriction and their nuclear scope.

Kratzer (1995) observes a difference between individual-level and stage-level predicates wrt adverbial quantification, the possibility to extract from subject position (in German), and the interpretation of bare plural arguments in subject position. Based on the evidence cited, Kratzer (1995) concludes that only stage-level predicates introduce an event argument, whereas individual-level predicates do not. I will quickly recapitulate her discussion concerning adverbial quantification.

The distinction between individual- and stage-level predicates goes back to Carlson (1977) and is illustrated in (58):

(58) a. Kemal speaks Turkish (on the phone right now).
    b. Kemal knows Turkish.

\(^{27}\) On this interpretation, (57) can be paraphrased as ‘For all sets of sets of events E’, there are some sets of events \(E \in E\) such that E is a plurality of events of individual boys sleeping.

\(^{28}\) This conclusion implies that verbal domain and the nominal domain may differ with respect to the existence of a hierarchy of individual or event types. As shown by Schwarzschild (1992), there is no need to assume a hierarchy of types in the nominal domain, as is argued in Landman (1989).
The stage-level predicate *speak Turkish* in (58a) denotes a more transient property of Kemal. It only holds of Kemal at certain points of time. Other examples of stage-level predicates are *being furious, being happy, being asleep*. The individual-level predicate in (58b), on the other hand, denotes a property that holds of Kemal over time. Other examples of individual-level predicates are *be smart, be 6ft tall, be altruistic*.29

Now consider (59ab). In (59a), the adverbial quantifier *always* is combined with a stage-level predicate in its restriction and its nuclear scope, and the sentence is grammatical. In (59b), the adverbial quantifier is combined with an individual-level predicate, and the sentence is ungrammatical (Kratzer 1995:129).

(59)  a. Always, [when Kemal speaks Turkish], [he speaks it well].
    b. *Always, [when Kemal knows Turkish], [he knows it well].

Interestingly, (59b) becomes grammatical if the proper noun *Kemal* is replaced with an indefinite NP (ibid.).

(60)  Always, when a Kurd knows Turkish, he also knows Kurdish.

Kratzer accounts for the difference between (59a) and (59b), on the one hand, and between (59b) and (60) on the other, by means of the following four assumptions.

(61)  i. Stage-level predicates introduce an event variable, individual-level predicates do not. (ibid.:131)
    ii. Indefinite NPs have no quantificational force of their own. They introduce a variable that is bound by an overt quantifier, or by existential closure. (ibid.:130)
    iii. Existential closure applies to the nuclear scope of a quantifier. It binds all non-anaphoric (i.e. free, or novel occurrences of variables in its scope. (ibid.:143)
    iv. Every quantifier Q must bind (at least one occurrence of) a variable x, both in its restriction and in its nuclear scope. (ibid.:131)

All but (61i) are independently motivated in connection with other phenomena. (61ii) is the analysis of indefinite expressions in the DRT-tradition (Kamp 1981, Heim 1982), which was already utilised in the syntactic analysis of German numeral expressions in chapter I.2.4.2. (61iii) is from Heim (1982). It was already – more or less implicitly – present in our discussion of adverbial quantification in section 1.3. (61iv) is Kratzer’s ‘Prohibition on Vacuous Quantification’. It says that quantifiers cannot apply vacuously (see also Chomsky 1982).

With (61i-iii), and using the general scheme of adverbial quantification in (53), (59ab) and (60) are analysable as in (62a-c):

---

29 Note that predicates, including predicates like *speak English* as in *Do you speak English?*, can be ambiguous between stage- and individual-level readings. The ambiguity of *be stupid* in (ab) is determined by the linguistic context, in particular the presence of *never and that day*:

   (i)  a. John was stupid. He *never* knew any answers at school.
      b. John was stupid *that day*. He always regretted this particular mistake. It was his only one.

In general, there is a certain amount of vagueness involved in the categorisation of particular predicates as stage- or individual-level, which is mostly based on contextual information or our knowledge of the world. See Kratzer (1995:125-126) for discussion.
In (62a), the universal quantifier binds the event variable \( e \) in restriction and nuclear scope, obeying the prohibition on vacuous quantification (61iv). In (62c), the universal quantifier binds an individual variable \( x \) in its restriction and its nuclear scope, again obeying the prohibition on vacuous quantification. In (62b), however, there are no variables to be bound. The proper name Kemal does not introduce an individual variable, nor does the individual-level predicate know Turkish (well). This follows on Kratzer’s assumption (61i). As a consequence, the quantifier has no variables to bind, and (62b) is ungrammatical because it violates the ‘Prohibition on Vacuous Quantification’ in (61iv). Hence, the assumption that only stage-level predicates introduce event variables into the logical representation of a clause provides an account for the data in (59ab) and (60).

The ungrammaticality of (59b) remains even if we replace the individual-level predicate in either the restriction or in the nuclear scope with a stage-level predicate.\

\[ (63) \]
\begin{enumerate}
\item a. *Always, [when Kemal speaks Turkish], [he knows it].
\item b. *Always, [when Kemal knows Turkish], [he speaks it well].
\end{enumerate}

(63ab) support the claim that adverbial quantifiers must bind an event variable, not only in their restriction, but also in their nuclear scope. The same holds for adverbial jeweils, which cannot co-occur with an individual-level predicate, as shown by (64b).

\[ (64) \]
\begin{enumerate}
\item a. Peter hat jeweils Finnisch gesprochen.
\begin{flushright}
‘Each time, Peter spoke Finnish.’
\end{flushright}
\item b. *Peter hat jeweils Finnisch gekonnt.
\begin{flushright}
*‘Each time, Peter knew Finnish.’
\end{flushright}
\end{enumerate}

I conclude that jeweils behaves like other adverbial quantifiers. It cannot occur with individual-level predicates because it has to bind an event variable in its nuclear scope.

1.5 Events as External Arguments

The importance of events for quantification with adverbial quantifiers raises the question where they are located in the logical representation. In this subsection, I briefly summarise Kratzer’s argument that the event variable is the (implicit) external argument of stage-level verbs. As such it is the outermost argument of the verb, located outside the VP.

Empirical evidence for the external argument status of events comes from the interpretation of bare subjects with stage-level predicates in German. (65a) is ambiguous between a generic reading and an existential reading for the subject. In contrast, the bare subject must be interpreted generically with an individual-level predicate (cf.65b).

---

\( ^{30} \) (63ab) are grammatical under an interpretation that treats to know as a stage-level predicate, i.e. under the assumption that one can sometimes know and sometimes not know the same thing.
(65)  

(a) ... weil Hunde bellen.
   ‘...because dogs bark/ dogs are barking.’

(b) ... weil Hunde dumm sind.
   ‘...because dogs are stupid.’

* ‘...because there are stupid dogs.’

On the generic reading, the variable introduced by the bare subject is bound by a generic operator. On this reading, (65a) means that dogs generally bark. On the existential reading, it means that there is an event of dogs barking. On this reading, the variable introduced by the bare subject is bound by an existential operator introduced by existential closure, which applies at the edge of VP (see also Diesing 1992). In order to get into the scope of the existential quantifier, the bare subject NP must reconstruct at LF into its base position inside VP. Without reconstruction, the subject remains in its base position, and can only be bound by a generic operator. The emergence of the two readings is schematised in (66ab).

(66)  

(a) No reconstruction:
\[ [\text{IP} \text{dogs}\_1 [\text{VP} \text{t}\_1 \text{bark}]] \rightarrow \text{Gen}_x [\text{dogs’}(x)] [x \text{barks}] \rightarrow \text{generic reading} \]

(b) Reconstruction:
\[ [\text{IP} \exists e, x [\text{VP} \text{dogs bark}]] \rightarrow \exists e, x [\text{dogs’}(x)] [x \text{barks in } e] \rightarrow \text{existential reading} \]

The possibility of an existential reading shows that the base position of the subject in (65a) must be inside the VP below the locus of existential closure. Since the external argument is by definition that argument which is base-generated outside the VP, it follows that the subject argument cannot be the external argument. It follows by exclusion that the implicit event argument must be the external event argument.

This conclusion is supported by the non-ambiguity of (65b). Stage-level predicates do not introduce an event argument. Therefore the subject NP is the external argument of the verb and must be base-generated outside the VP. It follows that the subject cannot reconstruct to a position inside the VP. Hence it cannot get into the scope of the existential quantifier at the edge of VP. And therefore the existential interpretation is impossible for (65b).

1.6 Summary

The preceding discussion has delivered the following results concerning the semantics of events in general, and the semantics of adverbial quantification and of adverbial jeweils in particular:

(67)  

i.  Events are semantically real (though syntactically implicit) entities. Stage-level predicates introduce them as event variables into the logical representation of sentences.

ii.  The event is realised as the external argument of a stage-level predicate.

iii.  Event variables can be bound in two ways: (i.) by adverbial quantifiers, or (ii.) by existential closure (in the absence of adverbial quantifiers, or in the nuclear scope of an adverbial quantifier).

iv.  Events can be complex in various ways. Atomic events can form material parts of other events, or they can combine to form plural events. Adverbial
quantifiers, including adverbial jeweils, operate only over such pluralities of events, which can be represented as sets.

v. Adverbial quantifiers take two sets of events as arguments.

vi. Adverbial quantifiers, including adverbial jeweils, must bind an event variable in their restriction and their nuclear scope.

This provides the necessary background for the semantic analysis of adverbial jeweils.

2 The Semantics of Adverbial Jeweils

This section presents the semantic analysis of adverbial jeweils. The analysis is compositional, with jeweils being interpreted in its surface position. This approach is in line with methodological principle (M2): Interpret elements in their surface position if this can be done compositionally. In chapter III.1, adverbial jeweils was argued to be located in VP-joined position. The syntactic structure, which provides the input for interpretation, is repeated as (68).

(68) ... weil [IP Peter [VP jeweils [VP t1 lachte]].]

because Peter each time laughed

The analysis is based on the assumption that adverbial jeweils is an adverbial quantifier. The relevant observations supporting this assumption are repeated in (69):

(69) i. jeweils is distributed like adverbial quantifiers. It is adjoined to VP (or higher)

ii. jeweils is incompatible with other adverbial quantifiers

iii. jeweils distributes over sets of events from the preceding discourse.

iv. jeweils binds an event variable in its nuclear scope

The semantic analysis of adverbial jeweils as an adverbial quantifier follows directly. In section 2.1, I show how the general scheme of adverbial quantification in (53) applies to adverbial jeweils. However, jeweils is argued to be a special instance of an adverbial quantifier in section 2.2. This claim is based on the special morphosyntactic shape of jeweils. In chapter III.4.2.1, the s-suffix on jeweil-s was analysed as a genitive marker that licenses a phonetically empty prepositional head. In 2.2, I argue that this empty preposition has semantic content. It provides a relation variable R that establishes a relation between two events. As shown in section 1.3, the presence of a relation variable in the semantic representation must be assumed for adverbial quantification anyway. In my view, jeweils differs from other adverbial quantifiers in that it contributes the relation variable itself. In section 2.3, I discuss the context dependency of jeweils. In particular, I will support the view that the morpheme –weil- denotes a pronoun over sets of individuals. Arguments for this claim come from the parallel behaviour of jeweils and the plural pronoun sie ‘they’ regarding their discourse anaphoric properties. Finally, I show that the semantic analysis of adverbial jeweils accounts for all its syntactic properties, which were laid out in chapter III.1.
2.1 Interpreting adverbial jeweils

As a quantifier, adverbial jeweils requires a restriction and a nuclear scope argument semantically. In chapter III.4.2.2, it was shown that adnominal jeweils has incorporated its restriction in form of the proform –weil-. The proform refers to a set of entities over which adnominal jeweils distributes. It is natural to assume that the same holds for adverbial jeweils. In the case of adverbial jeweils, the proform –weil- refers to a set of events that is recoverable from the preceding discourse. As with adnominal jeweils, the quantificational force lies in the quantifier je-.

This assumption together with the general scheme of adverbial quantification from section 1.3 allow for a first representation of the meaning of adverbial jeweils as in (70). In section 2.2, the expression in (70) will be subject to a slight revision.

(70) *The Interpretation of Adverbial Jeweils (to be revised):*

\[
[[\text{jeweils}]] = \lambda r. \forall e [e \in E \Rightarrow r(e)]
\]

As indicated by the subscript, the semantic type of adverbial jeweils is \(<<v,\alpha,\alpha>>\). This makes adverbial jeweils a generalised quantifier in the domain of events. A typical argument of this generalised quantifier is of the form ‘\(r = \lambda e. \exists e' [R(e, e') \land q(e')]\)’, which is a set over events. This shows that adverbial jeweils does not directly combine with the VP-denotation even though VP is the syntactic sister of jeweils. Two semantic processes must apply at the level of VP before a composition with the meaning of jeweils is possible. The first is existential closure of the event variable (\(e'\)) that is introduced by the main verb. From Diesing’s ‘Mapping Hypothesis’, which states that the VP-denotation is mapped into the nuclear scope of a quantifier, and the assumption that existential closure applies to the nuclear scope (Heim 1982, Kratzer 1995), it follows that existential closure applies at the VP-level under normal circumstances. The existentially closed VP-denotation provides the input for the second semantic process that must apply. This process involves \(\lambda\)-abstraction over an event variable that is co-indexed with the syntactic sister of VP, i.e. jeweils. The process of \(\lambda\)-abstraction over indices of syntactic sisters has been argued for in Bittner (1994). The interpretation of moved elements by means of \(\lambda\)-abstraction over the moved element’s index, as explicated in Heim & Kratzer (1998) is only a special instance of this rule. We will later encounter this semantic operation in another context, and discuss it in more detail. For the time being, I assume its application without further argument.

(71) and (72) illustrate how the meaning of (68) is derived in a step-by-step procedure. Numbers on the nodes in the tree show where the respective semantic process applies:

---

31 The claim that the restriction of adverbial quantifiers is realised (morpho-)syntactically, is not new. Doetjes (1997:226f.) observes that adverbial quantifiers in French, Dutch, and English are often morphologically complex, with the second part being nominal in nature. Compare French toujours (all-days) ‘always’, English some-times, and Dutch dik-wijls (manyfold-while+GEN) ‘often’. Note that Doetjes’ analysis of Dutch dikwijls matches our analysis of jeweils.
(71) \[
\begin{array}{c}
\text{IP, 10} \\
\text{NP, 9} \\
\text{VP, 7, 8} \\
\text{Peter} \\
\text{jeweils, 6} \\
\text{VP, 3, 4, 5} \\
\text{t, 2} \\
\text{V, 1} \\
\end{array}
\]
\[
lachte
\]

(72) a. \(1 = \lambda x \lambda e'. R_x(e, e') \wedge \text{laughed}'(x, e')\) \(= [[\text{laughed}]]\)

b. \(2 = x_1\) \(\text{meaning of trace}\)

c. \(3 = \lambda e'. R_x(e, e') \wedge \text{laughed}'(x_1, e')\) \(FA\)

d. \(4 = \exists e' [R_x(e, e') \wedge \text{laughed}'(x_1, e')]\) \(\text{Existential Closure}\)

e. \(5 = \lambda e, \exists e' [R_x(e, e') \wedge \text{laughed}'(x_1, e')]\) \(\lambda\)-abstraction over ‘i’

f. \(6 = \lambda x. \forall e [e \in E \rightarrow r(e)]\) \(= [[\text{jeweils}]] = (70)\)

g. \(7 = \forall e [e \in E \rightarrow \exists e' [R_x(e, e') \wedge \text{laughed}'(x_1, e')]]\) \(by FA\)

h. \(8 = \lambda x, \forall e [e \in E \rightarrow \exists e' [R_x(e, e') \wedge \text{laughed}'(x_1, e')]]\) \(\lambda\)-abstraction over ‘1’

i. \(9 = \text{peter}\)

j. \(10 = \forall e [e \in E \rightarrow \exists e' [R_x(e, e') \wedge \text{laughed}'(\text{peter}, e')]]\) \(FA\)

(72j) is true if for all events \(e\) that are elements of a given set (of events) \(E\), there is an event \(e'\), such that \(e'\) stands in a (contextually determined) relation \(R\) to \(e\), and \(e'\) is a laughing by Peter. This adequately captures the truth-conditions of (68).

Despite its yielding a correct result, the analysis of adverbial jeweils will be subject to a slight revision in the next section. The revised analysis will not affect the overall result of the semantic derivation, but only the way of getting there.

### 2.2 Adverbial jeweils as a Double Quantifier

Motivation for a revision of the above analysis comes from the special morphological shape of jeweils, which is marked for genitive case. In chapter III.4.2.1, it was argued that genitive case on jeweil- licenses an empty prepositional head in line with Emonds’ (1987) Invisible Category Principle. The internal structure of jeweils is presented again as (73).

(73) \([\text{pp} \quad 1^{0} \quad [\text{qp} \quad \text{je} \quad \text{[np weill]-s}]]\)

The PP-status of adverbial jeweils is not surprising, given the existence of overt PP-adverbials in German.\(^{33}\) (74a-c) repeat examples with locative, temporal, and instrumental PP-adverbials respectively.

(74) a. \([\text{pp} \quad \text{an} \quad \text{[dp diesem Abend]}]\) on this evening

b. \([\text{pp} \quad \text{in} \quad \text{[dp Hamburg]}]\) in Hamburg

c. \([\text{pp} \quad \text{mit} \quad \text{[dp dem Messer]}]\) with the knife

\(^{32}\)See the discussion in connection with (50) for the status of \(R\) as an optional modifier to the verb.

\(^{33}\)Analogous proposals to explain all adverbials on the basis of prepositional phrases are found in Steinitz (1969:72) and Bartsch (1976:362).
In (74a-c), the prepositions contribute to the meaning of the PP. They specify whether a locative, or temporal, or instrumental relation is established between an event and the individual denoted by the DP. It therefore appears plausible that the empty prepositional head in (73) also contributes to the overall meaning of the PP-adverbial. This means that \( P^0 \) should introduce a relation into the meaning of \( \text{jeweils} \). In the absence of any phonological features that could specify a particular relation, I assume that \( P^0 \) is reduced to its core prepositional meaning. It provides a free relation variable \( R \). \( R \) is assigned its value from the context. Since adverbial \( \text{jeweils} \) is an adverbial quantifier relating two sets of events, we expect \( R \) to establish a relation between two events, in line with the general scheme of adverbial quantification in (54). However, since \( R \) is a transitive relation, it must come along with two event variables, only one of which (the ‘old’ event) is bound by the universal quantifier. I conclude that the ‘new’ event variable must be bound by an existential quantifier in the nuclear scope of the universal quantifier. The revised lexical entry for adverbial \( \text{jeweils} \) is found in (75), with the newly added meaning components highlighted in bold.

\[
(75) \quad \text{The Interpretation of Adverbial jeweils (final version):} \\
[ [ P^0 \text{jeweils} ] ] = \lambda q_{<v,t>} \forall e \in E_i \exists e' [ q(e') \land R(e,e') ]
\]

The existential quantifier which binds the additional event variable \( e' \), and the relation variable \( R \) are familiar from the general scheme of adverbial quantification in (54), and from the first lexical entry for adverbial \( \text{jeweils} \) in (70). Their presence is semantically motivated. The only difference between (70) and the revised representation in (75) is the source of existential quantifier and relation variable. In connection with (54), it was assumed that \( R \) was added to the verb meaning as an optional modifier whose basic function is to establish discourse coherence. The existential quantifier was introduced at the VP-level in the presence of the adverbial quantifier in order to bind the event variable of the verb. In contrast, both relation variable and existential quantifier are part of the semantics of the sequence \( P^0 \text{jeweils} \) in (75), which I take to be a lexicalised semantic unit. Since the introduction of relational modifier and existential closure at the VP-level were triggered by the presence of the adverbial quantifier on the old approach anyway, locating them as part of the semantics of \( \text{jeweils} \) only seems logical. In addition, the revised representation in (75) accounts for the genitive morphology on adverbial \( \text{jeweils} \), and allows it to combine directly with the VP-denotation. Existential closure and \( \lambda \)-abstraction at the VP-level (steps 4 and 5 in the derivation in (72)) become unnecessary. I take this to be sufficient reason for treating adverbial \( \text{jeweils} \) as a double adverbial quantifier that has an existential quantifier in the nuclear scope of the universal quantifier.

On the revised semantic analysis of adverbial \( \text{jeweils} \) in (75), the derivation of the meaning of (68), repeated as (76), proceeds as shown in (77):

\[
(76) \quad \text{a. ... weil } [_{IP} \text{Peter}, [_{VP} \text{jeweils} [_{VP} t_i \text{lachte}]]]. \\
\text{because } \quad \text{Peter each.time laughed}
\]
(77) a. 1 = λxλe. laughed’(x, e’)
   b. 2 = x₁
   c. 3 = λe’. laughed’(x₁, e’) = [[VP]]
   d. 4 = λqₓₑₜ. ∀e [e ∈ Eₐ → ∃e’ [q(e’) ∧ Rₑ(e, e’)]] = [[jeweils.]] = (75)
   e. 5 = ∀e [e ∈ Eₐ → ∃e’ [laughed’(x₁, e’) ∧ Rₑ(e, e’)]]
   f. 6 = λx₁, ∀e [e ∈ Eₐ → ∃e’ [laughed’(x₁, e’) ∧ Rₑ(e, e’)]]
   g. 7 = peter
   h. 8 = ∀e [e ∈ Eₐ → ∃e’ [laughed’(peter, e’) ∧ Rₑ(e, e’)]]

(77h) is true iff for all events e that are elements of a given set (of events) E, it holds that there is an event e’, such that e’ stands in a (contextually determined) relation R to e, and e’ is a laughing by Peter. The truth-conditions are the same as for (72j) above. This shows that the derivation with the revised meaning of jeweils has the same output as the one using the general scheme of adverbial quantification. At the same time, the revised analysis of adverbial jeweils puts fewer burdens on the compositional component, which combines the meanings of syntactic constituents. This is reflected by the fact that the derivation in (77) comprises fewer steps. The simplification in the compositional component is bought at the price of locating more meaning components in the meaning of adverbial jeweils itself. In particular, it involves adding a relation variable and treating adverbial jeweils as a double quantifier that introduces an existential quantifier over events. As seen, the first move is motivated independently by overt morphological case on jeweils. The relation variable is provided by the empty preposition P⁰. The second move follows from the first, since the additional event variable introduced by the relation needs to be bound in the scope of the universal quantifier.

Summing up, I have suggested treating adverbial jeweils as a double quantifier that contains a relation variable in its semantic representation. The analysis proposed allows for a surface compositional derivation of the meaning of sentences with adverbial jeweils. In addition, it accounts for the genitive marking on jeweils. In section 4, it will be shown that the semantic analysis of adverbial jeweils carries over to adnominal jeweils.

---

34 One may speculate if adverbial jeweils is the only adverbial double quantifier. Historically at least, there are other candidates if overt genitive marking is a reliable diagnostic (as argued in the main text). Grimmelshausen (17th century) consistently uses the genitive form aller-wegen (allerGEN, wayGEN) or öfters (more.frequentGEN) or öfters (more.frequentGEN), meaning often. The existence of other genitive adverbial quantifiers shows that adverbial jeweils is not as exotic as appears on first sight.
2.3 The Dynamic Behaviour of Adverbial *Jeweils*

This section is devoted to the context dependency of adverbial *jeweils*, for which there are two sources. The relation variable *R* must be assigned a value from the context. And the restriction variable *E*, which ranges over a set of atomic events, must anaphorically pick up an appropriate antecedent from the preceding discourse. In the previous section, it was argued that the source of *R* is the covert preposition *P₀*, while the source of *E* is the pronominal element –*weil*. We look first at how *R* can get varying values depending on the context. After that, the set variable –*weil* is shown to behave like other set variables found in natural language. In particular, it is shown that the context dependency observed with adverbial *jeweils* parallels that of the plural pronoun *sie* ‘they’. The latter is analysed as a variable over sets in the individual domain in Kamp & Reyle (1993). I will take the parallel behaviour of *jeweils* and *sie* as evidence for the present analysis of *jeweils*, and in particular for the pronominal status of the morpheme –*weil*.

The following examples illustrate the context dependency of *R*.

(78) a. Die Jungen kamen nacheinander herein. Die Mädchen lachten jeweils.  
   The boys came after another in the girls laughed each time  
   ‘The boys came in one after the other. Each time, the girls laughed.’

   The boys make many jokes the girls laughed each time  
   ‘The boys cracked many jokes. Each time, the girls laughed.’

c. In jedem Land fand ein Radrennen statt. Es gewann jeweils ein Italiener.  
   A bike race took place in every country. An Italian won in each case.’

The value for *R* differs depending on the context. In (78a), the two sets of events are most plausibly temporally related. In (78b), the events of girls laughing follow the events of cracking jokes (temporal relation). Alternatively, they may be caused by the first events (causal relation). Finally, *jeweils* seems to establish an inclusive relation between the bike racing events and the respective winning events in (78c). I take the examples in (78a-c) as sufficient evidence for the context dependency of *jeweils* along the relational dimension.

Turning next to the discourse anaphoric behaviour of *jeweils*, it turns out that *jeweils* is licensed in the same contexts as the plural pronoun *sie* ‘they’. These are either a plural DP or a coordination structure in the preceding clause. Examples are given in (79) and (80).

   Peter and Hans came after another in They saw tired  
   ‘Peter and Hans came in one after the other. They looked tired.’

b. Peter und Hans kamen nacheinander herein. Die Mädchen lachten jeweils.  
   Peter and Hans came after another in The girls laughed each time

(80) a. Peter schrie und Hans sang. Sie waren sehr betrunken.  
   Peter shouted and Hans sang They were very drunk

b. Peter schrie und Hans sang. Die anderen Gäste beschwerten sich jeweils.  
   Peter shouted and Hans sang The other guests complained

The parallel behaviour of *jeweils* and *sie* in (79) and (80) supports the analysis of *jeweils* as containing a set-denoting proform which is anaphorically linked to an appropriate antecedent in the context.
It is not quite clear how the antecedent of *sie* and *–weil-* is identified. The interesting case is provided by (80): The plural pronoun *sie* ‘they’ is anaphorically related to a pluralic group of individuals, although these individuals are not introduced into the discourse by a single constituent. It appears that an appropriate plural value for *sie* is construed by collecting the different atomic individuals in the context and turning them into a plural entity. Whatever the exact status and working of this process, (80b) shows that a similar process applies in the domain of events.

An account of the discourse anaphoric behaviour of *jeweils* in terms of Groenendijk & Stokhof’s (1990, 1991) ‘Dynamic Montague Grammar’ does not appear to solve the problem. Groenendijk & Stokhof analyse the meaning of clauses in terms of their discourse change potential. On this analysis, every clause contains a variable *p* over possible continuations in its semantic representation. In addition, every ‘static’ quantifier has a dynamic counterpart that can take scope across sentence boundaries. So, if an existential quantifier were to introduce a set of events into the preceding discourse, the variable *E* in the semantic representation of *jeweils* could get into its scope. Unfortunately there is no overt quantificational element introducing a set of events in the first sentences in (79) and (80). To the contrary, the set of events is construed only later, out of the separate conjuncts. This shows that the anaphoric behaviour of *jeweils* cannot be accounted for by placing it in the scope of a dynamic existential quantifier over sets of events, simply because this quantifier is not present.

Instead of Dynamic Montague Grammar, I would like to propose a DRT-style account for the discourse anaphoric behaviour of *jeweils*. In order to account for the plural reference of the personal pronoun *sie* ‘they’ in (79a) and (80a), Kamp & Reyle (1993:306ff.) propose the semantic operation of ‘summation’. This operation collects several individual discourse referents from the context and turns them into a plural discourse referent. I propose that summation can also apply in the domain of events. Let us assume that each verb introduces its own event discourse referent in coordinated structures such as (80b). Summation will turn these singular discourse referents into a plural discourse referent *E* that can be referred to in subsequent discourse. As a result, the proform *–weil-* is free to pick up *E* as its value. Looking back at (78), it turns out that the assumption of summation cannot account for these cases. The separate individual events are located in the scope of a universal quantifier (an overt one in (78c), and – arguably – the covert distributivity operator *DIST* in (78ab)) and cannot be collected by summation. For cases like these, Kamp & Reyle (1993:309ff.) propose a second semantic operation of ‘abstraction’, which is able to form a set from entities in the scope of quantifiers. If abstraction also applies in the domain of events, the discourse anaphoric behaviour of adverbial *jeweils* in (78a-c) is accounted for (see also section 1.2.2, fn.14 for a related discussion).

In this section, I have discussed the context dependency of adverbial *jeweils*. The value for the relation variable *R* is not dependent on a specific linguistic context, and the assignment of an appropriate value depends to a great extent on the language user’s knowledge as to which relations can plausibly hold between two sets of events. In contrast, the value for the restriction variable *E* is denoted by the proform *–weil-*, whose antecedent must be recoverable from the context. It was shown that the same contexts

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35 I simplify somewhat. To be more precise, dynamic quantifiers have a variable over possible continuations in their scope. As the discourse proceeds, the variable is replaced with the semantic representation of subsequent sentences. As a result, any free variables contained in these representations will get into the scope of the dynamic quantifier.
license the construction of antecedents for the plural pronoun sie and –weil-, supporting the analysis of –weil- as a proform. Finally, I have suggested that the construction of appropriate plural antecedents for jeweils happens by means of the two dynamic semantic operations of summation and abstraction from Kamp & Reyle (1993). These processes take place at the discourse level of semantic representation and form plural events out of individual events. The plural events can be picked up anaphorically by jeweils.

2.4 Accounting for the Distribution of Adverbial Jeweils

The semantic analysis of adverbial jeweils accounts for its syntactic distribution as well. This is important because one of the underlying assumptions of this thesis is that lexical elements occur only in positions where they can be interpreted (compositionally). It has already been shown that adverbial jeweils can be interpreted in VP-adjoined position. It still needs to be shown how jeweils can also be interpreted in higher positions, namely in IP-adjoined position or in SpecCP, and why it cannot be interpreted in lower positions, that is, inside VP.

I will start by recalling why adverbial jeweils can be interpreted in VP-adjoined position. Adverbial jeweils denotes a generalised quantifier over events. It is of type <<v,t>>, and needs an argument of type <<v,t>>, i.e. a set of events. This type is the logical type of VPs on the subject internal hypothesis. That VPs uniformly denote sets of events follows on Kratzer’s claim that the event argument is the external argument of the verb, which – by definition – must be realised outside the verb’s maximal projection. Since the VP-denotation is of the right type to serve as semantic argument for the meaning of jeweils, the two expressions can combine by functional application.

It also follows from the external argument status of the event argument that adverbial jeweils cannot be located inside VP, say adjoined to V (81a), or adjoined to V’ (81b).

(81) a. *\[VP t_{subj} [v DO [v jeweils V]]] b. *\[VP t_{subj} [v jeweils [v DO V]]]

The semantic type of the bare transitive verb in (81a) is <e<<v,t>,v,t>>. Transitive verbs establish a ternary relation between two individuals (subject and object) and an event. The semantic type of the verb is not of the right kind to combine with the quantifier meaning of jeweils, resulting in type mismatch. By the same token, adverbial jeweils cannot be interpreted in V’-adjoined position in (81b). The semantic type of V’ after functional application of the verb denotation to the object denotation is <e<<v,t>,v,t>>. This type cannot serve as argument to the generalised quantifier jeweils either, again causing a type mismatch. The same reasoning applies to intransitive verbs, which are of the same semantic type as V’. The impossibility of adverbial jeweils inside VP therefore follows from the semantic type of jeweils.

Regarding the possibility of jeweils to occur adjoined to IP, or in SpecCP, I assume that jeweils has moved there from its base position, which is adjoined to VP. The structure after movement is shown in (82).

(82) \[CP jeweils_{1} hat [IP Peter_{2} [VP1 t_{1} [VP2 t_{2} gewonnen]]].
   each.time has Peter won
   ‘Each time, Peter won.’

It seems implausible that the content element jeweils is base generated in the functional left periphery of the clause, which functions as the landing site of topicalised elements and
question words. Not surprisingly, jeweils in (82) has topic status, like other elements that have moved to the left periphery. (82) is interpretable on the assumption that the moved jeweils leaves behind a trace of type <v> (event). The situation is parallel to the situation found with moved generalised quantifiers in the individual domain, which leave behind a trace of type <e> (individual). The meaning of (82) is composed as follows.

\[(83)\]

\(\begin{align*}
\text{a. } [[\text{VP}_2 \ t_2 \ \text{gewonnen}]] & = \lambda e. \ \text{won}'(x_2, e) \\
\text{b. } [[\text{VP}_1 \ t_1 \ t_2 \ \text{gewonnen}]] & = \text{won}'(x_2, e_1) \\
\text{c. } [[\text{VP}_1 \ t_1 \ t_2 \ \text{gewonnen}]] & = \lambda x_2. \ \text{won}'(x_2, e_1) \\
\text{d. } [[\text{IP} \ \text{Peter}_2 \ t_1 \ t_2 \ \text{gewonnen}]] & = \text{won}'(\text{Peter}, e_1) \\
\text{e. } [[\text{IP} \ \text{Peter}_2 \ t_1 \ t_2 \ \text{gewonnen}]] & = \lambda e_1. \ \text{won}'(\text{Peter}, e_1) \\
\text{f. } [[\text{jeweils}_1]] & = \lambda q, x_2, e \ [e \in E \Rightarrow \exists e' [q(e') \land R(e,e')]] \\
\text{g. } [[\text{CP} \ \text{jeweils}_1 \ \text{hat} \ \text{Peter}_2 \ t_1 \ t_2 \ \text{gewonnen}]] & = \forall e \ [e \in E \Rightarrow \exists e' [\text{won}'(\text{Peter}, e') \land R(e,e')]]
\end{align*}\]

(83g) is true iff for each atomic event of a contextually determined set of events E, there is an event e' such that Peter won in e' and such that e' is (temporally, causally, etc.) related to e. This adequately specifies the truth-conditions for (82), showing that adverbial jeweils can be correctly interpreted after overt movement.

2.5 Summary

Summing up, it has emerged that jeweils is compositionally interpretable in its base position, which I take to be a VP-adjoined position. Jeweils denotes a double quantifier which universally quantifies over a plurality of atomic events, and which introduces an additional event in its nuclear scope. An existential quantifier in the scope of the universal quantifier binds this new event. It is related to the event bound by the universal quantifier by means of a free relation variable R whose value is contextually determined. The relation variable is the denotation of the empty preposition P0, which forms a semantic unit with the QP jeweils. The discourse anaphoric behaviour of adverbial jeweils was put down to the anaphoric nature of the proform –weil-. The antecedent of –weil-, a set of events, is usually construed by means of the DRT operations of summation and abstraction, or some such process. Finally, it was shown that the syntactic distribution of adverbial jeweils follows directly from its semantics. Adverbial jeweils occurs only in those surface positions where it can be interpreted.

3 The Semantics of Adnominal Jeweils - Preliminaries

In the previous section, adverbial jeweils was analysed as a generalised quantifier over events. This section prepares the semantic analysis of adnominal jeweils (and its counterparts in other languages), to be presented in section 4. I start with a few remarks concerning some general objectives of the semantic analysis of adnominal jeweils in section 3.1. In section 3.2, I give an overview over existing semantic accounts of adnominal jeweils or its distance-distributive counterparts in other languages.

3.1 Desiderata for the Analysis

In chapter II, adverbial and adnominal jeweils have been shown to occur in different syntactic configurations. Adverbial jeweils is adjoined to VP. Adnominal jeweils forms
part of a complex DP. The position and internal structure of jeweils-DPs is repeated in (84ab):

(84)  a. ...., weil [DP die Jungen, [VP t₁ [DP jeweils zwei Würstchen] gekauft haben]].
    b. [DP [PP jeweils]₂ D₀ [NP zwei Würstchen] t₃]]

In III.4.3, I have presented arguments to the extent that adnominal jeweils does not move at LF, and should therefore be interpreted in situ. This result fits in nicely with the requirements of surface compositionality and leaves us with a first desideratum for the semantic analysis of adnominal jeweils: The semantic analysis of adnominal jeweils should take surface structures as in (84ab) as its input.

A second desideratum results from the co-existence of adverbial and adnominal jeweils. We have seen that the two occur in different syntactic configurations. But from this it does not automatically follow that they differ in lexical meaning. The difference in meaning could also be due to the proposed difference in syntactic position. Such a claim has been made e.g. by von Stechow (1996) for ambiguities observed with German wieder 'again'. Obviously, an analysis in terms of structural ambiguity that assigns adnominal jeweils a reading as close as possible to that of adverbial jeweils is to be preferred. Ideally, adnominal jeweils should be analysed as denoting a generalised quantifier as well.

On the other hand, we have to account for the d(istance)-distributive behaviour of adnominal jeweils, which poses a considerable challenge for a surface compositional analysis, and which led Choe (1987:27) to postulate a special semantic treatment of d-distributive each in English: “since s-each [= d-distributive each, MZ] is not affected by QR, it is like type 3 in that it requires special semantic interpretation.” What Choe means is that the special semantic behaviour of each (its d-distributivity, the clausemate constraint on its antecedent etc.) should be handled not in the syntactic component of the grammar, let’s say by applying QR, but by some semantic interpretation rule (ibid..28). In section 4.2, it will become apparent that a special semantic procedure is indeed necessary for an in situ interpretation of jeweils, albeit not along the lines proposed in Choe.

The objectives of section 4 are threefold, then: First, to develop a semantic analysis for adnominal jeweils that takes surface structures as those in (84ab) as input, and that is as close as possible to that of adverbial jeweils. In addition, given the observed similarities between adnominal jeweils and its d-distributive counterparts in other languages (binominal each, French chacun(e)), we should aim at a cross-linguistically unifying analysis. A second objective is to account for the d-distributive behaviour of adnominal jeweils, in particular its occurrence together with the DistShare inside a complex DP. The third objective is to forge disparate claims that the distributive effect with d-distributive elements involves either universal quantification or a special distributive relation into a uniform account.

In brief, the analysis of adnominal jeweils in section 4 is based on the following claims:

(85)  i. It is possible to interpret adnominal jeweils in surface position.
    ii. Adnominal and adverbial jeweils have (almost) the same semantics: both are generalised quantifiers.
    iii. Distance-distributivity does not exist as an independent semantic phenomenon (follows from 85ii)
    iv. The additional semantic complexity of adnominal jeweils that leads to its d-distributive behaviour is due to the complex structure of its embedding DP.
v. The (all-)quantificational force observed with adnominal *jeweils* is due to the QP *jeweil* itself. The relational part of its meaning is due to the presence of P⁰.

Before turning to the actual analysis, I give an overview over existing accounts of the semantics of d-distributivity, and of adnominal *jeweils* in particular. A discussion of the strengths and merits, as well as the weaknesses and shortcomings of the various proposals will provide a useful background for the discussion to follow.

### 3.2 Existing Accounts of D-Distributivity

There are not too many detailed semantic analyses of adnominal *jeweils*, or d-distributive elements in general. To my knowledge, four different semantic analyses have been proposed for German adnominal *jeweils* or its short form *je*: Link (1986/98), Moltmann (1991), Moltmann (1997), and Sauerland (2001).

As discussed in chapter III.2.1.2, Link (1986/98) treats adnominal *je(weils)* as an overt instance of the distributivity operator, i.e. as denoting a universal quantifier adjoined to VP. A number of empirical arguments against such an analysis were listed there, and I shall set Link’s approach aside.

As discussed in III.4.2.6, Sauerland (2001) treats adnominal *je(weils)* as a universal quantifier with deleted NP-complement, which obligatorily moves at LF. Given the empirical and conceptual arguments against movement of adnominal *jeweils* at LF, I will set Sauerland’s analysis aside as well.

This leaves us with the two analyses of German *je(weils)* in Moltmann (1991) and (1997), to which we will turn shortly. The semantic analyses of d-distributivity in other languages are, to my knowledge, equally scarce in number. Most accounts (Safir & Stowell 1988, Choe 1987, Moltmann 1991, 1997) are about English binominal *each*. Junker (1995) is an interesting study of the semantics of French d-distributive *chacun*.

In the following subsections, I briefly present and criticise each analysis in turn. The purpose of these subsections is threefold: First, I will show that none of the existing analyses is surface compositional in the strict sense. Even stronger, with the exception of Moltmann (1997), none of the analyses is compositional at all. It is the non-compositionality of the existing analyses, then, which legitimates the search for a new, surface compositional analysis. At the same time, the conspicuous lack of compositional analyses underlines the problem posed for (surface) compositionality by the existence of d-distributive elements. Second, the discussion of previous analyses will bring to light that most of them suffer from other shortcomings besides their being non-compositional. Again, this is meant to motivate the search for an alternative analysis. Third, the survey of the existing analyses will bring to light that two central assumptions are found repeatedly in most analyses. The first is the contention that d-distributive elements are essentially ‘relational’ in nature. This means that their key function seems to be to establish a relation between members of the DistKey and members of the DistShare. The second assumption found in most analyses is that the distributive effect is due to the presence of a universal quantifier. Below, I argue that both assumptions are essentially on the right track. Consequently, both notions of a distributive relation and of universal quantification form part of the surface compositional analysis of *jeweils* to be presented in section 4.

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36 The same holds for other theories of distributivity which make crucial use of overt or covert distributivity operators, e.g. that of Roberts (1987).
3.2.1 Safir & Stowell (1988): D-Distributive Each as a Binary Quantifier

As discussed in chapter II.5.3, Safir & Stowell’s (1988) analysis of d-distributive each focuses on LF-movement. Since the authors are mainly interested in the syntax of the construction, a detailed semantic analysis is lacking. Nevertheless, a brief look at their analysis will prepare the scene for the discussion of subsequent analyses.

Safir & Stowell argue that d-distributive each is relational in nature. For them, it relates elements of the DistKey and elements of the DistShare by means of a 1:1-function. For instance, in (86), each seems to map each member of the set of boys onto a different ball such that the two stand in a kicking-relation.

(86) The boys kicked one ball each.

Formally, Safir & Stowell capture the relational nature of binominal each by treating it as a binary quantifier that quantifies over pairs of (elements of) two sets such that a particular relation obtains between the two members of the pair. The two sets are denoted by DistKey and DistShare respectively. (87) is a tentative formalisation of (86) in the spirit of Safir & Stowell (cf. the formal reconstruction of Safir & Stowell’s idea in Moltmann 1991:287):

(87) $\text{each}_{\text{binom}}(<\text{[the boys \text{DistKey}]}, \text{[one ball \text{DistShare}]}>)(\lambda x \lambda y. y \text{ kicks } x)$

Given an appropriate definition for the binary quantifier $\text{each}_{\text{binom}}$, (87) will be true iff each element of the set of boys stands in a kicking relation with an element of the set of singletons of balls, and no two boys kick the same ball.

The semantic content of each is reflected to a certain extent in the syntactic analysis of Safir & Stowell (1988). They take each to project a QP by combining with expressions that are co-referent with DistKey and DistShare respectively. This QP is base-generated in a position adjoined to the DistShare, and then raised and adjoined to IP at LF. (88ab) show base and LF-structure (after additional LF-movement of the DistKey subject) of the construction (see chapter II.5.3 for further discussion).

(88) a. $[\text{IP the boys$_i$} [\text{VP kicked [DP [DP one ball$_j$] [O$_{\text{PRO}}$ [each $_i$]]]]}]$  
b. $[\text{IP the boys$_i$} [\text{IP [O$_{\text{PRO}}$ [each $_i$]]$_i$} [\text{VP kicked [DP [DP one ball$_j$] t$_j$]]}]$]

Safir & Stowell’s analysis captures some important insights into the semantic nature of d-distributive each. Nevertheless, a number of problems remain. The first problem is empirical in nature. As will be shown in connection with the discussion of Moltmann (1991) in section 3.1.3, there is reason to doubt the assumption that each always maps elements of the DistKey onto elements of the DistShare in 1:1-fashion. This is unproblematic for the semantic analysis in (87), though, which does not explicitly express the 1:1-restriction. An appropriate definition of $\text{each}_{\text{binom}}$ should be able to solve this problem.

The second problem stems from treating each as a binary quantifier that takes a pair of sets as its first argument. It differs in meaning from D(eterminer)-each, which ranges over sets only. Stowell & Safir’s account therefore leaves us with no explanation for the formal similarity between D-each and d-distributive each. By the same token, extending Safir & Stowell’s account to German jeweils would leave us with no account for the
formal identity of adnominal jeweils and adverbial jeweils. The latter was shown to be a
generalised quantifier over events in IV.2.

The third problem arises in connection with compositionality. It remains somewhat
mysterious how to get to the logical representation in (87) from the LF-structure in (88b).
The following questions arise in particular. How is the trace of the raised QP interpreted,
or how does its value combine with the meaning of the object DP? How can the VP
denote a relation, as it should if the logical representation in (87) is on the right track? In
this connection, it is also not clear to me how the object argument slot can be “opened up”
by λ-abstraction, without losing the descriptive content expressed by the object DP one ball.

Summing up, it shows that a compositional interpretation of binominal each is at best
problematic on Safir & Stowell’s analysis, perhaps impossible. It also shows that the
analysis does not allow for a uniform account of d-distributive each (or jeweils for that
matter) and D-each on the one hand, and adverbial jeweils on the other. On a positive
note, Safir & Stowell are the first to point out the relational character of d-distributive
constructions with each. Let us keep this part of their analysis in mind.

3.2.2 Choe (1987): A Bipartite Analysis of D-Distributivity
Choe (1987) also stresses the relational nature of distributivity. The basic idea is to factor
out the distributive meaning aspects of a sentence from its propositional content. On this
view, the distributive sentence in (86) denotes a bipartite structure, namely a conjunction
of two parts. The first part is the propositional meaning, the second part specifies the
distributive relation.

(89) kick’([[the boys]], [[one ball]]) & Dist([[the boys]], [[one ball]])

(89) says that there is a kicking of balls by the boys and that elements of the set of boys
and elements of the set of balls stand in a distributive relation to one another.
Unfortunately, Choe (1987) is forced to step back from the representation in (89) for
technical reasons that need not concern us here (cf. ibid.:115). Nevertheless, he succeeds
in maintaining the split between propositional and distributive aspects of a sentence’s
meaning, albeit in a different form. Choe proposes to build the split into the semantic
component of the grammar. On this view, the semantic component is a step-by-step
procedure, which first sees the construction of a propositional core that is underspecified
concerning possible distributive relations between arguments of the same predicate. On
this propositional structure, a distributive relation is superimposed in a second step.
Crucially, the distributive relation is restricted to co-arguments. This restriction accounts
for the clausemate restriction observed with d-distributive elements in chapter II.1.7). It is
important that, contrary to what Choe (1987:76) claims, the distributive relation is not
factored in by means of ‘conjunction’, but rather through binding of variables by insertion
of appropriate quantifiers (ibid.:114). In a third step, any remaining free variables are
bound by existential closure. The resulting picture is shown in (90).

(90) 1st step: construct the propositional core meaning
    ⇒ logical representation underspecified as to distributivity

2nd step: introduce a distributive relationship into the logical representation by in-
serting appropriate quantifiers, thus binding free (argument) variables

3rd step: bind the remaining free variables by means of existential closure.
    ⇒ logical representation fully specified as to distributivity
To illustrate, consider Choe’s example (91):

(91) Two examiners marked six scripts.

(91) is at least three-ways ambiguous between the readings in (92a-c).

(92) a. A group of two examiners marked a group of six scripts.
    b. Each of two examiners marked a group of six scripts.
    c. Each of six scripts was marked by a group of two examiners.

The so-called ‘group reading’ in (92a) establishes no distributive relation between the two arguments of the verb. In (92b), groups of six scripts are distributed over the parts of a group of two examiners. In (92c), the inverse distributive relationship holds. Groups of two examiners are distributed over the parts of a group of six scripts. How do we get from (91) to the different readings in (92)? In Choe’s system, the first interpretive step in (90) assigns (91) the preliminary propositional meaning in (93):

(93) \( M( E_2, S_6) \)

\( E_2 \) and \( S_6 \) are free variables introduced by the numeral indefinites in (91). \( E_2 \) is a variable for plural individuals consisting of two examiners. Likewise, \( S_6 \) is a variable for plural individuals consisting of six scripts (ibid.:111). If no distributive relation is established, step two in (90) is left out, and the two variables are bound by existential closure. This leaves us with (94) as the semantic representation for the group reading in (92a).

(94) \( \exists E_2 \exists S_6 [M( E_2, S_6)] \)

When a distributive relation between the two arguments is established, step 2 in (90) applies. It introduces a universal and an existential quantifier into the representation.\(^{37}\) It is important that the existential quantifier always occurs to the right of the existential quantifier. Depending on which variable is bound by universal and existential quantifier respectively, we arrive at the logical representations in (95ab) (where \( i\text{-part} \) stands for the individual part-relation):

(95) a. \( \forall e [i\text{-part}(e, E_2)]: \exists S_6 [M( e, S_6)] \)
    b. \( \forall s [i\text{-part}(s, S_6)]: \exists E_2 [M(E_2, s)] \)

(95ab) still contain one unbound variable each: \( E_2 \) in (95a), and \( S_6 \) in (95b). In step 3 of the interpretive procedure, these are bound by existential closure, as shown in (96ab):

(96) a. \( \exists E_2 [\forall e [i\text{-part}(e, E_2)]: \exists S_6 [M( e, S_6)]] \)
    b. \( \exists S_6 [\forall s [i\text{-part}(s, S_6)]: \exists E_2 [M(E_2, s)]] \)

\(^{37}\) Cf. Kempson & Cormack (1981) and Gil (1982b) for a more detailed discussion of such sentences and what they can mean.

\(^{38}\) In addition, the upper key variable bound by the universal quantifier must be replaced with a corresponding lower key variable that ranges over i-parts. See Choe (1987:116) for details.
(96a) is the logical representation of (92b), and (99b) the logical representation of (92c). Both formulas adequately specify the truth-conditions of (92bc).

The two core features of Choe’s analysis are the bipartition in propositional meaning and distributive meaning and the derivation of the distributive effect from the interaction of a universal quantifier and an existential quantifier in its scope. Furthermore, the analysis seems to give an adequate account of sentences of the kind in (91).

A number of problems remain, though, some of them not trivial. To begin with a technical problem, Choe’s analysis implies the existence of a potentially infinite number of variable types. This is because he does not separate the variable provided by indefinites from their descriptive content, as is done for instance in Heim (1982) or Kamp (1981). Instead of assuming one variable type for atomic individuals and another one for plural entities, he assumes the existence of variables that stand for groups of a particular kind and of a particular size. In the example above, $E_2$ is a variable that stands for groups of two examiners. That way, Choe must assume a different variable type for every possible description of a group of individuals (examiners, scripts, tables, dogs, women, man, children, professors etc.). Thus, the mechanism leads to a system with a potentially infinite number of different variables for entities of the same logical type (group or set), instead of a system in which the variables differ only with respect to the logical type (entity, set, group etc.) of the things they replace. I leave it open here, if this unwelcome consequence can be overcome, possibly by teasing apart the variable content and the descriptive content (the restriction of the variable) along the lines proposed in Heim (1982) or Kamp (1981).

Turning to the compositionality or non-compositionality of the analysis, Choe (ibid.:76, fn.2) acknowledges that his analysis of distributivity is not in line with standard compositional semantics. This is so because his analysis first factors out the distributive aspect of the meaning from the propositional content of a sentence, and brings it back in later on in the interpretive procedure. For multiply ambiguous sentences such as (91), which are plausibly analysed as being underspecified regarding distributivity, such an approach might seem feasible. First, we interpret the verb and its two arguments, which are overtly expressed. A second step factors in the distributive relation, which is not overtly expressed. It should be clear, though, that such an account runs into problems as soon as a sentence is disambiguated (for distributivity) by the presence of an overt distributive element. In (97), the presence of d-distributive each forces distribution of the object denotation over the subject denotation:

(97) Two examiners marked six scripts each.

Now, if it is true that the semantic component first construes the bare propositional aspect of the meaning, and only then its distributive content, we expect the first step of the semantic composition to be blind to the presence of each. It only becomes relevant in the second step. Each itself seems to be void of any semantic content. Its d-distributive nature only helps the semantic component to choose from a number of alternative procedures, which can apply independently anyway. Presence of d-distributive each signals the semantic component that the NP forming a constituent with each (here: six scripts) must be interpreted as the DistShare of the distributive relation. It follows that only the logical representation in (96a) is an adequate representation for (97), for neither in (94) nor in (96b) does the meaning of six scripts form the DistShare.

It seems, then, that Choe does not locate the quantificational force inside the d-distributive element itself. Rather, this element is void of any semantic content except for
a general instruction to the semantic component: “Whatever I form a constituent with, must be interpreted as DistShare”. Perhaps, it is because of this semantic emptiness that Choe does not feel obliged to discuss the semantics of d-distributive each in detail (cf. also Junker 1995:113).

Summing up, in Choe’s non-compositional framework it is impossible to ascribe a specific meaning to d-distributive elements such as binominal each and jeweils. In addition, the formal resemblance between D-quantifiers and d-distributive quantifiers in many languages would appear to be a mere accident. On the positive side, the distributive effect is derived from the interaction of a universal quantifier with an existential quantifier in its scope. This is reminiscent of the discussion of the semantics of adverbial jeweils in section 2, suggesting a uniform analysis of the two items. Furthermore, Choe (1987) suggests a semantic split in the construction of propositional and distributive parts of the meaning. Some special mechanism seems to be required to combine the basic meaning of the verb with the distributive meaning of the d-distributive element, which forms a constituent with the DistShare. The final analysis in section 4 will feature just such a special mechanism.

3.2.3 Moltmann (1991): A Bipartite Function Analysis

Three features of Safir & Stowell’s (1988) and Choe’s (1987) analyses are found back in Moltmann’s (1991) analysis of English d-distributive each, which is formally much more explicit than the previous two. From Safir & Stowell, we find back the analysis of each as a binary distributive quantifier, and the assumption that distribution with binominal each involves a 1:1-function from elements of the DistKey onto elements of the DistShare. From Choe, we find back the assumption that the semantic representation of sentences with binominal each is bipartite, i.e. split into a propositional and a distributive part. Both parts are joined by conjunction. The semantic representation of (98) is given in (99) (ibid.:287f.), where P denotes the ‘relevant part of’-relation, domf the domain of f, and ranf the range of f.

(98)  The singers sang one song each.
(99)  \[ \exists e \left[ \text{sing}(e, \{\text{the singers}\}, x) \& \text{songs}(x) \& \exists f \left[ \text{f is a 1:1-function}, \text{its domain constituted by the set of singleton sets of songs}, \text{its range constituted by the set of singers}, \text{and f relates individual singers and songs in the relation of singing.}\right] \right] \]

(99) reads as ‘There is an event e, and an individual x such that e is a singing of songs by the singers and there is a function f such that f is a 1:1-function, its domain constituted by the set of singleton sets of songs, its range constituted by the set of singers, and f relates individual singers and songs in the relation of singing.’

This treatment adds two new aspects to the discussion of d-distributivity. To begin with, Moltmann considers distributive 1:1-functions to be semantically relevant entities. The distributive effect is attributed to the 1:1-function, and not to universal quantification. I therefore refer to Moltmann’s analysis as ‘function analysis’. On this treatment, (98) involves two event layers, a lower one of individual singers singing one song, and a higher one of a complex superevent that has the individual singing events as its (material) parts. The assumption of two event layers will be found back in the semantic analysis of adnominal jeweils to come. However, as indicated at the end of section 1.3, I will capture the relation between the atomic events and the higher event level in terms of

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39 To be fair, the two items have no formal resemblance in Korean, on which Choe’s analysis is partly based. They do, however, in English, on which his analysis is based as well.
the element-of, rather than the material part-of relation. This is because sentences containing adnominal jeweils invariably have a plural participant because of the plurality condition on adnominal jeweils from section II.1.5. If I am correct in analysing the presence of a plural participant as indicating the presence of a plural event (see section 1.2.2), it follows directly that the presence of adnominal jeweils indicates the presence of a plural event.

Moltmann’s (1991) analysis is formally explicit and seems to adequately capture the truth conditions for sentences containing d-distributive each. In addition, the analysis incorporates events and functions as semantically significant entities. Furthermore, the analysis succeeds in giving a unified account of sentences involving d-distributive each and sentences involving event-related quantifiers. Consider (100).

(100) John wrote the book in chapters

The semantic representation of (100) is similar to that of (98) in (99). The relevant difference is that the range of the 1:1-function in (100) is not constituted by individuals participating in a superevent, but by a group of subevents of the superevent of John writing the book.

Since Moltmann’s analysis can deal with individual (i.e. participant) and event related quantifiers, it may look tempting to apply it to adverbial jeweils as well. After all, distributing over events is just what adverbial jeweils does. However, there are a number of reasons not to do so. First, it was shown in section 2 that adverbial jeweils can be analysed as an adverbial quantifier over events. There is no need, then, to replace this analysis with a more complicated analysis à la Moltmann. Second, Moltmann does not extend her analysis of binominal each to adnominal je(weils) because of a purported difference between the two items concerning their scopal behaviour concerning indefinite arguments in their c-command domain. In a nutshell, Moltmann claims that such arguments obligatorily take wide scope over each in English, while they can take scope under je(weils) in German.

(101) a. The men gave one flower each to two women.  (ibid.:289, ex. 41.b)  
   ‘There are two women, such that each of the men gave them a flower.’  

b. Die Männer gaben je eine Blume einer Frau.  (ibid.:291, ex. 45b)  
   the men gave each one flower one woman  
   ‘The men gave a flower each to a different woman.’  (M.’s paraphrase)

According to Moltmann, the obligatory wide scope of the indefinite prepositional object in English is accounted for since it enters the first conjunct of the bipartite structure qua its status as argument. Being located inside the first conjunct, it cannot get into the scope of the function in the second conjunct. Since narrow scope is possible for the indirect object in German, Moltmann (1991:291) argues that the analysis of German je(weils) must be different. She proposes to treat je(weils) as a binary universal quantifier over individuals. I will leave aside the details of her analysis. I will also leave aside the question of whether the indefinite prepositional object must take scope over each in (101a). What makes

40 Moltmann (1991:289) concedes that not all English speakers share this judgment. If so, there is no reason to treat each and jeweils in a different manner, at least not for these speakers. Alternatively, one could argue that the prepositional object is not in the c-command domain of binominal each in (101a). If so, the difference between English and German would be structural in nature.
Moltmann’s proposal somewhat unappealing as an analysis of je(weils) is that it does not allow for a unified treatment of English and German d-distributive elements. Given that the two items behave alike in many respects, this is not a welcome result.

Turning back to the formal analysis of each, observe that Moltmann’s analysis is not surface compositional. It is not clear how to get from the surface structure of (98) to the semantic representation in (99). For convenience, the two structures are repeated as (102ab).

(102) a. [IP The singers [VP sang [DP one song each]]].
    b. \( \exists x \{ \text{sing}(e, [[\text{the singers}]], x) \& \text{songs}(x) \& \exists f \{ 1:1 \& \text{ranf} = \{ z | z P [[\text{the singers}]] \} \& \text{domf} \subseteq \{ \text{one song} \} \& f \subseteq \{ < z, y > \mid \exists e’ (e’ P e \& \text{sing}(e’, z, y)) \} \} \]

In particular, it remains unclear what the lexical meaning of each is and how it combines with the other elements of the sentence. In addition, there are a number of technical questions of which I will mention two.

First, the value of the direct object one song enters the semantic representation in (102b) twice. In the first conjunct it provides the plural restriction songs for the variable x. In the second conjunct, it helps to define the domain of f. The question is how the object can enter the semantic composition twice, and how the plural restriction songs is abstracted from the concrete phrase one song.

The second question regards the nature of the function as being necessarily a 1:1-function. The 1:1-status is based on a claim that is repeatedly found in the literature and which was already discussed in connection with Safir & Stowell’s analysis (see also Choe 1987). According to the cited studies, d-distributive each has a property which is not shared by D-each, or floated each. D-distributive each is considered to impose a ‘co-variation’ or ‘distinctness’ condition on its DistShare. Consider (103ab):

(103) a. The boys kicked one ball each.
    b. Each boy kicked one ball.

It is true that (103a) is preferably interpreted in such a way that each boy kicked a different ball, i.e. the balls vary with the kicking boys. The same does not hold for the D-quantifier each in (103b), which is ambiguous between a reading on which the same ball is kicked by all the boys (wide scope for one ball), and a reading on which different balls are kicked (narrow scope), and a number of intermediate readings. The 1:1-restriction on the function in the formal representation in (102b) is meant to capture this distinctness condition. However, Moltmann (1991:285) also observes that the distinctness condition (encoded by the 1:1-restriction) is too strong when applied to actual entities in a model. She argues, correctly I think, that (104) can be uttered felicitously in situations in which some of the films are watched by more than one child.

(104) The children watched five movies each.

In response to (104), Moltmann suggests that the distinctness condition should not hold between actual entities, but between discourse referents (Kamp 1981, Heim 1982). In other words, the use of d-distributive each in (103a) “does not imply that the actual movies are distinct, but rather that the movies as they are represented in the universe of discourse are distinct” (ibid.). Even if this explanation could be made to work, it remains unclear why the distinctness condition should still form part of the truth-conditions in
As it stands, (102b) is too strong because it excludes the existence of an overlapping reading for (104).

To conclude, Molhann’s analysis is not compositional. It leaves open the question of how the object denotation can enter the semantic representation twice (and in different form). And it makes an incorrect empirical prediction regarding the distinctness condition. In addition, the analysis does not allow for a uniform account for English *each* and German *jeweils*. On the positive side, Moltmann points out the existence of two event layers in connection with d-distributive elements.

3.2.4 Junker (1995): A Conceptual Function Analysis

Junker discusses the semantics of the French counterpart of *jeweils* and *each*, *chacun(e)*. Her analysis is cast in the semantic framework of Jackendoff’s conceptual semantics (Jackendoff 1983). In this framework, syntactic units (words and maximal projections) are mapped onto conceptual entities such as (sets of) entities, events, processes etc. Nevertheless, Junker’s analysis incorporates concepts similar to those we have encountered above. In particular, she also takes a relational view on distributivity. The analysis relates elements of the conceptual counterparts of DistKey and DistShare by means of a function.

Junker analyses d-distributive *chacun(e)* as consisting of a distributive operator *chaque* and a pronominal element *un(e)*. The pronominal element ranges over sets and denotes (is co-indexed) with the DistKey, the distributive ‘domain’ in her terminology. So far, the analysis is in line with the analysis of *jeweils* from chapter III, where it was argued that *jeweils* consists of a quantifier *je*, and a proform –weil-, which ranges over sets. The meaning of d-distributive *chacun(e)* is given in (105), with \( X \) = the domain, \( Y \) = the co-domain (i.e. the DistShare), and \( P \) standing for the relation ‘a relevant part of’:

\[
\forall x P X \exists y P Y [f(x) = y]
\]

(105) reads as ‘for each relevant part \( x \) of the domain (the DistKey), there is a relevant part \( y \) of the co-domain (the DistShare) such that \( x \) is mapped onto \( y \) by function \( f \).’ Again, we encounter the concept of ‘function’ in connection with distributivity. And again, the distributive operator seems to demand two sets (here \( X \) and \( Y \)) as arguments. Presumably, the value of the domain \( X \) is identified through co-indexation of pronoun and an appropriate antecedent. The value of the co-domain \( Y \) is established structurally. It is provided by the maximal projection that forms the syntactic sister of *chacun(e)*, or by the constituents dominated by this maximal projection. In the case of d-distributive *chacun(e)*, which forms a constituent with the DistShare expression, it is this DistShare expression that provides the co-domain. On Junker’s analysis, (106a) has the semantic representation in (106b):

(106) a. Les garçons, ont acheté [[deux livres] chacun].

b. \( \forall x P [[the boys,]] \exists y P [[two books]] [f(x) = y]\)

‘For each \( x \) which forms an individual part of the group of boys, there is an individual \( y \) of the set of groups of two books, such that \( x \) is mapped onto \( y \) by function \( f \), which here is the function of ‘being bought by’ applied to \( x \).’
The paraphrase of (106b) should not be understood as a truth-condition. Rather it indicates that certain syntactic entities (here domain and co-domain) are mapped distributively onto conceptual entities such that these stand in a particular relation, e.g. a relation of buying.

The merit of Junker’s analysis lies in its unifying force regarding the semantics of D-chaque ‘D-each’, floated chacun(e), and d-distributive chacun(e). They all have the same underlying lexical entry in (105). They differ concerning the syntactic complement of the quantifier itself (D-chaque: full NP, floated and binominal chacun(e): pronominal element), and they differ concerning the syntactic sister of the entire QP (D-chaque: IP, floated chacun(e): VP, binominal chacun(e): DP). Differences in interpretation of the various elements derive from differences in the interpretation of their syntactic sisters. This highlights the importance of structural factors. Apart from providing a unified analysis for the different distributive quantifiers of French (which seems easily transferable to English), the sensitivity to syntactic structure is a second merit of Junker’s analysis. Unfortunately, compositionality does not go all the way through. Only the determination of domain and co-domain is compositional, while the function part itself is not (cf. Junker 1995:124).

3.2.5 Moltmann (1997): Binary Distributive Quantifiers - Modified

Moltmann (1997) revises her earlier analysis of d-distributive each and jeweils. These elements are still analysed as binary distributive quantifiers, but the details of the analysis have changed considerably. There are two major differences to the analysis in Moltmann (1991). First, the distributive effect is not due to the working of a 1:1-function, but results from the interaction of universal and existenial quantification (as in Choe 1987). Second, adnominal jeweils is analysed as always (universally) quantifying over (parts of) events.

Moltmann’s argument for the inherent event-quantificational nature of adnominal jeweils is based on sentences like (107), which were introduced in chapter II.1.8 under the heading ‘Moltmann’s observation’.

(107) Peter hat Maria aus jeweils zwei Gründen gelobt und kritisiert.
Peter hasMaria for each two reasons praised and criticised
‘Peter praised and criticised Maria for two reasons respectively.’

In (107), jeweils seems to distribute over the parts of a complex event that consists of the two subevents of Peter praising Maria and Peter criticising Maria. Based on (107), Moltmann extends the analysis of adnominal jeweils as an event-quantifier to (108), which so far has been analysed as involving quantification over the DP-denotation, a plurality of children.

(108) Die Kinder bekamen jeweils ein Geschenk. (ibid.:207, ex. 108c)
the children got each one present
‘The children got one present each.’

In Moltmann’s semantic system, events are assumed to be complex along the temporal, the local, and the participant dimension. According to Moltmann, jeweils targets the participant dimension in (108). Jeweils distributes over a complex receiving event, which is denoted by the ‘D-term’ (= DistKey) bekamen ‘got’, and which consists of several subevents of individual children getting a present. Unlike German jeweils, English each cannot distribute over events, but only over individuals denoted by DPs (ibid.:207).
Therefore, the English counterpart of (108) is well-formed, while the English counterpart of (107) is not.

At first sight, the analysis of adnominal jeweils as a universal quantifier over parts of events looks appealing. With adverbial jeweils quantifying over parts of events as well, a single operation of event quantification seems to account for both instances of jeweils. Differences between the two occurrences of jeweils concern the context dependency of adverbial jeweils, and the way the distributive relation is established semantically. Therefore, a word of caution is in order before we go on to look at the formal implementation of Moltmann’s proposal. In the next subsection, it will be shown that an analysis of adnominal jeweils as obligatorily quantifying over events faces certain problems and should not be maintained.

Moltmann (ibid.:206) spells out the formal details of her analysis for the sentence in (109), possibly the most complex instance of adnominal jeweils that can be found. The complexity of (109) is also reflected in the final analysis proposed in section 4.3.4.

(109) Maria kritisierte und lobte jeweils zwei Bücher. (ibid.: ex. 108a)

‘Maria criticised and praised two books respectively.’

According to Moltmann (1997:208), (109) has the following denotation, with s standing for situations:

\[
\lambda s. \exists x[((kritisierte und lobte)s (e, maria, x) = 1 \& \forall e', e'' [(e' <_s e \& e'' <_s e \& e' \neq e'') \rightarrow \exists x', x'' [x' <_s x \land x'' <_s x \land [\text{zwei Bücher}] (x') = 1 \land [\text{zwei Bücher}] (x'') = 1 \land x' \neq x''] \land [\text{lobte und kritisierte}] s (e', maria, x') = 1 \land [\text{lobte und kritisierte}] s (e'', maria, x''))]
\]

(110) describes “situations in which there is an event e of Mary’s criticizing and praising an entity x such that for any two distinct parts e’ and e’’ of e there are two distinct groups x’ and x’’ of two books that are part of x such that e’ is a praising and criticizing of x’ and e’’ is a praising and criticizing of x’’” (ibid.).

It is unnecessary to go through all the details of (110). A few points seem worth mentioning, however. First, the bipartition into propositional content and distributive content shows up again in form of a conjunction. The main proposition is expressed by the first conjunct, the distributive relation is expressed by the second conjunct. Secondly, the descriptive content of the DistShare-DP ‘zwei Bücher’ ‘two books’ enters the semantic representation only in the distributive part (unlike in the earlier version, see the discussion of Moltmann (1991) above). In the propositional part, the object to be praised or criticised is expressed by a variable x. Third, the distinctness condition is now weakened to the non-overlap condition x’ ≠ x’’, which requires any two groups of two books to be non-identical.\(^{41}\) The last two points can be seen as improvements on the earlier analysis in Moltmann (1991).

A serious problem, at least in my eyes, comes from the fact that the distribution is over parts of a complex event, but not over the descriptive content of these subevents. The three-place relation that is predicated of the triple consisting of event, Mary, and a group

\(^{41}\) This condition allows for the same book to be part of both groups of two books in principle. In other words, (109) should be also true in a situation in which Mary praises ‘Absalom, Absalom’ and ‘To kill a Mockingbird’ (for their imagery of the South) and criticises ‘Absalom, Absalom’ and ‘Moby Dick’ (for their complexity).
of two books is still complex after distribution. It still denotes a conjunction of two Event types, a praising and a criticising. Consequently, the two (distributed) subevents \( e' \) and \( e'' \) are still events of praising and criticising, against our intuition. Moltmann sees this problem and argues that “an event can be a praising and criticizing even if it consists only of a praising or only of a criticising event” (1997:208). In other words, the truth conditions come out correctly if the second instance of \( [kritisierte und lobte] \) in (110) is applied to a praising event alone, and if the third instance is applied to a criticising event alone. Thus, (110) will be true in situations in which Mary praises two books and criticises two other books. However, with this extra assumption, the truth conditions become too weak for (109). If the conjoined relation \( [kritisierte und lobte] \) can apply to criticising or praising events in isolation, (109) will have to be true also in cases where Mary praises two books and praises two books in addition, i.e. where she praises four books in total. The same holds for Mary’s criticising four books (possibly in pairs of two), which should also come out as true. I do not see how to avoid this unwelcome consequence if we maintain that conjoined Event types can be instantiated by events that fulfil only part of the description. If we drop this additional assumption, however, the distributive effect will disappear, for then the subevents \( e' \) and \( e'' \) (after distribution) will still be complex events of praising and criticising.

A second problem regards surface compositionality. Moltmann’s (1997) analysis is compositional in the sense that the meanings of smaller syntactic units combine to form the meanings of larger units. However, the analysis is not surface compositional because it is forced to treat subject and verb as a syntactic unit (ibid.:208). This assumption is not in line with most work on the syntactic structure of German in the generative tradition (see e.g. Fanselow 1987a, Grewendorf 1988 among others). Clearly, a surface compositional analysis, which does not treat subject and verb as forming a constituent, is to be preferred.

The biggest problem for Moltmann’s analysis lies somewhere else, though. As mentioned already, the problem comes from the general claim that adnominal \( jeweils \) always distributes over events (as arguments of verbs). In the following, I present a number of empirical arguments that cast doubt on this claim.

3.2.6 Adnominal \( jeweils \) Does Not Always Distribute over Events

There are three empirical arguments which cast doubt on the assumption that adnominal \( jeweils \) always distributes over parts of events. The base line of all three arguments is the same. I show that adnominal \( jeweils \) is possible in contexts that either provide no event argument, or in which an adverbial quantifier competes for the same event argument. The possibility of adnominal \( jeweils \) in these contexts argues against an analysis as an (obligatory) event quantifier.

The first occurrence of adnominal \( jeweils \) that is not easily reconciled with an event-distributive analysis is already familiar from chapter II. There, it was shown that adnominal \( jeweils \) can occur inside a PP that is embedded inside another DP.\(^{42}\) Consider (111).

\[(111) \text{ Nur } [\text{DP } [\text{NP Autoren [PP von jeweils zwei Bestsellern]]}] \text{ wurden eingeladen.} \]
\[\text{‘Only authors of each two bestsellers were invited} \]
\[\text{‘Only authors of two bestsellers were invited to the party.’} \]

\(^{42}\) To be fair, Moltmann (1997:207) seems to assume an analysis different from the one above for \( jeweils \) in constructions like (111). Consider her comment above (107b). Unfortunately, no details are given.
In (111), *jeweils* seemingly distributes over a group of authors, each of whom is the author of two bestsellers. *Jeweils* does not distribute over the event argument of the main verb *eingeladen* ‘invited’. Such a construal would lead to the implausible statement that each of a group of invitations of an author involves two books. There also seems to be no event argument inside the DP over which *jeweils* could plausibly distribute. If a ‘hidden’ secondary event of *writing* was located inside the DP, (111) would incorrectly state that there is a set of writing events by a group of authors such that the individual writing events by individual authors result in two bestsellers, and that only authors involved in writing two bestsellers in one go were invited.\textsuperscript{43} I conclude that adnominal *jeweils* in (111) does not distribute over a group of events, but over a group of authors.

The second empirical argument against the analysis of adnominal *jeweils* as necessarily distributing over events comes from its co-occurrence with individual-level predicates. As shown in section 1.1.4, individual-level predicates do not take event arguments. It was also shown that adverbial *jeweils* is impossible with individual-level predicates for this reason. There is no event variable for the universal quantifier to bind in its nuclear scope. The impossibility of adverbial *jeweils* with individual-level predicates is shown again in (112ab):

(112) a. *Die Jungen haben jeweils Finnisch gekonnt.*
   The boys have each time Finnish known
   ‘Each time, the boys knew French.’

   the soldiers of the 5th division were each time short-sighted
   ‘The soldiers of the 5th division were short-sighted each time.’

In contrast, adnominal *jeweils* can co-occur with individual-level predicates without problem. This is shown in (113ab), where *jeweils* must be taken to distribute over the plural subject DP, due to the lack of events with individual-level predicates.

(113) a. *Die Jungen können jeweils zwei Fremdsprachen.*
   the boys know each two foreign languages
   ‘The boys know two foreign languages each.’

b. *Die Soldaten hatten jeweils nur ein Bein.*
   the soldiers had each only one leg
   ‘The soldiers had only one leg each.’

The insensitivity of adnominal *jeweils* to the absence of an event argument in (113) argues against its analysis as an event quantifier, especially when contrasted with the ungrammaticality of adverbial *jeweils* in (112).

The final argument against an analysis of adnominal *jeweils* as distributing over events comes from its co-occurrence with other event quantifiers. In section 1.3, it was shown that the co-occurrence of two (or more) event quantifiers leads to additional semantic

\textsuperscript{43} Even if an analysis in terms of hidden events could be made to work for (111), it is easy to find structurally parallel examples, where an analysis of the head noun in terms of a hidden event argument seems highly implausible. Consider (i):

(i) *Die Köche trugen Kuchen mit jeweils zwölf Kerzen herein.*
   the chefs carried cakes with each twelve candles in
   ‘The chefs carried in cakes, each with twelve candles.’
complexity. An extra event layer must be construed, and the higher quantifier quantifies over the restriction of the lower quantifier. Relevant examples are given in (114ab).

(114) a. The boys always slept sometimes.
    b. ?The boys sometimes always slept.

Similar facts obtain for adverbial jeweils, as shown in (115).

(115) ?Die Jungen haben immer jeweils geschlafen.
     the boys have always each time slept
     ? ‘The boys always slept each time.’

Like its English paraphrase, (115) requires considerable interpretive effort. In my view, this is due to the fact that the plurality of the subject induces a hierarchy of event types. The lower quantifier, jeweils ‘each time’, quantifies over a plural event of the individual boys sleeping. The higher quantifier immer ‘always’ quantifies over a set of sets of events.

If adnominal jeweils quantified over events like its adverbial counterpart, we would expect the former to interact with adverbial quantifiers in the same way. In particular, we would expect the higher quantifier to quantify over the restriction of the lower, with the corresponding semantic complexity. This expectation is not borne out, as witnessed by (116).

(116) Die Jungen haben immer jeweils zwei Frauen gemocht.
     the boys have always each time two women liked
     a. ‘The boys have always liked two women each.’
     b. ??‘The boys have always liked two women each time.’

In chapter II.2, sentences such as (116) were analysed as structurally ambiguous between an adnominal structure with an adnominal reading (116a), and an adverbial structure with an adverbial reading (116b). The adverbial reading of (116b) is very difficult to get. On the adverbial reading, (116) would be true in a situation where year after year (the effect of immer ‘always’), there are four balls, and on each of these balls (the effect of jeweils ‘each time’), each of the boys liked two women. In other words, the higher quantifier, immer, quantifies over the restriction of the lower quantifier, jeweils, which in turn must quantify over a plural event because of the plurality of die Jungen ‘the boys’ and the inherent distributivity of the predicate mögen ‘liked’.

In contrast, the adnominal reading does not involve double quantification over a plurality of events. (116a) only states that for all plural events E (in a contextually given

44 Note that the restricting set of events for adverbial jeweils need not be construed from the context in (115). It is provided by a plural event introduced by the higher quantifier immer ‘always’.

45 The contrast between adverbial and adnominal reading is predicted to be not so clear with predicates that allow for a collective construal, e.g. kaufen ‘to buy’. This is because events with collectively acting participants are not plural events (cf. section 1.2.1, fn.17). It follows that the higher quantifier need not quantify over a set of plural events, but only about a plural event. The prediction seems to be borne out, as witnessed by the fact that (i) allows for an adverbial reading more readily than (116).

(i) Die Jungen haben immer jeweils zwei Würstchen gekauft.
the boys have always each time two sausages bought
‘All plural events E (of relevant kind) are such that the boys have bought two sausages together in e.’

It seems, then, that the data in (116) and (i) support the claim that event quantification involves hierarchies of event types.
set of plural events $E'$), it holds that $E$ consists of the infatuations of the individual boys with two women each. The reduced interpretive complexity seems to follow from the fact that the higher quantifier \textit{immer} ‘always’ does not quantify over the restriction of the lower quantifier \textit{jeweils} ‘each’. Instead, both quantifiers seem to select their restriction independent of one another, which is accounted for if adnominal \textit{jeweils} distributes over the set of boys (the subject denotation) in (116), and not over a set of (sets of) events. I take this as evidence that both quantifiers distribute over different entities, a set of events in the case of \textit{immer}, and a set of individuals in the case of \textit{jeweils}.

Summing up, this section has adduced arguments against an analysis of adnominal \textit{jeweils} as obligatorily distributing over parts of events. I have presented three kinds of evidence: (i.) The possibility of adnominal \textit{jeweils} inside larger DPs where no event argument is accessible; (ii.) the possibility of adnominal \textit{jeweils} with individual-level predicates, where no event argument is present at all; (iii.) the non-interference of adnominal \textit{jeweils} with other event quantifiers. I conclude that adnominal \textit{jeweils} is free to distribute over entities other than events.

3.3 Summary

The overview over existing analyses of d-distributive elements has delivered the following results. There is no satisfactory surface compositional analysis so far. Second, all existent analyses attribute the observable distributive effect to the interaction of universal and existential quantifier, or to a distributive relation, or both. Third, adnominal \textit{jeweils} does not obligatorily quantify over events.

In the following, I present a surface compositional analysis of adnominal \textit{jeweils} which treats it as a generalised quantifier on a par with its adverbial counterpart. The analysis makes use of a universal quantifier and a relational part, and it does not treat adnominal \textit{jeweils} as necessarily quantifying over events. Instead, adnominal \textit{jeweils} is argued not to be subject to any constraints regarding its domain of distribution. In principle, any plurality can form the restriction for adnominal \textit{jeweils}.

4 Interpreting Adnominal \textit{Jeweils}: The Semantics of Distance-Distributivity

The survey of previous analyses of adnominal \textit{jeweils} and its counterparts in other languages has brought to light that there is no working surface compositional analysis to date. Furthermore, the discussion has suggested that a distributive relation should be present in the semantic analysis of these elements, apart from universal quantification. The semantic analysis of adnominal \textit{jeweils} should therefore contain such a relational component.

The objective of this chapter is to interpret clauses containing adnominal \textit{jeweils} in compositional fashion from surface structure. The structure for sentence (117a) has been identified in chapter III.4, and is repeated in (117bc). (117b) shows the structure for the entire clause on the adnominal reading. (117c) shows the internal structure of the \textit{jeweils}-DP.

(117) a. …, weil die Jungen jeweils zwei Bücher gekauft haben. ‘… because the boys each two books bought have’

b. …, weil [dp die Jungen, [vp t₁ [dp jeweils, zwei Bücher] gekauft haben]].

c. [dp [dp P₀ jeweils], D₀ [np [np zwei Bücher] t₁]]
The semantic analysis must provide an answer to the two questions in (118):

(118) i. How is the jeweils-DP in (117c) interpreted?
   ii. How does the meaning of the DP compose with the meaning of the remaining parts of the clause in (117b)?

In what follows, I will first give an answer to (118i), and then to (118ii).

As pointed out above, the two concepts of universal quantification and distributive relations play a crucial role in the analysis of jeweils-DPs. I argue below that the meaning of the constituent \([P^0 \text{jeweils}]\) provides for both - as was the case with adverbial jeweils. The quantifying element \(je\) provides the universal quantifier. The empty preposition \(P^0\) provides a relational variable \(R\). This way, the semantic values of adverbial and adnominal jeweils are identical. Adnominal jeweils differs from adverbial jeweils in that the value for \(R\) is not assigned by the context. Instead, it is provided by an overt relation-denoting element in the clause. The upshot of the discussion will be that jeweils-DPs do not denote entities of type \(<e>\), or generalised quantifiers of type \(<et, t>\), but propositions of type \(<t>\). Section 4.1 shows how this works in detail.

As for the question of how the proposition denoted by the jeweils-DP combines with the meaning of the rest of the clause, I will argue for a new semantic rule in 4.2. This semantic rule can be viewed as a more constrained version of Bittner’s (1994) rule of \(\lambda\)-abstraction. At the same time, it can be viewed as a more general version of Heim & Kratzer’s (1998) rule for interpreting moved constituents. That is, the semantic rule responsible for the interpretation of jeweils-DPs is motivated independently. As shown below, it is this rule that is responsible for assigning a value to the relation variable \(R\).

In applying the analysis to d-distributive jeweils, I adopt the strategy of simplest cases first. We begin with the interpretation of jeweils-DPs in object position of transitive individual-level predicates (cf.119a), and jeweils-DPs embedded inside another DP (119b). In both cases, jeweils occurs in an event-free environment (see section 3.2.6). The discussion then moves on to jeweils-DPs in object position of stage-level predicates, which take an event as argument. This case is illustrated by (117a) above. The presence of the event argument makes an additional assumption necessary, namely that the event argument of the verbal predicate can be bound by existential closure before the meanings of verb and jeweils-DP combine. In section 4.3, the analysis is extended to jeweils-DPs in indirect object position of ditransitive clauses (cf.119c), to jeweils-DPs inside PP-adverbials (119d), and finally to instances of Moltmann’s observation in (119ef).

(119) a. Die Jungen haben jeweils zwei Tätowierungen.
   the boys have each two tattoos
   ‘The boys have two tattoos each.’

   b. Listen mit jeweils drei Namen wurden herumgereicht.
   lists with each three names were passed around
   ‘Lists with three names on (each of) them were passed around.’

---

46 See Lipták & Zimmermann (2000) and Zimmermann (to appear, a) for earlier accounts of an in situ interpretation of d-distributive jeweils. In the cited studies, the required semantics were written into the lexical entry for d-distributive jeweils. This move generated the correct overall meaning, but made a unified treatment of adverbial and adnominal jeweils impossible. In comparison, the present analysis allows for a unified analysis of adverbial and adnominal jeweils, while at the same time deriving the correct readings from independent principles.
The semantic analysis of adnominal *jeweils* to be developed in this chapter presents a unified and coherent picture of the constructions in (119). All sentences with *jeweils*-DPs are compositionally interpreted from surface structure in uniform fashion. All interpretations are based on the same semantic value for adnominal *jeweils*.

Despite this welcome result, it will become clear at the beginning of section 4.3 that there are still more syntactic occurrences of *jeweils*-DPs that need accounting for. Most prominently, these include *jeweils*-DPs in underlying subject position as discussed in chapter II.1.6. The interpretation of *jeweils*-DPs in subject position is postponed to chapter V, where one additional piece is added to the analysis. The general picture is not changed by this addition. All instances of adnominal *jeweils* are interpretable in surface position in a uniform manner.

The structure of section 4 is as follows. In 4.1, I discuss the interpretation of *jeweils*-DPs. In 4.2, I introduce the λ-abstraction rules that are responsible for combining the meaning of a *jeweils*-DP with the meaning of its syntactic sister, and apply it to the basic cases in (119ab) and (117a). In section 4.3, I extend the analysis to the more complex cases in (119c-f).

### 4.1 The Interpretation of *Jeweils*-DPs

In this section, I lay out how *jeweils*-DPs can be interpreted compositionally. The syntactic input for the semantic component is repeated as (120).

\[
(120) \quad [\text{DP} [\text{PP} P^0 \text{jeweils}], \text{D0} [\text{NP} \text{zwei Bücher}] t_i]]
\]

In a first step, we interpret the structure of *jeweils*-DPs before overt movement of *jeweils* to SpecDP (cf. chapter III.4.2.4) The base structure is repeated in (121a). It corresponds to the surface structure of English *each*-DPs in (121b). Accordingly, the semantic analysis of adnominal *jeweils* should carry over directly to English binominal *each*, or French *chacun(e)*.

\[
(121) \quad \begin{align*}
\text{a. } & [\text{DP} D^P [\text{NP} \text{zwei Bücher}] [\text{PP} P^0 \text{jeweils}]] \\
\text{b. } & [\text{DP} D^P [\text{NP} \text{two books}] [\text{PP} P^0 \text{each}]]
\end{align*}
\]

Having interpreted (121a), I show that the meaning of the *jeweils*-DP is the same after overt movement of *jeweils* to SpecDP.
4.1.1 Basic Assumptions

In this section, I lay out the basic assumptions on which the surface compositional semantic analysis of *jeweils*-DPs is based. The assumptions are listed in (A1) – (A5).

(A1) Adnominal *jeweils* has the same meaning as adverbial *jeweils*. It denotes a generalised quantifier, like ‘normal’ QPs. It takes a set as argument and maps it onto a truth-value.

As with adverbial *jeweils*, the restriction of adnominal *jeweils* is expressed by the proform *weil-*, which is co-indexed with a plural DistKey. As with adverbial *jeweils*, the denotation of the empty preposition contributes to the meaning of the PP consisting of P° and *jeweils*.

As with adverbial *jeweils*, adnominal *jeweils* denotes a double quantifier. An existential quantifier in the nuclear scope of the universal quantifier asserts the existence of elements of the DistShare. The lexical entry for the PP [P° *jeweils*] is given in (122).

\[ [(PP P°_jeweils)] = \lambda P. \forall z \left( (z \in Z_i) \rightarrow \exists x [P(x) \land R_j(f(x))] \right) \]

The analysis of adnominal *jeweils* in (122) allows for a unified treatment of adverbial and adnominal *jeweils*. Both have the categorial status of PP and both denote a (double) quantifier. The difference lies in the ontological category of the entities over which they quantify. Adverbial *jeweils* quantifies exclusively over events (cf. section 2), whereas adnominal *jeweils* can, but need not quantify over events (cf. section 3.2.6).

(A2) The distributive relation between elements of DistKey and elements of the DistShare is specified by the relation variable *R*.

*R* is necessary in order to control for the distributive relation that holds between the elements of DistKey and DistShare. In the case of (117a), where the boys buy two books each, it is the presence of *R* which ensures that the distributive relation between individual boys and groups of two books is one of buying, not one of borrowing, lending, selling.

---

47 The syntactic complexity of the PP in (122) raises the question of how its meaning is composed from its parts. One could use brute force and assume that the meaning of the QP *jeweils* in isolation is a function from relations into functions from properties into truth-values. This is compositional, but a rather uncommon denotation for a QP. Alternatively, one could assume that the meanings of QP and P° combine non-compositionally, and form a complex generalised quantifier that has the meaning of P° as one of its parts. Such an analysis was suggested for ILCs in chapter III.3.4.2, and was implicitly assumed to hold for adverbial *jeweils* as well.

Zimmermann (to appear, c) presents a semantic analysis of *jeweils*-DPs that combines the values of P° and *jeweils* compositionally, while treating *jeweils* as a generalised quantifier. The analysis involves Skolem functions of type <e,e> and is based on a DP-internal small clause structure like the one discussed in chapter III.3.6 for ILCs. The derivation is illustrated for the *each*-DP *three sausages each* in (i). The distributive relation is established by a Skolem function *f*, which is part of the denotation of the head of the small clause Pr, and which maps elements of the DistKey onto elements of the DistShare:

(i) a. \[ [[Pr+P]] = \lambda Q_{e \in e_0} \lambda P_{e \in e_0} \lambda F_{e \in e_0}. Q(e). (P(f(e)) \land R_j(f)(e)) \]
b. \[ [[\forall each-ei]] = \lambda P. \forall z [z \in Z_i \rightarrow P(z)] \]

by FA of [[each]] to [[ei]]
c. \[ [[Pr°+P° each-ei]] = \lambda P_{e \in e_0} \lambda F_{e \in e_0} \lambda P_{e \in e_0}. \forall z [z \in Z_i \rightarrow (P(f(z)) \land R_j(f)(z))] \]

by FA of (ia) to (ib)
d. \[ [[PrP three sausages each-ei]] = \lambda F. \forall z [z \in Z_i \rightarrow (PrP(f(z)) \land R_j(f)(z))] \]

by FA of (ia) to [[three sausages]]
e. \[ [[D° three sausages each-ei]] = \exists F [\forall z \in Z_i \rightarrow (D°(f(z)) \land R_j(f)(z))] \]

by FA of [[D°]] to (ia) (with [[D°]] = \lambda F. \exists F(f))

(iie) states that there is a function *f* which maps each element *z* of a (so far) unspecified set into a set of three sausages *f*(z) such that *f(z)* stands in some (distributive) relation to *z*. 
devouring etc. As argued above, \( R \) is provided by the empty preposition \( P^0 \). The precise value for \( R \) is specified in the course of the derivation by a co-indexed relational expression. In the case of (117a), the value for \( R \) is provided by the denotation of the transitive verb \( \text{kaufen} \) ‘buy’. Observe again that the variable status of \( R \) corresponds to the empty status of \( P^0 \) in the syntax. Apparently, the only semantic effect of an empty prepositional head is the contribution of a relation variable, whose value is determined either by an overt relation denoting expression (under co-indexation), or by the context. In this respect, relation variables do not differ from other pronominal expressions. In the case of adnominal \( \text{jeweils} \), the value of \( R \) is fixed under co-indexation with a clausemate expression. With adverbial \( \text{jeweils} \), the value of \( R \) is determined by the context.

(A3) The indefinite NP that forms the DistShare denotes a predicate.

According to one’s view on the semantics of plurals, indefinite NPs can be construed as first-order predicates (type <et>) over (mereological) plural individuals (Link 1991), or as a second-order predicates (type <et,t>) over sets (Winter 1998). Since nothing hinges on the choice, I will go on treating pluralities as sets. Plural predicates such as \( \text{two books} \) are consequently treated as second order predicates over sets. The numeral \( \text{two} \) denotes the property of being a set of two elements (Higginbotham 1987). The complex predicate \( \text{two books} \) denotes the complex property of being a set containing two books. The denotation of the numeral NP \( \text{two books} \) is formalised in (123). I use Link’s (1983) ‘*’-operator and upper case variables in order to indicate that the predicate ranges over plural individuals.

\[
(123) \quad \left[\text{zwei Bücher}\right] = \lambda X. \text{two}'(X) \land *\text{book}'(X)
\]

In what follows, I will often abbreviate the expression for the complex predicate on the right-hand side in (123) as \( \lambda X. \text{two_books}'(X) \), or even as \( \lambda X. \text{2books}'(X) \), for the sake of brevity.

(A4) The distributive effect is due to the interaction of universal quantifier and the existential quantifier in its scope.

The predicate denoted by the numeral NP is the semantic argument of the universal quantifier denoted by \( \text{jeweils} \). It predicates a property of a set variable that is bound by the existential quantifier in the nuclear scope of the universal quantifier. This way, elements of the DistShare are distributed over elements of the restriction of the universal quantifier, the DistKey.

(A5) \( \text{jeweils}-\)DPs denote (open) propositions.

The present analysis is based on the assumption that DPs can denote propositions. This claim will be qualified and elaborated upon in the following section. A treatment of \( \text{jeweils}-\)DPs as proposition denoting has the advantage of accounting for the intuition that sentences with d-distributive elements express two propositions in one: A core propositional part in which the main event is expressed, and a distributive part in which elements of the DistKey and elements of the DistShare are distributively related to one another. This intuition is reflected by the choice of a bipartite semantic representation in Choe (1987) and Moltmann (1991, 1991). In the present proposal, it is the \( \text{jeweils}-\)DP that contributes the distributive aspect of the meaning in form of a proposition. Nevertheless,
contrary to Choe (1987) and Moltmann (1991,1997), I assume the eventual semantic representation to consist of one proposition only. Section 4.2 demonstrates how the two propositions are forged into one.

4.1.2 On Proposition-Denoting DPs

Before going on, let us dwell a little on the assumption that DPs can denote propositions. This may seem surprising in light of the fact that nominal expressions are often thought of as being restricted to denote entities of type \(<e>\) (individuals), \(<e,t>\) (set of individuals), and \(<e,t,t>\) (generalised quantifiers) (cf. Partee 1987).

There seems to be no principled reason why DPs should not denote propositions of type \(<t>\) as well, at least not in the theory of semantic types. If we look at CP, the other category of arguments, we see that it can denote entities of a variety of semantic types. A CP can be interpreted as a proposition \(<t>\) in form of a main clause (cf. 124a), or as a property \(<et>\) in form of a restrictive relative clause (cf. 124b), or as a ‘fact’ or event in form of an embedded clause (cf. 124c), or as a generalised quantifier in form of a free relative clause (cf. 124d), or as an individual in form of a so-called definite relative clause (cf. 124e) (cf. Capinagro 2001).

(124) a. [CP Not one word was he willing to say].
   b. I read the book [CP which you recommended].
   c. I know [CP that you bought a Porsche]
   d. [CP Whoever comes in first] will win.
   e. I have exactly [CP what you are looking for].

In light of the type variability displayed by CPs, one may wonder if DPs are equally flexible in semantic type. The existence of a number of DP-constructions with propositional properties, both in English and cross-linguistically, forms an argument in favour of this assumption.

In English, DP-internal clausal structures that are selected by a D-head have been postulated by Abney (1987:141f.) for gerundive ACC-ing constructions (125), by Kayne (1994:87) for DPs with restrictive relative clauses (126), and by den Dikken (1998:191) for the N-of-a-N construction (127). The postulated underlying and surface structures for the respective DP-constructions are given in the (b)- and (c)-examples.

(125) a. John singing the Marseillaise
   b. [DP [D'-ing [IP John [I- VP sing- the Marseillaise]]]]
   c. [DP John [D'-ing [I-VP singing] [IP t1 [I-VP tv the Marseillaise]]]]

(126) a. the man that is standing in the corner
   b. [DP the [CP [C-that [IP Bill [I-VP saw picture]]]]]
   c. [DP the [CP Pictures [C-that [IP Bill [I-VP saw t1]]]]]

(127) a. that idiot of a doctor
   b. [DP that [FP F0 [XP a doctor [X-X0 [NP idiot]]]]]49
   c. [DP that [FP [NP idiot] [F-X of [IP a doctor [X-Xt1]]]]]

48 ‘Facts’ are frequently analysed as special propositions. In this case, there is no difference between (124a) and (124c) (Ede Zimmermann, p.c.).

49 den Dikken (1998:191) is not explicit about the categorial nature of X. It seems to have the same status as the overt predication marker (copular) be. For our purposes, X could possibly be identified with I.
The reader is referred to the cited studies for further details. What is relevant for the purpose at hand is that a functional D-head selects for a proposition-denoting constituent in all the analyses in (125) – (127). The proposition-denoting constituent consists of a subject-predicate structure, meaning that there is an expression which functions as semantic subject, and an expression that predicates a property of this subject. A parallel situation is found with jeweils-DPs where jeweils is a second order predicate (qua its nature as a generalised quantifier) over the set denoted by the DistShare (= the semantic subject of the proposition). (125) is of particular interest because the DP as a whole seems to make an existential statement about an event (‘John is singing the Marseillaise’), a property usually associated with clauses (see section 1.1). Or as Abney (187:143) puts it: “The only noun-phrase property of ACC-ing [gerund, MZ] if its structure is as in [125b] is its external distribution.” That is, the D-head does not so much add semantic content, but carries the D-features (gender, number, person, case) that determine the external distribution of ACC-ing gerunds. I assume that the empty D-head in jeweils-DPs has the same syntactic function.

The foregoing remarks are intended to show that (overt or covert) determiners are able to select for proposition-denoting constituents. This assumption is also supported by the fact that DPs in the shape of inverse linking constructions (ILCs) can function as the semantic input for propositional operators. This is illustrated in (128).

(128) [One apple on every plate] is too much / necessary / possible.

Sentential operators such as too much, necessary, and possible operate over propositions (Thomason & Stalnaker 1973, Bartsch 1976). They evaluate the state of affairs expressed by the proposition, or they determine its epistemic status as necessary, possible, probable etc. If this view on sentential operators is correct, the propositional argument for the operators in (128) must be provided by the ILC in subject position. In chapter III.4, jeweils-DPs were analysed as a special instance of ILCs. Therefore, it is natural to assume that jeweils-DPs denote propositions as well.

Cross-linguistically, many languages exhibit constituents that are clause-like in expressing a propositional content, but which feature characteristic syntactic properties of nominal constituents, such as case-marking or nominal classifiers. In Finnish, proposition-denoting expressions that are embedded under a believe-type verb can be realised with accusative marking on a non-finite verb (129a). The synonymous clausal equivalent is given in (129b). (129c) shows that the same ACC-marker -n occurs on simple accusative objects.

(129) a. Luul-i-n [teidän tunte-va-n isoglossin käsitteen].
   believe-past-I you_{pl}-GEN know-ptc-ACC isoglosses notion
   ‘I thought that you knew the notion of isoglosses.’
   (Hakulinen & Karlsson 1979:187, ex.157)

b. Lulin [että te tunnisisite isoglossin käsitteen].
   believe-past-I that you_{pl}-NOM know-past-2pl isoglosses notion

---

50 See section 7 and Zimmermann (to appear,a) on the interpretation of proposition-denoting ILCs.
51 The construction in (129a) is referred to as lauseenvastike ‘clausal equivalent’ in Hakulinen & Karlsson (1979:187).
c. Metsästäjä ampui lehmän.

hunter shot cow-ACC
‘The hunter shot the/a cow.’ (Hakulinen & Karlsson 1979:184, ex.138a)

In my view, the accusative marking in (129a) indicates that propositions can be denoted by DPs in Finnish.\(^{52}\)

In Tsez, a Daghestanian language, the verb in embedded clauses can appear with a noun class marker.

(130) Enir [užā magalu būc’ruli] r-iyxo.

mother boy bread.Ill.abs.ate. IV IV-know
‘The mother knows that that the boy ate the bread.’

(Bobaljik 2001, ex.14a, quoting from Polinsky & Potsdam 2001)

In (130), the embedded clause is marked with the noun class suffix for the fourth noun class (agreeing with the matrix verb), just as the noun magalu is marked for the third noun class. Again, I take the expression of noun class suffixes on embedded clauses to indicate that propositional content can be expressed in the shape of a DP.

If analysed correctly, the examples from Finnish, Turkish and Tsez show that DPs can denote propositions at least in these languages. I take this observation and the additional evidence concerning proposition-denoting expressions in English as sufficient support for the claim that German jeweils-DPs denote propositions as well.

4.1.3 Interpreting Jeweils-DPs

With (A1) – (A5) in place, we can proceed to compose the meaning of a jeweils- DP on the base of the meaning of its parts. We begin by interpreting the base structure of the jeweils- DP, with jeweils in postnominal position. The denotation of the PP \([PP^0 jeweils)]\) in (122), repeated as (131a), combines with its argument, the value of the numeral NP zwei Bücher in (131b) by functional application. The result is given in (131c).\(^{53}\)

\[(131)\]
\[
a. \lambda \text{P. } \forall z [z \in Z_i \rightarrow \exists X [P(X) \land *R_j(z,X)]]
\]
\[
b. \lambda \text{X. } \text{two_books'}(X)
\]
\[
c. \lambda \text{X. } \forall z [z \in Z_i \rightarrow \exists X [\text{two_books'}(X) \land *R_j(z,X)]]
\]

The expression on the right-hand side in (131c) reads as ‘For every individual \(z\) of a given set \(Z_i\) there is a set \(X\) of two books such \(z\) and \(X\) stand in relation \(R_j\) to one another.’ This

\(^{52}\) In Turkish, this is the unmarked way for expressing embedded clauses. The verbal stems in this kind of embedded clause carry nominalisation markers and nominal suffixes such as nominal person agreement markers and case suffixes (cf. Kornfilt 1997:45f.). Examples of a (nominalised) embedded subject clause and a corresponding simple noun phrase are given in (iab) (Kornfilt 1997:50, exs.215 & 216):

(ia) a. [Ahmed-in sinema-ya yaln \(i\)z başına git-me-si] ben-i çok üz-dü.

Ahmet-GEN cinema-DAT alone go-Nom 3sg I-ACC very sadden-past
‘That Ahmet went to the movies by himself made me very sad.’


Ahmet I-ACC very sadden-past
‘Ahmet made me very sad.’

The case marking on the verbal stem in (ia) indicates that propositions can be expressed by means of a nominal constituent in Turkish.

\(^{53}\) Like unary predicates, relational predicates can be second order predicates over sets. The ‘plurality’ of the relation is indicated using Link’s star operator (cf. Sternefeld 1998).
proposition is the meaning of the jeweils-DP. What still needs to be shown is that overt movement of adnominal jeweils to SpecDP does not affect the meaning.

Moving to SpecDP, jeweils leaves behind a trace. Since the moved constituent denotes a generalised quantifier of type <et,t>, we expect its trace to be of type <e>. This is a standard assumption in analyses that assume that QPs of type <et,t> raise covertly at LF in order to avoid type mismatch and to ensure interpretability (cf. May 1985, Heim & Kratzer 1998, Fox 2000). The second standard assumption is that movement of an element with index ‘i’ triggers λ-abstraction over ‘i’ on the syntactic sister of the moved element’s landing site (here on D’). Third, I assume D0 to be semantically empty in indefinite DPs. With these assumptions, the derivation of the meaning of the jeweils-DP in (132) proceeds as in (133).

\[
\begin{align*}
(132) & \quad [\text{DP} [P^0 \text{jeweils}_i], D^0 [\text{NP [NP zwei Bücher] t}_i]] \\
(133) & \quad \text{a. } [[[\text{NP zwei Bücher t}_i]]] \quad \text{by FA of (131b) to [t_i]} \\
& \quad = (\lambda X. \text{two_books}'(X))(Y_1) = \text{two_books}'(Y_1) \\
& \quad \text{b. } [[[\text{NP zwei Bücher t}_i]]] = \lambda Y_1, \text{two_books}'(Y_1) \quad \lambda\text{-abstraction over ‘i’} \\
& \quad \text{c. } [[[\text{DP}^0 \text{jeweils} D^0 \text{zwei Bücher t}_i]]] \quad \text{by FA of (131a) to (133b)} \\
& \quad = (\lambda P. \forall z ((z \in Z_i) \rightarrow \exists X [(P(X) \land \ast R_j(z,X))])(\lambda Y_1, \text{two_books}'(Y_1)) \\
& \quad = \forall z ((z \in Z_i) \rightarrow \exists X [\text{two_books}'(X) \land \ast R_j(z,X)])
\end{align*}
\]

The final expression in (133c) is identical to (131c) above, showing that the semantic value of the jeweils-DP is not affected by movement of jeweils.

(133c) shows that a jeweils-DPs denotes an open proposition that expresses a distributive relation between DistKey and DistShare. The proposition contains two free variables, Z and R, which need to be assigned a value in the course of the derivation. In the next section, it will be shown how Z and R are assigned their semantic values, and how the meaning of the jeweils-DP in (133c) combines with the meaning of its syntactic sister, the main verb gekauft ‘bought’. In the process, it will emerge that providing the content for R, and combining the meanings of jeweils-DP and its sister are really just two sides of the same coin. They are the result of the same semantic operation. An analogous operation is later responsible for assigning Z its value, in this case the denotation of the subject DistKey expression.

4.2 Composing the Meanings of Jeweils-DP and its Sister

This section presents the basic mechanism behind the semantic analysis of d-distributive quantifiers. To that end, two semantic rules of λ-abstraction are introduced. The first rule can be viewed as a variant of Bittner’s (1994) rule of λ-abstraction for avoiding type mismatch. At the same time, it can be viewed as a generalisation of the idea behind Heim & Kratzer’s interpretation rule for moved constituents. The rule is independently motivated because it also accounts for the interpretation of other syntactic configurations, including the interpretation of moved elements and the interpretation of hanging topics. The second rule of λ-abstraction also prevents non-interpretability from type mismatch, but it applies only in cases where the first rule cannot apply.

In 4.2.1, I introduce the two rules. In 4.2.2, it is shown how the first rule of λ-abstraction allows for interpreting movement and hanging topic structures. With the rule of λ-abstraction in place and independently motivated, it is applied to the most basic instances of jeweils-DPs in 4.2.3. These are jeweils-DPs in object position of individual-level predicates, and jeweils-DPs which are embedded inside another DP. In both
contexts, jeweils occurs in an event-free environment (see section 3.2.6). In 4.2.4, the analysis is extended to jeweils-DPs in object position of transitive stage-level verbs, which take an event argument, making the analysis slightly more complex. Finally, the analysis is extended to other syntactic occurrences of jeweils-DPs in section 4.3.

4.2.1 Two λ-Abstraction Rules

The λ-notation of type logic has proven particularly useful in the formal semantic analyses of natural language expressions. One of its advantages is that it allows for the formal expression of complex semantic denotations (e.g. functions, functions from functions into functions, functions from functions into functions into functions etc.) in a concise and brief manner. More important still, the type-logical operations of ‘λ-conversion’ and ‘λ-abstraction’ have proven useful in compositional semantic analyses. λ-conversion is the formal operation accompanying the semantic operation of functional application. It combines the meaning of two expressions one of which serves as argument to the other. λ-abstraction is the opposite process. It allows for a decomposition of the (known) meaning of a complex structure into the meaning of its parts. λ-abstraction filters out the semantic contribution of those parts of the structure whose meaning is known, yielding the meaning for those parts whose meaning was previously unknown. At the same time, application of λ-abstraction turns saturated expressions (in Frege’s terminology) into unsaturated expressions, i.e. into functions, which demand an argument. An example from Frege (1891) may serve to illustrate this point. Consider the DP in (134).

(134) the capital of the German Empire

In Frege’s time, the DP in (134) denoted the city of Berlin. Frege argues that this meaning can be derived on the base of the meaning of its parts. He suggests to decompose the DP into two parts of which we know the meaning of one (the German Empire). He further proposes to analyse the meaning of the remaining part of the DP, the capital of, as a function which takes countries as input and maps them onto their respective capital. The functional nature of the meaning of the capital of is illustrated in (135). (135a) shows the functional nature of the expression. Choosing different countries as argument to this function yields different values (cf. 135b-c).

(135) a. \([[\text{the capital of}]\] (x) = y
b. \([[\text{the capital of}]\] (germany’) = berlin’
c. \([[\text{the capital of}]\] (finland’) = helsinki’

The functional nature of the meaning of the capital of can be derived by applying λ-abstraction to the meaning of the DP the capital of the German Empire in (134). By factoring out the known meaning of German Empire, we arrive at the semantic representation for [[the capital of]] in (136).

(136) [[the capital of]] = λx.<e>. the unique city which is the capital of x.

The expression on the right-hand side of the equation represents a function and reads as ‘a function from individuals x (of type <e>) into the unique city which is the capital of x’. By convention, expressions to the left of the dot, stand for the arguments of the function. Expressions to the right of the dot stand for the function values. These are, typically, an
individual (as in the case at hand), a truth value (represented by the truth conditions), or another function.

What is of general interest here is that λ-abstraction is a process that creates unsaturated expressions from saturated ones. As such, it can be employed in semantic derivations in order to ensure interpretability. Bittner (1994:69) postulates the rule of λ-abstraction as a cross-linguistic universal.

(137) Bittner's Rule of λ-Abstraction (simplified version):
Let α have have a translation \([α]\), and let the index ‘i’ be the index of either α or a sister of α, and let \([α]\) contain a variable u with index ‘i’. Then \(λu.([α])\) is a translation of α.

Stated in simple terms, the rule applies by adding a λ-operator to the denotation of α, thus binding a variable which has an index identical to an index on either α or α’s sister. Applying λ-abstraction results in ‘opening up’ an argument position in the denotation of α. Thus, λ-abstraction turns saturated expressions which contain a free variable into functions which can apply to arguments of the same type as the variable. On this view, λ-abstraction enters the semantic derivation in order to ensure the interpretability of otherwise uninterpretable configurations. A typical non-interpretable configuration obtains when two syntactic sisters are of the ‘wrong’ semantic type, i.e. when they cannot be combined with each other. Such situations are generally grouped under the label of ‘type mismatch’. Type mismatch arises in three cases: (i) both sisters denote saturated expressions such that none can take the other as its argument; (ii) both sisters are functions, but none is of the right kind to serve as argument to the other; (iii) one sister denotes a function, and the other a saturated expression, but of the wrong kind. Summing up, λ-abstraction applies in order to ensure interpretability in cases of type mismatch.

Since it is meant to apply universally, (137) is stated in a very general form.54 For the purposes at hand, I will use a more restricted version of (137), which allows for a composition of the meaning of jeweils-DP and its syntactic sister, and which can be shown to apply elsewhere in the grammars of German and English. The restricted λ-rule is given in (138):

(138) Index-Triggered λ-Abstraction:
If the semantic types of a proposition-denoting expression α and its syntactic sister β do not match, and if \([α]\) contains a free variable u that shares an index ‘i’ with β, λ-abstraction in \([α]\) over index ‘i’ is licensed, and \(λu.([α])\) is a value for α.55,56

54 E.g., (137) is defined in such a way that it can also account for the semantic effects of syntactic head movement, which shall not concern us here.
55 At first sight, the formulation of (138) creates a problem for compositionality. The meaning of the node consisting of α and β cannot be derived by looking at the meanings of α and β alone. For λ-abstraction to be licensed, the co-indexed free variable must be visible at the stage of the derivation where α and β combine, which it is not. As a result, the semantic derivation apparently looks into the meaning of α, of which the variable forms a part, a process not in line with compositionality (and which seems to lead Bittner (1994) to assume a mechanism of variable storage). However, Dekker (1993:165f.) shows that the apparent problem for compositionality can be overcome by working with partial assignment functions. See also Dekker 1998:332, fn.5 on the special case of the assignment function assigning the empty set. (thanks to Ede Zimmermann, p.c., for pointing this out)
The application of \( \lambda \)-abstraction is limited to configurations where no interpretation is possible otherwise. A second restriction limits the application of \( \lambda \)-abstraction to proposition-denoting expressions. A third restriction specifies the conditions under which \( \lambda \)-abstraction can apply. The rule says that \( \lambda \)-abstraction can apply to a proposition if this proposition contains a free variable which is co-indexed with the syntactic sister of \( \alpha \). The idea is that saturated expressions can be "opened up" in the course of the derivation when they encounter a constituent with the right index. The rule in (138) is the basic semantic mechanism for combining the meanings of \textit{jeweils}-DPs and their syntactic sisters.

Before I go on to show how (138) is applied in the interpretation of \textit{jeweils}-DPs, we need to assume one more semantic rule. In the course of the discussion, we will encounter situations where \( \lambda \)-abstraction appears necessary for reasons of type mismatch, but where the licensing conditions in (138) are not met. Such situations arise when the sister of a proposition-denoting expression \( \alpha \) cannot does not carry an index which is identical to that of a free variable \( x \) contained in \( \alpha \). This happens if the syntactic sister of \( \alpha \) and the free variable contained in \( \alpha \) do not match in type. The situation is illustrated in (139), anticipating a configuration that will arise in the discussion of \textit{jeweils}-DPs with stage-level predicates in section 4.2.4.

\[
\begin{array}{c}
\gamma \\
\alpha_{\gamma},
\end{array}
\begin{array}{c}
\beta_{\gamma},
\end{array}
\begin{array}{c}
\ldots x_{\gamma},
\end{array}
\]

In (139), \( x \) and \( \beta \) are of different logical types, and should not carry the same index since co-indexation here is taken to express co-reference.\(^{57}\) Co-indexation is also blocked in cases where the sister of \( \alpha \) is of the same semantic type as an indexed variable in the denotation of \( \alpha \), such that the two could be co-indexed in principle, but where the semantic type of \( \alpha \)'s sister is the result of a previous application of (index-triggered) \( \lambda \)-abstraction. Assuming that indices enter the syntactic and semantic derivation from the lexicon, and cannot enter the derivation afterwards, it is too late for indexing in such a

\(^{56}\) As indicated by the formulation "[…] is a value for \( \alpha \)"; the rule in (138) does not ensure an unambiguous mapping from syntactic structure to interpretation. In other words, the notation ‘[[\( \alpha \)]]’ is not unambiguously defined. The problem is ameliorated by the fact that (138) only applies in cases where the combination of \( \alpha \) and \( \beta \) is uninterpretable otherwise, due to type mismatch. This ensures that the mother node of \( \alpha \) and \( \beta \) has an unambiguous reading in almost all cases (if either receives no interpretation, or it receives the interpretation resulting from \( \lambda \)-abstraction). Nevertheless, there is a configuration in which application of (138) can lead to ambiguity on the mother node – at least in principle. The situation arises when both sisters \( \alpha \) and \( \beta \) are proposition-denoting, \( \alpha \) is co-indexed with a free variable in the denotation of \( \beta \), and \( \beta \) is co-indexed with a free variable in the denotation of \( \alpha \). The situation is given schematically in (i)

\[
(i) \quad [ [ \alpha ] ] \quad [ [ \beta ] ]
\]

In this situation, \( \lambda \)-abstraction according to (138) can apply either to \( \alpha \) (over index ‘\( j \)’) or to \( \beta \) (over index ‘\( i \)’). Independent of the question whether this configuration actually arises, we should keep in mind that applying (138) to (i) results in the derivation of a family of readings that is passed up in the semantic derivation, rather than in the derivation of an unambiguous reading. Thanks to Ede Zimmermann for discussion of this point.

\(^{57}\) Bittner (1994), who assumes the possibility of ‘vacuous indexation’ of non-referring elements, does not share this view. If non-referring elements can be co-indexed with referring expressions, the same should be possible for two expressions of different logical types.
case. We will encounter the latter case repeatedly in connection with the process of ‘crosswise $\lambda$-abstraction’ in chapter V.2.

A possible solution for the dilemma of missing indices would be to return to Bittner’s rule in (137), which also allows for $\lambda$-abstraction over an index ‘i’ if $\alpha$ itself carries the index ‘i’. On the assumption that the index ‘i’ can be passed up to the level of $\alpha$ in (139), $\lambda$-abstraction in $\alpha$ would be licit. The same solution would apply to the second case of missing indices mentioned above. On the other hand, this assumption raises several non-trivial questions regarding the nature of index percolation. Also, allowing for free percolation of indices has the effect that expressions of different logical types can end up being co-indexed. In a framework that views indices as markers for (co-) reference, this assumption seems undesirable.

Instead, I suggest to meet the problem of missing indices by postulating a second rule of $\lambda$-abstraction. The rule is formulated in (140).

(140) 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 $u_i$ of type $<\sigma>$, and $\beta$ is of type $<\sigma,t>$ or $<\sigma>$, $\lambda$-abstraction in $[[\alpha]]$ over index ‘i’ is licensed, and $\lambda u_i[[\alpha]]$ is a value for $\alpha$.

Application of type-triggered $\lambda$-abstraction turns $\alpha$ into an expression which is either of the same type as $\beta$, or which takes the denotation of $\beta$ as its semantic argument. The first case is illustrated in schematic form in (139), where the meanings of $\alpha$ (after $\lambda$-abstraction) and $\beta$ can combine by predicate modification. The second case is instantiated by applications of crosswise $\lambda$-abstraction in chapter V.2. Bear in mind that type-triggered $\lambda$-abstraction can only apply if there is a type mismatch, and if index-triggered $\lambda$-abstraction does not apply (and if the other licensing conditions in (140) are also met). This essentially makes type-triggered $\lambda$-abstraction a last resort mechanism that only applies if all else fails. From this, one would expect its potential range of application to be rather restricted.

The two rules of $\lambda$-abstraction in (138) and (140) together account for the interpretation of all occurrences of adnominal jeweils. I leave it open if they can be subsumed under one general rule.

4.2.2 Motivating Index-Triggered $\lambda$-Abstraction
The purpose of this section is to provide independent motivation for the assumption of index-triggered $\lambda$-abstraction in (138). The rule is shown to apply in other configurations independent of jeweils-DPs. First, the rule is applied in the interpretation of structures with moved constituents, as in (141a) with passive movement. After that, the rule is applied in the interpretation of hanging topic construction in (141b) from Dutch.

(141) a. Peter$_1$ was attacked t$_1$.

---

58 (140) also allows for potential ambiguities in the mapping from syntactic structure into meaning. The general problem with (140) is the same as with (138), discussed in fn.56, although the number of potential configurations that may lead to ambiguity is higher with (140). Again, I am not aware of any actual situations where this could lead to problems.
(141ab) have little to do with *jeweils*-DPs structurally, except that they meet the licensing conditions in (138). The fact that the rule for index-triggered $\lambda$-abstraction in (138) can handle these cases is a welcome result. It shows that the rule is a general rule which applies to a range of configurations, and which is not exclusively designed to ensure the interpretability of *jeweils*-DPs.

Let us look at the movement case in (141a) first. In (141a), the underlying object *Peter* has moved out its base position (complement of V) to SpecIP for reasons of case. The structure of (141a) after movement is as shown in (142).

(142) $[\text{IP Peter$_1$} [\_ was [\_ attacked t$_1$]]].$

The semantic value of I’ is given in (143).\(^{59}\)

(143) $[[v\text{-attacked } t_1]] = [[[\text{I was attacked } t_1]]] = \exists x [\text{attacked’}(x,y_{1})]$

The right-hand expression in (143b) meets the licensing conditions for index-triggered $\lambda$-abstraction in (138). It is a proposition, and it contains a free variable ($y_{1}$) which is coindexed with the syntactic sister of I’. Therefore $\lambda$-abstraction over index ‘1’ is licit, yielding (144a). (144a) is a function from individuals into truth values. This function then applies to the value of *Peter$_1$*, as shown in (144b).

(144) a. $[[\text{I was attacked } t_1]] = \lambda y_{1}. \exists x [\text{attacked’}(x,y_{1})]$
   b. $[[\text{Peter$_1$ was attacked } t_1]] = \exists x [\text{attacked’}(x,\text{Peter})]$

(144b) is true iff there was somebody who attacked Peter.

The working of (138) is similar to Heim & Kratzer’s (1998:186) interpretation rule for moved constituents. Heim & Kratzer’s (1998) account is also based on the assumption that movement of a constituent leaves behind a trace. This trace (a variable) is coindexed with an index that is adjoined to the syntactic structure just below the landing site of the moved element. This is shown in (145).

(145) \[
\begin{array}{c}
\text{IP} \\
\text{Peter} \\
\text{I’} \exists x [\text{attacked’}(x,y_{1})] \\
\text{I} \\
\text{was} \\
\text{VP} \\
\text{attacked} \\
\text{t$_1$}
\end{array}
\]

\(^{59}\) I neglect the temporal information expressed on the auxiliary, and treat the latter as semantically zero for simplicity. I have also left out the event argument since its presence or absence has no bearing on the point to be made. For a more complete semantic representation of passive sentences see the discussion in section 1.1.3.
In Heim & Kratzer’s system, the presence of index ‘1’ as the sister of I’ triggers \(\lambda\)-abstraction over ‘1’ in the denotation of I’. Application of \(\lambda\)-abstraction results in a function which can functionally apply to the meaning of Peter. The last two steps are identical to the derivation in (144ab) above, showing that the rule of \(\lambda\)-abstraction in (138) gives the same result as Heim & Kratzer’s rule when applied to the interpretation of structures after syntactic movement.

A major difference between Heim & Kratzer’s rule and the rule of index-triggered \(\lambda\)-abstraction in (138) is syntactic in nature.\(^{60}\) Heim & Kratzer’s system requires the index ‘1’ to occupy its own syntactic position. It is inserted as a direct result of movement. Heim & Kratzer’s rule of \(\lambda\)-abstraction is therefore dependent on movement of some element, for without movement no index in the structure, and without an index in the structure no \(\lambda\)-abstraction over this index. In contrast, (138) is indifferent to whether or not movement has taken place. For (138), it is only important that the index be located on some sister position to a node that denotes an open proposition with a free variable.

The indifference to (non-)application of movement makes (138) a more general version of the rule found in Heim & Kratzer (1998). We therefore expect to find other cases of index-triggered \(\lambda\)-abstraction in configurations which satisfy the restrictions in (138), but which do not involve movement. Such cases exist, e.g. in the form of the ‘hanging topic’ construction in (141b), repeated as (146).

\((146)\) Jan\(_i\), die\(_i\) heb ik gisteren ontmoet. \[\text{[Dutch]}\]
Jan that-one have I yesterday met
‘(Talking about) Jan, I have met him yesterday.’

Hanging topic constructions feature a topic element that is attached to the left periphery of a root clause and that is picked up by a demonstrative pronoun in preverbal position. I take this position to be SpecCP (but see Rizzi 1997). Presumably, the pronoun die has moved to SpecCP from its underlying argument position. In contrast, the hanging topic Jan does not seem to move. Rather, it seems to be base-generated as a left- peripheral ‘satellite’ (see e.g. Weerman 1988). On this analysis, (146) has the structure in (147).

\((147)\)

\[\text{a. } \left[\text{Jan}_{i}, \text{CP}\left[\text{die}_{i}, \text{C'}\left[\text{heb}, \text{IP}\left[\text{ik}_{i}, \text{VP}\left[\text{gisteren}_{i}, \text{ontmoet}_{i}\right]\right]\right]\right]\right]\]
\[\text{b. } ?? \]

\[\text{Jan}_{i} \quad \text{CP} \quad \text{die}_{i} \quad \text{C'} \quad \text{heb} \quad \text{IP} \quad \text{ik}_{i} \quad \text{VP} \quad \text{gisteren}_{i} \quad \text{ontmoet}_{i} \quad \text{ontmoet}_{i} \quad \text{ontmoet}_{i} \quad \text{ontmoet}\]

\(^{60}\) This is an oversimplification. The main difference lies in the architecture of the syntax-semantic interface. In Heim & Kratzer (1998), the insertion of an extra syntactic node for the index is motivated by the need to ensure an unambiguous mapping from each syntactic node into its interpretation (see fns. 56 and 58).
Let us look at the relevant parts of the semantic derivation. We start with the denotation of C’ in (148) (again, I neglect the semantic contribution of the auxiliary in C₀).

\[(148)\quad \text{[[ have I yesterday t, met ]] = } \exists e [\text{met}'(I, y_i, e)]\]

The expression in (148) satisfies the licensing conditions for \(\lambda\)-abstraction over index \(i\). It is a proposition, it contains a free variable \(y_i\), and its syntactic sister \(\text{die}\) is co-indexed with \(y_i\). Application of (138) to (148) yields the function in (149a), which is then applied to the denotation of \(\text{die}\), again a variable with index \(i\). The denotation of the entire CP in (149b) is equivalent to that of C’.

\[(149)\quad a. \quad \text{[[ have I yesterday t, met ]] = } \lambda y_i. \exists e [\text{met}'(I, y_i, e)]
\[\quad b. \quad \text{[[ that one, have I yesterday t, met ]] = } \exists e [\text{met}'(I, y_i, e)]]\]

Since (149b) is equivalent to (148), and since the hanging topic \(\text{Jan}\) is also indexed with \(i\), the structure meets the licensing conditions for repeated \(\lambda\)-abstraction. Repeated \(\lambda\)-abstraction creates the function in (150a), which is equivalent to (149a) and which can apply to the denotation of \(\text{Jan}\), as in (150b).

\[(150)\quad a. \quad \text{[[ that one, have I yesterday t, met ]] = } \lambda y_i. \exists e [\text{met}'(I, y_i, e)]
\[\quad b. \quad \text{[[ Jan, that one, have I yesterday t, met ]] = } \exists e [\text{met}'(I, \text{jan}, e)]]\]

(150b) will be true iff I have met \(\text{Jan}\) yesterday, correctly specifying the truth conditions for (146). This shows that the \(\lambda\)-abstraction rule in (138) can apply in non-movement configurations as well.\(^{61}\)

To conclude, in this section we have seen two applications of the semantic rule of index-triggered \(\lambda\)-abstraction in (138). It was shown that an application of (138) derives the correct interpretation for structures with and without movement, given the right indexation. Hence, (138) is more general than Heim & Kratzer’s rule of \(\lambda\)-abstraction, which depends on indices introduced by movement. On the other hand, the rule in (138) is restricted in its application to certain well-defined configurations.

**4.2.3 Interpreting Jeweils-DPs in Event-Free Environments**

With the interpretation of jeweils-DPs and the semantic rules of index-triggered and type-triggered \(\lambda\)-abstraction in place, it is possible to demonstrate how the meaning of the jeweils-DP composes with the meaning of its syntactic sister. We begin with the two basic cases where adnominal jeweils occurs in an event-free configuration and which are illustrated in (151ab). The jeweils-DP is indicated with brackets in each case. Jeweils is co-indexed with its respective DistKey antecedents, \(P^0\) with the relation-denoting expressions \(\text{haben} ‘\text{have}’\) and \(\text{von ‘of}’\) respectively. The reason for the second co-indexation will become apparent below.

---

\(^{61}\) Of course, Heim & Kratzer’s rule could apply to hanging topic constructions if these are analysed as involving movement of the topic in the left periphery. A possibility would be to treat the pronoun in SpecCP as a resumptive pronoun which acts as the phonetic spellout of an intermediate trace.
(151) a. jeweils + individual-level predicate:

..., weil die Jungen, [P0 jeweils,] eine Tätowierung] haben,

because the boys each one tattoo have

‘...because the boys have one tattoo each.’

b. jeweils embedded inside a DP.\(^\text{62}\)

Listen, mit\(i\) [P0 jeweils,] drei Namen] wurden herumgereicht.
/lists with each three names were passed around.

‘Lists each with three names on them were passed around.’

The two configurations exhibit the basic characteristics of all jeweils-DPs. First, jeweils-DPs always require a relation-denoting expression, be it a transitive verb as in (151a), or a preposition as in (151b). This relation expression provides the appropriate value for the relation variable \(R\) in the meaning of the PP [P0 jeweils]. Second, jeweils-DPs require a plural expression (the DistKey) over which jeweils can distribute. The plural expression can be a plural argument as denoted by the plural subject die Jungen ‘the boys’ in (151a), or a plural predicate as denoted by the plural noun Listen ‘lists’ in (151b). The plural argument enters the semantic derivation by functional application, the plural predicate by predicate modification. We now turn to the details of the semantic derivation.

Following the discussion in section 4.1, the jeweils-DP in (151a) denotes the proposition in (152). The structure of the clause and the denotation of the syntactic sister of the jeweils-DP are indicated in (153).

(152) \text{[P0 jeweils,} eine Tätowierung]] = \forall z [z \in Z_i \rightarrow \exists x [\text{tattoo'(x) } \land R_j(z,x)]]

(153) \[
\begin{array}{c}
\text{die Jungen}_i \\
\text{VP} \\
\text{DP} \\
\text{P0 jeweils, eine Täto. haben}_j
\end{array}
\]

The problem for a compositional analysis is that the jeweils-DP denotes a saturated expression of type \(<t>\). Being of type \(<t>\), it cannot serve as an argument for the transitive individual-level predicate haben ‘have’, which is of type \(<e<e,t>>\). A type mismatch results, seemingly blocking further interpretation.

Looking at the semantic value of the jeweils-DP in (152) more closely, we see that it satisfies the licensing conditions for the application of index-triggered \(\lambda\)-abstraction in (138) above. It is a proposition, and it contains two free variables one of which is co-indexed with the transitive verb, the syntactic sister of the jeweils-DP.\(^\text{63}\) Therefore, \(\lambda\)-abstraction over index \(j\) can apply in (152). Since the expressions co-indexed with \(j\) are both relations, the result of \(\lambda\)-abstraction in (154) is a function from relations into truth values.

\(^{62}\) The talk about ‘event-free’ configurations only pertains to the immediate DP-environment here. Of course, the stage-level main verb in (151b) takes an event argument.

\(^{63}\) I assume that indices can be passed up from lexical entries to the syntactic heads dominating them, and on to the maximal projections of these heads.
This function applies to the verb meaning, yielding (155) as the semantic value of VP.

\[(155) \quad [VP] = \forall z \in Z_i \Rightarrow \exists x \text{ [tattoo}'(x) \land \text{have}'(z,x)]]\]

(155) shows that application of index-triggered $\lambda$-abstraction achieves two things at once. It allows for combining the meanings of jeweils-DP and its sister. And it (indirectly) provides a value for the relation variable $R$. It does so by creating a function from relations into truth values which can then apply to a relation (here: the verb). It is in this sense, that combining the meaning of jeweils-DP and verb and providing a semantic value for the relation variable can be seen as two sides of the same coin. They follow from the application of a sinlge semantic operation, $\lambda$-abstraction under co-indexation.

The VP-denotation in (155) combines with the subject (DistKey) denotation in the same way. The VP denotes a proposition with a free variable that is co-indexed with VP’s sister node (here $Z$). $\lambda$-abstraction over index $i$ yields (156a), a function from sets of individuals to truth values. Functional application to the subject denotation yields (156b) as the meaning of IP.

\[(156)\]
\[
\begin{align*}
\text{a.} \quad [VP] &= \lambda Z_i. \forall z \in Z_i \Rightarrow \exists x \text{ [tattoo}'(x) \land \text{have}'(z,x)] \\
\text{b.} \quad [IP] &= \forall z \in [[\text{the boys}]] \Rightarrow \exists x \text{ [tattoo}'(x) \land \text{have}'(z,x)]
\end{align*}
\]

(156b) is true iff for each $z$ out of a specific set of boys there is a tattoo $x$ such that $z$ has $x$. We have seen, then, that the “trick” in interpreting jeweils-DPs lies in the right co-indexation of the two free variables $R$ and $Z$ with a relation-denoting and with a set-denoting expression respectively, thus triggering $\lambda$-abstraction in line with the rule in (138).

The mechanism of co-indexation and $\lambda$-abstraction (followed by functional application) directly extends to (151b), where the jeweils-DP is embedded inside a PP inside another DP. The denotation of the jeweils-DP in (151b) is spelt out as (157). The structure of the embedding DP, including suitable indices, is given in (158).

\[(157) \quad [[P_j \text{jeweils}_i \text{drei Namen}]] = \forall z \in Z_i \Rightarrow \exists X \text{ [3names}'(X) \land \star R_j(z,X)]\]

As before, the jeweils-DP denotes a proposition with two free variables. As before, its sister, the relation-denoting preposition von ‘of’ cannot take the value of the jeweils-DP as its argument because of type mismatch. As before, index $j$ on the preposition licenses $\lambda$-
abstraction over \( j \) in the denotation of the jeweils-DP (cf.159a). As before, the resulting function from relations into truth-values applies to the value of the preposition, yielding the proposition in (159b).

\[
\lambda \mathcal{R}_i. \forall z \left[ z \in \mathcal{Z}_i \rightarrow \exists X \left[ \text{names}'(X) \land \forall \mathcal{R}(z,X) \right] \right]
\]

Since \( N_i \) is co-indexed with the free variable \( Z \) in (159b), index-triggered \( \lambda \)-abstraction over \( i \) can apply, yielding (160a). (160a) combines with the meaning of \( N_i \) in (160b) not by functional application, but by predicate modification. The result is shown in (160c).

\[
\lambda \mathcal{Z}_i. \exists x \left[ x \in \mathcal{Z}_i \land \exists X \left( \text{names}'(X) \land \forall \mathcal{R}(z,X) \right) \right]
\]

The expression in (160c) stands for a set of plural entities, which is the correct interpretation for bare NPs such as \textit{lists with three names}. It is therefore free to serve as the restriction of an existential quantifier, resulting in the correct reading for (151b): There were lists, each having three names on it, which were passed around. This shows that the proposed semantic mechanism of index-triggered \( \lambda \)-abstraction gives the desired result also for jeweils-DPs that are embedded inside another DP. The only difference to the first case concerns the way in which the meanings of DistKey and its syntactic sister combine. With jeweils-DPs and individual-level predicates, the meaning of DistKey is an argument to the meaning of its sister. With jeweils-DPs that are embedded inside another DP, the meaning of the DistKey combines with that of its sister by predicate modification. We will encounter both processes again in the discussion of the other occurrences of adnominal jeweils.

In this section, I have shown that the first semantic rule of index-triggered \( \lambda \)-abstraction, together with well-established semantic rules such as functional application and predicate modification, allows for a correct derivation of the meaning of adnominal jeweils in event-free environments. In the next section, the analysis is extended to jeweils-

\[\text{(i)}\] With \[ \text{PP Noriega [in power]} \] we will have to cancel our vacation.

‘Given that Noriega is in power, we will have to cancel our vacation.’

See also Heim & Kratzer (1998:227), who explore the possibility that PPs (optionally) contain a subject, which would make them proposition denoting.

\[\text{(ii)}\] \[\lambda \mathcal{P}. \exists \mathcal{X} \left[ \mathcal{P}(X) \land \forall \mathcal{Y}(\forall Y \subseteq X) \land Z \subseteq X \land Q(Z) \Rightarrow (|Z| > |X| \cdot |Z|) \right]\]
DPs that occur as direct objects of stage-level predicates, which take an additional event argument.

### 4.2.4 Interpreting Jeweils-DPs with Stage-Level Verbs

The interpretation of object jeweils-DPs with stage-level verbs, as in (161), faces one additional difficulty.

(161) ..., weil die Jungen gerade [P₀ jeweilsᵢ zwei Würstchen] kaufenᵢ,

‘…because the boys are buying two sausages each.’

In (161), the distributive relationship between the elements of the DistKey (here: boys) and elements of the DistShare (here: sets of two sausages) is one of buying, hence the co-indexation of P and the main verb. The jeweils-DP is interpreted according to the semantic scheme developed in 4.1 (cf.162a). The problem lies in the meaning of the syntactic sister of the jeweils-DP, the transitive stage-level verb kaufen ‘to buy’. (162b) shows that the transitive stage-level verb kaufen ‘buy’ does not denote a binary, but a ternary relation between an event and two individual arguments (see section 1.4 for discussion).

(162) a. \[ [P₀ jeweilsᵢ zwei Würstchen]] = ∀ᵢ[z ∈ ZᵢÆ ∃ Xᵢ[2sausages’(X) ∧ *Rᵢ(z,X)]]

b. \[ [kaufenᵢ] = λy λx.∃e.buy’(x,y,e) \]

The problem is that the values in (162ab) cannot combine by a sequence of λ-abstraction plus functional application, as demonstrated in the preceding section. Applying λ-abstraction over index ‘i’ in (162a) would result in a function from binary relations into truth-values. Such a function could not take the ternary relation in (162b) as its argument, resulting in type mismatch.

The problem therefore lies in the presence of the additional event argument, which (in this case, but see the discussion in chapter V!) plays no role in establishing a distributive relation between DistKey and DistShare. In order to overcome this problem, I propose that existential closure over the event argument can apply inside the VP, at least sometimes.⁶⁶⁶⁷ In the case of (161), this means that existential closure applies before the meanings of verb and jeweils-DP are combined, yielding the expression in (163).

(163) \[ [kaufenᵢ] = λy λx.∃e.buy’(x,y,e) \] by existential closure over ‘e’

---

⁶⁶ This claim is not in line with Diesing’s (1992) hypothesis according to which existential closure always applies at the level of VP. It is not clear, though, if the two proposals differ in their predictions. In any event, Eckardt (1998) shows that existential closure over higher event layers can also apply at a level above VP (see also the discussion of multiple event quantification at the end of 1.3). If so, it is not a priori impossible that existential closure over smaller event layers applies inside the VP, if the VP denotes a plurality of events. As argued at the end of section 3.2.6, presence of adnominal jeweils leads (indirectly) to the construal of a plural event consisting of individual boys buying two sausages. If correct, VP-internal existential closure in (161) is licensed by the need to existentially close off the lowest event layer, namely that of individual events.

⁶⁷ If however the assumption of existential closure over events inside the VP should turn out to be problematic for some reason, there are at least two other possible strategies one could pursue in order to ensure the interpretability of (161). The first possibility is to assume that the existential quantifier in the nuclear scope of the universal quantifier in (162a) unselectively binds all free variables in its scope, including the event variable. The second possibility is to assume a family of denotations for the complex formed by P₀ and jeweils. The members of the family would differ in the acidity of the relation variable R (binary, ternary, …) and, corresponding to the acidity of R, in the number and kind of variables bound by the existential quantifier ‘∃’.
With (163), the meanings of jeweils-DP and its sister can combine by means of the semantic mechanism from above. The semantic derivation is given in (164).

\[(164)\]

\[\begin{align*}
  & a.\ [\text{[}P^0_i\ \text{jeweils, zwei Würstchen]}] & \text{by λ-abstraction over 'j'} \\
  & = \lambda R_i, \forall z [z \in Z_i \rightarrow \exists X [2\text{sausages}(X) \land \neg R_i(z,X)]] \\
  & b. \ [\text{[}P^0_j\ \text{jeweils, zwei Würstchen kaufen]}] & \text{FA of (164a) to (163)} \\
  & = \forall z [z \in Z_i \rightarrow \exists X [2\text{sausages}(X) \land \exists e [\neg \text{buy}'(z, X, e)]]] \\
  & c. \ [\text{[}P^0_j\ \text{jeweils, zwei Würstchen kaufen}]] & \text{λ-abstraction over 'i'} \\
  & = \lambda Z_i, \forall z [z \in Z_i \rightarrow \exists X [2\text{sausages}(X) \land \exists e [\neg \text{buy}'(z, X, e)]]] \\
  & d. \ [\text{[die Jungen, P^0_j jeweils, zwei Würstchen kaufen}]] & \text{by FA to [[the boys]}} \\
  & = \forall z [z \in [[\text{the boys}]] \rightarrow \exists X [2\text{sausages}(X) \land \exists e [\neg \text{buy}'(z, X, e)]]] = 1 \text{ iff} \\
  & e. \text{for each } z \text{ which belongs to a specific group of boys there is a set of two sausages } X \text{ and an event } e \text{ such that } z \text{ buys } X \text{ in } e.'
\end{align*}\]

The result in (164e) is similar to Moltmann’s (1991,1997) analysis in that the semantic representation contains subevents of individual boys buying two sausages. These subevents, which are bound by an existential quantifier, can combine to form a plural event. Higher-level event modifiers or quantifiers should be able to modify or quantify over this plural event. (165ab) show this expectation to be borne out.

\[(165)\]

\[\begin{align*}
  & a. \text{Die Jungen haben [VP immer [VP jeweils zwei Würstchen gekauft]]]} \\
  & \text{the boys have always each two sausages bought} \\
  & \text{‘The boys have always bought two sausages each.’} \\
  & b. \text{Die Jungen haben [VP im Laden jeweils zwei Würstchen gekauft]]]} \\
  & \text{the boys have in the store each two sausages bought} \\
  & \text{‘In the store, the boys have bought two sausages each.’}
\end{align*}\]

Repeated event quantification was discussed at the end of section 1.3, and also in 3.2.6. There, it was shown that the presence of two event quantifiers leads to quantification of the higher quantifier over the restriction of the lower quantifier. It follows that the implementation of existential closure over the event variable in (163) was not precise enough in order to deal with instances of repeated adverbial quantification. As discussed in 1.3 and 3.2.6, the event bound by the existential quantifier ‘∃’ must be part of a plural event E which provides the restriction for ‘∃’, and which is quantified over by the higher quantifier immer ‘always’. The element-of relation between individual events and the plural event is captured formally by adding the restriction ‘e \in E’ to the semantic representation.

Since the lower VP in (165a) denotes a proposition, λ-abstraction over E must apply before the VP-denotation can be an argument to the event quantifier. λ-abstraction is triggered by co-indexation of an index on e’ and the quantifier. After λ-abstraction, the value of the lower VP is as in (166a).\(^{69}\) Functional application of the meaning of immer ‘always’ to (166a) yields (166b).

\(^{68}\) See Eckardt (1998:123), where a similar strategy is proposed for capturing the phenomenon of repeated event modification. Eckardt’s approach differs from ours in that she utilises the (material) subpart-of relation ‘e \subseteq e’ instead of the element-of relation in the main text, presumably in order to avoid a hierarchy of event types for sentences like (i):

(i) In ten minutes, Erna buttered each bagel.

\(^{69}\) I assume that quantifiers are co-indexed with the variable they bind.
(166a) \[ [\forall_{\text{jeweils}} \text{zwei Würstchen gekauft}] \]
\[ = \lambda E_k \forall z [\exists X [2\text{sausages}'(X) \land \exists e \in E_k [*\text{buy'}(z, X, e)]]] \]

(166b) \[ [\text{immer jeweils jeweils zwei Würstchen gekauft}] \]
\[ = (\lambda p. \forall E' [E' \in E'' \rightarrow \exists E [\ast R'(E', E) \land p(E)]])(\lambda E_k \forall z [\exists X [2\text{sausages}'(X) \land \exists e \in E_k [*\text{buy'}(z, X, e)]]]) \]
\[ \iff \forall E'[E' \in E'' \rightarrow \exists E [\ast R'(E', E) \land \forall z [\exists X [2\text{sausages}'(X) \land \exists e \in E [\ast \text{buy'}(z, X, e)]]]]] \]
\[ \iff \forall E'[E' \in E'' \rightarrow \exists E [\ast R'(E', E) \land \forall z [\exists X [2\text{sausages}'(X) \land \exists e \in E [\ast \text{buy'}(z, X, e)]]]]] \]

(166b) is true iff for all plural events \( E' \) of a contextually given set of plural events \( E'' \), there is a plural event \( E \) such that \( E \) stands in a (causal, temporal, subpart) relationship to \( E' \), and for all elements \( z \) of a given set \( Z \) there is a set of two sausages \( X \) and there is an event \( e \) element of \( E \), such that \( z \) buys \( X \) in \( e \). \( \lambda \)-abstraction over \( Z \) plus FA to \( [\text{the boys}] \) gives the correct truth conditions for (165a). Similar considerations should allow for a correct derivation of (165b), which features event modification of the plural event constituted by the individual buying events. In contrast to adverbial quantifiers, the adverbial event modifier \( \text{im Supermarkt} \) ‘in the store’ in (165b) is unlikely to be co-indexed with a complex event argument. Rather, I assume that the type mismatch between the lower VP (type \( <t> \)) and the adverbial PP (type \( <vt,t> \)) is resolved by applying the second rule of (type-triggered) \( \lambda \)-abstraction from (140) to the meaning of the lower VP. It seems that repeated event modification over different event layers could be resolved by means of this mechanism in general, independent of the presence of \( \text{jeweils} \). After \( \lambda \)-abstraction over the VP-denotation, the denotations of the adverbial PP and its sister are of the right type (\( <vt,t> \)) to combine by way of predicate modification.

This concludes the discussion of \( \text{jeweils} \)-DPs as objects of transitive stage-level predicates. The discussion has shown that a correct (compositional) interpretation of \( \text{jeweils} \)-DPs in this context depends on existencial closure of the event variable inside the VP.

### 4.3 Interpreting \( \text{jeweils} \)-DPs in other Syntactic Configurations

Taking stock, so far we have accounted for the basic occurrences of \( \text{jeweils} \)-DPs as objects of transitive verbs (both stage- and individual) level, and as part of a PP embedded inside another DP. The correct truth conditions were derived compositionally by making use of basic semantic mechanisms such as (co-) indexation, \( \lambda \)-abstraction, functional application, predicate modification, and existential closure. On the assumption that these semantic mechanisms are universal, the analysis of adnominal \( \text{jeweils} \) in object position should carry over directly to the counterparts of \( \text{jeweils} \) in the other languages, e.g. English \( \text{each} \) and French \( \text{chacun(e)} \). This expectation is based on the claim from chapter III that the underlying structure of \( d \)-distributive constructions in these languages is identical to that of \( \text{jeweils} \)-DPs in German.

However, German \( \text{jeweils} \)-DPs can occur in a wider range of syntactic configurations, some of which are unattested for languages such as French or English (see the discussion in chapters II.4 and III.5). The examples in (167) show that \( \text{jeweils} \)-DPs and DistKey expressions are quite free in their syntactic distribution. \( \text{Jeweils} \)-DPs in indirect object position distribute over subject DPs (167a). \( \text{Jeweils} \)-DPs in adjunct position distribute over subject (or object) DPs (167bc). Furthermore, \( \text{jeweils} \)-DPs distribute over verb conjunctions from either adjunct position (167d) or from direct object position (167e).
(167) a. Die Jungen, haben [jeweils, zwei Mädchen] Rosen gegeben. The boys have given two girls each roses.
   the boys have each two girlsDAT roses given
b. Die Jungen, haben [in jeweils, zwei Läden] Rosen gekauft. The boys have bought roses in two shops each.
   the boys have in each two stores roses bought
c. Die Jungen, haben [[jeweils, zweimal] geklopft]. The boys have knocked twice each.
   the boys have each twice knocked
d. Peter hat Maria [aus jeweils, zwei Gründen] [gelobt und kritisiert]. Peter has praised and criticised Mary for two reasons respectively.
   Peter has Maria for each two reasons praised and criticised
e. Maria hat [jeweils, zwei Bücher] [gelobt und kritisiert]. Maria has each two books praised and criticised
   Maria has each two books praised and criticised two books respectively.

The last two cases were grouped under the label ‘Moltmann’s observation’ and are of particular interest. They illustrate the capacity of adnominal jeweils to distribute over pluralities denoted by non-DPs. In (167de), jeweils distributes over pluralities of events or predicates. The analysis of (167c) was shown to be problematic on Moltmann’s (1997) account. Thus, a satisfactory analysis of (167de) would be an argument in favour of the present account.

Jeweils-DPs are possible in even more syntactic positions. Jeweils-DPs in subject position distribute over object DPs (168a) or over an implicit set of events (168b). Jeweils-DPs in direct object position distribute over indirect object DPs (168c), and over PP-adverbials (168d).

(168) a. [Jeweils, zwei Offiziere] begleiten die Ballerinen, nach Haus. The ballerinas are accompanied home by two officers each.
   each two officers accompany the ballerinas to home
b. [Jeweils, zwei Jungen] standen Wache. Two boys kept watch at a time.
   each two boys kept watch
c. Peter hat zwei Mädchen, [jeweils, zwei Rosen] gekauft. Peter has bought two roses each in three stores.
   Peter has two girlsDAT each two roses bought
   Peter has in three stores each two roses bought
   ?Peter has bought two roses each in three stores.

An empirically adequate analysis of adnominal jeweils must account for all the occurrences of jeweils listed in (167) and (168). In the remainder of section 4, I show that the semantic tools introduced so far allow for a correct derivation of the readings of (167a-e). In particular, I will demonstrate that the analysis accounts for Moltmann’s observation, illustrated in (167de). Section 4.3.1 discusses jeweils-DPs in indirect object position (cf.167a). Section 4.3.2. discusses jeweils-DPs in adjunct position (cf.167bc). The discussion of (167c) raises, again, the question of whether there are really two syntactic instances of jeweils. The question is answered in the positive in 4.3.3. Finally, 4.3.4. presents the analysis of Moltmann’s observation.
The proper analysis of (168a-d) requires an additional assumption and will be postponed to chapter V. Nevertheless, the interpretation of (168a-d) is derivable by means of the same semantic mechanisms as the interpretation of (167a-e). The discussion in the remainder of this and in the following chapter will show the interpretive procedure for jeweils-DPs to be a very flexible semantic mechanism. It is the flexibility of this mechanism that accounts for the wide syntactic distribution of jeweils-DPs. As will emerge, there are only three structural conditions that need to be satisfied in order for a successful interpretation of adnominal jeweils. The licensing conditions for adnominal jeweils are summarised in (169).

(169) Licensing Conditions for Adnominal Jeweils:
In order to be interpretable, all occurrences of adnominal jeweils require:

i. a predicate denoting expression in sister position (= DistShare)

ii. a relation-denoting expression as sister of the jeweils-DP (=the distributive relation)

iii. a c-commanding plural expression (= DistKey)

Notice that (169i) and (169iii) look suspiciously close to the indefiniteness and the plural requirement on adnominal jeweils from chapter II.1.5. We now turn to the interpretation of the sentences in (167a-e).

4.3.1 Jeweils-DPs in Indirect Object Position
In (170) (=167a), the jeweils-DP is in indirect object position and takes the V’-constituent formed by V and direct object as its syntactic sister.

(170) Die Jungen haben [[P₀ jeweils] zwei Mädchen] [V Rosen gegeben]].

‘The boys have given two girls each roses.’

It follows from compositionality that the denotations of jeweils-DP and V’ combine first. The denotation of V’ is of the same semantic type as that of stage-level transitive verbs above: The ditransitive verb gegeben ’given’ has already applied to its first semantic argument, the direct object denotation and denotes a ternary relation between two individuals and an event argument. We therefore expect the interpretation of (170) to be analogous to that of jeweils-DPs in direct object position of stage-level transitive verbs (see section 4.2.4). This expectation is borne out, as witnessed by the derivation in (171).

Again, existential closure over the event argument applies VP-internally before the meanings of V’ and jeweils-DP combine.

(171)a. [[P₀ jeweils] zwei Mädchen] = ∀z [z ∈ Zᵢ → ∃X [2girls(X) ∧ *Rᵢ(X,z)]]

b. [[R Rosen gegeben]] = λuλv. ∃e∃Y [*rose(Y) ∧ *given'(v, Y, u, e)]

↓

λ-abstraction over Rᵢ in (171a)

c. [[P₀ jeweils] zwei Mädchen]] = λRᵢ, ∀z [z ∈ Zᵢ → ∃X [2girls(X) ∧ *Rᵢ(X,z)]]

FA of (171c) to (171b)

d. [[P₀ jeweils] zwei Mädchen Rosen gegeben]] =

∀z [z ∈ Zᵢ → ∃X [2girls'(X) ∧ ∃e∃Y [*rose'(Y) ∧ *given'(z, Y, X, e)]]]

↓

λ-abstraction in over index i of subject (trace), plus FA

e. ∀z [z ∈ [[the boys]] → ∃X[2girls'(X) ∧ ∃e∃Y [*rose'(Y) ∧ *given'(z, Y, X, e)]]]
(171c) is true iff for each z which is element of a specific group of boys there is a set of two girls X and an event e and a set of roses Y such that z gave Y to X in e, matching the truth conditions of (170).

The derivation in (171) shows that the analysis of jeweils-DPs in direct object position can be extended directly to jeweils-DPs in indirect object position. The denotations of the verb (a relation) and of the DistKey (a plurality) are factored in by λ-abstraction over their index, which is followed by functional application. Apparently, the same mechanism works for English double object constructions, as witnessed by the grammaticality of (172).

(172) The boys gave two girls each roses.

4.3.2 Jeweils-DPs in Adjunct Position

The structure of (173) (=167b) differs from the cases analysed so far in that the jeweils-DP is embedded inside an adjunct.\textsuperscript{70}

(173) [Die Jungen], haben [VP[PP in j [P\textsuperscript{0} jeweils, zwei Läden]]][VP t, Rosen gekauft]].

the boys have in each two stores roses bought

'The boys have bought roses in two shops each.'

In (173), the jeweils-DP is part of a PP-adjunct that – like all other event modifiers – is adjoined to VP (see section 1.1.1). The jeweils-DP is syntactically selected by a preposition that provides the content for the distributive relation variable R.

The semantic value of the adjunct-PP in (174d) is derived from the meaning of the jeweils-DP in (174a), by λ-abstraction over index j (174b), and by FA to the meaning of in in (174c).

(174) a. [[P\textsuperscript{0} jeweils, zwei Läden]] = \forall z \left[z \in Z_i \rightarrow \exists X \left[2\text{stores}'(X) \land *R_j(z, X]\right]\right]

b. [[P\textsuperscript{0} jeweils, zwei Läden]] = \lambda R. \forall z \left[z \in Z_i \rightarrow \exists X \left[2\text{stores}'(X) \land *R_j(z, X]\right]\right]

c. [[in]] = \lambda x \lambda y. \exists e[\text{in}'(x, y, e)]\textsuperscript{71}

d. [[PP in j jeweils, zwei Läden]] = \forall z \left[z \in Z_i \rightarrow \exists X [2\text{stores}'(X) \land \exists e[\text{in}'(z, X, e)]]\right]

A difficulty arises when (174d) combines with the VP-denotation in (175).

(175) [[VP t, Rosen gekauft]] = \lambda E. \exists Y [\text{*rose}'(Y) \land \text{*bought}'(z_i, Y, E)]

The VP-denotation in (175) denotes a set of plural events (the reason for the plurality will become apparent shortly) while the adjoined PP-denotation in (174d) is of type \langle\text{c}\rangle. Because of the resulting type-mismatch the two values cannot combine with one another – or so it seems.

\textsuperscript{70} I ignore the intermediate trace of the topicalised subject in SpecIP.

\textsuperscript{71} I assume that the preposition in (optionally) denotes a ternary relation between two individuals and an event,,
saying that an individual y is located in place x in e. The preposition in in (174c) is of the same type as transitive stage-level verbs. From this and from the general semantic setup, it follows that existential closure over the event argument must apply before preposition and jeweils-DP combine. The necessity for analysing in as containing an event argument in its lexical entry will become apparent shortly.
We came across a similar problem in connection with (165ab) above. There, it was shown that a VP which contains a jeweils-DP and which is therefore of type \(<v,t>\) can be subject to further modification with an event modifier over a higher event layer (of type \(<v_{t},t>\)). In the present case, we are presented with the mirror image of this constellation. An event modifier of type \(<>\) (due to the presence of jeweils) occurs next to a VP of type \(<v_{t},t>\). There, the problem was mended by applying type-triggered \(\lambda\)-abstraction to an event variable \(E\) that provided the semantic restriction for the existential quantifier over the event argument of the verb. The resulting expression was combined with the event modifying expression by predicate modification. Using the same mechanism, (174d) can be made to contain a free event variable as well. As in the above case, an event variable \(E\) should be able to restrict the existential quantifier over the event argument of the preposition. Granted this, (174d) will be able to undergo type-triggered \(\lambda\)-abstraction over \(E\). The output of \(\lambda\)-abstraction is given in (176a), the result of predicate modification is shown in (176b).

\[
(176)\begin{align*}
a.\ & \lambda E.\ldots = \exists X[2stores'(X) \land \exists e \in E[\ldots]] \\
b.\ & \lambda E.\ldots = \lambda E.\exists Y[\ldots] \land \lambda E.\exists X[2stores'(X) \land \exists e \in E[\ldots]]
\end{align*}
\]

Existential closure over \(E\), followed by \(\lambda\)-abstraction over index \(i\) and FA to the subject denotation yields (177):

\[
(177)\exists E[\exists Y[\ldots] \land \exists E[\ldots]] \land \forall z [z \in \ldots] \rightarrow \exists X[2stores'(X) \land \exists e \in E[\ldots]]
\]

(177) is true iff there is a plural event \(E\) in which the boys buy roses and for each individual boy \(z\) there is a set of two stores \(X\) and an event \(e\) element of \(E\) such that \(z\) is in \(X\) in \(e\). I.e., each event of rose buying by an individual boy takes place in two stores. \(^{72}\)

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\(^{72}\) At least three comments are in order. First, the atomic events \(e\) are taken to be materially complex events that are spread out locally over two stores. This indicates that individual events do not necessarily occur at one location only, but that parts of events can spread out over space (as they can over time). Second, the individual events \(e\) are elements of a plural event, which forms part of the pluralised predicate \(*bought'\). The star operator \(*\) turns the simple relation \(bought'\), which holds between individuals, into a higher-order relation between sets of buyers \(X\), bought things \(Y\), and events \(E\) such that for each element of the sets \(X\), \(Y\), and \(E\), there are elements of the other two sets such that the three stand in the (simple) buying relation (cf. Stermenfeld 1998:316). That is, \(*bought'\) corresponds to a set of sets of ordered pairs of individual buyers, things bought, and events. These sets express all conceivable events of rose buying by the boys, be they distributive, collective, or cumulative in nature. Third, \(E\) in (176a) stands for a plural event, and – correspondingly - the result of \(\lambda\)-abstraction over \(E\) comes out as a predicate over sets of events. Since (176a) and the VP-denotation in (175) are argued to combine by predicate modification (cf.176b), it follows that the VP-denotation in (175) must also denote a predicate over plural events, and not a predicate over events as usual. In order to account for this, one has to assume that verbal predicates over events (type \(<v_{t},t>\) can optionally be type-shifted to verbal predicates over plural events (type \(<vt_{t},t>\)). This type-shift operation is structurally analogous to the type-shift operation that maps individual predicates of type \(<v,t>\) into plural predicates (or generalised quantifiers) of type \(<vt,t>\) in the nominal domain (cf. Partee 1987, Winter 1999). Additional support for a type-shifting operation from event predicates into predicates of pluralities of events comes from the overt existence of so-called ‘pluractionality markers’ (Lasersohn 1995) as again and again, now and then whose presence seems to effect precisely such a type-shift from \(<v_{t},t>\) to \(<vt_{t},t>\). Compare the denotation of the ordinary VP in (ia) with the pluralised VP in (ib):
Given that the above considerations are on the right track, the existence of jeweils-DPs inside PP-adjuncts is accounted for. Again, the mechanism of type-triggered $\lambda$-abstraction plays a central role in combining the VP-denotation with that of the event modifying adjunct-PP.

A welcome result of the semantic analysis of (173) is that it provides an account for an apparent problem that was pointed out in chapter II.2.3. It is illustrated again in (178).

(178) Der Papst ist [[$\text{PP in jeweils drei Länder}$] $\text{VP t1 gereist}$].

The pope is in each three countries travelled

‘The Pope travelled to three countries each time / on each trip.’

The apparent problem with (178) is that an instance of adnominal jeweils (as witnessed by its being embedded inside a PP) distributes over an implicit set of events in the absence of a plural DP that could serve as DistKey. In other words, adnominal jeweils in (178) has an adverbial-like reading in the sense that it distributes over events.

The adverbial-like reading of (178) is derived as follows. The derivation parallels that of (173) up to the point where the values of PP and VP combine. The value of the PP in jeweils drei Länder ‘in three countries each’ is given in (179).

(179) $[[\text{PP in jeweils drei Länder}]] = \forall z [z \in Z_i \rightarrow \exists X [3\text{countries}'(X) \land \text{to}'(X, z)]]$

Now, the distributive effect over a set of events is achieved by interpreting $Z_i$ as a variable over sets of events. This move is licit since the only formal requirement on $Z_i$ is that it be a set variable (for entities of any kind). If so, type-triggered $\lambda$-abstraction can apply to $Z_i$ directly. The result combines with the VP-denotation by predicate modification, parallel to the case in (173). (180) shows the result of predicate modification.

(180) $[[\text{in jeweils drei Länder gereist}]]$

$= \lambda E. *\text{travelled}'(z_1, E) \land \forall z [z \in E \rightarrow \exists X [3\text{countries}'(X) \land \text{to}'(X, z)]]$

As desired, the restriction for the universal quantifier is provided by a set of events in (180). In the next step, the subject denotation is factored in by $\lambda$-abstracting over index ‘1’ of the subject trace, and by functionally applying the result to the subject denotation. Finally, the expression applies to an implicit set of events $E_i$ provided by the context.

(181) $*\text{travelled}'(\text{the pope}, E_i) \land \forall z [z \in E_i \rightarrow \exists X [3\text{countries}'(X) \land \text{to}'(X, z)]]$

(181) is true if there is a given set of events $E$ of the pope travelling, and for each element $e$ of $E$ it holds that there are three countries that were travelled to. This adequately captures the truth-conditions for (178), showing that the proposed semantic analysis is flexible enough to deal with the existence of adverbial-like readings with adnominal jeweils on which the latter distributes over an implicit set of events. In chapter V, it will emerge that this is a general option for adnominal jeweils whenever the relevant licensing conditions are met.

(167c), repeated as (182) is interpretable in a similar way.

b. $[[ \forall\text{Peter whistles now and then}]] = \text{the set of sets of events which are whistling events by Peter such that they occur in regular (temporal) intervals}
(182) Die Jungen haben [VP doppelten jeweils zweimal] [VP t. geklopft].

‘The boys have knocked twice each.’

The only difference to the above construction is that the DistShare zweimal ‘twice’ in (182) is of type <vt,t> and denotes a cardinal predicate over plural events. It follows that the relation variable $R$ contained in jeweils establishes a relation between individuals (here: the set of boys), and sets of events which arepredicated to be of cardinality 2 by the DistShare. The jeweils-DP as a whole is an (adverbial) event modifier, and as such adjoined to VP.

The denotation of the jeweils-DP is given in (183a), that of the lower VP before existential closure in (183b). Notice that the VP must again denote a second order predicate over pluralities of events (cf. fn.72).

(183) a. $[[DP P_0 jeweils_doppelten zweimal]] = \forall z [z \in Z_i \rightarrow \exists E \cdot \text{twice}'(E) \land *R_j(z, E)]$

b. $[[VP t. geklopft]] = \lambda E. *\text{knocked}'(X_i, E)$

The question of how to combine the two denotations in (183ab) presents us with the by now familiar problem of type mismatch. Once again, I suggest the by now familiar remedy of type-triggered $\lambda$-abstraction over a free variable in (183a). As in the case of (173), I suggest that the free variable is an event variable $E'$ which restricts the existentially bound set of events $E$ in (183a). However, since $E$ stands for a plurality of events already, namely events of knocking twice, I suggest that $E$ and $E'$ are related to one another by the subset relation. With these assumptions, $\lambda$-abstraction over $E'$ results in (184a). This expression combines with (183b) by predicate modification, yielding (184b). Finally, existential closure over $E'$ and $\lambda$-abstraction over the subject’s index plus functional application to the subject denotation yield (184c).

(184) a. $[[DP P_0 jeweils_doppelten zweimal]] = \lambda E'. \forall z [z \in Z_i \rightarrow \exists E \subseteq E' \cdot \text{twice}'(E) \land *R_j(z, E)]$

b. $[[P_0 jeweils_doppelten t. geklopft]] = \lambda E'. *\text{knocked}'(X_i, E') \land \forall z [z \in Z_i \rightarrow \exists E \subseteq E' \cdot \text{twice}'(E) \land *R_j(z, E)]$

c. $[[\text{Die Jungen, haben jeweils, zweimal geklopft}]] = \exists E' \cdot \exists E \subseteq E' \cdot *\text{knocked}'(\{\text{the boys}\}, E') \land \forall z [z \in \{\text{the boys}\} \rightarrow \exists E \subseteq E' \cdot \text{twice}'(E) \land *R_j(z, E)]$

(184c) reads as ‘There is a plurality $E'$ of knocking events by the boys and for each individual boy $z$, there is a subset $E$ out of $E'$ such that $E$ consists of two atomic events and such that $z$ stands in some relation to this event’. An interesting property of (184c) is that the free relation variable $R_j$ remains free and must therefore be assigned a value from the context. In the situation depicted, the only meaningful values for $R_j$ are values such as IN or AT (indicating that $z$ participates in the event) or, more specifically, a relation such as AG, indicating that $z$ is the acting agens of the event. I assume that any ‘incorrect’ values for $R_j$ are correctly excluded by contradiction with the condition $*\text{knocked}'(\{\text{the boys}\}, E')$ in the first part of the conjunct.

In conclusion, it was shown that jeweils-DPs in event modifying adjuncts can be correctly interpreted by means of the semantic tools introduced so far. The central role in

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73 I take the event modifier zweimal, literally ‘two times’, to be of category NP due to the nominal status of its head mal ‘time’. On the existence of bare NP-adverbs, cf. Larson (1985b).
the derivation is played by type-driven λ-abstraction that applies to a plural event variable E. The application of λ-abstraction over E paves the way for combining the semantic values of adjunct and VP by way of predicate modification.

4.3.3 On the Necessity of Adnominal jeweils in Ambiguous Sentences

The discussion of adnominal jeweils with event predicates such as zweimal ‘twice’ raises the question of whether we really need adnominal jeweils in ambiguous sentences such as (117), which is repeated as (185).

(185) ..., weil die Jungen jeweils zwei Bücher gekauft haben.
because the boys each two books bought have

a. ‘The boys have bought two books each.’

b. ‘The boys have bought two books each time.’

The problem is the following. Up until now, I have argued that (185) is structurally ambiguous. The adverbial reading (185b) involves an instance of adverbial jeweils, which combines with the VP denoting an event predicate. The adnominal reading (185a) involves an instance of adnominal jeweils, which forms the object DP together with the DistShare, and which distributes over the subject DistKey. In the preceding section, however, we have come across a case of jeweils combining with an event predicate as its DistShare, while distributing over a plural subject nonetheless. Now, if it is possible for jeweils in (182) to combine with an event predicate (zweimal ‘twice’) and to distribute over a plural subject (die Jungen ‘the boys’), why should it be impossible for jeweils in (185) to combine with a VP (also an event predicate) and distribute over a plural subject as well? If this were an option, there would be no need for postulating two different structures in (185). Both readings would fall out from the structure in (186), the difference in interpretation being due to a difference in indexation. (186) shows the supposed indexation for the ‘adnominal’ reading (185a).

(186) Die Jungen haben \[\text{VP jeweils,}\text{VP zwei Bücher gekauft}\].
the boys have each two books bought

If correct, this reasoning would stand in stark contrast to the empirical evidence in favour of structural ambiguity that was adduced in chapter II.2. Fortunately, though, a closer inspection of (186) shows that the assumption of structural ambiguity need not be abandoned. It can be shown that (186) is not interpretable at all. To see this, consider the derivation in (187). (187a) shows the value for jeweils. (187b) shows the denotation of the VP. (187c) shows the denotation of the two constituents combined.

(187) a. \[[P_0^j jeweils,]] = \lambda P. \forall z [z \in Z_i \rightarrow \exists e [P(e) \land R_j(z,e)]]

b. \[[t_i zwei Bücher gekauft ]] = \lambda e. \exists Y [2books'(Y) \land *bought'(v_i, Y, e)]

c. \[[P_0^j jeweils, t_i zwei Bücher gekauft]] =
\forall z [z \in Z_i \rightarrow \exists e [\exists Y [2books'(Y) \land *bought'(v_i, Y, e)] \land R_j(z,e)]]

The next step in the derivation is the crucial one. In order to factor in the subject denotation, λ-abstraction must apply over index ‘i’. This λ-abstraction is followed by functional application, incorrectly yielding (188) as a possible meaning for (185).
(188) \[
[[\text{Die Jungen haben jeweils } i \text{ zwei Bücher gekauft}]] = \\
\forall z(\exists e[[\text{theboys}]] \rightarrow \exists Y[2\text{books'(Y)} \land \text{bought'}[[\text{theboys}],Y,e]] \land R_j(z,e))
\]

The problem with (188) is that universal quantification over the set of boys does not result in distribution over the boys regarding the buying event. The set of boys still features as the subject of the predicate \text{bought'} in the nuclear scope of the universal quantifier. (188) could be paraphrased roughly as ‘For each individual boy \(z\), there is an event \(e\) such that there are two books \(X\), such that \(\text{all the boys bought } X\) in \(e\), and \(z\) stands to \(e\) in an additional relation.’ It is not clear to me if this paraphrase is in any way meaningful. In any event, it does not express the adnominal reading in (185a).

The problem with (188) stems from the fact that the subject variable is located in the nuclear scope of the universal quantifier in (187c). Since the subject variable is co-indexed with the DistKey, in this case the plural subject, \(\lambda\)-abstraction over index ‘\(i\)’ (on the variables \(Z\) and \(v\)) and functional application to the denotation of the plural subject bring it back into the nuclear scope of the universal quantifier, counteracting the (distributive) effect of universal quantification.

I conclude that adnominal \text{jeweils} can only take event predicates as its DistShare argument if the event predicate does not contain a variable that is co-indexed with the DistKey. Typical event modifiers that meet this condition are adjuncts like \text{zweimal ‘twice’}. In contrast, VPs, which contain a trace of the DistKey (e.g. the subject trace) do not satisfy the condition. It follows that \text{jeweils} cannot directly combine with the VP in (185) in order to give rise to the adnominal reading. The structural ambiguity of (185) is therefore not only supported by empirical arguments, but also by semantic considerations.

### 4.3.4 Distribution over Plural Events and Plural Predicates

We turn now to the analysis of sentences (167de), repeated as (189ab). Both sentences are instantiations of Moltmann’s observation.

(189) a. Peter hat Sue \([\text{aus jeweils } i \text{ zwei Gründen}] \text{ gelobt und kritisiert}].

‘Peter has praised and criticised Sue for two reasons respectively.’

b. Maria hat \([\text{jeweils } i \text{ zwei Bücher}] \text{ gelobt und kritisiert}].

‘Maria has praised and criticised two books respectively.’

(189ab) stand out because \text{jeweils} does not distribute over a plurality of (concrete) individuals denoted by an argument DP, but over the denotation of the verb conjunction \text{gelobt und kritisiert ‘praised and criticised’}. Of course, the present semantic analysis of adnominal \text{jeweils} should capture its capacity to distribute over the denotation of non-DPs. I would like to argue that the occurrence of adnominal \text{jeweils} in the constructions in (189ab) is licensed by its inherent flexibility regarding the nature of its DistKey, as long as the latter denotes a plurality for \text{jeweils} to distribute over. In particular, I argue that \text{jeweils} distributes over a plural event in (189a) and over a plural predicate in (189b).

Looking at (189a) first, its structure is given in (190).

(190) \(P,\text{hat } S_2[\text{aus jeweils zwei G.}]\text{[gelobt } t_1 t_2 \text{ kritisiert}]].

‘P. has S. for each two reasons praised and criticised’
I assume that the event modifying PP *aus jeweils zwei Gründen* ‘for two reasons each’ is adjoined to VP, as are all event-modifying expressions. I also assume that the object *Maria* has scrambled out of the VP at surface structure since it precedes the adverbial modifier that is adjoined to VP.

I assume that the conjoined VPs in (189a) denote a predicate over plural events that is formed by Krifka’s mechanism of predicate conjunction. Translating Krifka’s (1990) mechanism for predicate conjunction into set notation, we get the following denotation for the conjoined VP.

\[(191) \lambda E_\iota \exists e_1 \exists e_2 [E_\iota = \{e_1, e_2\} \land \text{praise}'(x_1, y_2, e_2) \land \text{criticise}'(x_1, y_2, e_1)]\]

(191) stands for a set of complex events E which consist of two subevents e_1 and e_2 such that e_1 is a praising of y by x, and e_2 is a criticising of the same person y by the same person x. With (191), the rest of the derivation is standard and given in (192).

\[(192)\]

(a) \[[\text{aus jeweils zwei Gründen}]\] = \(\forall z [z \in Z_i \Rightarrow \exists X [2\text{reasons}'(X) \land \text{for}'(X, z)]]\)

for each two reasons

\(\lambda\)-abstraction in (192a) over ‘i’ triggered by index on V

(b) \[[\text{aus jeweils zwei Gründen}]\]

\(= \lambda Z_i \forall z [z \in Z_i \Rightarrow \exists X [2\text{reasons}'(X) \land \text{for}'(X, z)]]\)

\(\downarrow\)

predicate modification of (191) and (192b)

(c) \[[\text{aus jeweils zwei Gründen}]\]

\(= \lambda E_\iota \exists e_1 \exists e_2 [E_\iota = \{e_1, e_2\} \land \text{praise}'(x_1, y_2, e_2) \land \text{criticise}'(x_1, y_2, e_1)] \land \forall z [z \in E_\iota \Rightarrow \exists X [2\text{reasons}'(X) \land \text{for}'(X, z)]]\)

\(\downarrow\)

FA to object and subject; existential closure over E_i

(d) \exists E_\iota \exists e_1 \exists e_2 [E_\iota = \{e_1, e_2\} \land \text{praise}'(p, s, e_1) \land \text{criticise}'(p, s, e_2)] \land \forall z [z \in E_\iota \Rightarrow \exists X [2\text{reasons}'(X) \land \text{for}'(X, z)]]\]

(192d) is true iff there is a complex event E_i which consists of a criticising of Sue by Peter and a praising of Sue by Peter and for each element z of the complex event E_i there is a set X of two reasons such that z happened because of X. This paraphrase correctly

\[\forall z [z \in E_\iota \Rightarrow \exists X [2\text{reasons}'(X) \land \text{for}'(X, z)]]\]

74 The event modifying PP *aus jeweils zwei Gründen* ‘for two reasons each’ is perhaps not the optimal choice because P and NP form a semantically non-transparent constituent. The basic meaning of the preposition *aus* is usually not ‘for’, but ‘from’. Somehow, *aus* inherits its causative flavour from the meaning of the head noun, *Gründen* ‘reasons’, which leads to the following value for the entire PP:

(i) \[[\text{aus jeweils zwei Gründen}]\] = \(\forall z [z \in Z_i \Rightarrow \exists X [2\text{reasons}'(X) \land \text{for}'(X, z)]]\)

Still, I will continue using this possibly non-compositional example in order to avoid additional data confusion and because the same facts are observable with regular, compositional PPs. In (ii), the preposition combines with the *jeweils*-DP on its regular reading.

(ii) *Peter hat Sue an jeweils zwei Orten gelobt und kritisiert.*

P. has S. at each two locations praised and criticised

‘Peter has praised and criticised Sue at two locations respectively.’

75 I gloss over the question if (189a) is better analysed as involving conjunction of bare verbs or of whole VPs plus across-the-board-extraction. Winter (1999:70-72) shows that Krifka’s mechanism works for predicates of type \(<e,t>\) (or \(<v,t>\), the type of the conjoined VPs), but that the attempt at a recursive extension to higher types (e.g. \(<et,t>\) fails. Since Krifka’s mechanism works fine with predicates, it should work for the present case if we assume that the conjoined entities are VPs of type \(<v,t>\). Semantic considerations therefore argue in favour of VP-conjunction in (190). By the same argument, the structure of (189b) may differ from (189a) because *jeweils* will shortly be shown to distribute over a plural relation in (189b). It would make sense if this semantic difference were reflected in a different syntactic structure in form of bare V-conjunction.
captures the truth-conditions of (189a), showing that the present semantic analysis of adnominal jeweils successfully deals with apparently problematic cases where jeweils distributes over a plural event denoted by verb (phrase) conjunction. It is worthwhile pointing out that nothing special is required except for Krifka’s mechanism of predicate conjunction, which is needed independently anyway.

It is also worth noting that the derivation in (192) resembles that of (151b), repeated as (193), in that the denotation of the DistKey enters the semantic derivation by predicate modification (see section 4.2.3).

\[(193)\] Listen mit jeweils drei Namen wurden herumgereicht.  
lists with each three names were passed around

In both cases, the denotation of a PP containing the jeweils-DP combines with a plural predicate. In the case of (189a), the VP-conjunction lobte und kritisierte ‘praised and criticised’ denotes a plural predicate over events. In (193), the bare plural noun Listen ‘lists’ denotes a plural predicate over concrete individuals. Therefore, sentence (189a) can be viewed as the ‘eventive’ counterpart of (193) in the verbal domain. This shows once again that the syntactic flexibility observed with adnominal jeweils is not due to the application of different semantic processes in each case, but to the inherent semantic flexibility of jeweils regarding the nature of its DistKey.

We now turn to (189b), which is even more complex, as we will see shortly.

\[(189)\] b. Maria hat [jeweils zwei Bücher] [gelobt und kritisiert].  
Maria has each two books praised and criticised  
‘Maria has praised and criticised two books respectively.’

(189b) is special in that the verb conjunction does not only provide the content of the distributive relation between DistKey and DistShare, a praising or a criticising. Intuition tells us that the denotation of the conjoined verbs also provides the plurality (the DistKey) over which jeweils distributes. I would like to argue that this intuition is correct and that jeweils indeed distributes over the plural predicate denoted by gelobt und kritisiert ‘praised and criticised’ in (189b).

As indicated in fn.75, I assume that the two verbs conjoin directly. In addition, I assume that the jeweils-DP has overtly moved and adjoined to VP. The structure of the VP in (189b) is given in (194).

\[(194)\]

The two conjoined verbs in (194) denote a set of relations, as indicated in (195a). For convenience, the same expression is given in set notation in (195b).
(195) a. \[[\text{gelobt und kritisiert }]]
\[= \lambda R. R = \lambda y \lambda x. \exists e_2[\text{praised'(x,y,e,1)}] \lor R = \lambda y \lambda x. \exists e_2[\text{criticised'(x,y,e,2)}]\]
b. \[\Leftarrow \{\lambda y \lambda x. \exists e_1[\text{praised'(x, y, e_1)}], \lambda y \lambda x. \exists e_2[\text{criticised'(x, y, e_2)}]\}\]

Notice that existential closure over the event variable(s) must take place before the two verbs conjoin. This is necessary because the two event predicates praise and criticise should not apply to the same event because of their (usually) mutually exclusive interpretation. If existential closure happened after verb conjunction, the two event predicates would apply to the same event, making it a simultaneous praising and criticising of something by someone, contrary to our intuitions concerning (189b).

In a next step, the set of relations must apply to the object trace, which is an argument to both individual relations \(R_1\) and \(R_2\). I assume that a set of relations consisting of \(R_1\) and \(R_2\) can apply to an individual entity \(x\) by forming a set of unary predicates consisting of \(P_1\) and \(P_2\), with the relevant argument position being saturated by \(x\). This way, we get (196a) as the denotation for \(\lambda V_1\) in (194). A second application to the subject trace (using the same mechanism) gives (196b), a set of propositions, consisting of \(P_1\) and \(P_2\), as the denotation of the pluralised VP.

(196) a. \[[t_1 \text{ gelobt und kritisiert }]]
\[= \lambda P. P = \lambda x. \exists e_1[\text{praised'(x,y,1,e,1)}] \lor P = \lambda x. \exists e_2[\text{criticised'(x,y,1,e,2)}]\]
b. \[[t_2 \ t_1 \text{ gelobt und kritisiert}]]
\[= \lambda P. P = \exists e_1[\text{praised'(x,y,1,e,1)}] \lor P_2 = \exists e_2[\text{criticised'(x,y,1,e,2)}]\]

In a next step, \(\lambda\)-abstraction over index ‘1’ of the moved jeweils-DP reverts the transition from (196a) to (196b) by opening up the object position. This gives us (197a) as the value for the sister of the jeweils-DP. The expression in (197a) stands for a set of predicates that is co-indexed with the free variable \(Z_i\) in the denotation of the jeweils-DP in (197b).

(197) a. \[\lambda P. P = \lambda y. \exists e_1[\text{praised'(x_2,y,e,1)}] \lor P = \lambda y. \exists e_2[\text{criticised'(x_2,y,e,2)}]\]
\[\Leftarrow \{\lambda y. \exists e_1[\text{praised'(x_2,y,e,1)}], \lambda y. \exists e_2[\text{criticised'(x_2,y,e,2)}]\}\]
b. \[[P_0^i \text{jeweils}, \text{zwei Bücher}]] = \forall P [P \in Z_i \Rightarrow \exists X [\text{2books' (X) } \land \lambda (P,X)]]\]

As mentioned above, adnominal jeweils in (189b) is special in that it distributes not over a set of individuals, but over the set of predicates in (197a), which is denoted by the sister of the jeweils-DP in (194). This is indicated by co-indexation of \(\lambda VP\), and the DistKey variable \(Z_i\) in (197b). It follows that index-triggered \(\lambda\)-abstraction over index ‘i’ can apply in (197b), yielding (198a). The resulting expression takes the \(\lambda VP\)-denotation as its argument, yielding (198b).

(198) a. \[[P_0^i \text{jeweils, zwei Bücher}]] = \lambda Z_i. \forall P[P \in Z_i \Rightarrow \exists X [\text{2books' (X) } \land \lambda (P,X)]]\]
b. \[[P_0^i \text{jeweils, zwei Bücher} [\lambda VP t_1 t_1 \text{ gelobt und kritisiert}]]]\n\[= \forall P [P \in \{\lambda y. \exists e_1[\text{praised'(x_2,y,e,1)}], \lambda y. \exists e_2[\text{criticised'(x_2,y,e,2)}]\} \Rightarrow \exists X [\text{2books' (X) } \land \lambda (P,X)]]\]

The right hand expression in (198b) reads ‘For each predicate \(P\) that expresses either a being praised by somebody, or a being criticised by somebody, there is a set of two books \(X\) such that \(P\) stands in a certain relation \(\lambda R_j\) to \(X\). Since there is no overt relation-denoting expression in the clause, a plausible candidate value for \(R_j\) must be searched for.
elsewhere, presumably in the extra-linguistic context. We have come across a similar case of a contextually specified value for $R_j$ in connection with (182) in section 4.3.2.

Thinking about what kind of relation can plausibly be established between a predicate (over sets) $P$ and a set $X$, candidate values that come to mind are ‘$P$ holds of $X$’, ‘$P$ functionally applies to $X$’ etc. I assume that $*R_j$ in (198b) is assigned some such value in the absence of an overt index ‘$j$’ in the syntactic structure in (194). With this assumption the bold-faced restriction $*R(P, X)$ in (198b) reduces to $*P(X)$. After factoring in the subject denotation (by applying $\lambda$-abstraction over ‘2’ and functionally applying the result to the subject denotation), we get (199) as the eventual reading for (189b).

(199) $\forall P \{P \in \{\lambda y. \exists e_1[praised'(maria,y,e_1)], \lambda y. \exists e_2[criticised'(maria,y,e_2)]\} \Rightarrow \exists X [2books'(X) \land *P(X)]\}$

(199) will be true if for each predicate $P$ of the set of two predicates of being criticised by Maria and of being praised by Maria, there is a set of two books $X$ such that the predicate holds of this set, i.e., the set of books is either praised by Maria or criticised by her.

This seems to adequately capture the truth-conditions of (189b). The semantic representation in (199) allows for (189b) to be true if the praised and criticised books are the same. At the same time, it excludes the possibility that (189b) is true in a situation in which Mary criticised four books without doing any praising. As shown in 3.2.5, this was the fundamental problem with Moltmann’s analysis of sentence (189b).

4.4 Summary

This concludes the discussion of the semantics of adnominal jeweils. Adnominal jeweils has been analysed as a double quantifier that introduces an existentially quantified set in the scope of a universal quantifier. It was shown to distribute over all kinds of plural entities, including individuals, events, and properties. This assumption allows for a correct interpretation of jeweils in a range of syntactic configurations, using standard semantic mechanisms like functional application, predicate modification, existential closure, predicate conjunction, and the two $\lambda$-rules from section 4.2.1. All these mechanisms are attested independently of the presence of adnominal jeweils, which gives the analysis grounding on independent principles and mechanisms.

5 Accounting for the Properties of Adnominal Jeweils

In this section, I show how the semantic analysis of adnominal jeweils accounts for the characteristic properties of jeweils, and of d-distributive elements in other languages. As shown in chapters II.1 and III.2.4.1, these are the indefiniteness restriction on DistShare, the plurality requirement on DistKey, and the clusmate-condition. For convenience, the three properties are illustrated again in (200a-c).

76 The fact that ‘$j$’ cannot be explicitly expressed in the syntactic structure in (194) follows from the framework used here. One could think of ways to encode ‘$j$’ in the structure in (194), for instance by introducing a functional syntactic head PRED$_j$ into the structure. I will leave it open whether and how this can be made to work, and assume that $R_j$ is assigned its value as a result of a general reasoning procedure concerning possible relations between predicates and arguments.
(200) a. *Die Jungen lieben jeweils diese Frau. (indefinite DistShare)
   *‘The boys love this woman each.’
b. *Peter liebt jeweils zwei Frauen. (plural DistKey)
   *‘Peter love(s) two women each.’
   *‘The store clerks said that Peter had bought a balloon each.’ (clausemate)

The indefiniteness constraint on DistShare follows on the meaning of jeweils in (201).

(201) \[ [P^0 jeweils] = \forall z [(z \in Z_i) \rightarrow \exists x [P(x) \land R_j(x)(z)]] \]

The denotation of jeweils requires one semantic argument that is provided by the syntactic sister of jeweils, the DistShare. Since (201) specifies that this argument must be a property (or alternatively a set of individuals), the DistShare expression must be able to denote such a property. This is usually the case with indefinite or numeral expressions.

(201) allows for any property-denoting expression as argument. It follows that definite DPs can also occur as DistShare expressions, as long as they denote a property. This is possible with non-specific (or type-denoting, cf. Vergnaud & Zubizarreta 1992) definite DPs (see also chapter II.1.5, fn.8). As a result, (202a) is interpretable and grammatical.

(202) a. Die Mädchen haben jeweils [die beste Freundin (von sich)] eingeladen.
   *The girls have invited the(ir) best girlfriend each.*
   b. [[die beste Freundin]] = \lambda x. x is the best girlfriend (of y_i)

The plurality requirement on the DistKey also follows on the meaning of jeweils in (201). The denotation of the DistKey expression provides the value for the set variable Z_i. Since Z_i necessarily ranges over pluralities of entities, it cannot be co-indexed with a singular-denoting expression.77

To see how the clausemate-condition follows on the semantics proposed, it is necessary to look at the derivation of (200c) in detail. We start at that point in the derivation where the values of the jeweils-DP in (203a), and of the transitive stage-level verb in (203b) combine to yield (203c). Recall that the necessary precondition for combining the values is \lambda-abstraction over the relation variable that is contained in the denotation of the jeweils-DP.

(203) a. [[jeweils einen Ballon]] = \lambda R_j. \forall z [(z \in Z_i) \rightarrow \exists x [\text{balloon}'(x) \land R_j(x)(z)]]
   each a balloon
   b. [[gekauft hat]] = \lambda y \lambda x. \exists e [\text{bought}'(x,y,e)]
   bought has
   c. [[jeweils einen Ballon gekauft hat]]
   = \forall z [(z \in Z_i) \rightarrow \exists x [\text{balloon}'(x) \land \text{bought}'(z,x,e)]]

77 I assume that the element-of relation is not reflexive. I.e., an entity cannot be an element of itself.
(203c) is the denotation of $V'$, which contains the direct object and the verb. The value of this constituent cannot combine with the value of the subject trace because of type mismatch between $<e>$ (subject trace) and $<t>$ ($V'$).

\[
\begin{array}{c}
\text{VP} \\
\text{t}_{<e>} \\
\text{?} \\
\text{x} \\
\forall z \left( (z \in Z_i) \rightarrow \exists x,e \ [\text{balloon'}(x) \land \text{bought'}(z,x,e)] \right) \\
\text{DP} \\
\text{V} \\
\text{jeweils einen Ballon gekauft}
\end{array}
\]

The type-mismatch in (204) cannot be resolved. The denotation of $V'$ is an open proposition with one free variable, namely $Z_i$. Thus, it allows for \(\lambda\)-abstraction over $Z_i$ in principle. The meaning of the trace is an individual variable $x$, though, which cannot be co-indexed with the plural variable $Z_i$. Co-indexation is blocked by the plurality requirement (see above). Therefore, index-triggered \(\lambda\)-abstraction from 4.2.1 cannot apply to the denotation of $V'$. At the same time, \(\lambda\)-abstraction over $x$ in the left hand daughter would result in a Skolem function from individuals to individuals, namely the identity function \(\lambda x.x\). In conclusion, there is no way for the two daughters of VP in (204) to combine semantically, and the semantic derivation stops dead.

The only way to interpret the structure in (204) is for the subject trace to denote a variable over plural entities. This is the case with traces left behind by a plural subject, as shown in (205).

\[
\text{Die Verkäufer sagen, dass die Jungen jeweils einen Ballon gekauft haben.}
\]

‘The store clerks said that the boys each a balloon bought have’

In (205), the subject of the embedded clause is invariably the DistKey for jeweils. This is so for the simple reason that it must be interpreted as such under the constellation in (204). There is no way for the semantic derivation to by-pass the subject trace, or to assign it another semantic role, because the denotation of $V'$ has exactly one semantic argument position free after \(\lambda\)-abstraction, that of the DistKey.

The reason for the ungrammaticality of (200c), and for the impossible reading for (205), then, does not lie in the fact that the DistKey expression is syntactically too far away from jeweils. It lies solely in the fact that the subject of the embedded clause must be interpreted as DistKey due to the way the interpretive procedure is set up. If the embedded subject is of the right kind, i.e. if it is a plural expression as in (205), it must be interpreted as DistKey. If the subject is not of the right kind, i.e. if it is a singular expression as in (200c), it cannot be interpreted at all. The semantic derivation cannot proceed, and the sentence is ungrammatical because it is uninterpretable.

---

78 This argumentation implies that the trace of an argument inherits the plural or singular status from its raised antecedent. Alternatively, one could assume that traces are always optionally of type $<e,t>$, and that the type mismatch in (204) arises in a position higher in the tree, where $I'$ combines with the raised subject.

79 This is not fully true. There is an additional syntactic reason for why (200c) is out. The sentence could be interpreted if QR raised the jeweils-DP out of the embedded clause, leaving behind a trace of type $<e>$. However, there is reason to believe that QR is clausebound (cf. e.g. Reinhart 1997), making extraction of the jeweils-DP impossible.
Concluding, the three characteristic properties of adnominal jeweils, namely indefiniteness requirement, plurality requirement, and clausemate condition, can be shown to follow from the semantics of the construction. Furthermore, on the plausible assumption that the semantics involved are universal, we can also explain why these properties hold for d-distributive constructions cross-linguistically.

6 A Cross-Linguistic Difference: DDs in Small Clauses

The discussion of German jeweils has shown that its semantics are very flexible and do not seem to impose restrictions on the syntactic distribution of these elements. In the previous section, it was suggested that the meaning of d-distributive elements and the semantic operations involved in interpreting d-distributive constructions are the same cross-linguistically. It follows that the interpretation of d-distributive constructions in other languages should happen along the same lines as in German. Therefore, d-distributive elements in other languages should be interpretable in the same way as German jeweils in those positions in which they are licensed syntactically (see chapter III.5.4). This section shows in exemplary fashion that this prediction seems to be correct for English and for the other languages under discussion. In light of this, the impossibility of d-distributive each in subject position of small clauses (SCs), which was left as an open problem in chapter III.5.5, comes unexpected. The greater part of this section is therefore devoted to an integrated syntactic and semantic account of d-distributive elements in SCs.

Focussing on English, we see that the d-distributive element each occurs in direct object position of individual level verbs (206a), in direct object position of stage-level verbs (206b), in indirect object position (206c), and inside PP-adverbs (206d). In each position, each is syntactically licensed by a c-commanding DistKey-DP.

(206) a. The boyi have [two tattoos eachi].
   b. The boysi bought [two sausages eachi].
   c. The boysi gave [two girls eachi] roses.
   d. The boysi bought books [in three bookstores eachi].

On the null hypothesis, the semantic derivations for the sentences in (206) are the same as those introduced for the corresponding German structures in sections 4.2 and 4.3.

(207) shows examples of d-distributive elements inside PP-adjuncts from a number of languages. The occurrence of d-distributive elements in this position is expected, since the syntactic requirement of a c-commanding DP as DistKey is met, and since the interpretive procedure is capable of interpreting such structures (cf. section 4.3.2)

(207) a. Strákarnir keyptu bækur í þremur bókabúðum hvor / hver. [Icelandic]
   boys-DUAL the bought books in three bookstores eachPL. (Hrafn, p.c.)
   b. I ragazzi hanno comprato i libri in ciascuno dei tre negozi [Italian]
      the boys have bought the books in each of the 3 stores
      (d’Allessandro,p.c.)
   c. Guttene kjøpte boker i hver sine tre butikker. [Norwegian II]
      boys-DUAL the bought books in each theirREFL three store
      (Vangsnes, p.c.)
      ‘The boys bought books in three stores each.’
In light of these cross-linguistic correspondences, the following contrast between English and German is surprising. It concerns the (non-) availability of a d-distributive element in the subject position of a (resultative) small clause.

(208) a. Die Jungen [haben jeweils zwei Häuser rot gestrichen.]
   the boys have each two houses red painted
b. *‘The boys have painted two houses each red.’

This contrast was pointed out as problematic in chapter III.5.5, but there we lacked the necessary semantic tools for solving the problem. The problem is that the d-distributive element in the English (208b) is ungrammatical although is c-commanded by a DistKey DP. According to the discussion in chapter III.5.4, the D-features of the boys should be able to copy onto the proform complement of each and check against the D-features of the latter if this process is licensed under c-command. Hence, it cannot be the syntax (in isolation), which is responsible for the ungrammaticality of (208b). On the other hand, we have just argued that the semantics of d-distributive constructions are the same universally. Given this, it cannot be the semantics (in isolation), which are responsible for the ungrammaticality.

In response to this problem, I would like to argue that semantic and syntactic factors conspire to rule out (208b), and to rule in (208a). More to the point, I argue that the semantics are the same in both sentences, but that they only tolerate a certain syntactic structure. This structural requirement is matched by German (208a), but not by English (208b). The relevant difference lies in the fact that German is underlyingly SOV, whereas English is SVO (cf. chapter I.2.3). This way, the difference between (208a) and (208b) is reduced to an underlying syntactic difference between the two languages. Even so, the ungrammaticality of (208b) ultimately arises from semantic factors: The English structure in (208b) cannot be properly interpreted. If correct, this explanation provides a powerful argument for an integrated syntactic and semantic analysis. Only by looking at syntax and semantics in parallel can we determine the reason for the difference in grammaticality between (208a) and (208b).

How does the difference between (208a) and (208b) follow from a difference in underlying word order? In order to see this, we must look at the syntactic structures of the two sentences and ask how they can be interpreted. The surface structures of the VPs are given in (209ab).

(209) a. [VP t subj [V' SC zwei Häuser AP rot] gestrichen].
   each two houses red painted
b. [VP t subj [V painted SC two houses each AP red]]).

The striking difference between (209a) and (209b) is the position of the main verb. In German it occurs in sentence-final position, adjacent to the SC-predicate 'red'. In English, it precedes the SC, and does not stand adjacent to its predicate. Deriving the meaning of (209b), we begin with the meaning of the each-DP in (210).

(210) [if two houses P each, ]] = \forall z [z \in Z, \exists x [*2houses'(x) \land R(x)(z)]]
(210) is a saturated expression, a proposition, with the two free variables $Z_i$ and $R_j$. But this expression cannot combine with the denotation of its sister, the property-denoting predicate $\text{red}$. The predicate does not denote a relation, hence it cannot be substituted for $R_j$. On the other hand, the predicate does denote a set of entities and could be – in principle – inserted for $Z_i$ (making each distribute over the set of red things). In a next step, the verb denotation could be inserted for $R_j$. The resulting expression is a proposition with no free variables, which means that there is no way to incorporate the denotation of the subject (trace). It follows that the entire clause (208b) cannot be interpreted and is consequently ruled out for semantic reasons. The problem is reminiscent of the problems encountered in connection with the clausemate condition in the previous section.

Why is the German counterpart in (208a) ruled in? I would like to argue that the difference is effected by the adjacency of SC-predicate and main verb. In my view, the two elements optionally undergo reanalysis, thus forming a complex relation-denoting predicate $\text{rotgestrichen} \ '\text{painted red}'. I leave it open if this reanalysis is accomplished through re-categorisation, or if it happens through incorporation (to the right) of the SC-predicate into the verb. What is clear is that it cannot simply be a phonological process at PF, for its result is visible to the semantic component. After reanalysis, the denotation of the complex verb $\text{rotgestrichen}$ is as in (211).

\[(211) \quad [\lambda x \lambda y \lambda e. \text{painted}\_\text{red}(x,y,e)]\]

This expression is inserted for $R_j$ in (210) by the by now well-known double application of $\lambda$-abstraction over $R_j$ and functional application to $[[V]]$. The result is (212), which combines with the subject denotation in the usual manner.

\[(212) \quad [\lambda y \lambda x \lambda e. \text{painted}\_\text{red}(x,y,e)] \]

The explanation for the grammaticality is therefore ultimately rooted in the adjacency of SC-predicate and main verb in German, which in turn is due to the underlying SOV-order of German. Reanalysis provides the jeweils-DP with a semantic argument of the right kind. In English, this fails because reanalysis cannot apply.

The above argument is supported by the fact that d-distributive each becomes possible (or significantly better) inside English SC-subjects if the SC-predicate occurs adjacent to

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81 The assumption of reanalysis raises a number of possibly non-trivial questions. To begin with, it must also be assumed to apply to SC-predicate and the trace of a verb, since (i) is grammatical.

(i) Die Jungen streichen gerade jeweils zwei Häuser rot t v.

'the boys paint just each two houses red.'

Sentence (i) seems to argue in favour of a derivational approach on which the SC-predicate first moves to V, and then V moves on to I and C, leaving the predicate behind. Such processes are well attested in German with particle verbs, e.g. with an-rufen 'to call' in (ii):

(ii) Die Jungen rufen gerade jeweils zwei Freunde an.

'the boys call just each two friends up.'

Against the movement analysis argues the fact that the process only applies under adjacency, for it obviously does not apply in English although the structural configurations are identical and movement in English would be to the left. I will leave this issue open, assuming that some sort of reanalysis that is conditioned by adjacency must take place in German.
the main verb. This is the case in (213), where the ‘heavy’ SC-subject has been right-dislocated across the SC-predicate by ‘Heavy NP-shift’.

(213) The boys painted red two ugly houses in the neighbourhood each.

On the assumption that main verb and SC-predicate can reanalyse under adjacency in order to form a complex relation-denoting expression, the interpretability and hence grammaticality of (213) is ensured. (213) shows, again, that structural and semantic factors interact in the derivation of sentences with d-distributive each and jeweils. Only some structures are interpretable structures.

Let us conclude this section by briefly touching upon another possibility to ‘rescue’ d-distributive each inside SCs. Stowell (1999) observes that SCs with d-distributive each improve if the each follows the SC-predicate, as in (214).

(214) The boys painted [two houses red] each.

It is possible that the constituents two houses and red in (214) combine to form a complex predicate that denotes the property of being a group of two red houses. This complex property can serve as the first semantic argument for d-distributive each. On this view, the semantic derivation of (214) would be parallel to that of (215) with a postnominal PP-modifier inside the DistShare expression.

(215) The boys painted [two houses in the neighbourhood] each.

I will leave it open whether each in (214) combines with the SC as a whole, or with a complex NP as in (215).

In conclusion, this section has given an answer to the first of the unsolved problems from chapter III.5.5. We have accounted for a difference between English and German that was unexpected on the assumption that the semantic mechanisms involved in interpreting jeweils-DPs are universal. The difference concerns the impossibility of each in subject position of SCs. It was reduced to the difference in underlying word order in German and English, i.e. to a syntactic difference. Only the German structure can be properly interpreted. This explanation allows for maintaining the assumption that the semantics of d-distributive elements are the same universally. The discussion has also shown that the complex facts that show up in connection with the distribution of d-distributive elements cannot be accounted for in purely syntactic terms. Sometimes, semantic factors need to be considered as well.

7. Applying the Semantics to Inverse Linking Constructions

In chapter III.4, it was argued that jeweils-DPs and ILCs on the “inverse” reading have the same underlying structure. In this section, I show that ILCs can be interpreted in the same way as jeweils-DPs. This supports the claim that both constructions are identical underlyingly.

The structure of ILCs on the “inverse” reading is repeated for (216a) in (216b):
In III.3, it was argued that the structure in (216b) is the result of re-interpreting the postnominal PP as a generalised quantifier, as shown in (217).\(^{83}\)

\[
\text{(217)} \quad \text{[[in every basket]]} = \lambda P \cdot \forall z \left[ \text{basket}'(z) \rightarrow \exists X \left[ P(X) \land \text{*in}'(X,z) \right] \right]
\]

This expression takes a property, denoted by the numeral NP, as its semantic argument. The resulting denotation of the upper NP-node is given in (218). If \(D^0\) is semantically empty (as was argued to be the case with jeweils-DPs), (218) is also the denotation of the entire DP.

\[
\text{(218)} \quad \text{[[one apple in every basket]]} = \forall z \left[ \text{basket}'(z) \rightarrow \exists X \left[ \text{one_apple}'(X) \land \text{*in}'(X,z) \right] \right]
\]

Next, (218) is expected to combine with the denotation of the predicate is rotten, which denotes the set of rotten things. But how can the proposition in (218), which does not seem to contain any more free variables, combine with the property of being rotten?

I propose a strategy that resembles the one employed in connection with the interpretation of jeweils-DPs inside PP-adjuncts (see section 4.3.2). The same strategy was employed in the interpretation of object jeweils-DPs that occur in the scope of event modifiers (see section 4.2.4), and - more generally - some version of it seems to be required in all cases of multiple event modification (see section 1.3). For all cases mentioned, I argued that the existentially bound event variable is restricted by a free variable over pluralities (sets) of events. This free set variable could be targeted by \(\lambda\)-abstraction. This way, the derivation moved from the level of atomic events to the level of plural events. Technically, an analogous operation is conceivable for ILCs. Assume that the existentially bound variable \(X\) in (219) is restricted by an additional variable over sets of sets.\(^{84}\)

\[
\text{(219)} \quad \text{[[one apple in every basket]]} = \forall z \left[ \text{basket}'(z) \rightarrow \exists X \left[ \text{*X}'(X) \land \text{one_apple}'(X) \land \text{*in}'(X,z) \right] \right]
\]

In analogy to the case of repeated event quantification from section 1.3, the index on the set variable \(X_i\) can be targeted by \(\lambda\)-abstraction (cf.220a). The resulting expression, a function from sets into truth-values, takes the denotation of the plural predicate is rotten...
as its argument and delivers the proposition in (220b). (220b) correctly specifies the truth conditions for (216a).

(220) a. \[[\text{one apple in every basket}]\] by \(\lambda\)-abstraction over \(X\):
\[
\lambda X, \forall z \ [\text{basket}'(z) \rightarrow \exists X \ [\text{one_apple}'(X) \land \text{in}'(X,z)]]
\]
b. \[[\text{one apple in every basket is rotten}]\]
\[
\forall z \ [\text{basket}'(z) \rightarrow \exists X \ [\text{rotten}'(X) \land \text{one_apple}'(X) \land \text{in}'(X,z)]]
\]

(220b) is true iff for each basket \(z\), there is a singleton set \(X\) such that \(X\) consists of an apple and \(X\) is rotten and \(X\) is in \(z\). This is true if there is one rotten apple in every basket.

Summing up, ILCs can be interpreted along the same lines as jeweils-DPs. Since the two constructions are argued to derive from the same underlying structure, this is a welcome result. The crucial move in interpreting ILCs lies in positing an implicit variable over sets of sets, and let \(\lambda\)-abstraction apply to the index of that variable. The assumption of such an implicit variable parallels our treatment of repeated event modification over different event layers discussed in 1.3. The interpretation of ILCs therefore poses no problem for the semantic system proposed here.

8. Conclusion

Chapter IV has presented the semantic analysis of the German distributive marker jeweils, in particular on its distance-distributive use. The results are summarised in the following.

(221) i. Adverbial and adnominal jeweils have the same underlying meaning. Both denote a generalised quantifier that contains a free relation variable \(R\) (expressed by genitive case).
ii. The ambiguity of adverbial and adnominal jeweils is structural in nature.
iii. Adverbial jeweils is an event quantifier. Its restriction -weils- picks up an implicit set of events. The relation variable \(R\) stays free, thus establishing coherence with the preceding discourse.
iv. Adnominal (= distance-distributive) jeweils distributes over individuals or events, depending on its syntactic position. Its restriction -weils- co-refers with the DistKey, which is (usually) expressed by means of a clausemate plural expression. The relation variable \(R\) is bound by an overt relation-denoting expression (normally, a transitive verb or a preposition) that indicates the kind of distributive relationship that is established.
v. The analysis allows for the correct interpretation of distance-distributive jeweils in a variety of syntactic configurations.
vi. The analysis is applicable to the interpretation of distance-distributive constructions in other languages, and to the interpretation of inverse linking constructions.

The final chapter of the thesis deal with instances of adnominal jeweils in sentence-initial position, where the clear-cut distinction between adnominal and adverbial jeweils is systematically blurred by syntactic and semantic factors.