Semantic Properties of Split Topicalization in German

This paper examines semantic properties of measure phrases (MPs), in particular, MPs adjacent to their host NP (non-split MPs) and MPs split from their host NP in Split Topicalization (split MPs). I show that both non-split and split MPs are subject to semantic restrictions on the nominal domain, while only split MPs are subject to restrictions on the verbal domain. I argue that this is because non-split MPs measure in the nominal domain (the amount of individuals in the extension of the nominal predicate), while split MPs measure in the verbal domain (the amount of events in the extension of the verbal predicate). The present analysis reveals that there is an algebraic parallelism between the nominal and verbal domains. Furthermore, this analysis can be extended to various cross-linguistic constructions.

1. Introduction

German has so-called Split Topicalization (ST), a construction in which some part of noun phrases is split up from the rest of the noun phrase. Examples in (1)-(2) show that ST can involve quantificational elements such as numerals and measure phrases.

(1) a. [Drei Studenten] haben gestern getanzt.
    three students have yesterday danced
    ‘Three students danced yesterday.’

   b. Studenten haben gestern drei getanzt.
    students have yesterday three danced

    Hans has [three liter water] drunk
    ‘Hans drank three liters of water.’

   b. Wasser hat Hans drei Liter getrunken.
    water has Hans three liter drunk

Numerals and measure phrases in a non-split topicalized sentence (non-ST) are generally used to express amount in noun phrases. For instance, in drei Studenten ‘three students’ in

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2 This paper deals with Split NP Topicalization only, excluding other types of ST like Split PP Topicalization and Split VP Topicalization (or VP Fronting).

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In (1)a, the amount of relevant students is indicated by *drei* ‘three’. In the same vein, in (2)a, the denotation of *Wasser* ‘water’ is measured by *drei Liter* ‘three liters’. In the following, the term **measure phrases** (henceforth MPs) refers to both numerals (e.g. *drei*) and genuine measure phrases (e.g. *drei Liter*). Moreover, I call MPs in non-ST **non-split MPs**, while I call MPs in ST **split MPs**. The difference between the two is that split MPs do not form a nominal constituent with their host NP, while non-split MPs and their host NP are adjacent to each other forming a constituent. A natural question that arises is whether a split MP (in (1)b, (2)b) measures in the nominal domain in the same way as its non-split counterpart (in (1)a, (2)a). In this paper, I argue that non-ST and ST differ in their domains of measurement: non-ST involves the measurement of individuals in the nominal domain, while ST involves the measurement of events in the verbal domain. The measurement of events is done by measuring individuals mapped from the events via a homomorphism.

In section 2, I argue that both non-split and split MPs are subject to semantic restrictions on the nominal domain. In section 3, I argue that only split MPs are subject to semantic restrictions on the verbal domain. The central claim is that split MPs measure in the verbal domain, while non-split MPs measure in the nominal domain. Section 4 reveals that it is possible to compositionally achieve the semantic properties of ST. Section 5 concludes this paper with a discussion of other related phenomena and cross-linguistic data.

2. **Monotonicity in the Nominal Domain**

The purpose of this section is to show that Schwarzschild’s (2002a, 2002b) monotonicity constraints can account for some semantic restrictions on non-ST and ST.

2.1. **The Data**

I present two sets of data indicating that both non-split and split MPs are subject to some semantic restrictions on the nominal domain.

First, not all NPs can be the host NP of non-split and split MPs. For instance, (3) and (4) show that *Traubenmarmelade* ‘grape jam’ and *Trauben* ‘grapes’, respectively, can be the host NP, while (5) shows that *Traube* ‘grape’ cannot be.

(3) a. Hans hat [drei Kilo *Traubenmarmelade*] gekauft.  
Hans has [three kilo grape jam] bought  
‘Hans bought three kilos of grape jam.’

grape jam has Hans three kilo bought

Hans has [three kilo grapes] bought  
‘Hans bought three kilos of grapes.’

grapes has Hans three kilo bought
   ‘Hans bought three grams of grape.’
b. ??Traube hat Hans drei Gram gekauft.
   ‘Hans bought three grams of grape.’

Second, it is not the case that any MPs can be used in these two constructions. In (2) above, I showed that drei Liter ‘three liters’ can appear both in non-ST and in ST. In contrast, as in (6), drei Grad ‘three degrees’ is inappropriate as a non-split or a split MP.

   ‘(lit.) Hans drank three degrees of water.’
   ‘Wass drank three degrees of water.’

The question to be addressed is what the source of these two restrictions is, that is, the restriction on the host NP and on the MP.

2.2. Schwarzschild’s (2002) Monotonicity Constraints

The same restrictions are observed in Schwarzschild’s (2002a) work on pseudopartitives in English such as five inches of wire or two days of work.3,4 First, not all NPs can be used in this construction, as shown in (7)a. Second, some MPs are excluded, as in (7)b.

(7) a. seven pounds of meat / ??seven pounds of baby
    b. three liters of water / *three degrees of water

Schwarzschild accounts for these two restrictions by examining how measure functions apply to nominal predicates. Before I introduce Schwarzschild’s analysis, I first discuss what a measure function is.

MPs such as three liters and three degrees are used to measure elements. Such a measurement is done by making use of a measure function µ (see Cartwright 1975). It is generally assumed that MPs consist of a number, represented by the number word (e.g. three) and a measure function, denoted by the measure word (e.g. liters) (Krifka 1989, among others). In Krifka’s (1989) analysis where measure functions are lexically denoted by measure words (e.g. in three liters of water, the measure function is liter), measure functions are functions from individuals to numbers which preserve certain structures in the object domain. Krifka further introduces a special class of measure functions, namely, extensive measure functions. One of the requirements for extensivity is that the measure function be additive. For example, if there are two objects which weigh three grams and

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3 Pseudopartitives are syntactically different from partitives regarding whether the NP takes determiners: pseudopartitives occur with a bare NP as in three pounds of apples, whereas partitives occur with a definite NP as in three pounds of the/those/her apples (see Selkirk 1977).

4 The pseudopartitive in English corresponds to the combination of a non-split MP and a measured NP in German (e.g. drei Liter Wasser ‘three liters of water’).
five grams, respectively, an extensive measure function yields eight grams. Krifka argues that the contrast in (8) is due to the fact that the measure function *ounces in (8)a is extensive (e.g. five ounces plus ten ounces will give us fifteen ounces), while *carats in (8)b is not (e.g. we cannot obtain fifteen carats by adding five carats and ten carats).

(8)  
   a.  five ounces of gold  
   b.  *twenty carats of gold  
      (Krifka 1989:82)

In this approach, a measurement scheme is lexically expressed by a measure word. For example, in *three feet of rope, the measure function is denoted by feet, and the length measure function maps an individual in the extension of rope to a number. That is, feet denotes a function from an individual to a real number. Schwarzschild (2002a, 2002b) points out that the relevant measurement scheme is determined by different factors such as world knowledge, context, etc. For instance, the measurement scheme is ‘length’ in John bought three feet of rope, and it is ‘depth’ in three feet of snow piled up. If a measurement scheme is lexically expressed by a measure word, we need to assume that a measure word has multiple lexical entries (e.g. feet as the length function and as the depth function). However, intuitively, what is relevant in these examples is how the MP three feet measures the NPs rope and snow, rather than what the measure word feet means. Based on this intuition, Schwarzschild proposes that, instead of assuming that a measure function is denoted by a measure word, a measure function is a measurement scheme (e.g. volume, temperature, depth, etc.) obtained from a relation between an MP and the element to which the MP applies. For instance, in five ounces of gold, since five ounces specifies how much the relevant gold weighs, the measure function is ‘weight’. In the following, a measure function μ is indicated as μ: measurement scheme (e.g. μ: weight).

Let us now turn to Schwarzschild’s (2002a, 2002b) analysis of the contrast in (8). As discussed above, Krifka (1989) claims that the measure function must be extensive in (8). One of the requirements for extensive measure functions is additivity; *ounces, but not *carats, is additive. As an alternative to additivity, Schwarzschild proposes monotonicity, which is based on Lonning’s (1987) monotonicity. A measure function is monotonic relative to the denotation of some element if it tracks part-whole structures of the element, i.e. a measure obtained for that element is larger than a measure obtained for proper subparts of it, and is smaller than a measure obtained for proper superparts of it. For example, μ: volume is monotonic to [water], since, if a quantity of water has a certain volume, proper subparts of it will have lower volumes and superparts of it will have higher volumes. μ: Temperature, however, is not monotonic to [water], since, if the water has a certain temperature, it is not necessarily true that proper subparts of it have lower temperatures or that superparts of it have higher temperatures. Formally, the measure function μ is monotonic relative to the denotation of the host NP iff it satisfies (9).

(9)  
   A measure function μ is monotonic relative to domain I iff:
   For individuals x, y in I:
   If x is a proper subpart of y, then μ(x) < μ(y)  
   (Schwarzschild 2002b)

Schwarzschild captures the contrast in (8) by claiming that the measure function in pseudopartitives has to be monotonic relative to the part-whole structure expressed by the host NP. In *five carats of gold, μ: proportion in *twenty carats of gold is not monotonic to [gold]: if the gold has a certain
proportion (e.g. twenty carats), it is not necessarily true that proper subparts of it will have lower proportions (e.g. ten carats) or that superparts of it will have higher proportions (e.g. twenty-five carats). The same analysis applies to the contrast in (7)b, i.e. three liters of water vs. *three degrees of water. Since µ: volume, but not µ: temperature, is monotonic to [water], three liters of water is acceptable, but not three degrees of water.

Schwarzschild further argues that monotonicity can account for the contrast on the host NP in (7)a, i.e. seven pounds of meat vs. ??seven pounds of baby. Meat in English is a mass noun, and mass nouns have part-whole structures. For example, if you have a chunk of meat, any smaller chunk of that big piece is still meat. Moreover, if there are two chunks of meat, their sum is also meat. Thus, the measure function can be monotonic relative to the denotation of mass nouns: in the extension of mass nouns, we can pick two elements where one is a proper subpart of the other, and apply the measure function in a monotonic fashion (assuming that the constraint on the measure function is satisfied). In contrast, baby is a singular count noun, and the extension of a singular count noun is considered to be a set of atomic elements. Atomic elements are defined in a way that they do not have a subpart which has the same property as a superpart. For instance, a smaller part of baby, say toe, is not baby, lacking properties that baby has. A measure function cannot be monotonic relative to the denotation of singular count nouns, since there is no part-whole structure to work off of to begin with. In other words, baby must be interpreted like meat for it to have a part-whole structure, evoking a gruesome interpretation. Schwarzschild further assumes that plural count nouns behave like mass nouns, since they come with a part-whole structure given by the plural-part structure. Thus, his analysis predicts that plural count nouns can be used in pseudopartitives just like mass nouns. Indeed, this prediction is borne out as is clear from examples like four pounds of coffee beans and three kilos of grapes.5

A common way to represent the extension of a noun that has a part-whole structure is to use a lattice structure (Link 1983). A lattice is a partially ordered set, i.e. a set of objects ordered by a reflexive, anti-symmetric and transitive relation. For example, take a set containing elements in the figure in (10), where x, y, and z are atomic individuals, ∪I is an individual sum operator, and the lines indicate the ordering part-of relation ≤.

(10)

If the extension of a given noun is a lattice of individuals, some members of the denotation of a noun are a subpart of some other members. First, suppose that x, y, and z are water, Singular count

Mass, Plural count

5 Pseudopartitives with plural count nouns are not always acceptable, as in twenty kilos of babies, which seems to be odd. The oddness can be attributed to pragmatic reasons. Individual babies are generally not measured by µ: weight, but by µ: cardinality using numerals (e.g., three babies). Thus, when µ: weight is used to measure babies, we tend to imagine a situation where some parts of babies are measured, which leads us to a gruesome interpretation. If we create a context where individual babies are measured by µ: weight, twenty kilos of babies should sound better. Suppose that a nurse moved babies to a doctor’s room using a big cart and that the cart can carry up to twenty kilos. Then we might be able to say ‘A nurse carried twenty kilos of babies by cart’.

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then their sums \((x \cup y, x \cup z, y \cup z, x \cup y \cup z)\) are also water. In the denotation of water, that is, \(\{x, y, z, x \cup y, x \cup z, y \cup z, x \cup y \cup z\}\), members can be ordered by the part-of relation (e.g. \(x \cup y\) is a subpart of another member \(x \cup y \cup z\)). Thus, the extension of a mass noun can be modeled as a lattice of individuals, as shown in (10).

Suppose now that \(x \cup y\) and \(x \cup z\) are dogs. Then the sum of the two, i.e. \(x \cup y \cup z\), is also dogs. Thus, in the denotation of dogs, namely, \(\{x \cup y, x \cup z, y \cup z, x \cup y \cup z\}\), members can be ordered by the part-of relation just like in the denotation of mass nouns. There have been discussions on whether plural count nouns take a set of atomic individuals in their extension. In this paper, following Link (1983) but contra Hoeksema (1983), I assume that a set of atomic individuals are included in the extension of a plural count noun. One of the arguments for this view comes from the interpretation of the determiner no (Lasersohn 1988, Schwarzschild 1991). In no dogs barked, for example, if \([\text{dogs}]\) does not include a set of atomic individuals, the sentence is predicted to be true in the situation where a single dog barked. However, the intuition is that the sentence is false under the described situation, which is predicted by Link’s view. Thus, the denotation of dogs would be \(\{x, y, z, x \cup y, x \cup z, y \cup z, x \cup y \cup z\}\). It follows that the extension of a plural count noun as well as that of a mass noun is a lattice of individuals, as in (10). In contrast, in the denotation of a singular count noun, no member is a part of the other member. Thus, unlike the extensions of a plural count noun and a mass noun, the extension of a singular count noun is not a lattice of individuals. In contrast, unlike the extensions of a plural count noun and a mass noun, the extension of a singular count noun is not a lattice of individuals. Suppose that the denotation of dog is \(\{x, y, z\}\). In this denotation, no member is a part of the other member.

Let us now introduce the operation of semantic pluralization, namely, the *-operator (the ‘star’-operator) that applies to a one-place predicates \(P\) and generates all the individual sums of members of the extensions of \(P\) (Link 1983). With this operator, the denotation of a plural count noun will be a set of atomic elements plus a set of the non-atomic elements. For instance, if the denotation of dog is \(\{x, y, z\}\), the denotation of *dog or dogs would be \(\{x, y, z, x \cup y, x \cup z, y \cup z, x \cup y \cup z\}\). *P is closed under sum formation: any sum of parts that are *P is also *P, as in (11).

(11) a.  \(x\) and \(y\) are dogs and \(x\) and \(z\) are dogs iff \(x\), \(y\), and \(z\) are dogs.
b.  \(*\text{dog}(x \cup y) \land *\text{dog}(x \cup z) \leftrightarrow *\text{dog}(x \cup y \cup z)\)

Part-whole relations of nouns stay the same for noun phrases. For instance, \([\text{old dogs}]\) is a lattice of individuals exactly in the same way as \([\text{dogs}]\), and \([\text{old dog}]\) well as \([\text{dog}]\) is not a lattice. In section 3.2, I show that the mass-count distinction is analogous to the atelic-telic distinction in the verbal domain and that the atelic-telic distinction is tied to a VP (a verb plus its internal argument) rather than to a verb by itself. Thus, the analogies will be made between NPs and VPs, not between nouns and verbs. For this reason, in the following, the relevant mass-count distinction is tied to NPs, as summarized below:

6 In Link (1983), besides singular individuals like John, there are also plural individuals or individual sums of type e such as John \(\cup\) Mary that are different from sets like \{John, Mary\}. For alternative approaches, see Schwarzschild (1996), among others.
7 I assume here that the highest projection in the nominal structure is DP, not NP (Abney 1987, among others). In this view, the extension of a DP is an individual (or a generalized quantifier), while the extension of an NP is a set of individuals just like the extension of a noun.
(12) Algebraic Properties of NPs

<table>
<thead>
<tr>
<th>Nominal Domain</th>
<th>With a lattice</th>
<th>No lattice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass NPs</td>
<td>(water, hot water)</td>
<td></td>
</tr>
<tr>
<td>Plural Count NPs</td>
<td>(dogs, old dogs)</td>
<td></td>
</tr>
<tr>
<td>Singular Count NPs</td>
<td>(dog, old dog)</td>
<td></td>
</tr>
</tbody>
</table>

Having a lattice in its extension is analogous to having a ‘part-whole’ structure in Schwarzschild’s analysis. Thus, we can replace a part-whole structure with a lattice of individuals: plural count NPs and mass NPs can satisfy the monotonicity constraint on the host NP, since their extensions are lattices, i.e. they have a part-whole structure. In contrast, singular count NPs cannot satisfy monotonicity, since their extension is not a lattice.

In sum, Schwarzschild argues that pseudopartitives in English must satisfy the two monotonicity constraints, which are summarized below:

(13) Monotonicity constraints on the Nominal Domain (cf. Schwarzschild 2002a,b)

a. The Constraint on the Host NP: The host NP must have a part-whole structure, i.e. the extension of the NP must be a lattice of individuals.

b. The Constraint on Measure Functions: The measure function µ must be monotonic relative to the given part-whole structure, i.e. a lattice of individuals (as defined in (9)).

The first constraint captures the contrast in (7)a between mass NPs like meat and singular count NPs like baby. The former has a part-whole structure, while the latter does not. The second constraint accounts for the contrast in (7)b between µ: volume and µ: temperature. The former, but not the latter, can be monotonic to [water].

2.3. Application to the German Data

Schwarzschild’s monotonicity approach straightforwardly extends to the German data. The first of the two monotonicity constraints in (13) is on the host NP: the host NP must have a part-whole structure, i.e. the extension of the NP must be a lattice of individuals. Recall the restriction on the host NP observed for German in (3), (4), and (5). These examples show that a mass NP Traubenmarmelade ‘grape jam’ and a plural count NP Trauben ‘grapes’ are acceptable in both non-ST and ST, whereas a singular count NP Traube ‘grape’ is not. This is because the extensions of a mass NP and of a plural count NP are lattices of individuals, while the extension of a singular count NP is not: without a lattice, there is no way of applying a measure function in a monotonic fashion.

The second of the two monotonicity constraints in (13) is on measure functions: the measure function µ must be monotonic relative to a lattice of individuals (see (9)). (2) and (6) illustrate the contrast between drei Liter Wasser ‘three liters of water’ and *drei Grad Wasser ‘three degrees of water’: the former, but not the latter, can be used in non-ST and ST. Recall that the same contrast is observed in pseudopartitives in English. Thus, the same monotonicity account presented for English applies to German: the measure function µ for drei Liter Wasser is µ: volume and it is monotonic to [Wasser]. In contrast, µ: temperature, which is the measure function for drei Grad Wasser, is not monotonic to [Wasser]. Hence, only µ: volume satisfies the monotonicity constraint.

Summing up, both non-ST and ST are subject to the monotonicity constraints on the nominal domain. There are two monotonicity constraints, one on the host NP (the extension
3. Monotonicity in the Verbal Domain

We saw in section 2 that non-ST and ST behave alike in terms of monotonicity on the nominal domain. In 3.1, three sets of empirical data will be presented to show that only ST is sensitive to certain restrictions on the verbal domain. To account for this fact, in 3.2, I extend Schwarzschild’s monotonicity constraints on the nominal domain to the verbal domain. The central claim is that ST is sensitive to the constraints on the verbal domain, while non-ST is not. In 3.3, I show that the data on monotonicity in 2.1 and 3.1 naturally follow from the claim that non-ST measures in the nominal domain, whereas ST measures in the verbal domain. Section 3.4 is the summary of this section.

3.1. The Data

The previous section revealed that non-ST and ST are equally sensitive to the monotonicity constraints on the nominal domain. Turning our attention to the verbal domain, I show that the distribution of ST is more restricted than that of their non-split counterparts. In particular, I present the following three semantic restrictions on ST: ST is incompatible with single-occurrence events, it cannot co-occur with individual-level predicates, and it generally disallows collective interpretations.

The first difference between the two constructions relates to the sorts of VPs that they occur with. The examples in (14)a and (15)a show that non-ST is compatible with any VP, while not all VPs can be used in ST, as illustrated by the contrast between (14)b with *hit Peter* and (15)b with *kill Peter*. The observation here is that ST is subject to a restriction on the verbal domain, whereas there is no restriction for non-ST: ST is incompatible with VPs denoting an event that can occur only once (e.g. *kill Peter*).8

\[(14)\]
\[
a. \text{[Drei Studenten ] haben Peter geschlagen.} \quad \text{[three students] have Peter hit} \\
\text{‘Three students hit Peter.’} \\
b. \text{Studenten haben Peter drei geschlagen.} \quad \text{students have Peter three hit} \\
\text{‘Students hit Peter three times.’}
\]

\[(15)\]
\[
a. \text{[Drei Studenten ] haben Peter umgebracht} \quad \text{[three students] have Peter killed} \\
\text{‘Three students killed Peter.’} \\
b. ?\text{Studenten haben Peter drei umgebracht.} \quad \text{students have Peter three killed}
\]

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8 (15)b is acceptable in the context where Peter is a zombie who can possibly die multiple times.
The second difference is found with respect to stage-/individual-level predicates, where S(tage)-level predicates correspond more or less to temporal states and I(ndividual)-level predicates roughly correspond to permanent states (Carlson 1977). It has been observed that ST is compatible with S-level predicates, but not with I-level ones, as shown in (16) (Diesing 1992, Pafel 1995). Non-ST can occur with any predicate.

\[\begin{align*}
\text{(16) a. } & \text{Wildschweine sind viele verfügbar.} \\
& \text{wild boars are many available} \\
& \text{‘As for wild boars, many are available.’}
\end{align*}\]

\[\begin{align*}
\text{b. } & \text{*Wildschweine sind viele intelligent.} \\
& \text{wild boars are many intelligent} \\
& \text{‘As for wild boars, many are intelligent.’} \quad \text{(Diesing 1992:40)}
\end{align*}\]

The third difference is on distributive/collective readings. Non-ST allows a distributive reading (each of the three boys built a model boat) as well as a collective reading (three boys together built a model boat), while ST allows a distributive reading only, as in (17).

\[\begin{align*}
\text{(17) a. } & \text{[Drei Jungen] haben ein Modellboot gebaut.} \\
& \text{[three boys] have a model boat built} \\
& \text{‘Three boys built a model boat.’} \quad \checkmark\text{distributive, }\checkmark\text{collective}
\end{align*}\]

\[\begin{align*}
\text{b. } & \text{Jungen haben drei ein Modellboot gebaut.} \\
& \text{boys have three a model boat built} \quad \checkmark\text{distributive, }??\text{collective}
\end{align*}\]

Summing up, unlike non-ST, ST is restricted in their distribution, as shown in (18). The goal for the rest of this section is to account for why there are such differences.

\[\begin{align*}
\text{(18) Semantic Properties of Non-ST and ST} \\
\begin{array}{c|c|c}
\text{Single-occurrence events} & \text{Non-ST} & \text{ST} \\
\hline
\text{S-/I-level predicates} & \checkmark\text{-S-level, }\checkmark\text{-I-level} & \checkmark\text{-S-level, }*\text{-I-level} \\
\text{Distributive/collective} & \checkmark\text{distributive, }\checkmark\text{-collective} & \checkmark\text{distributive, }*\text{-collective}
\end{array}
\end{align*}\]

3.2. The Monotonicity Constraints on the Verbal Domain

My central claim in this section is that ST must satisfy monotonicity constraints on the verbal domain, while non-ST does not need to. This is because the measure function associated with split MPs somehow measures the amount of events denoted by the VP, while the measure function associated with non-split MPs only measures the amount of individuals denoted by the host NP. I will show that this claim can account for the distributional differences between the two constructions. Recall that there are two monotonicity constraints on the nominal domain, i.e. a constraint on the host NP and a constraint on measure functions (in (13) above). In the following, I examine how the two monotonicity constraints extend to the verbal domain.

3.2.1. I begin the discussion by considering the monotonicity constraint on the host NP: the extension of the NP must be a lattice of individuals. Mass and plural count NPs can satisfy
this constraint, while singular count NPs cannot. The question is how to extend this constraint to the verbal domain. It has been claimed that there are analogies between the mass-count distinction and the atelic-telic distinction in verbal predicates; mass nouns are like atelic predicates, and count nouns are like telic predicates (van Meulen 1984, Krifka 1989, Bach 1986). The denotation of an atelic predicate has no set terminal point, while the denotation of a telic predicate includes a terminal point (cf. Vendler 1957, Verkuyl 1972, Dowty 1979). One of the diagnostic tests to determine the telicity of verbal predicates is to combine the verbal predicates with durative adverbs such as for two hours and time span adverbs such as in two hours. Atelic verbal predicates are compatible with durative adverbs, but not with time span adverbs. The opposite holds for telic verbal predicates. Based on this test, in (19), ran is an atelic predicate and die is a telic predicate.

(19) a. John ran {for ten minutes / *in ten minutes}.  
b. John died {*for ten minutes / in ten minutes}.

Aspectual properties of a verbal predicate are not determined by the verb alone: PPs or internal arguments can influence aspectual properties of the entire expression (Garey 1957, Verkuyl 1972, 1993, Dowty 1979, Platzack 1979, Tenny 1987, 1994, Krifka 1989, 1992, Jackendoff 1996, Rothstein 2004). For instance, as in (20), a complex verbal predicate is telic when the internal argument is a singular count noun, and atelic when the internal argument is a plural count noun or a mass noun. Hence, telicity needs to be determined by examining the entire complex verbal expression and not just the verb by itself. A complex verbal expression here corresponds to a VP.

(20) a. John ate an apple {*for ten minutes / in ten minutes}.  
b’. John ate apples {for ten minutes / *in ten minutes}.  
b”. John drank wine {for one hour / *in one hour}.

Recall the discussion in 2.2 that the mass-count distinction is tied to NPs. Since telicity is tied to VPs, the parallelism holds between mass NPs and atelic VPs and between count NPs and telic VPs. By introducing Davidsonian event arguments (Davidson 1967), we can represent the denotation of VPs by a lattice of events, which is analogous to a lattice of individuals in (10) (Krifka 1989, 1992, 1998, Landman 1996, 2000). Consider a set containing elements in the figure in (21), where $e_1$, $e_2$, and $e_3$ are singular events, $\cup_k$ is an event sum operator, and the lines indicate the ordering part-of relation $\leq$.

(21)

\[
\begin{align*}
 & e_1 \cup_k e_2 \cup_k e_3 \\
 & e_1 \cup_k e_1 \\
 & e_2 \\
 & e_3 \\
 & e_1 \cup_k e_2 \\
 & e_1 \cup_k e_3 \\
 & e_2 \cup_k e_3
\end{align*}
\]

Atelic,                 Plural telic
Singular telic

9 It is not always the case that the mass-count distinction of the internal argument correlates with the atelic-telic distinction of the complex verbal predicate, as exemplified in (i).

(i) a. John saw a zebra {for an hour / *in an hour}.  
b. John saw zebras {for an hour / *in an hour}.  

(Krifka 1992:31) Suffice it to say here that telicity needs to be determined by examining a complex verbal predicate, and the status of internal arguments often but not always influences telicity.
Telic VPs are analogous to count NPs. For instance, in the same way as a singular count NP like *dog* denotes a set of atomic individuals, a singular telic VP like *break a car* denotes a set of atomic events. What is different is that, unlike NPs, VPs in most languages are not overtly marked for plurality. Even without overt plural marking, however, telic predicates can be pluralized by applying the semantic pluralization operation * used for pluralization in the nominal domain (see section 2.2, see also Landman 1989a, b, 2000). With the help of the *-operator, telic VPs can be semantically pluralized. In the same way as a plural count NP denotes a set containing atomic individuals and their sums, I consider a plural telic VP to denote a set containing atomic events and their sums. For instance, suppose that the denotation of the telic VP *break a car* is \( \{ e_1, e_2, e_3 \} \). Then the extension of the pluralized telic VP \(*break a car*\) is the lattice containing \( e_1, e_2, e_3, e_1 \cup E e_2, e_1 \cup E e_3, e_1 \cup E e_2 \cup E e_3 \).11

(22) a. Singular telic VPs: \([ \{ \text{break a car} \} ] = \{ e_1, e_2, e_3 \} \)  
   b. Plural telic VPs: \([ \{ *\text{break a car} \} ] = \{ e_1, e_2, e_3, e_1 \cup E e_2, e_1 \cup E e_3, e_1 \cup E e_2 \cup E e_3 \} \)

Atelic VPs are like mass NPs in that their extension is a lattice. For example, if we have some driving-a-car event, any part of that event is still a driving-a-car event. In the same vein, if we have some water, any part of that water is still water. Moreover, if we have two driving-a-car events, the sum of the two is also a driving-a-car event.

To sum up, the extensions of a plural telic VP and of an atelic VP are a lattice of events, while the extension of a singular telic VP is not. In this way, the nominal and verbal domains are parallel with respect to algebraic lattice formation. As discussed above, NPs and VPs differ in that VPs in most languages, unlike NPs, lack an overt plural marker. When a VP lacks a plural marker, there is no way of telling whether the VP is semantically pluralized by the covert *-operator. Put differently, a VP without a plural marker can always be understood as being semantically pluralized. An exception to this generalization is a telic VP that denotes a single-occurrence event like *kill Peter*: assuming that Peter dies only once, the killing-Peter event can occur only once. That is, even if we pluralize it, the extension of *kill Peter* is always a singleton, i.e. not a lattice of events. The algebraic parallelism between the nominal and verbal domains is summarized below:

(23) Algebraic Parallelism between the Nominal and the Verbal Domain

<table>
<thead>
<tr>
<th>Nominal Domain</th>
<th>With a lattice</th>
<th>No lattice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass NPs ( \text{(water, hot water)} )</td>
<td>Plural Count NPs ( \text{(dogs, old dogs)} )</td>
<td>Singular Count NPs ( \text{(dog, old dog)} )</td>
</tr>
<tr>
<td>Verbal Domain</td>
<td>Atelic VPs ( \text{(drive a car)} )</td>
<td>Plural Telic VPs ( \text{(*break a car)} )</td>
</tr>
</tbody>
</table>

Let us now go back to the data in section 3.1 and examine properties of the relevant VPs. In (14)b and (15)b, a contrast is observed between *hit Peter* and *kill Peter*, where the

10 There are some languages that can overtly pluralize verbs as well as nouns by using so-called pluractional markers, i.e. morphemes for pluralization, although it is not always the case that pluractional markers reflect the plurality of verbs (Lasersohn 1995, among others).

11 For lack of a better notation, I will use the symbol * to refer to verbal pluralization also in natural language, not just in the formal language. For example, *dog* pluralizes into *dogs*, and *break a car* pluralizes into *break a car.*
latter is incompatible with ST. The following examples show that hit Peter is an atelic VP, while kill Peter is a telic VP.

(24) a. Hans hat Peter {zehn Minuten lang/*in zehn Minuten} geschlagen.
    Hans has Peter {ten minutes long/in ten minutes} hit
    ‘Hans hit Peter {for ten minutes/in ten minutes}.’

b. Hans hat Peter {*zehn Minuten lang/in zehn Minuten} umgebracht.
    Hans has Peter {ten minutes long/in ten minutes} killed
    ‘Hans killed Peter {for ten minutes/in ten minutes}.’

The extension of hit Peter is a lattice of events, since this VP is atelic. In contrast, kill Peter denotes a singleton containing a single-occurrence telic event, thus its extension, even if it is pluralized, cannot be a lattice. I argue that the measure function associated with split MPs somehow measure in the verbal domain, thus it is subject to the monotonicity constraint on the VP: the extension of the VP must be a lattice of events. The extension of hit Peter is a lattice of events, thus the measure function can apply monotonically, satisfying the monotonicity constraint on the VP. In contrast, the extension of kill Peter is a singleton, hence monotonicity fails, which accounts for why ST is incompatible with this VP. In this way, the contrast between hit Peter and kill Peter is captured by the monotonicity constraint on the VP. The measure functions associated with non-split MPs, in contrast, only measure the individuals denoted by the host NP, thus they have nothing to do with the measurement in the verbal domain. It follows that non-ST is not subject to the monotonicity constraint on the VP, which explains why they are compatible with any VP.

The monotonicity analysis predicts that pluralized telic VPs are compatible with ST, since their extension is a lattice of events just like pluralized count NPs. The prediction is borne out, as in (25). Although kill a mouse is a telic VP (John killed a mouse {*for / in} one hour), it can be pluralized (since there are multiple mice), unlike kill Peter. For instance, it is possible to say John killed a mouse many times last year, where kill a mouse is pluralized. Thus, the extension of kill a mouse is a lattice of events, correctly predicting that ST can co-occur with this predicate.12

---

12 Some informants judged (25) to be a little awkward. This awkwardness arises when the object is indefinite regardless of whether the VP can or cannot denote a lattice, as in (iv)b. In ST, the topicalized NP is a contrastive topic and the split MP is focused (see section 5 below). The position preceding the sentence final non-finite verb is claimed to be a focus position, thus the sentence sounds the best when the split MP appears in this position. When the object is definite, it can freely undergo scrambling to the higher position in the Mittelfeld (mid field), as in (i) (Grewendorf and Sternefeld 1990). As a result, the split MP occurs in the focus position, as in (ii)b. However, indefinite objects do not seem to undergo scrambling as freely as definite objects, as in (iii). Thus, as shown in (iv)b, ST involving a scrambled indefinite object is not perfectly acceptable. (iv)a is also not so good, since the split MP does not appear in the focus position. Thus, the acceptability of ST with indefinite objects is always controversial.

(i) a. Hans hat gestern Peter geschlagen.
   Hans has yesterday Peter hit
   ‘Hans hit Peter yesterday.’

b. Hans hat Peter gestern geschlagen.
   Hans has Peter yesterday hit

(ii) a. ? Studentenhaben drei Peter geschlagen.
   students have three Peter hit
   ‘Three students hit Peter yesterday.’
Event Arguments in Syntax, Semantics, and Discourse

(25) *Students* haben drei eine Maus umgebracht.
    students have three a mouse killed
    ‘Three students killed a mouse yesterday’

The table in (26) summarizes the claims of this section. Non-ST is compatible with any VP since it is not subject to monotonicity on the VP. ST measures in the VP, thus it is subject to the monotonicity constraint that the VP must have a part-whole structure.

(26) Restrictions on the VP

<table>
<thead>
<tr>
<th>Verbal Domain</th>
<th>With a lattice</th>
<th>No lattice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atelic VPs</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Plural Telic VPs</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Singular Telic VPs</td>
<td>√</td>
<td>*</td>
</tr>
</tbody>
</table>

The monotonicity analysis is capable of accounting for the second set of data on S-/I-level predicates: ST is incompatible with I-level predicates, while non-ST is compatible with both S-level and I-level predicates. This contrast naturally follows from the monotonicity constraint on the VP and from Kratzer’s (1995) claim that, unlike S-level predicates, I-level predicates lack event arguments in their denotation (cf. Diesing 1992). In ST, the extension of the VP must be a lattice of events to satisfy the monotonicity constraint on the VP. However, since I-level predicates lack event arguments, their extension cannot be a lattice of events. Non-ST, in contrast, is immune to the constraint on the VP, hence it is acceptable with both predicates.

3.2.2. We have seen that one of the monotonicity constraints, i.e. the constraint on the VP, successfully accounts for why ST is not compatible with single-occurrence events and with I-level predicates. Let us now turn to the other monotonicity constraint on measure functions: measure functions must be monotonic relative to a lattice of events. For instance, in (27)a, the monotonicity analysis says that the measure function must be monotonic relative to the lattice of the hitting-Peter events. However, (27)a necessarily involves three students, implying that drei ‘three’ must somehow express the cardinality of the students. The observation that the measure function associated with split MPs measures the host NP becomes even clearer when we compare (27)a with (27)b, where dreimal ‘three times’ is simply counting a number of events without being associated with the number of students: while (27)a must involve three students, (27)b does not have to. (27)b means that a certain unknown number of students hit Peter three times. It is generally assumed that adverbial
expressions like *three times* directly apply to verbal predicate and express cardinality of the relevant event (Doetjes 1997). Thus, the difference between (27)a and (27)b shows that, in (27)a, the measure function is not just applying to events.

(27) a. *Studenten* haben Peter *drei* geschlagen.
    students have Peter three hit
    ‘Three students hit Peter.’

b. *Studenten* haben Peter *dreimal* geschlagen.
    students have Peter three times hit
    ‘Students hit Peter three times.’

The situation is rather puzzling: we have learned from the data in section 3.1 that ST is subject to the monotonicity constraint on the VP. In contrast, non-ST is not, since they measure in the nominal domain. Then the working hypothesis is that ST measures in the verbal domain. However, we just saw that the measure function associated with split MPs must, in the end, measure the cardinality of individuals. To solve this dilemma, what seems to be called for is a mechanism that maps the relevant event to the host NP. Although ST measures in the verbal domain, the measure function associated with split MPs does not apply to events directly. Rather, with the help of the mapping from events to individuals, it applies to individuals. For example, in (27)a, the hitting-Peter event needs to be mapped to its agent *students*, making $\mu$: cardinality apply to *students*.

A mechanism along these lines is proposed in Krifka (1989) to account for the semantics of temporal adverbials like *for three hours* in ‘John slept for three hours’. Krifka claims that temporal adverbials cannot apply to events directly, but they can apply to entities which bear a relation to events, most notably times. That is, *for three hours* indirectly measures the sleeping event by measuring the run time of the event. Formally, he assumes that there is a homomorphism $h$ from events $E$ to event run times $T$, with $h(e_1 \cup_1 e_2) = h(e_1) \cup_T h(e_2)$, as in (28), where $\cup_1$ and $\cup_T$ are sum operators for events and times, respectively. A homomorphism is a function that preserves some structural relation defined on its domain in a similar relation defined on the range. Furthermore, Krifka claims that, given a measure function $\mu$ for times and a homomorphism from $E$ to $T$, we can construe a derived measure function $\mu'$ for events, as in (29). A derived measure function describes the transfer of a measure function from one domain to another. In (29), $\mu'$ is defined by $\mu$ and $h$: for all events, the amount of the event $e$ measured by $\mu'$ in $E$ is equal to the amount of $h(e)$ measured by $\mu$ in $T$.

\[
(28) \quad E \xrightarrow{h} T \quad \text{where } h(e_1 \cup_1 e_2) = h(e_1) \cup_T h(e_2)
\]

\[
(29) \forall e \ [ \mu'(e) = \mu(h(e)) ] \quad \text{(Krifka 1989:97)}
\]

Extending Krifka’s analysis to the German data, I argue that there is a homomorphism $h$ from events in $E$ denoted by the VP to individuals in $I$ denoted by the host NP, satisfying $h(e_1 \cup_1 e_2) = h(e_1) \cup_I h(e_2)$ ($\cup_1$ and $\cup_I$ are sum operators for events and individuals).

\[
(30) \quad E \xrightarrow{h} I \quad \text{where } h(e_1 \cup_1 e_2) = h(e_1) \cup_I h(e_2)
\]
From the data on non-split MPs, it is clear that measure functions can apply to individuals (e.g. in *three liters of water*, $\mu$: volume applies to water). Following Krifka, given a measure function $\mu$ for individuals and a homomorphism $h$ from $E$ to $I$, we can derive a measure function $\mu'$ for events. Then we can assume that a split MP is associated with $\mu'$, which measures events. (31) and (32) illustrate measure functions associated with a non-split MP and with a split MP, respectively. In (31), a measure function associated with a non-split MP directly applies to a set of individuals (the grey-shaded area in (31)) and returns measured amounts. Thus, the monotonicity constraints apply to a lattice of individuals, as discussed in section 2. In contrast, a measure function associated with a split MP in (32) applies to a set of events (the grey-shaded area in (32)) and returns measured amounts. It follows that split MPs are subject to the monotonicity constraint on the VP, as discussed in 3.2.1, i.e. the constraints on single-occurrence events and on I-level predicates. As in (29), since the derived measure function $\mu'$ for events in (32) amounts to $\mu(h(e))$, the same measurement as (32) can be represented as in (33).

(31) A measure function associated with a non-split MP

(32) A measure function associated with a split MP

(33) A measure function associated with a split MP

In (33), a measure function applies to individuals mapped from events by a homomorphism $h$, i.e. the range of $h$ (the grey-shaded area in (33)). According to (29), $\mu'(e)$ in (32) (the measured amount obtained by a derived measure function applying to events) is equal to $\mu(h(e))$ in (33) (the measured amount obtained by a measure function applying to individuals mapped from events). That is, a derived measure function $\mu'$ for events is a combination of a homomorphism and a measure function $\mu$ for individuals. By mapping events to individuals and measuring the range of that mapping, $\mu$ measures at the same time individuals (since $\mu$ applies to the output of $h(e)$, $\mu(h(e))$) and events (since the derived $\mu'$ applies to $e$, $\mu'(e)$). In this way, ST indirectly measures events by measuring individuals. This analysis successfully captures the observation that a measure function associated with split MPs operates both on the VP denotation – yielding the monotonicity constraints on the verbal domain – and on the denotation of the host NP, measuring individuals. Based on the discussion so far, we can define a measure function $\mu$ that is monotonic relative to $[\text{VP}]$, as in (34) (cf. (9) for $\mu$ that is monotonic relative to $[\text{NP}]$).
A measure function $\mu$ is monotonic relative to domain $E$ iff:

For events $e_a, e_b$ in $E$:

If $h(e_a)$ is a proper subpart of $h(e_b)$, then $\mu(h(e_a)) < \mu(h(e_b))$,

where $h$ is a homomorphism from $E$ to $I$ such that $h(e_1 \cup e_2) = h(e_1) \cup h(e_2)$.

The crucial difference between (31) for non-split MPs and (33) for split MPs is that the measure function in (31) applies to individuals directly, while the measure function in (33) applies to individuals mapped from events, i.e. the range of a homomorphism. This difference plays a crucial role in capturing the fact that ST lacks collective readings, which is shown in (17)b above. A lattice of building-a-model-boat events is mapped to a lattice of boys by a homomorphism, as in (35). **[build a model boat]** is a lattice of events, and the homomorphism in (35) preserves the lattice in **[boy]**. The measure function $\mu$: cardinality-of-individuals applies to the range of the homomorphism $h(e)$, i.e. a set of boys, satisfying (34). For instance, take two events $e_1$ and $e_1 \cup e_2$, where $h(e_1)$ (i.e. $x$) is a proper subpart of $h(e_1 \cup e_2)$ (i.e. $x \cup Iy$). It is true that the cardinality of $h(e_1)$, i.e. one, is lower than that of $h(e_1 \cup e_2)$, i.e. two. In (35), the split MP specifies that the cardinality of events is three $e_1 \cup e_2 \cup e_3$, which is mapped to $x \cup Iy \cup IZ$. This yields a distributive reading in that $e_1 \cup e_2 \cup e_3$ is a sum of three events each of which is done by $x$, $y$, $z$, respectively.

Two possible ways of obtaining collective readings are ruled out by the monotonicity constraints on the verbal domain. The first is a case where there is a homomorphism from a singleton containing a building-a-model-boat event $e$ to the sum of three students $x \cup Iy \cup IZ$, as in (36). This mapping is ruled out in the same way as **kill Peter** by the monotonicity constraint on the VP: a measure function cannot apply in a monotonic fashion since the extension of **build a model boat** or of **kill Peter** is a singleton.

The second case is where three building-a-model-boat events $e_1$, $e_2$, $e_3$ are mapped to the sum of three boys $x \cup Iy \cup IZ$, and an extension of **boys** is a singleton containing $x \cup Iy \cup IZ$, as in (37). By the definition of a homomorphism $h(e_1 \cup e_2) = h(e_1) \cup h(e_2)$, the sums of these atomic events $e_1 \cup e_2$, $e_1 \cup e_3$, $e_2 \cup e_3$, $e_1 \cup e_2 \cup e_3$ are also mapped to $x \cup Iy \cup IZ$. This is ruled out by the monotonicity constraint on measure functions: for the measure function to be monotonic, we need to have $h(e_1)$ and $h(e_2)$, where one is a proper subpart of the other.

---

13 For simplicity, I illustrate the situation with an isomorphism, where the range of $h$ exhausts **[boy]**.
However, in a described situation, all events are mapped to $x \cup y \cup z$, thus there are no two members in the range of the homomorphism which are in a part-of relation. Crucially, a measure function on the verbal domain applies to the portion of a lattice of individuals obtained from the mapping from events, and not to the entire lattice of individuals with the NP-property. In the relevant example, boys, being a plural count NP, denotes a lattice of individuals. However, in the described situation, only $x \cup y \cup z$ is relevant. In this situation, the measure function cannot be monotonic because there is no part-whole structure to work off of. In this way, monotonicity constraints on the verbal domain successfully rule out collective readings of ST in (17)b.

(37)

Summing up, I proposed a mechanism where, with the help of a homomorphism $h$ from events to individuals, the measure function associated with split MPs applies to individuals mapped from events, i.e. the range of $h$. This mechanism accounts for the data on distributivity presented in 3.1. The monotonicity constraints on the verbal domain are given in (38), which parallels the constraints on the nominal domain in (13).

(38) Monotonicity constraints on the Verbal Domain

a. The Constraint on the VP: The VP must have a part-whole structure, i.e. the extension of the VP must be a lattice of events.

b. The Constraint on Measure Functions: The measure function $\mu$ must be monotonic relative to the given part-whole structure, i.e. a lattice of events (as defined in (34)).

3.3. Domains of Measurement: Nominal Monotonicity Revisited

The discussion so far has revealed that non-ST and ST are both subject to some semantic restrictions on the nominal domain and that only ST is sensitive to restrictions on the verbal domain, as summarized in (39).

---

14 Interpretations obtained in ST might be relevant to event-related readings discussed in Krifka (1990). In (i), besides the obvious reading that presupposes the existence of 4000 ships, Krifka argues that there is an additional reading where four thousand refers to a number of events, that is, there could be fewer than 4000 ships.

(i) Four thousand ships passed through the lock last year.

In the event-related reading in (i), the numeral combining with ship measures a number of passing-through-the-lock events. The mechanism of deriving event-related readings proposed in Krifka (1990) might be able to capture the semantics of ST, where an MP that is clearly associated with individuals actually measures events. However, Krifka’s mechanism must be different from the mechanism of a homomorphism for ST, since event-related readings are available both in non-ST and ST. For this reason, I assume that the grammar contains both Krifka’s mechanism for event-related readings and my mechanism of a homomorphism for ST.
Restrictions on Non-Split/Split Topicalization

<table>
<thead>
<tr>
<th></th>
<th>Nominal domain</th>
<th>Verbal domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Split Topicalization</td>
<td>with restrictions</td>
<td>no restriction</td>
</tr>
<tr>
<td>Split Topicalization</td>
<td>with restrictions</td>
<td>with restrictions</td>
</tr>
</tbody>
</table>

The generalization I propose here is that MPs in non-ST and ST are sensitive to the monotonicity constraints on the domain to which the measure function denoted by the MPs applies. In section 4, I show that this generalization is compatible with the syntax of these constructions: the measure function associated with a non-split or a split MP is sensitive to the monotonicity constraints on the domain with which the MP combines in the syntax.

In non-ST, the measure function measures in the nominal domain (the amount of individuals in the extension of the host NP), hence we observe the monotonicity constraints on the nominal domain. This semantic mechanism of measurement correlates with the syntactic structure of non-ST, where a non-split MP directly combines with the host NP in the syntax. That is, a non-split MP measures individuals denoted by a nominal predicate, since it combines with the nominal predicate in the syntax.

As for ST, we saw in section 3.2 above that they are subject to the monotonicity constraints on the verbal domain, which leads to the claim that the measure function measures in the verbal domain (the amount of events in the extension of the verbal predicate), thus ST must obey the monotonicity constraints on the verbal domain. The discussion in section 4 reveals that a split MP can be analyzed as an adjunct combining with a verbal predicate in the syntax, hence the present semantic claim correlates with the syntactic structure, just like in the case of non-ST. In section 3.2.2, I proposed that the measure function for events is defined by the measure function for individuals and a homomorphism $h$ from events to individuals, that is, $\mu'(e) = \mu(h(e))$ (see (29)). As schematized in (33), the measure function $\mu$ associated with split MPs applies to the range of a homomorphism from events to individuals, that is, $\mu$ applies to the domain of individuals. Hence, $\mu$ must be monotonic to $[\text{NP}]$ as well as to $[\text{VP}]$. Note that the monotonic behavior of ST in the nominal domain is a side-effect of the monotonicity constraints on the verbal domain: with a homomorphism $h$ from events to individuals, the monotonicity constraints on the verbal domain affect the range of $h$, i.e. the nominal domain mapped from the verbal domain. Hence, the monotonicity constraints on the verbal domain alone can capture the monotonic behaviors of ST in the nominal domain. As a result, a simple picture emerges: both non-ST and ST are subject to monotonicity constraints. The difference between them is that non-ST measures in the nominal domain, while ST measures in the verbal domain. Hence, these constructions are sensitive to the monotonicity constraints in the nominal and verbal domains, respectively. Furthermore, in ST, there is a homomorphism from events to individuals, thus they end up obeying the monotonicity constraints on the nominal domain as well.

3.4. Summary

The data in 3.1 revealed that ST is semantically restricted in three respects: incompatibility with single-occurrence events, incompatibility with I-level predicates, and unavailability of collective readings. The restrictions are uniformly explained by claiming that ST is subject to monotonicity constraints on the verbal domain. This is so, because, while non-ST measures individuals directly, ST indirectly measures events by measuring individuals.
This is equal to saying that ST measures events directly, since a derived measure function for events is a combination of a homomorphism from events to individuals and a measure function for individuals. Furthermore, the monotonicity constraints on the verbal domain are analogous to the constraints on the nominal domain proposed in the previous section, empirically attesting that the two domains are algebraically parallel.

Before we conclude this section, let us briefly discuss the pragmatics of ST. It has been claimed that, in ST, the host NP must be a contrastive topic and the split MP must be focused (Krifka 1998, among others). This pragmatic constraint may play a role to explain semantic properties of ST. In 3.1, I showed that ST is incompatible with single-occurrence events such as \textit{kill Peter} (see (15)b), which is accounted for by the monotonicity constraint on the VP. Alternatively, we could argue that the infelicity of such examples is due to the pragmatic constraint. The contrastive nature of the host NP implies that there is a group of non-students who killed Peter. Since Peter cannot be killed multiple times, the sentence is infelicitous. However, the pragmatic approach cannot explain why ST lack collective readings: although ST in (40)A satisfies the topic-focus constraint, it still disallows collective readings. Thus, the pragmatic analysis predicts that ST cannot occur with a single-occurrence event, but it cannot account for why it lacks collective readings. In contrast, the monotonicity analysis can uniformly account for both properties.

\begin{enumerate}
\item[	extbf{4.}] The Syntax of Split Topicalization
\end{enumerate}

This section examines whether the semantic analysis proposed above is compatible with the syntax of ST. Among a great deal of work done on the syntax of this construction, the most dominant view is the transformational analysis, where an MP is base-generated in the same nominal constituent as its host NP, and ST is derived from this configuration by moving the host NP (van Riemsdijk 1989, Diesing 1992, among others). I first raise two problems with such an account, i.e. agreement facts and the lack of non-split counterparts. Then, I suggest an alternative analysis of treating a split MP as an adjunct adjoined to a verbal predicate. This syntactic analysis is compatible with the monotonicity analysis proposed above.

It has been pointed out in the previous literature that some examples of ST lack corresponding non-split counterparts, as shown in (41) (Fanselow 1988, van Geenhoven 1998, Nolda to appear). The ungrammaticality of (41)a suggests that (41)b could not have been derived from (41)a. Further examples will be presented in (42) and (43).

\footnotesize
\begin{itemize}
\item See Nakanishi (2004: Chapter 5) for further discussion on this issue.
\end{itemize}
Another problem for the transformational analysis comes from morphological agreement. In ST, the host NP and the split MP always agree in terms of number and case in the same way the non-split MP agrees with the NP (van Riemsdijk 1989). It has been argued that number/case agreement obtains within the nominal domain. Based on this assumption, the agreement data has been taken as one of the strongest arguments for the transformational approach (van Riemsdijk 1989, among others): agreement obtains when an MP and its host NP form a nominal constituent, then the host NP undergoes movement leaving the MP behind. As a result, non-split MPs and split MPs necessarily show the same agreement. However, such an analysis runs into trouble with examples where ST lacks a non-split counterpart, as in (42). (42)a shows that the host NP and the MP must agree in terms of case, and (42)b-c show that they cannot form a nominal constituent. Whatever the mechanism of case agreement turns out to be, it is clear that the nominal constituency of kein- and its host NP is not a necessary condition for case agreement.

Another example comes from welch-, which means ‘which’ in prenominal position, as in (43)a-b and ‘some’ in split position, as in (43)c. Regardless of whether welch- is split, it agrees with the NP in terms of case. Given the nature of semantic difference between the split and non-split welch-, it is hard to argue that (43)c is transformationally related to (43)a-b. We are forced to conclude that case agreement obtains even when welch- does not form a nominal constituent with its host NP, as in (43)c.
Benmamoun (1999). In any case, what is important for us here is that the agreement facts do not naturally follow from the transformational approach as originally argued.

So far, I have raised two problems with the transformational analysis of ST. Let us now turn to the semantic arguments against the transformational analysis. In section 3.1, I showed that ST is semantically different from its non-split counterpart at least in three respects: (i) incompatibility with single-occurrence events, (ii) incompatibility with 1-level predicates, and (iii) unavailability of collective interpretations. We may be able to argue that semantic differences *per se* do not rule out the transformational analysis. Indeed, we might expect to observe some semantic differences as a result of syntactic transformations. However, it is not clear how syntactic movements can be the source of the types of semantic differences discussed here.

Alternatively, in an important line of the previous work on ST, it has been proposed that a split MP and its host NP are base-generated separately (Fanselow 1988, 1993, van Geenhoven 1998, Krifka 1998, Fanselow and Cavar 2002, de Kuthy 2002). Under such an approach, a split MP can be considered as an adjunct adjoined to a verbal predicate just like an adverb. Recall now the claim in section 3.3 that a non-split MP syntactically combines with, and correspondingly semantically measures, a nominal predicate. Following the reasoning for non-split MPs, the working hypothesis proposed in section 3.3 is that a split MP syntactically combines with, and correspondingly semantically measures, a verbal predicate. The data presented in this section independently support this hypothesis. In particular, split MPs can be syntactically analyzed as adjuncts that combine with verbal predicates. With this syntactic structure at hand, it is possible to compositionally achieve the semantic properties of ST.16

5. Concluding Remarks and Cross-Linguistic Implications

In this paper, I examined the semantic properties of non-ST and ST. The core argument is that these two constructions differ in that non-ST involves the measurement of individuals in the nominal domain, while ST involves the measurement of events in the verbal domain. The difference in their domains of measurement is reflected by the difference in their sensitivity to the monotonicity constraints on the nominal and verbal domains. I further proposed a mechanism of measurement in the verbal domain that makes use of a homomorphism from events to individuals. The proposed analysis uniformly accounts for semantic restrictions on the two constructions.

A very important question for any linguistic analysis is how well it stands up when applied to different languages. In Nakanishi (2004), I extensively showed that non-split and split MPs in Japanese have the same semantic properties as the German non-split and split MPs. In section 3.1, we saw that split MPs are subject to some semantic restrictions on the VP: incompatibility with single-occurrence events, incompatibility with individual-level predicates, and the lack of collective readings. The following examples show that split MPs in Japanese also have these properties.

16 See Nakanishi (2004: Chapter 3) for the actual compositional semantics of ST.
Since Japanese and German belong to different language families, the data suggest that the proposed monotonicity analysis extends to cross-linguistic data. Indeed, in Nakanishi (2004), I showed that the non-split and split MPs in Greek and Catalan also show semantic properties that can be explained by the monotonicity constraints.

Besides cross-linguistic non-split and split MP constructions, there are other constructions in different languages to which the proposed analysis (or parts of it) can be extended. One of the examples comes from for the most part in English. It has been claimed that for the most part can yield the effect of quantification over the individuals introduced by plural definite NPs (Berman 1991, Lahiri 1991, 2002, Williams 2000). This effect is referred to as the Quantificational Variability Effect (QVE). In (47), the adverbial expression for the most part quantifies over [his friends], evoking the interpretation ‘most of his friends’.

(47) *(For the most part,)* John(*, for the most part,*) likes his friends.

We could argue that (47) involves a homomorphism from the John’s-liking events to [his friends]. As a result, for the most part quantifies over [his friends], yielding the QVE interpretation ‘most of his friends’ (cf. Nakanishi and Romero 2004).

The proposed analysis on ST and on for the most part might bring to mind the existence of a QVE with adverbs of quantification (e.g. always, usually, etc.) observed with an indefinite NP, as in (48) (von Fintel 1994). (48) has the interpretation that ‘all blue-eyed bears are intelligent’, where always has the effect of semantically quantifying over a blue-eyed bear, although syntactically it is an adverb that combines with the verbal predicate.

(48) A blue-eyed bear is always intelligent.

It has been argued that the QVE with adverbs of quantification involves a correspondence between individuals and minimal situations containing each individual. Thus, the QVE in
(48) may make use of a similar mapping strategy as ST and for the most part, although they differ in that the former involves situations and the latter involve events. Despite this similarity, quantification over events and quantification over situations are fundamentally different in several respects (Nakanishi 2004, Nakanishi and Romero 2004). For example, while for the most part can quantify over the many (generic) events (in (49)a) or over parts of one episodic event (in (49)b), usually / always cannot be used in an episodic context, as the infelicity of (50)b suggests. The comparison between these two kinds of quantification is an important research topic that should be addressed further in future work.

(49) a. For the most part, the students who sit over there are smart.
     b. For the most part, the students sitting over there now are smart.
    (Nakanishi 2004:311)

(50) a. The students who sit over there are usually/always smart.
     b. #The students sitting over there now are usually/always smart.
    (Nakanishi 2004:311)

In this paper, I hope to have shown that the proposed analysis, which makes use of the notions of monotonicity and a homomorphic mapping from events to individuals provides us with an adequate tool to uniformly account for the grammar of ST as well as of other measurement constructions (the split MP construction in Japanese, for the most part in English, etc.).

References


Krifka, Manfred. 1998. Scope inversion under the rise-fall contour in German.


