

# Directional prepositions as numeral modifiers

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Master's thesis  
Linguistics: The Study of the Language Faculty  
August 2013

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# Acknowledgements

First and foremost, I want to thank Rick Nouwen for being the best supervisor anyone could ask for. The conversations I had with him always inspired me a great deal. From the very beginning, when I was still searching for the right angle, to the very end, when he gave comments on previous versions of this thesis, he always listened to what I had to say, forced me to be precise by asking me to clarify what I had said or written, and steered me in the right direction by asking questions and telling me his thoughts.

I also want to thank Henriette de Swart for her willingness to be my second reader even though I was unable to give her much time to read it.

My thanks goes out to Joost Zwarts for kindly agreeing to meet with me and share his expertise on prepositions. Without his guidance, I would have been lost in a domain that was almost entirely new to me.

This thesis could not have been written without the help of all my informants, who agreed to meet up with me to answer my questions about their language, tirelessly filled out questionnaire after questionnaire, and patiently replied to dozens of emails. I want to thank Silvia Rădulescu, Isa Bayirili (and his great American health insurance), Benjamin Storme, Loïc de Jong, Anna Folke Larsen, Pernille Borregaard, Maria Koutiva, Vicky Stefou, Stavroula Alexandropoulou, Dimitra Lazaridou-Chatzigoga, Farhad Mirdamadi, Fafa Same, Ben Rodenhäuser, Anja Goldschmidt, Ivano Ciardelli, Vincenzo Tabacco and Loes Burgers for forwarding my questions, Natalia Davidson, Lilla Magyar, Eduardo Dominicini, Rocío Romero, Alexia Guerra, Jenna Baranov, Wataru Uegaki, Ana Lucia Pessotto dos Santos, Bambang Kartono, Mengru Han, Yipu Wei, Yuning Sun, Ishani Guha and her friends Bidisha and Santosh Kumar, Simona Bernatavičiutė, Ruth Brillman and her semanticist friend, and Aron Hirsch.

For providing Dutch judgments when mine got increasingly blurry and sharing their thoughts on the topic with me, I want to thank Marjolein Wennekers, Marlijn Meijer, Lea ter Meulen, Chantal van Dijk, Indira Wakelkamp (a particularly hard-hit victim of my spamming), and Annemarie van Dooren (a fellow nerd). I also want to thank Indira and Annemarie for always being there for me to talk about my thesis (or *anything* else), and for never getting tired of my going on about the topic.

Als laatste wil ik mijn lieve Jeroen, mama, papa en Hildegarde bedanken: voor alle supermarktbezoeken en al het koken van heerlijke gerechten als ik het druk had (Jeroen), alle mooie, inspirerende en grappige gesprekken in de Olympiadekeuken (Jeroen, papa en Hildegarde) en tijdens het Mahallen (papa), alle fijne (telefoon)gesprekken tijdens welke jij — die me zo goed begrijpt — me weer de moed en het zelfvertrouwen gaf om door te gaan (mama), en de liefde en steun van jullie allemaal, de belangrijkste mensen in mijn leven.

# Contents

<b>1</b>	<b>Introduction</b>	<b>4</b>
<b>I</b>	<b>Directional numeral modifiers across languages</b>	<b>7</b>
<b>2</b>	<b>The A/B distinction</b>	<b>8</b>
<b>3</b>	<b>Properties of directional numeral modifiers across languages</b>	<b>12</b>
3.1	<i>Up to</i> is different from <i>at most</i> . . . . .	12
3.1.1	Downward entailment and negative polarity items . . . . .	12
3.1.2	The bottom-of-the-scale effect . . . . .	13
3.1.3	Positive directivity . . . . .	14
3.1.4	Cancellable upper bound . . . . .	15
3.1.5	Interim conclusion . . . . .	15
3.2	Directional numeral modifiers across languages . . . . .	16
3.3	Properties of directional numeral modifiers . . . . .	20
3.3.1	Class B effects . . . . .	20
3.3.2	Downward entailment . . . . .	21
3.3.3	Negative polarity items . . . . .	22
3.3.4	The bottom-of-the-scale effect . . . . .	23
3.3.5	Positive directivity . . . . .	24
3.3.6	Cancellable upper bound . . . . .	24
3.3.7	Interim conclusion . . . . .	25
<b>4</b>	<b>The semantics of directional numeral modifiers</b>	<b>27</b>
4.1	Nouwen's semantics of modified numerals . . . . .	27
4.1.1	The semantics of class A numeral modifiers . . . . .	27
4.1.2	The semantics of class B numeral modifiers . . . . .	28
4.2	Schwarz. et al.'s semantics of <i>up to</i> . . . . .	30
4.3	A tentative account for directional numeral modifiers . . . . .	33
4.3.1	Two levels of meaning . . . . .	33
4.3.2	An account for the quirks of directional numeral modifiers . . . . .	35
4.3.3	Interim conclusion . . . . .	36
<b>II</b>	<b>Prepositional numeral modifiers in Dutch</b>	<b>38</b>
<b>5</b>	<b>Properties of prepositional numeral modifiers in Dutch</b>	<b>39</b>
5.1	Dutch prepositional numeral modifiers in the spatial domain . . . . .	40

5.2	Dutch prepositional numeral modifiers in the numerical domain . . . . .	41
5.2.1	Three properties of <i>tegen</i> and <i>richting</i> . . . . .	41
5.2.2	Properties of Dutch prepositional numeral modifiers . . . . .	44
5.3	Interim conclusion . . . . .	49
<b>6</b>	<b>Classifications of directional prepositions</b>	<b>51</b>
6.1	Svenonius’s clasification of prepositions in English . . . . .	51
6.1.1	Properties of prepositions in English . . . . .	53
6.1.2	Transferring Svenonius’s classification to Dutch . . . . .	54
6.1.3	<i>Tot, tegen, and richting</i> in Svenonius’s classification . . . . .	57
6.2	Zwarts’s classification of directional prepositions . . . . .	59
6.3	Interim conclusion . . . . .	62
<b>7</b>	<b>Reconciling the spatial and numerical behaviour of Dutch prepositional numeral modifiers</b>	<b>63</b>
7.1	<i>Tegen</i> and <i>richting</i> as directional prepositions . . . . .	64
7.2	<i>Tegen</i> and <i>richting</i> as locative prepositions . . . . .	67
7.3	<i>Tegen</i> and <i>richting</i> as ambiguous prepositions . . . . .	69
7.4	Interim conclusion . . . . .	70
<b>8</b>	<b>Summary and conclusion</b>	<b>71</b>
	<b>References</b>	<b>74</b>
	<b>Appendices: data</b>	<b>75</b>
A	Class B effects . . . . .	76
B	Downward entailment . . . . .	79
C	Negative polarity items . . . . .	82
D	The bottom-of-the-scale effect . . . . .	85
E	Positive directivity . . . . .	87
F	Cancellable upper bound . . . . .	91

# Chapter 1

## Introduction

Numeral modifiers are expressions that specify a relation between the number they modify and the element the modified numeral is applied to. In the case of (1-a), for example, the relation between the number three and the people who arrived is that the number of people who arrived is higher than three. Similarly, the relation between the number 150 and the amount of money Anne can spend on food this week in (1-d) is that the former is the upper bound of the latter.

- (1) a. More than three people arrived.
- b. Oliver owns at least four pairs of jeans.
- c. We accept reservations from parties from six guests.
- d. Anne can spend no more than €150 on food this week.
- e. Teachers generally earn under €40.000 a year.
- f. James can be sentenced to up to five years in prison.
- g. There will be between forty and fifty people at the party.

As is illustrated in (1), numeral modifiers can identify a lower bound ((1-a)-(1-c)), an upper bound ((1-d)-(1-f)), or both ((1-g)). Furthermore, numeral modifiers often seem to be elements that are borrowed from other areas of the grammar. These expressions can be comparatives as in (1-a) or negated comparatives as in (1-d), superlatives as in (1-b), or prepositions as in (1-c), (1-e), (1-f), and (1-g).

It is this last category of prepositional numeral modifiers that will be the topic of this thesis. More specifically, I will focus on expressions that function as directional prepositions in the spatial domain and as modifiers that set an upper bound in the numerical domain. In English, the prime example of this category is the expression *up to*. I take the property of directionality to mean ‘contributing a path’: a directional preposition, unlike a locative one, expresses that something moves along a certain path rather than conveying a static location (see e.g. Zwarts, 2008; Jackendoff, 1983).

I will show that directional numeral modifiers differ from other numeral modifiers in a number of ways. A preview of such a contrast is given in (2).

- (2) a. We lost at most a hundred soldiers, which is a relief.
- b. ?We lost up to a hundred soldiers, which is a relief.

While the version of this sentence with *at most* appears unproblematic, you would be unlikely to hear the one with *up to* from the mouth of someone who desires to win the war or values human lives.

I will use this and four other contrasts between non-directional and directional numeral modifiers to argue for the existence of a separate class of numeral modifiers, the underlying parameter of which is that of directionality. That is, I claim that directional prepositions form a coherent semantic category in the numerical domain just as they do in the spatial domain.

In the following chapter, I will discuss the categorisation of numeral modifiers put forward in Nouwen (2010b). Nouwen argues that there are two classes of numeral modifiers, one of which contains modifiers that can identify a specific cardinality and one of which requires quantification over a range of values. The result of this classification suggests that the grammatical function that numeral modifiers have in other domains plays a role in their behaviour in the numerical domain. For example, numeral modifiers that have the form of comparatives all fall into class A — the class of modifiers that can identify a specific cardinality — while superlatives belong in class B: the class of modifiers that lack this ability.

Nevertheless, a more fine-grained analysis of numeral modifiers is needed to get a clearer picture of the way in which form affects meaning. The superlative *at most* and the directional preposition *up to* appear alongside each other in class B in Nouwen’s classification despite the fact that they are elements of two completely different grammatical categories, which, as I will show in this thesis, results in non-uniform behaviour in the numerical domain. While it may seem at first sight as if all class B modifiers are alike, a closer look at their workings reveals that there are profound differences within the class. I will demonstrate that these differences are not quirks of particular lexical items but rather systematic contrasts between modifiers originating from different areas of the grammar.

I will show that it is the fact that certain numeral modifiers are *directional* prepositions that causes them to have certain specific semantic properties. I will do this by presenting data from 13 languages besides English in which directional numeral modifiers all display the same behaviour as *up to*. I will show that, as non-directional upper bound class B modifiers in these languages do not have any of the properties directional numeral modifiers have, it is clear that these characteristics are specific to directional prepositions.

Following Corver and Zwarts (2006), I will assume that prepositional phrases containing a prepositional modified numeral are not fundamentally different from other PPs. That is, the core meaning of the preposition *up to* in the spatial PP *up to the garden* is the same as its primary meaning in the numerical PP *up to a hundred*. Directional numeral modifiers are still directional prepositions, and are thus different from other numeral modifiers. This position is entirely compatible with the observation presented in this thesis that directional numeral modifiers crosslinguistically share a bundle of properties that other numeral modifiers lack.

However, the exact way in which the meaning of prepositions in the spatial domain corresponds to their meaning in the numerical domain is not always straightforward. This is a matter I will address in the final three chapters of this thesis, using three different prepositional numeral modifiers in Dutch as objects of study.

This thesis is organised in two levels: it consists of two main parts and three chapters within each of these parts. The first part of this work introduces the directional prepositions across languages that double as numeral modifiers and the five characteristics they share. It also includes a chapter on the semantics of numeral modifiers in general and directional numeral modifiers specifically. The primary aim of this part is to show that there is a crosslinguistic subclass of numeral modifiers that behave differently from other numeral modifiers, and that being a directional preposition is the condition for being a member of this subclass.

The second part of this thesis zooms in on three prepositional numerals in Dutch: *tot*, *tegen*, and *richting*; which roughly translate to ‘up to’, ‘against’ or ‘into’ and ‘towards’ or ‘in the direction of’ respectively. I will discuss the behaviour of these prepositions in the spatial and the numerical domain. The aim of this part of the thesis is to reconcile the workings of these three prepositions in the spatial domain with their behaviour in the numerical domain, again on the basis of the idea that the fundamental meaning of the prepositions remains the same across domains.

In the following chapter, I will elaborate on Nouwen’s (2010b) classification of numeral modifiers. Chapter 3 introduces the five characteristics that directional numeral modifiers share as well as the prepositions across languages that are members of the class of directional numeral modifiers. In chapter 4, I will discuss Nouwen’s semantics of numeral modifiers as well as a modification of this semantics put forward by Schwarz, Buccola, and Hamilton (2012) to account for some of the properties of *up to*. I will also propose a preliminary account of directional numeral modifiers that aims to uncover what underlies their unique characteristics.

In the first chapter of the second part of this thesis, I will explore the behaviour of the three Dutch prepositions *tot*, *tegen*, and *richting* in the spatial as well as the numerical domain. In chapter 6, I will delve into different classifications of prepositions to pinpoint the meaning of the relevant prepositions in the spatial domain. Chapter 7 is dedicated to the endeavour of exploring how exactly the spatial and the numerical uses of *tot*, *tegen*, and *richting* can be traced back to the core meaning of the prepositions.

Chapter 8 contains a summary of both parts of this thesis and concludes.

## Part I

# Directional numeral modifiers across languages



## Chapter 2

# The A/B distinction

In this section, I will discuss Nouwen’s (2010b) categorisation of numeral modifiers. The basic idea of this categorisation is that numerals belong in either of two categories depending on whether or not they are capable of referring to a specific cardinality. One of the properties of the directional numeral modifiers that are central to part I of this thesis is that they belong in the class that lacks this ability.

Numerals can be modified by a wide variety of expressions. Examples (from Nouwen, 2010b) are given in (1).

(1)	Comparative quantifiers	<i>more/less/fewer than n</i>
	Differential quantifiers	<i>no/many more than n</i>
	Superlative quantifiers	<i>at least/most n</i>
	Disjunctive quantifiers	<i>n or more/less/fewer</i>
	Locative quantifiers	<i>under/over n</i>
	Directional quantifiers	<i>from/up to n</i>
	Other expressions	<i>minimally/maximally n</i>

Nouwen’s aim is to posit an account that generalises over all these kinds of numeral modifiers. To this end he proposes to categorise numeral modifiers into two separate classes. Class A modifiers can express a relation between the number they modify and another specific amount. Class B modifiers, on the other hand, are incapable of doing so. They are only acceptable in contexts where the modified numeral is related to a range of values. This phenomenon is referred to as the *range requirement*.

To see how this works, let us consider the examples below. If we only take into account the set of numbers picked out by the modified numeral, (2) and (3) intuitively appear to express the same proposition: the number of sides of a hexagon is a member of the set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. However, (2) is an acceptable statement while (3) is infelicitous or false.

- (2) A hexagon has fewer than 11 sides.  
(3) #A hexagon has at most 10 sides.

Because a hexagon has a specific number of sides, the class A numeral modifier *fewer than* but not the class B modifier *at most* can be used to specify that number. The A/B distinction is exemplified again in (4).

- (4) I know exactly how much memory my laptop has...
- a. ...and it is more than 1GB.
  - b. #...and it is at least 1GB.

The reason (4-a) but not (4-b) is acceptable here is that only class A modifiers can be used in a context where the modified numeral stands in a relation to an exact amount. The range requirement in (4-b) creates an ignorance effect: the range of values expressed corresponds to the options the speaker considers possible. This is incompatible with exact knowledge, and it is this incompatibility that causes the infelicitousness of (4-b).

When a modified numeral is compared to a range of values, both class A modifiers such as *less than* and class B modifiers such as *at most* can be used felicitously. This is shown in (5) and (6) below.

- (5) a. Computers of this kind have less than 2GB of memory.  
 b. Computers of this kind have at most 2GB of memory.
- (6) a. Jasper invited more than 50 people to his party.  
 b. Jasper invited at least 50 people to his party.

In (5), the relevant range of values comes from the plural *computers*. Multiple computers and therefore multiple possible amounts of memory capacity are under discussion. In (6), the range of values represents the different amounts of people for which the speaker considers it possible that Jasper invited that amount of people. If we interpret these sentences without a range, we take all computers in (5) to have the same fixed amount of memory and the speaker of (6) is assumed to have a specific number of people in mind who were invited by Jasper. Note that the a-sentences are ambiguous between a specific reading and a range reading, while the class B numeral modifiers in the b-sentences enforce range readings. This is demonstrated in (7) and (8).

- (7) a. Computers of this kind have less than 2GB of memory, namely 1GB.  
 b. Computers of this kind have at most 2GB of memory, #namely 1GB.
- (8) a. Jasper invited more than 50 people to his party, namely 60.  
 b. Jasper invited at least 50 people to his party, #namely 60.

In sum, Nouwen (2010b) divides numeral modifiers into two classes: class A, which contains modifiers that can be used to express a relation between the number they modify and a specific cardinality, and class B, which consists of modifiers that can only convey a relation between the modified numeral and a range of other cardinalities. A tentative overview of which numeral modifiers belong in which class according to Nouwen is given in table 2.1 for English and in table 2.2 for Dutch.

	Class A	Class B
Positive	more than $n$ over $n$	at least $n$ minimally $n$ from $n$ (up) $n$ or more
Neutral	between $n$ and $n$	from $n$ to $n$
Negative	fewer than $n$ less than $n$ under $n$	at most $n$ maximally $n$ up to $n$ $n$ or fewer $n$ or less

Table 2.1: Classification of numeral modifiers in English

	Class A	Class B
Positive	<i>meer dan</i> $n$ (more than $n$ ) <i>boven de</i> $n$ (above the $n$ )	<i>tenminste</i> $n$ (at least $n$ ) <i>minstens</i> $n$ (at least $n$ ) <i>op z'n minst</i> $n$ (at least $n$ ) <i>vanaf</i> $n$ (from $n$ ) <i>zeker</i> $n$ (certainly $n$ ) <i>minimaal</i> $n$ (minimally $n$ )
Neutral	<i>tussen de</i> $n$ <i>en de</i> $n$ (between the $n$ and the $n$ )	<i>van</i> $n$ <i>tot</i> $n$ (from $n$ to $n$ )
Negative	<i>minder dan</i> $n$ (fewer/less than $n$ ) <i>onder de</i> $n$ (under the $n$ )	<i>ten hoogste</i> $n$ (at most $n$ ) <i>hoogstens</i> $n$ (at most $n$ ) <i>op z'n hoogst</i> $n$ (at most $n$ ) <i>tot</i> $n$ (up to $n$ ) <i>maximaal</i> $n$ (maximally $n$ )

Table 2.2: Classification of numeral modifiers in Dutch

Nouwen's classification sheds some light on the differences between numeral modifiers by describing two kinds of scalar quantification and providing tests to check what kind of quantification a numeral modifier allows. As I will discuss in chapter 4, Nouwen also explains the differences between these two classes by proposing an account of the semantics for each class.

The broad scope of Nouwen's classification makes it a useful tool, but many details of the behaviour of numeral modifiers are lost due to its coarse-grainedness. As can be seen in the tables above, some patterns emerge from this classification. In English as well as in Dutch, comparatives and locative prepositions are members of class A, while superlatives, directional prepositions, and most other expressions are in class B. However, with this, the limit of the specificity of the account has been reached. As can be seen in the upper right corner of table 2.2, the classification does not distinguish between the superlative *tenminste*, the modal adverb *zeker*, and the directional preposition *vanaf*. Although it is helpful to consider the bigger picture and to regard the similarities between all these modifiers, it is equally important to look into the contrasts between modifiers that occur within class A and class B, and to consider the link between the role of these expressions in other areas of the grammar and their workings

in the numerical domain.

As I mentioned in the introduction, the focus of this thesis will be on directional prepositions that double as numeral modifiers with an upper bound such as *up to* and its Dutch counterpart *tot*. As can be observed in (9), *up to* has rightfully been placed in class B.

(9) Computers of this kind have up to 2GB of memory, #namely 1GB.

The fact that directional expressions such as *up to* display class B effects seems to follow from their meaning in the spatial domain. Directional prepositions are usually taken to denote a path (e.g. Talmy, 1983; Verkuyl & Zwarts, 1992; Zwarts, 2008; Svenonius, 2010; Pantcheva, 2011). If we take a range to be a path in the numerical domain, the connection between directional prepositions and class B properties can be made quite straightforwardly. While *up to the supermarket* identifies a path from a certain point in space to the supermarket, *up to fifty* specifies a path from 1 to 50 on a numerical scale.<sup>1</sup>

However, directional numeral modifiers display some other behaviours that seem unrelated to their membership of class B but all the more linked to their directional prepositional nature. In the following chapter, I will show in which ways directional numeral modifiers differ from other numeral modifiers and provide crosslinguistic data to demonstrate that it is directional prepositions generally that are different, and not just a few lexical items in English and Dutch that happen to be directional prepositions.

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<sup>1</sup>This does not explain why the starting point in the numerical domain is always 1, but perhaps this has more to do with a psychological tendency to see 1 as a starting point than with the semantics of *up to*.

## Chapter 3

# Properties of directional numeral modifiers across languages

In this section, I will discuss five properties of directional numeral modifiers and introduce the crosslinguistic lexical items that share these properties. Two of the characteristics I will explore come from Schwarz et al. (2012). These authors argue that *up to* belongs in a different subcategory within class B than other class B modifiers such as *at most*. They make this claim on the basis of the observations that, unlike *at most*, *up to* is not downward entailing, does not license NPIs, and cannot be combined with the numeral at the bottom of the scale it quantifies over. They propose that a modified version of Nouwen's (2010b) semantics for class B quantifiers is fit to describe the meaning of *up to* but not that of *at most*.

In the following section, I will discuss the three properties of *up to* Schwarz et al. mention. Then I will present two additional characteristics of *up to* that strengthen the claim that *up to* should be placed in a different category than *at most*. Section 3.2, shows that directional numeral modifiers such as *up to* occur in a wide variety of languages. In section 3.3, I will argue that the properties that distinguish *up to* from *at most* are not idiosyncrasies of English but features of directional numeral modifiers in general. On that basis, I will propose that there is a separate, crosslinguistic class of numeral modifiers that share a bundle of properties, and that directionality is the element that binds this class. Like Schwarz et al., I will restrict myself to upper-bound numeral modifiers.

### 3.1 *Up to* is different from *at most*

#### 3.1.1 Downward entailment and negative polarity items

The first difference between *at most* and *up to* mentioned by Schwarz et al. concerns monotonicity and NPI licensing. As can be seen in (1), *at most* is clearly downward entailing.<sup>1</sup>

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<sup>1</sup>(1) and (2) are from Chierchia and McConnell-Ginet (2000), cited in Schwarz et al. (2012).

- (1) a. At most three students smoke.  $\models$   
 b. At most three students smoke cigars.

In accordance with Ladusaw's (1979) theory of NPI licensing, *at most* licenses NPIs, as is demonstrated in (2).

- (2) At most three people had ever been in this cave.

Conversely, *up to* appears to be neither downward monotone nor an NPI licenser.

- (3) a. Up to three students smoke.  $\not\models$   
 b. Up to three students smoke cigars.  
 (4) \*Up to three people had ever been in this cave.

The authors argue for their intuition regarding (3) by sketching the following scenario. If the speaker is sure that one, two, or three students smoke, and she is sure that one or two but not three students smoke cigars, she can felicitously utter (3-a) but not (3-b). Hence, (3-a) does not entail (3-b), so *up to* is not downward entailing.

### 3.1.2 The bottom-of-the-scale effect

A second contrast between *at most* and *up to* is what Schwarz et al. call the *bottom-of-the-scale effect*. As is shown in (5) and (6), *at most* can be combined with the number at the bottom of the scale it quantifies over, whereas *up to* is not able to do so.<sup>2</sup>

- (5) a. At most ten people died in the crash.  
 b. At most one person died in the crash.  
 (6) a. Up to ten people died in the crash.  
 b. #Up to one person died in the crash.

Schwarz et al. argue that *one* is the bottom element of the scale here because while it is possible for half a person to be covered in sand, it is impossible for half a person to die. The number that is at the bottom of the scale is context-dependent. In a situation where eggs can only be bought in half-dozen cartons, the number six is the lowest number on the contextually relevant scale. As is demonstrated in (7) and (8), *at most* but not *up to* is compatible with *half a dozen* in such a situation.

- (7) a. He bought at most a dozen eggs.  
 b. He bought up to a dozen eggs.  
 (8) a. He bought at most half a dozen eggs.  
 b. #He bought up to half a dozen eggs.

In the same vein, *up to* is compatible with the number *one* if that number is not the lowest number on the scale. As can be observed in (9), *up to* can occur with *one litre*, as litres can be divided into smaller quantities such as millilitres.

- (9) a. We will need at most one litre of milk.  
 b. We will need up to one litre of milk.

---

<sup>2</sup>(5-a) and (6-a) are from Nouwen (2008).

Thus, it is not specifically the number *one* that *up to* is incompatible with, but more generally the lowest number on the relevant scale.

### 3.1.3 Positive directivity

Thus, Schwarz et al. argue that *up to* is different from *at most* on the basis of its differing behaviour regarding monotonicity, NPI licensing, and the bottom-of-the-scale effect. One of the differences between *up to* and *at most* I would like to add to the list concerns what I will refer to as the *directivity* of these quantifiers, following Nouwen (2010a).<sup>3</sup> Some quantifiers not only express a quantity but also direct the emphasis of the sentence towards either the positive or the negative side of the quantity. When a quantifier has positive directivity, the emphasis lies on the elements for which the sentence holds. Negatively directive quantifiers direct the accent of the sentence to the elements for which the sentence does not hold. To see how this works, consider (10) and (11) (from Sanford, Fay, Stewart, & Moxey, 2002, p.130).

- (10) a. In the airplane crash, a few people were killed, which is a terrible thing.  
b. ?In the airplane crash, a few people were killed, which is a good thing.
- (11) a. ?In the airplane crash, few people were killed, which is a terrible thing.  
b. In the airplane crash, few people were killed, which is a good thing.

The quantifier *a few* in (10) directs the emphasis of the sentence to the people who were killed. *Few*, on the other hand, highlights the people who survived the crash. (10-a) and (11-b) sound fine because for most people, the judgments on the situation in the second part of the sentence correspond to the emphasis established in the first part. Conversely, (10-b) and (11-a) can only be uttered felicitously by people of a rather morbid nature.

The difference between *a few* and *few* is analogous to that between *up to* and *at most*: *up to* has positive, and *at most* has negative directivity. One way to see this is to look at a sentence with an evaluative adverb such as *fortunately*. Assuming that getting time off work is a desirable circumstance and having to listen to the performance of a poor singer results from a less fortunate turn of events, (12-a) and (13-b) are acceptable, whereas (12-b) and (13-a) are not.

- (12) a. Fortunately, I can get up to five days off work.  
b. ?Fortunately, that horrible singer will sing up to five songs.
- (13) a. ?Fortunately, I can get at most five days off work.  
b. Fortunately, that horrible singer will sing at most five songs.

The reason for this is that the sentences with *up to* emphasise the number of days off the speaker received and the amount of songs that will be sung, while those with *at most* shift the accent to the days off work the speaker did not receive and the songs that will not be sung.

Besides the use of evaluatives such as *fortunately*, another way to see the difference between the directivity of *up to* and *at most* is to consider a context in which the speaker wishes to emphasise either the positive or the negative

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<sup>3</sup>The notion of directivity should be kept apart from that of polarity (see Nouwen (2010a) and references therein).

aspect of the sentence. One such context is that of an advertisement. When it is advertised that certain items are on sale, advertising executives obviously want to stress that the discounts that can be received are considerable discounts. This is why (14) but not (15) can be used felicitously in an advertisement.

- (14) Get a discount of up to 50%!  
(15) ?Get a discount of at most 50%!

While (14) highlights the discount itself, (15) emphasises all the discounts of more than 50% that could have been given. The difference in directivity between *up to* and *at most* lies at the root of this contrast.

### 3.1.4 Cancellable upper bound

A final contrast between these two numeral modifiers is the fact that the upper bound *at most* sets is much stricter than the one created by *up to*. At first sight, *up to n*, like *at most n*, seems to roughly mean *somewhere in the range between 1 and n*. However, the upper bound of *up to* is less precise than that of *at most* and can even be cancelled. This observation is exemplified in (16) and (17). (16-b) is a good continuation of (16-a), which means the upper bound of thirty (16-a) creates is defeasible. As is shown in (17), this is impossible for *at most*.

- (16) a. Up to thirty people showed up at the party.  
      b. In fact, I believe there were thirty-two people there.  
(17) a. At most thirty people showed up at the party.  
      b. ??In fact, I believe there were thirty-two people there.

### 3.1.5 Interim conclusion

In this section, I demonstrated that *at most* and *up to* differ with regards to five aspects: the characteristics relating to monotonicity, NPI licensing, and the bottom-of-the-scale effect mentioned by Schwarz et al., and the two additional properties regarding directivity and the strictness of the upper bound set by these modifiers that I added to the list. On the basis of these observations, I concur with Schwarz et al. that Nouwen's division of numeral modifiers into two classes is too coarse-grained.

The question that begs itself now is whether the contrasts between *up to* and *at most* I have discussed are simply idiosyncrasies of these particular lexical items or if there is evidence to suggest that there is a particular semantic parameter that determines whether numeral modifiers share the characteristics of *up to*.

In what follows, I will argue that there is indeed evidence to suggest that there is a semantic parameter underlying the contrasts between *at most* and *up to*, and that this parameter is directionality. Across languages, directional prepositions used as numeral modifiers consistently turn out to be the expressions that have the set of properties I explored in this section.

In section 3.2, I will introduce the crosslinguistic parallels of *up to*. In section 3.3, I will demonstrate that these expressions display the same behaviour as *up to* with regards to the five properties I discussed in this section.



## 3.2 Directional numeral modifiers across languages

Although it is obvious that *up to* has both a directional and a numerical use, what is less evident is whether the directional and the numerical versions of *up to* are related. I will argue that they are, and that it is the directionality of *up to* and its crosslinguistic counterparts that sets it apart from the rest of class B.

Intuitively, the meanings of these two uses of *up to* seem intimately linked. *Up to* in (18-a) identifies a path from a certain point where Mary was to the door of the house. In (18-b) it conveys a range from 1 to 50,000, which can also be regarded as a path on a numerical scale that starts at 1 and ends at 50,000.

- (18) a. Mary walked up to the door of the house.  
b. These cars can cost up to €50,000.

Furthermore, counterparts of *up to* — directional prepositions that double as numeral modifiers — can be found in a wide array of languages. To verify this, I collected data from 13 languages. This was done in several steps. In a bid to find as many directional expressions as possible, I asked my informants to imagine a situation where there is a man and a store, and to express the man's going to the store in all the ways they could think of. I then asked them to translate some English sentences containing the expressions *up to* and *toward* to their language to be sure that translations of those expressions were among the candidates. Finally, I asked them to select the directional expressions they had used to answer the previous two questions that could be used to modify numerals, and to give an example of a sentence in which the directional expression functioned as a numeral modifier.

Some examples given by the informants had to be filtered out. One frequently occurring problem was that, as *up to* has the same form as *until* in many languages, informants would give sentences with temporal indications such as *until five o'clock* rather than purely numerical examples. While these constructions are certainly similar to and may in fact be modified numerals, there is no quantification over cardinalities. To err on the side of caution, I decided not to include these examples.

Another issue was that some informants chose examples with verbs that already have an aspect of motion in them, such as *count up to ten* or *increase up to 50*. In these cases, it is possible that the translation of *up to* can only occur in that position because of the verb and is not a real numeral modifier. As can be seen in (19), *to* can be used instead of *up to* in both of these expressions, yet *to* is clearly not a numeral modifier.

- (19) a. Little Johnny can already count to ten.  
b. The number of guests has increased to ten.  
c. \*To ten people arrived.

Once I had obtained the relevant expressions, I asked more specific questions about the behaviour of these expressions to check if they shared the characteristics of *up to* discussed in section 3.1. This was done mainly by asking my informants to translate English sentences into their language using the directional numeral modifier that came out of the previous round of questions to translate *up to* and asking them to judge the grammaticality and felicitousness

of their translations.

The directional numeral modifiers I found using this method along with an example of how they are used in a directional and in a numerical context are given in (20)-(32).<sup>45</sup>

- (20) Dutch: **tot**
- a. Jeroen loopt tot de rand van het zwembad.  
Jeroen walks TOT the edge of the swimming pool.  
'Jeroen walks up to the edge of the swimming pool.'
  - b. Voor dat delict kun je tot vijf jaar gevangenisstraf krijgen.  
For that offence can you TOT five years prison sentence get.  
'For that offence you can be sentenced to a prison sentence of up to five years.'
- (21) Romanian: **până la**
- a. Am mers până la marginea lacului.  
We walked PÂNĂ LA the edge of the lake.  
'We walked up to the edge of the lake.'
  - b. Se pot înscrie până la cinci persoane.  
Can register PÂNĂ LA five persons.  
'Up to five people can register.'
- (22) Turkish: **kadar**
- a. Golun sonuna kadar yuruduk.  
Lake edge KADAR we walked.  
'We walked up to the edge of the lake.'

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<sup>4</sup>Chinese has an expression *dao* that can be used in directional contexts and in modified numerals. However, as is demonstrated in (ii), it can only be used as a numeral modifier when there is a negation in the sentence. Furthermore, it does not have any of the five properties described in section 3.1. For these reasons, I believe this is a different phenomenon, and I did not include *dao* in my data.

- (i) Wo men zou dao hu bian. 'We walked towards the edge of the lake.'  
We walk to edge lake.
- (ii) Jiao shi li bu dao san ge ren. 'There are no more than two persons  
Classroom in not to three CLASSIFIER person.  
in the classroom.'

<sup>5</sup>Brazilian Portuguese has an expression *até*, which can be used as a directional preposition and as a numeral modifier. This is shown in (i) and (ii).

- (i) Nós andamos até a beira do lago. 'We walked up to the edge of the lake.'  
We walked ATÉ the edge of the lake.
- (ii) Os passageiros têm direito de despachar até duas malas de 32 kg. cada.  
The passengers have right of dispatch ATÉ two suitcases of 32 kg. each.  
'Passengers are allowed to dispatch up to two suitcases of 32 kg. each.'

However, my informant said that *até* was only felicitous when embedded under a modal. This interfered with many of the judgments. Due to time restrictions, I was unable to research this matter further, so I decided not to include Brazilian Portuguese to err on the side of caution. However, my informant did give me examples that showed that *até*, unlike *no máximo*; 'at most', has positive directivity. This suggests that its workings are like that of the other directional numeral modifiers presented here. The examples can be found at the end of appendix E.

- b. 10 bavula kadar uccretsiz goturebiilirsiniz.  
10 luggage KADAR for free you can take.  
'You can take up to ten items of luggage for free.'
- (23) French: **jusqu'à**
- a. On a marché jusqu'au bord du lac.  
One has walked JUSQU'À the edge of the lake.  
'We walked up to the edge of the lake.'
- b. On peut prendre jusqu'à 5 valises avec vous dans la voiture.  
One can take JUSQU'À 5 suitcases with you in the car.  
'You can take up to 5 suitcases with you in the car.'
- (24) Danish: **op til**
- a. John går op til butikken.  
John goes OP TIL the shop.  
'John goes up to the shop.'
- b. Der kan være op til 5 personer i elevatoren.  
There can be OP TIL 5 persons in the elevator.  
'Up to 5 people are allowed in the elevator.'
- (25) Greek: **mehri**
- a. Perpatissime mehri tin akri tis limnis.  
We walked MEHRI the edge of the lake.  
'We walked up to the edge of the lake.'
- b. Sto anelkistãñra khorane mehri 5 atoma.  
In the elevator fit MEHRI 5 people.  
'Up to 5 people can fit in the elevator.'
- (26) Farsi: **ta**
- a. Ta labe daryache raftim.  
TA the edge of the lake went.  
'We walked up to the edge of the lake.'
- b. U panj ta shirini khord.  
He five TA cookies ate.  
'He ate up to five cookies.'
- (27) German: **bis zu**
- a. Jan geht bis zum Laden.  
'John goes BIS ZU the store.'  
'John goes up to the store.'
- b. In den Bus passen bis zu fünf Leute.  
In the bus fit BIS ZU five people.  
'Up to five people can fit in the bus.'
- (28) Italian: **fino a**
- a. Giovanni va fino al negozio.  
'John goes FINO A the store.'
- b. In macchina possono salire fino a quattro persone.  
In the car can get in FINO A four persons.  
'Up to four people can fit in the car.'
- (29) Polish: **do**

- a. Jan idzie do sklepu.  
John goes DO the store.  
'John goes up to the store.'
- b. Dozwolone do pięciu sztuk bagażu.  
Allowed DO five items of luggage.  
'It is allowed to take up to five items of luggage.'
- (30) Hungarian: **közel**<sup>6</sup>
- a. Úrhida közel van Székesfehérvárhoz.  
Úrhida near is Székesfehérvárhoz.  
'Úrhida is near Székesfehérvárhoz.'
- b. A vendégek száma közel van a százhoz.  
The guests number-POSS KÖZEL is the hundred-ALLATIVE.  
'The number of guests is nearly a hundred.'
- (31) Spanish: **hasta**
- a. Juan camina hasta la tienda.  
John walked HASTA the store.  
'John walked up to the store.'
- b. Juan ha invitado hasta 30 amigos.  
John has invited HASTA 30 friends.  
'John has invited up to 30 friends.'
- (32) Russian: **do**
- a. My došli do kraja ozera.  
We walked DO the edge of the lake.  
'We walked up to the edge of the lake.'
- b. U nego ot 5 do 6 domov.  
Of he from 5 DO 6 houses.  
'He has between 5 and 6 houses.'

These data show that lexical items that share the same meaning bipartition as *up to* are widespread: *up to* is not unique or exceptional.<sup>7</sup> To convey the link between *up to* and all of its counterparts in other languages, I will from now on use the notation UP TO to refer to all crosslinguistic versions of *up to*. That is, UP TO refers to directional numeral modifiers with an upper bound that display both class B effects and the five characteristics of directional numeral modifiers described in section 3.1. To set UP TO apart from the crosslinguistic equivalents of *at most*, I will use the notation AT MOST to identify the set of analogues of AT MOST my informants provided. AT MOST thus refers to non-directional class B numeral modifiers.

Furthermore, the fact that expressions that can convey both the directional and the numerical sense of *up to* occur in such a wide variety of languages suggests that these two meanings are linked to one another. It may be the case

<sup>6</sup>According to my Hungarian informant, *közel* literally means something like *close to*. However, as will become apparent in the following section, it does share all essential properties with the other crosslinguistic *up to* counterparts. See also chapters 5-7 for Dutch expressions that convey proximity and have the properties described in section 3.1.

<sup>7</sup>As was mentioned above, many of my informants indicated that the translation of *up to* in their language can also be used in temporal contexts. English, which has two separate lexical items for *up to* and *until*, seems to be an exception. However, I will focus on the directional and numerical meaning of *up to*'s crosslinguistic counterparts in this thesis.

that directional UP TO and numerical UP TO are one and the same lexical item in all these languages. The only meaning that comes from this lexical item could then be the meaning of a path with an end point. Whether this path is literally path in space or a path along a numerical scale would be determined by the rest of the sentence in this scenario. Another way to see the relation between directional and numerical UP TO is to assume that the core meaning of introducing a path remains the same regardless of the domain in which UP TO is used but the precise meaning of UP TO differs depending on whether it is used directionally or numerically. Either way, it is clear that numerical UP TO is not semantically disjoint from directional UP TO.

In this section, I have established that it is not a coincidence that directional and numerical *up to* share the same form: language after language shows the same pattern. However, the fact that there are directional numeral modifiers in a wide array of languages does not by itself provide grounds to posit a separate subclass of directional numeral modifiers. To do this, it is necessary to determine that the five areas where *up to* differs from *at most* are also the domains where UP TO differs from AT MOST. This will be the topic of the following section.

### 3.3 Properties of directional numeral modifiers

The aim of this section is to show that the directional numeral modifiers given in the previous section behave in the same way that *up to* does with regards to the phenomena mentioned in section 3.1. The fact that there is a set of qualities that directional numeral modifiers share across languages indicates that these modifiers should be regarded as a class of its own within class B.

In what follows, I will first establish that not only *up to* but also directional numeral modifiers in other languages should be categorised as class B quantifiers according to Nouwen’s (2010b) classification. To be sure that the crosslinguistic analogues of *at most* I use to set apart UP TO from the rest of class B are in fact comparable to the English *at most*, I will also demonstrate that AT MOST displays class B effects. Then I will discuss the properties specific to directional numeral modifiers one by one to show that they hold for all languages I have studied by providing examples from these languages. For the sake of legibility I will not give examples from every language for every property. A comprehensive list of examples can be found in the appendix.

#### 3.3.1 Class B effects

Nouwen (2010b) places *up to* in class B along with numeral modifiers such as *at most* and *maximally*. As was mentioned in chapter 2, the crucial property of class B modifiers is that they can only be used felicitously if they quantify over a range of values. This explains the infelicitousness of (3) of chapter 2, repeated here as (33). The number of sides a hexagon has is a specific cardinality that does not vary, and *at most* cannot be used to refer to a specific cardinality. As can be seen in (34), the same applies to *up to*.

(33) #A hexagon has at most 10 sides.

(34) #A hexagon has up to 10 sides.

*Up to*'s counterparts in other languages also require that they quantify over a range of values. This was the case for all languages I studied, and is exemplified in (35) and (36) for Romanian and Hungarian. The fact that the translation of *fewer than* in these languages can be used felicitously in these examples shows that the languages are sensitive to the A/B distinction and that not all numeral quantifiers in these languages display class B effects.

(35) **Romanian**

- a. Un triunghi are mai puțin de 11 fețe.  
A triangle has fewer than 11 sides.
- b. #Un triunghi are până la 10 fețe  
A triangle has up to 10 sides.

(36) **Hungarian**

- a. A háromszögnek kevesebb mint 10 oldala van.  
A triangle fewer than 10 sides is.  
'A triangle has fewer than 10 sides.'
- b. #A háromszögnek közel 10 oldala van.  
A triangle near 10 sides is.  
'A triangle has up to ten sides.'

In the following sections, UP TO's distinctive properties are shown by setting it apart from AT MOST. As is exemplified in (37) and in (38), again for Romanian and Hungarian, all the translations of *at most* provided by my informants displayed class B effects. Thus, they are actual analogues of *at most* and not closer to class A modifiers such as *less than*.

(37) **Romanian**

- #Un triunghi are cel mult 10 fețe.  
A triangle has at most 10 sides.  
'A triangle has at most 10 sides.'

(38) **Hungarian**

- #A háromszögnek legfeljebb 10 oldala van.  
A triangle at most 10 sides is.  
'A triangle has at most 10 sides.'

### 3.3.2 Downward entailment

As shown in Schwarz et al. (2012) and in section 3.1.1, *up to*, unlike *at most*, is not downward entailing. As exemplified in (39) and (40) for Italian and in (41) and (42) for Polish, this contrast between directional numeral modifiers and other class B quantifiers holds across languages.

(39) **Italian**

- a. I danesi mangiano pesce al massimo tre volte al giorno. ⊨  
The Danish eat fish at most three times a day.  
'The Danish eat fish at most three times a day.'
- b. I danesi mangiano salmone al massimo tre volte al giorno.  
The Danish eat salmon at most three times a day.  
'The Danish eat salmon at most three times a day.'

- (40) a. I danesi mangiano pesce fino a tre volte al giorno.  $\neq$   
 The Danish eat fish up to three times a day.  
 ‘The Danish eat fish up to three times a day.’  
 b. I danesi mangiano salmone fino a tre volte al giorno.  
 The Danish eat salmon up to three times a day.  
 ‘The Danish eat salmon up to three times a day.’
- (41) **Polish**  
 a. Najwyżej trzy studenci pala.  $\models$   
 At most three students smoke.  
 b. Najwyżej trzy studenci pala cygara.  
 At most three students smoke cigars.
- (42) a. Do trzech studentów pali.  $\neq$   
 Up to three students smoke.  
 b. Do trzech studentów pali cygara.  
 Up to three students smoke cigars.

This was the case for all languages I looked at. Thus, directional numeral modifiers are not downward entailing.

### 3.3.3 Negative polarity items

In English, the directional numeral modifier *up to* fails to license negative polarity items despite the fact that other upper bound class B quantifiers, such as *at most* and *maximally*, do license NPIs. All of my informants agreed with the intuition that directional numeral modifiers do not license NPIs. This is exemplified in (43) and (44) for French and German with the NPIs *qui que ce soit* and *jemals*.<sup>8</sup>

- (43) **French**  
 a. ?Trois personnes au plus ont vu qui que ce soit.  
 Three persons maximally have seen anyone.  
 ‘At most three people have seen anyone.’  
 b. \*Jusqu’à trois personnes ont vu qui que ce soit.  
 Up to three persons have seen anyone.
- (44) **German**  
 a. Maximal fünf Leute waren jemals hier.  
 Maximally five people were ever here.  
 ‘At most five people have ever been here.’  
 b. \*Bis zu fünf Leute waren jemals hier.  
 Up to five people were ever here.  
 ‘Up to five people have ever been here.’

Some informants, however, said that in their language, *at most* does not license NPIs, either. As can be observed in (45) and (46), this is the case for Farsi and Spanish (NPIs: *hickas* and *ningún*). In these languages, this contrast between directional numeral modifiers and other class B modifiers does not exist.<sup>9</sup>

<sup>8</sup>My French informant mentioned that (43-a) sounds a little strange as *quelqu’un*; ‘someone’, sounds more natural than *qui que ce soit*.

<sup>9</sup>This part of the data is missing for Romanian, as my Romanian informant and I were unable to find an NPI in Romanian. In fact, the existence of negative polarity in Romanian

- (45) **Farsi**
- a. \*Hadeaksar panj nafar hichkas ra dideand.  
At most five persons anyone have seen.  
'At most five people have seen anyone.'
  - b. \*Ta panj nafar hichkas ra dideand.  
Up to five persons anyone have seen.  
'Up to five people have seen anyone.'
- (46) **Spanish**
- a. \*Como mucho cinco personas no tienen ninguna manzana.  
At most five persons NEG have any apples.  
'At most five people have any apples.'
  - b. \*Hasta cinco personas no tienen ninguna manzana.  
Up to five persons NEG have any apples.  
'Up to five people have any apples.'

Although the difference between AT MOST and UP TO is not visible with respect to NPIs here, UP TO does display all other relevant properties of directional numeral modifiers in these languages. The difference between AT MOST and UP TO is invisible here because AT MOST does not license NPIs, not because UP TO behaves differently in these languages than it does in other languages.

### 3.3.4 The bottom-of-the-scale effect

As was mentioned in section 3.1.2, *at most* but not *up to* can be used to modify a numeral that is at the bottom of the scale the numeral modifier quantifies over. This is another property that holds for directional numeral modifiers generally and not only for *up to*. All my informants agreed that the bottom-of-the-scale effect occurred in sentences with UP TO in their language. This is exemplified in (47) for Turkish and in (48) for French.

- (47) **Turkish**
- a. Kazada en cok bir insan oldu.  
In accident at most one person died.  
'At most one person died in the accident.'
  - b. #Kazada bir insana kadar oldu.  
In accident one person up to died.  
'Up to one person died in the accident.'
- (48) **French**
- a. Au plus une personne est morte dans l'accident.  
At most one person is died in the accident.  
'At most one person has died in the accident.'
  - b. #Jusqu'à une personne est morte dans l'accident.  
Up to one person is died in the accident.  
'Up to one person has died in the accident.'

---

is sometimes questioned, as in Fălăuș (2008).



### 3.3.5 Positive directivity

In section 3.1.3, I introduced the notion of directivity. I stated that the difference between a quantifier that has positive and a quantifier that has negative directivity is that the former highlights the elements for which the sentence holds, while the latter emphasises the elements for which the sentence does not hold. I then showed that *up to* has positive, and *at most* has negative directivity. This was done by using the evaluative adverb *fortunately* in sentences with *up to* and *at most*. As is exemplified in (49) and (50) for Greek and in (51) and (52) for Danish, the difference in directivity between UP TO and AT MOST holds crosslinguistically. Again, speakers of all 13 languages I examined agreed with this intuition for their language.

- (49) **Greek**
- a. Eftihos, boro na paro mehri pede meres adhia.  
Fortunately I can get up to five days off.
  - b. ?Eftihos, aftos o traghikos traghudistis tha pi mehri pede traghudhia.  
Fortunately, that horrible singer will sing up to five songs.
- (50) a. ?Eftihos, boro na paro to poli pede meres adhia.  
Fortunately I can get at most five days off.
- b. Eftihos, aftos o traghikos traghudistis tha pi to poli pede  
Fortunately, that horrible singer will sing at most five  
traghudhia.  
songs.
- (51) **Danish**
- a. Heldigvis kan jeg få fri fra arbejde i op til fem dage.  
Fortunately can I get free from work for up to five days.  
'Fortunately, I can get up to five days off work.'
  - b. ?Heldigvis vil den skrækkelige sanger synge op til fem sange.  
Fortunately will that horrible singer sing up to five songs.  
'Fortunately, that horrible singer will sing up to five songs.'
- (52) a. ?Heldigvis kan jeg højest få fri fra arbejde i fem dage.  
Fortunately can I at most get free from work for five days.  
'Fortunately, I can get at most five days off work.'
- b. Heldigvis vil den skrækkelige sanger synge højest fem sange.  
Fortunately will that horrible singer sing at most five songs.  
'Fortunately, that horrible singer will sing at most five songs.'

Again, it is assumed that getting time off work is desirable and having to listen to the performance of a bad singer is undesirable. UP TO is only compatible with a positive experience and *fortunately*, while AT MOST is only compatible with a negative experience and *fortunately*.

### 3.3.6 Cancellable upper bound

A final universal quality of directional numeral modifiers is that their upper bound seems less well-defined than the upper bound of other class B modifiers

such as *at most*.<sup>10</sup> I have shown that this applies to *up to*. In this section, I will give an example from Dutch and one from Russian that demonstrate this phenomenon in these languages. In Dutch, it is possible to utter (53-a) and to then follow up on your remark by stating (53-b). However, (54-b) is not a good continuation of (54-a). The same applies to Russian, as is shown in (55) and (56).

(53) **Dutch**

- a. Er waren tot dertig mensen op het feest.  
There were up to thirty people at the party.
- b. Ik denk zelfs dat het er tweeëndertig waren.  
I think even that it there thirty-two were.  
'I think there might even have been 32 people there.'

- (54) a. Er waren maximaal dertig mensen op het feest.  
There were maximally thirty people at the party.
- b. ?Ik denk zelfs dat het er tweeëndertig waren.  
I think even that it there thirty-two were.  
'I think there might even have been 32 people there.'

(55) **Russian**

- a. Do tridcati ljudej prišlo na večerinku.  
Up to thirty people came on party.  
'Up to thirty people showed up at the party.'
- b. Na samom dele, ja dumaju čto tam bylo 32 čeloveka.  
In fact, I think that there were 32 people.  
'In fact, I believe there were 32 people there.'

- (56) a. Ne bolee tridcati ljudej prišlo na večerinku.  
At most thirty people came on party.  
'At most thirty people showed up at the party.'
- b. ?Na samom dele, ja dumaju čto tam bylo 32 čeloveka.  
In fact, I think that there were 32 people.  
'In fact, I believe there were 32 people there.'

### 3.3.7 Interim conclusion

I have shown that directional numeral modifiers share five properties: they are non-monotone, they do not license NPIs, they are incompatible with the numeral at the bottom of the relevant scale, they have positive directivity, and the upper bound they set is cancellable. On the basis of these observations, I propose that these modifiers constitute their own class within class B.

Moreover, I claim that there is a connection between the form of numeral modifiers and the class they belong to. The differences between *up to* and *at most* do not stand on their own, but can be generalised across languages if we take the factor behind these differences to be that of directionality. The fact

<sup>10</sup>In this case, there was one informant who did not share this intuition for her language. My Hungarian informant told me the upper bound for *közel*, 'near/up to' was as strong as that of *legfeljebb*, 'at most'. This may be due to the fact that *közel* is the only crosslinguistic expression I found that resembles UP TO but differs in meaning, as its spatial meaning is one of proximity and not one of directionality. More research is needed to discover why *közel* resembles UP TO in most ways but does not have a cancellable upper bound.

that UP TO is a directional preposition is not trivial, but is at the root of the differences that can be observed between AT MOST and UP TO.

A matter that remains obscure at this point is the question of why these specific five properties keep reoccurring in directional numeral modifiers. It seems unlikely that it just happens to be so that five random properties frequently occur in the same kinds of lexical items. What seems more probable is that there is a common root these characteristics share that makes them cooccur in directional numeral modifiers.

In what follows, I will first explore the ideas about the semantics of numeral modifiers put forward in Nouwen (2010b) and Schwarz et al. (2012). Then I will propose an account for the semantics of directional numeral modifiers, which aims to identify this common root, and to reduce the bundle of properties directional numeral modifiers share to a single difference between UP TO and AT MOST.

## Chapter 4

# The semantics of directional numeral modifiers

In this chapter, I will discuss three theories on the semantics of numeral modifiers. First, I will explore the semantics of class A and class B modifiers put forward in Nouwen (2010b). Then I will consider the alternative account Schwarz et al. (2012) proposed to explain some of the differences between *up to* and *at most*. Finally, I will discuss my own ideas regarding the semantics of directional numeral modifiers.

The aims of these three theories are not the same. The purpose of Nouwen’s account is to explain the differences between class A and class B numeral modifiers, while Schwarz et al. focus on explaining the bottom-of-the-scale effect and the ignorance effect of *up to*. My account will be focused on the five properties of directional numeral modifiers I have discussed. None of these theories tells the whole story or solves all problems, but it will nevertheless be instructive to look into these three accounts in some more detail to consider the semantics of numeral modifiers from three different angles.

### 4.1 Nouwen’s semantics of modified numerals

#### 4.1.1 The semantics of class A numeral modifiers

Nouwen assumes Hackl’s (2001) semantics for comparative numeral modifiers for class A quantifiers. In this framework, the semantics of comparative numeral modifiers runs parallel to that of comparative constructions in general.

- (1) a.  $\llbracket \text{more than } 10 \rrbracket = \lambda M. \max_n (M(n)) > 10$   
b.  $\llbracket \text{fewer than } 10 \rrbracket = \lambda M. \max_n (M(n)) < 10$   
(2)  $\llbracket \text{-er than } d \rrbracket = \lambda M. \max_{d'} (M(d')) > d$

(1) says that the maximal cardinality of the set of numbers which have a certain property  $M$  — for example the property of being the amount of sushis John ate — is higher ((1-a)) or lower ((1-b)) than 10. Similarly, (2) states that the maximal cardinality of the set of degrees  $d'$  which have a certain property — for example the property of being the degree such that John is tall to that degree

— is higher than another degree  $d$ .

Hackl assumes that DPs with a numeral always contain a silent counting quantifier *many* of type  $\langle d, \langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle$  which takes the numeral, of type  $d$  for degrees, as an argument. The phrase *ten sushis* has the logical form in (3). As is shown in (4), when *many* is applied to the numeral and *10 many* is applied to the noun *sushis*, the standard generalised quantifier denotation of *10 sushis* ensues.

- (3)  $[\text{DP}[10 \text{ many}] \text{ sushis}]$   
(4) a.  $\llbracket \text{many} \rrbracket = \lambda n \lambda P \lambda Q \exists x [\#x = n \wedge P(x) \wedge Q(x)]$   
b.  $\llbracket 10 \text{ many sushis} \rrbracket = \lambda Q \exists x [\#x = 10 \wedge \text{sushi}(x) \wedge Q(x)]$

The logical form of a sentence with a modified numeral is given in (5).

- (5)  $\text{fewer than } 10 \text{ sushis} \rightarrow [\text{DP}[\llbracket \text{fewer than } 10 \rrbracket \text{ many}] \text{ sushis}]$

As *fewer than 10* is a degree quantifier rather than a degree constant, it has to move in order to avoid a type clash. As demonstrated in (6), this movement leaves a degree trace and creates a degree property, which results in the semantics in (7).

- (6)  $\text{John ate fewer than } 10 \text{ sushis} \rightarrow$   
 $\llbracket \llbracket \text{fewer than } 10 \rrbracket [\lambda n [\text{Jasper ate } \llbracket [n \text{ many}] \text{ sushis} \rrbracket]] \rrbracket$   
(7)  $[\lambda M. \max_n (M(n)) < 10] (\lambda n. \exists x [\#x = n \wedge \text{sushi}(x) \wedge \text{ate}(j, x)]) =$   
 $\max_n (\exists x [\#x = n \wedge \text{sushi}(x) \wedge \text{ate}(j, x)]) < 10$

This semantics corresponds to the meaning conveyed by (6). In what follows, I will discuss Nouwen’s semantics for class B quantifiers.

#### 4.1.2 The semantics of class B numeral modifiers

Nouwen analyses class B quantifiers as maxima or minima indicators. The semantics of upper-bound class B numeral modifiers are as in (8).

- (8)  $\llbracket \text{MOD}_B^\downarrow \rrbracket = \lambda d \lambda M. \max_n (M(n)) = d$

Thus, the numeral modifier takes a degree  $d$  and a property  $M$ , and conveys that the maximal value of the set of numbers for which the property  $M$  holds is equivalent to the degree  $d$ .

The reason for the limited distribution of class B modifiers is the fact that when  $M$  denotes a singleton set, the semantics of a DP containing an upper-bound numeral modifier is equivalent to one of the meanings of a DP containing a bare numeral.

To see this, let us have a look at Nouwen’s semantics for bare numerals. (9) can mean either that John read at least ten books or that John read exactly ten books. Nouwen assumes that this is a semantic rather than a pragmatic ambiguity and accounts for it by positing two different *many* operators.

- (9) John read ten books.  
(10) a.  $\llbracket \text{many}_1 \rrbracket = \lambda n \lambda P \lambda Q \exists x [\#x = n \wedge P(x) \wedge Q(x)]$   
b.  $\llbracket \text{many}_2 \rrbracket = \lambda n \lambda P \lambda Q \exists! x [\#x = n \wedge P(x) \wedge Q(x)]$

$Many_1$  is equivalent to Hackl's *many* operator that was given in (4).  $Many_2$  expresses that there is exactly one numeral which is the cardinality of  $x$  and which has the properties  $P$  and  $Q$ . If  $many_1$  is used, (9) expresses that there is a number of books  $10$  such that John has read that number of books. This does not exclude the possibility that there is also a number  $11$ ,  $12$ , or  $13$  of books such that John has read that number of books. If  $many_2$  is used, on the other hand, (9) conveys that there is exactly one number of books such that John has read that many books, and this number is  $10$ . In this scenario John cannot have read  $11$  or more books, because that would mean there are multiple sets of  $10$  books that John has read.

When a maximality operator takes scope over the *many* operator, the use of  $many_1$  and  $many_2$  result in equivalent meanings. This can be seen in (12-b); the semantics of (11). If  $many_1$  is used, the part of the formula between the maximality operator and the equivalence sign denotes the set  $\{1,2,3,4,5,6,7,8,9,10\}$ . If  $many_2$  is used, it denotes the singleton set  $10$ . In both cases, the maximality operator picks out the maximal value  $10$ . Hence, the choice of  $many_1$  or  $many_2$  is irrelevant for the semantics of upper-bound numeral modifiers.

- (11) Jasper read maximally 10 books.  
(12) a. [maximally 10 [ $\lambda d$  [Jasper read  $d$   $many_{1/2}$  books]]]  
b.  $\max_n(\exists(!)x[\#x = n \wedge \text{books}(x) \wedge \text{read}(j, x)]) = 10$

If we assume this semantics for bare numerals and upper-bound numeral modifiers, (11) is equivalent to the  $many_2$  reading of (9), given in (13).

- (13)  $\exists!x[\#x = 10 \wedge \text{books}(x) \wedge \text{read}(j, x)]$

Nouwen argues that because (11) uses a much more complex form than (9) to express the same meaning as (9), (11) is blocked by (9). This blocking mechanism works in a way similar to Horn's (1984) division of pragmatic labour and Grice's (1975) maxim of brevity.

DPs with upper-bound numeral modifiers can still be given a denotation if we assume that they are interpreted with respect to a silent existential modal operator, which makes the sentence about what the speaker believes is possible. (11) would then have the semantics in (14).

- (14)  $\max_n(\diamond \exists(!)x[\#x = n \wedge \text{books}(x) \wedge \text{read}(j, x)]) = 10$

If we adopt this semantics, we take (11) to mean that  $10$  is the maximal number for which the speaker holds it possible that John has read that number of books. If we interpret (9) as being about what the speaker holds possible, the relevant semantics is the one in (15).

- (15)  $\diamond \exists!x[\#x = 10 \wedge \text{books}(x) \wedge \text{read}(j, x)]$

If (15) were a possible reading of (9), (9) would convey that the speaker considers it a possibility that John read exactly  $10$  books. This meaning is not equivalent to that in (14), which means that the bare numeral form cannot block the form with the numeral modifier. Thus, the semantics in (14) corresponds to the correct meaning of (11) and is not blocked by its semantic equivalent with a bare numeral.

Let us now turn our attention to lower-bound numeral modifiers. These have the semantics that is given in (16).

$$(16) \quad \llbracket \text{MOD}_B^\uparrow \rrbracket = \lambda d \lambda M. \min_n (M(n)) = d$$

Due to the minimality operator, the use of *many*<sub>1</sub> here leads to a different denotation than the use of *many*<sub>2</sub>. If we use *many*<sub>1</sub> in the logical form of (17), the minimality operator picks out the lowest number of the set  $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ . As can be deduced from (18), this leads to a contradiction; 1 does not equal 10.

(17) John read minimally 10 books.

$$(18) \quad \min_n (\exists x [\#x = n \wedge \text{books}(x) \wedge \text{read}(j, x)]) = 10$$

If we use *many*<sub>2</sub>, *minimally 10* is blocked by the *many*<sub>2</sub> reading of the bare numeral 10 for the same reason that upper-bound quantifiers are blocked by the bare numeral.

Nouwen again remedies this problem by introducing a silent modal possibility operator. The representation with *many*<sub>1</sub> remains contradictory as the minimality operator still picks out the number 1, which cannot be equated with the number 10. If we use *many*<sub>2</sub>, on the other hand, we obtain the correct truth conditions for (17).

$$(19) \quad \min_n (\diamond \exists! x [\#x = n \wedge \text{books}(x) \wedge \text{read}(j, x)]) = 10$$

(19) says that the minimal number of books for which the speaker regards it as possible that John read exactly that number of books is equal to 10. This is the correct meaning for (17).

## 4.2 Schwarz. et al.'s semantics of *up to*

As I discussed in section 3.1.1, Schwarz et al. (2012) note that *at most* is downward entailing while *up to* is non-monotone. For that reason, they argue that Nouwen's (2010b) non-monotone semantics for class B numeral modifiers is fit to describe the behaviour of *up to* only.

Restricting their attention to *up to*, Schwarz et al. note that there are still two things Nouwen's semantics cannot account for. The first is the bottom-of-the-scale effect *up to* displays. The second is the ignorance effect I briefly mentioned in chapter 2. As can be seen in (4) in chapter 2, repeated here as (20), exact knowledge is not compatible with class B numeral modifiers. (20-b) can only be uttered felicitously to convey that you do not know the exact amount of memory your computer has.

- (20) I know exactly how much memory my laptop has...
- a. ...and it is more than 1GB.
  - b. #...and it is at least 1GB.

To account for these two observations, Schwarz et al. propose the addition of a range requirement to the semantics of *up to*. They argue that this in combination with the use of *many*<sub>2</sub> can account for both aspects of the meaning of *up to* Nouwen's theory cannot explain. To see how this works, consider (21) with the LF in (22).

- (21) Up to ten people died in the crash.  
(22) [Up to 10 [ $\lambda d$  [ $\diamond$  [ $d$  many<sub>2</sub> people died in the crash]]]]

In the account of Schwarz et al., the semantics of (21) consists of two parts, given in (23).

- (23) a.  $\max_n(\diamond \exists! x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)]) = 10$   
b.  $\text{range}_n(\diamond \exists! x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)])$

If the bottom-of-the-scale numeral 1 is used, as in (24), the two parts of the meaning *up to* brings about contradict one another: a range must consist of more than one element. This accounts for *up to*'s incompatibility with a bottom-of-the-scale numeral.

- (24) a.  $\max_n(\diamond \exists! x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)]) = 1$   
b.  $\text{range}_n(\diamond \exists! x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)])$

Because of the range requirement, the meaning of *up to n* without a possibility operator is no longer equivalent to that of the bare numeral *n*, which lacks a range requirement. Thus, the meaning is no longer blocked by the meaning of the bare numeral. Therefore, the rationale for inserting a possibility operator appears to be lost.

However, if we omit the existential modal, as is done in (25), the use of *many<sub>2</sub>* guarantees that the set the maximality ranges over is always a singleton set. That is, the operator  $\exists!$  picks out only the exact number of people who died in the crash. This contradicts the range requirement in (25-b). Because of this contradiction, the meaning in (25) is blocked, and a possibility operator is in order to save the day. As in Nouwen's account, the possibility operator creates a range of possible values for which the sentence is true, which means the range requirement in (25) is fulfilled, and a contradiction no longer occurs.

- (25) a.  $\max_n(\exists! x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)]) = 10$   
b.  $\text{range}_n(\exists! x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)])$

Let us now turn to the reasoning behind the idea that the range requirement causes ignorance implications. Schwarz et al. argue that Nouwen's account does not imply speaker ignorance. Due to the covert possibility operator in (23-a), which would be the semantics of (21) in Nouwen's account, the meaning of the sentence is that the maximum number for which the speaker considers it possible that that number of people died is ten. However, this does not exclude the possibility that the speaker is sure that exactly ten people died. Therefore, the existential modal alone does not guarantee an ignorance implication.<sup>1</sup>

What does guarantee an ignorance implication is the possibility modal in combination with the range requirement. By adding the range requirement in (23-b) to Nouwen's semantics, Schwarz et al. ensure that there is a range of numbers for which the speaker holds it possible that that is the number of people who died in the crash, thus excluding the possibility that the speaker knows the

<sup>1</sup>However, the maximality operator in Nouwen's (2010b) semantics of class B numerals is only licensed when there is a range of values it can quantify over, which can be provided by an existential modal. If this condition is not met, the modified numeral is blocked by the strong reading of the bare numeral. Thus, even though there is no explicit range requirement in the semantics of Nouwen, it does follow from the semantics.



exact amount of people who died.

So far, Schwarz et al.'s account appears to do its job quite well. However, when  $many_1$  instead of  $many_2$  is brought into the equation, things become a little more tricky. The  $many_1/many_2$  distinction is irrelevant for their explanation of the bottom-of-the-scale effect. As the scale always contains one number only in cases where the bottom-of-the-scale effect occurs,  $many_1$  and  $many_2$  both give the singleton set  $\{1\}$  (or whatever other number is at the bottom of the relevant scale), which contradicts the range requirement. Therefore, the meaning of *up to* with a bottom-of-the-scale numeral is blocked regardless of which *many* is used.

The account seems to run into problems concerning the blocking effect. Above, I explained that if the possibility operator is removed, the fact that the maximality operator always ranges over a single numeral contradicts the range requirement. This blocks the form without the existential modal. However, a contradiction does not necessarily ensue when  $many_1$  is used. As can be observed in (26) — the semantics of (21) with  $many_1$  — when another number than the one at the bottom of the scale is used,  $many_1$  always creates a range. After all,  $many_1$  does not pick out a unique number but rather all the numbers for which the sentence is true. In the case of (26), it picks out the set  $\{1,2,3,4,5,6,7,8,9,10\}$ . In fact, this property of  $many_1$  makes the range requirement obsolete.

$$(26) \text{ a. } \max_n(\diamond\exists x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)]) = 10 \\ \rightarrow \max\{1,2,3,4,5,6,7,8,9,10\} = 10 \\ \text{ b. } \text{range}_n(\diamond\exists x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)])$$

As I explained above, the need for a possibility operator in Schwarz et al.'s system comes from a contradiction between the singleton set picked out by  $many_2$  and the range requirement. Thus, when  $many_1$  is used, they lose not only the range requirement but also the rationale for inserting a possibility operator. If there is no range requirement and no  $many_2$ , there cannot be a contradiction between the singleton set picked out by  $many_2$  and the range requirement. Thus, Schwarz et al. have lost their rationale for incorporating a range requirement as well as their reason for inserting a modal possibility operator. This leaves Schwarz et al. with the semantics without a possibility operator Nouwen rejected because it results in the meaning *exactly 10*.

Fortunately, Schwarz et al. have now arrived at a meaning that is equivalent to the  $many_2$  reading of the same sentence with the bare numeral. That is, they are now exactly at the point where Nouwen was before he introduced the possibility operator: there is no range requirement and no existential modal to create a range, so the meaning of a modified numeral is equivalent to that of a bare numeral. All that is left is the semantics in (27). For this reason, Schwarz et al. can follow in the footsteps of Nouwen and argue that this meaning is blocked by the bare numeral, which arrives at the same meaning using a less complicated form. Like Nouwen, they posit a silent possibility operator to remedy this. Thus, Schwarz et al. have a rationale for arriving at the correct interpretation with the possibility operator for each of the *many*'s.

$$(27) \quad \max_n(\exists x[\#x = n \wedge \text{people}(x) \wedge \text{died in the crash}(x)]) = 10$$

The real problem occurs when we revisit the ignorance implication. We have

seen that when *many*<sub>1</sub> is used, there is no longer a need for the range requirement, because *many*<sub>1</sub> creates a range. As it was the range requirement that excluded the option that the speaker only considers one possibility, Schwarz et al.'s account for the ignorance implication is lost. That is, their criticism of Nouwen's account that the interpretation *the highest number for which the speaker considers it possible that that number of people died is 10* does not exclude the possibility that the speaker knows that the exact number is 10 is now equally applicable to their account. Another issue Schwarz et al. do not mention is that their account of the bottom-of-the-scale effect also relies on the range requirement, so it, too, is lost.

Thus, Schwarz et al.'s account only works when there is no *many*<sub>1</sub> operator. However, if they assume only the *many*<sub>2</sub> operator exists, they cannot explain the two meanings of bare numerals. This problem is not solved.

### 4.3 A tentative account for directional numeral modifiers

Both the accounts of Nouwen (2010b) and the revised version of this account proposed by Schwarz et al. (2012) aim to provide an explanation for the fact that *up to* (and in the case of Nouwen: class B modifiers in general) needs a range to quantify over. Schwarz et al. also attempt to explain the bottom-of-the-scale effect *up to* displays, but fail to do so once the existence of *many*<sub>1</sub> is taken into account. In this section, I will posit a preliminary account that aims to explain the five differences that distinguish directional numeral modifiers from the rest of class B. Although this theory is far from complete, I believe it does shed some light on the singular behaviour of directional numeral modifiers.

#### 4.3.1 Two levels of meaning

The principal idea I would like to posit is that the contrasts between AT MOST and UP TO are due to differences regarding the part of the meaning that is most central to the expression. To remain theory-neutral, I will refer to this meaning as the *core meaning* and to the less essential part of the meaning as the *secondary meaning*.

More specifically, I believe the differences between UP TO and AT MOST are due to the fact that the core meaning of AT MOST is the upper bound it sets, while the central meaning of UP TO is the existence of at least one element for which the sentence is true. This is the secondary meaning of AT MOST, while the upper bound is the secondary meaning of UP TO. This idea is given in (28) and (29).

(28) *At most ten people showed up.*  
 Core meaning: No more than ten people showed up.  
 Secondary meaning: At least one person showed up.

(29) *Up to ten people showed up.*  
 Core meaning: At least one person showed up.<sup>2</sup>

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<sup>2</sup> *One* is used here and in (28) as a placeholder for the bottom element of the relevant scale. As I explained in section 3.1.2, this element can be higher or lower than one depending on the context.

Secondary meaning: No more than ten people showed up.

Furthermore, I propose that the secondary meaning is defined by its defeasibility and reinforcing. That is, one can test which part of the meaning is the core meaning and which is the secondary meaning by determining whether it can be cancelled and reinforced.

I am aware of the fact that the secondary meaning is starting to look suspiciously like a conversational implicature. However, it cannot be a true conversational implicature due to its lack of calculability. It is therefore unclear what the exact status of the secondary meaning is, and this is something that will need to be worked out in the future. However, for the present purposes, what is essential is that the differences between UP TO and AT MOST can be captured by looking at the relative strength of the two different parts of their meaning, and that the key element that determines the contrasts between directional and non-directional numeral modifiers is the upper bound/lower bound distinction.

The primary aim of this semantics is not to account for class B properties but for the characteristics of directional numeral modifiers. If a range requirement were to be added to the semantics of UP TO, it could be a presupposition as in Nouwen (2012).

Before I turn to how this semantics works, I will first demonstrate that the secondary part of the meanings of AT MOST and UP TO are indeed both cancellable and reinforcing. The cancellability of the secondary meaning of AT MOST is demonstrated in (30).

(30) At most ten people showed up. In fact, no one showed up.

As is shown in (31), this cannot be done for UP TO.

(31) Up to ten people showed up. #In fact, no one showed up.

The secondary meaning of AT MOST can also be reinforced, as exemplified in (32).

(32) At least one person and at most ten people showed up.

UP TO cannot be used felicitously in this sentence, as can be seen in (33).

(33) #At least one person and up to ten people showed up.

As was already demonstrated in sections 3.1.4 and 3.3.6, the secondary meaning of UP TO can be cancelled. This is shown in (34).

(34) Up to ten people showed up. In fact, I believe there were twelve people there.

The upper bound of AT MOST, on the other hand, cannot be cancelled, as can be observed in (35).

(35) At most ten people showed up. #In fact, I believe there were twelve people there.

As is demonstrated in (36) and (37), the upper bound of UP TO, unlike that of AT MOST, can not only be cancelled but also reinforced.

- (36) Up to ten people showed up, but there were no more than ten people there.
- (37) #At most ten people showed up, but there were no more than ten people there.

Thus, the principal idea of this account is that there are two levels of meaning that play a role in what UP TO and AT MOST convey. The core meaning can be neither cancelled without creating a contradiction nor reinforced without resulting in obsolescence. Both of these possibilities do exist for the secondary meaning of the expressions.

### 4.3.2 An account for the quirks of directional numeral modifiers

In this section, I will explore how the ideas I have presented can account for the five properties of directional numeral modifiers.

Let us first consider the bottom-of-the-scale effect. The core meaning of (38-a) is that at least one person died, while the secondary meaning contributes a cancellable boundary of 10 casualties. The core meaning of (38-b), on the other hand, is that very boundary of 10 people who died, with a defeasible secondary meaning that at least one person died.

- (38) a. Up to ten people died in the crash.  
 b. At most ten people died in the crash.

Likewise, (39-b) conveys that the upper boundary of the number of people who died is 1, while carrying a secondary meaning that expresses that at least one person died. Because this secondary meaning is cancellable, the possibility that no one died is left open. This is not so for (39-a). Here, the essential part of the meaning is that at least one person died. The cancellable secondary part of the meaning is that *one* is also the upper bound of the number of casualties.

- (39) a. Up to one person died in the crash.  
 b. At most one person died in the crash.

Therefore, (39-a) has the same meaning as its counterpart with a bare numeral, given in (40).

- (40) One person died in the crash.

In the same way that the meanings of class B numeral modifiers without a possibility operator are blocked in Nouwen's (2010b) account, the meaning of UP TO 10 would then be blocked by that of the bare numeral 10, which arrives at the same meaning as the expression with UP TO through a much simpler form.<sup>3</sup>

Conversely, AT MOST leaves open the possibility of zero casualties. This part of the meaning is not carried by the bare numeral in (40), which guarantees the

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<sup>3</sup>At this point, the reader may wonder whether UP TO 10 is blocked by the bare numeral *one*, considering that one of the readings of the bare numeral *one* is *at least one* and is thus equivalent to the core meaning of UP TO n. However, the bare numeral *one* cannot block UP TO 10 because the bare numeral does not have a secondary meaning that contributes a boundary of 10.

death of at least one person. Therefore, AT MOST is not blocked by the bare numeral. This is why AT MOST, unlike UP TO, can modify the numeral at the bottom of the scale. Put differently, neither UP TO nor AT MOST can modify a bottom-of-the-scale numeral, but the scale of AT MOST includes 0, which makes 1 the second element on its scale.

Now let us turn our attention to the directivity properties of UP TO and AT MOST. The fact that UP TO but not AT MOST has positive directivity comes from the fact that the core meaning of UP TO is existential in nature. When other quantifiers with positive directivity are considered, it turns out that they, too, necessarily express the existence of their complement. To see this, let us observe the examples in (41).

- (41) a. Few people were present, if any.  
 b. ??A few people were present, if any.

*Few*, which has negative directivity, does not guarantee the existence of any people who were present. Conversely, the positively directive *a few* does convey that at least one person must have been present. Other quantifiers which appear to have positive directivity, such as *many* and *nearly all* (examples from Sanford et al., 2002), share this phenomenon. Their negatively directive counterparts *not many* and *not quite all* do not guarantee the existence of an element for which the sentence holds.

AT MOST has an upper bound as its core meaning, and, like other negatively directive quantifiers, does not guarantee the existence of any elements for which the sentence is true, as I demonstrated in (30). Quite naturally, then, the focus of AT MOST is not on the existence of the number of elements for which the sentence is true but rather on the upper bound. If the reverse were the case, AT MOST would in some cases highlight the elements for which the sentence is true while at the same time conveying that there are no such elements. This causes AT MOST to have negative directivity.

The cancellable upper bound of UP TO follows from the fact that the upper bound is not a part of its core meaning. For AT MOST, the opposite is true.

Finally, let us consider the monotonicity of AT MOST and UP TO. If it is the core meaning that determines the monotonicity properties of an expression, we expect AT MOST to be downward entailing. We have seen that this is indeed the case across languages. What is more problematic is that this account predicts UP TO to be upward entailing. This would mean that (42-a) entails (42-b).

- (42) a. Up to three students smoke cigars. ?|=  
 b. Up to three students smoke.

This is not a very clear intuition and the people I have asked about this were split on the issue. One possible explanation for these hazy intuitions is that UP TO is in fact upward entailing as far as its core meaning is concerned, but the fact that its secondary meaning sets an upper bound blurs this intuition. I will not resolve this issue here.

### 4.3.3 Interim conclusion

I have presented an account of directional numeral modifiers on the basis of the five properties they share across languages. This account is by no means

complete. More details on the nature of the core meaning and the secondary meaning need to be worked out for it to be a fully-fledged theory. Furthermore, the monotonicity properties of *up to* need to be unravelled to test whether the idea on the core meaning of UP TO makes the correct predictions.

However, I believe that the ideas proposed in this section do explain the properties of directional numeral modifiers to an extent. For instance, it seems clear that the scale of UP TO starts at 1, while that of AT MOST includes 0. I feel that this provides a rather intuitive explanation of the bottom-of-the-scale effect. The cancellable upper bound of UP TO also follows very naturally from this account. Finally, the intuitions on the reinforcing and cancellability of certain parts of the meanings of UP TO and AT MOST seem to suggest that not all elements of the meanings of these expressions are created equal, which may be a sign that this account is on the right track.

In the earlier chapters of the first part of this thesis, I discussed five differences between *at most* and *up to* in English. I then introduced counterparts of *up to* in thirteen different languages to show that directional prepositions that double as numeral modifiers exist across languages. Finally, I demonstrated that *up to*'s crosslinguistic parallels differ with regards to the crosslinguistic analogues of *at most* in exactly the same five ways that *up to* differs from *at most* in English.

From all this, we can conclude that when directional prepositions are used as numeral modifiers, they do not magically morph into equivalents of other numeral modifiers that originate from different grammatical domains. Instead, the fact that directional numeral modifiers consistently display the same five characteristics across languages shows that they are bound by their nature of being a directional preposition. Rather than being simply members of class B that obediently display class B effects and nothing else, directional prepositions remain directional prepositions and they behave as such.

While I have discussed the way in which directionality can be linked to class B effects — the path created by the directional preposition is the range that is required to be a class B modifier — I have not gone into the details of how directional prepositions can have one and the same central meaning in two very different domains. As I mentioned in the introduction of this thesis, I will assume that modified numerals are PPs just like spatial PPs, and that the role of the preposition in the PP does not change when the domain changes, following Corver and Zwarts (2006).

The next part of this thesis will be dedicated to the endeavour of discovering how this could work. To this end, I will compare the meaning of three prepositional numeral modifiers in Dutch (*tot*, *tegen*, and *richting*) in the spatial domain to their meaning in the numerical domain. This will prove to be no easy feat.

## Part II

# Prepositional numeral modifiers in Dutch

## Chapter 5

# Properties of prepositional numeral modifiers in Dutch

In the previous three chapters of this thesis, I argued that there is reason to believe that directional numeral modifiers form their own subclass within the category of class B numeral modifiers. To provide evidence for this statement, I presented directional numeral modifiers from 13 different languages and showed that these expressions displayed the same properties as the English directional numeral modifier *up to*.

Another way to put meat on the bones of the idea of a separate subclass is to study several directional numeral modifiers in one language. The second part of this thesis is dedicated to this endeavour. The language I will examine is Dutch. The reason for this decision is twofold. First, Dutch was a natural choice for me as it is my native language. Second, as will become apparent in the subsequent chapters, the three directional numeral modifiers I will discuss provide an interesting puzzle.

The aim of the second part of this thesis is to explore how the meaning of a spatial preposition can be transferred to the numerical domain, working under the assumption that there is indeed one essential meaning that occurs in both domains. To do this, I will delve into different classifications of prepositions in a bid to unearth the meaning of the three prepositions I will study — *tot*, *tegen*, and *richting* — in the spatial domain.

The second part of this thesis is organised as follows. This chapter introduces the relevant directional numeral modifiers. In chapter 6, I will discuss how these expressions can be categorised in the existing literature on spatial adpositions. In chapter 7, I will attempt to reconcile the behaviour of the relevant lexical items in the spatial and the numerical domain. This task will prove to be anything but straightforward.

The next section introduces the relevant directional expressions and shows how they are used in spatial contexts. Section 5.2 is dedicated to showing the workings of Dutch directional numeral modifiers in the numerical domain.



## 5.1 Dutch prepositional numeral modifiers in the spatial domain

The first relevant expression is the most literal translation of the English expression *up to: tot*. As can be seen in (1), *tot* can be used in directional contexts.

- (1) Sarah rijdt tot het centrum van de stad.  
Sarah drives TOT the centre of the city.  
'Sarah drives up to the city centre.'

As is shown in (2), *tot* cannot be used in non-directional contexts. As is the case for *up to*, this is only possible in sentences with either a plural, as in (3-a) or an existential modal, as in (3-b).

- (2) \*Jan speelt tot het hek.  
Jan plays TOT the fence.  
'John plays up to the fence.'
- (3) a. De kinderen spelen tot het hek.  
The children play TOT the fence.  
'The children play up to the fence.'
- b. Jan mag tot het hek spelen.  
Jan is allowed to TOT the fence play.  
'John is allowed to play up to the fence.'

The second preposition I will discuss is *richting*. The form *richting* is both a noun and a preposition. As a noun, it translates to *direction*. As a preposition, the English word that most closely translates it is *towards*. *Richting* can be used as a directional preposition, as is demonstrated in (4).

- (4) Hans fietst richting de supermarkt.  
Hans cycles RICHTING the supermarket.  
'Hans cycles towards the supermarket.'

Unlike *tot*, *richting* can also be used in non-directional locative contexts without the need for a plural or a modal. This use of *richting* is exemplified in (5).

- (5) Lisa woont richting Den Haag.  
Lisa lives RICHTING The Hague.  
'Lisa lives in the direction of/close to The Hague.'

In this context, *richting* seems to indicate proximity. A speaker uttering (5) means that if you were to travel from where you are now to The Hague, you would find Lisa's house somewhere on the way, close to The Hague (but not on the other side of The Hague).

The final preposition that will be relevant is *tegen*, which can be translated as *into* or *against*. Like *richting*, *tegen* can be used both directionally and locatively. When it is used directionally, *tegen* is used to convey a path that ends with physical contact. In (6), this unpleasant physical contact occurs between Piet and a lamppost.

- (6) Piet liep tegen een lantaarnpaal.  
Piet walked TEGEN a lamppost.  
'Piet walked into a lamppost.'

When *tegen* is used in a non-directional fashion, it can simply indicate contact between two elements. In the case of (7), it conveys that the sofa touches the wall.

- (7) De nieuwe bank stond tegen de muur.  
The new sofa stood TEGEN the wall.  
'The new sofa stood against the wall.'

However, it can also be used in almost exactly the same way that *richting* is used in non-directional contexts. To illustrate this, I will repeat example (5) here as (8) and replace *richting* by *tegen*.

- (8) Lisa woont tegen Den Haag.  
Lisa lives TEGEN The Hague.  
'Lisa lives (very) close to The Hague.'

To me, there are two subtle differences between *richting* and *tegen* in this context. First, *richting* seems more deictic than *tegen* in that (5) means that Lisa lives close to The Hague and on the side of The Hague the speaker is on, while *tegen* conveys simply that Lisa lives near The Hague. Second, *tegen* seems to indicate Lisa's closeness to The Hague a little more strongly than *richting*. (8) appears to convey that Lisa lives slightly closer to the Hague than (5) does. In spite of these subtle differences, *tegen* and *richting* resemble each other in that they clearly have a proximity element to their meaning when they are used non-directionally.

We have seen that *tot*, *tegen*, and *richting* can all be used as directional prepositions. *Richting* and *tegen* also have a clear non-directional meaning. When they are used non-directionally, they both convey proximity. In the next section, I will explore the numerical use of these three expressions.

## 5.2 Dutch prepositional numeral modifiers in the numerical domain

In this section, I will demonstrate how *tot*, *tegen*, and *richting* are used in the numerical domain. First, I will discuss three properties of *tegen* and *richting*. Then I will show that all three numeral modifiers under discussion are true members of the class of directional numeral modifiers according to the criteria I discussed in section 3.1.

### 5.2.1 Three properties of *tegen* and *richting*

There are three ways in which *tegen* and *richting* differ from *tot* when it comes to their behaviour in numerical contexts. The first is that they convey a notion of proximity, as they do in the spatial domain when they are used non-directionally. This can be seen in (9) for *richting* and in (10) for *tegen*.

- (9) a. Er waren richting de honderd mensen aanwezig bij de demonstratie.  
 There were RICHTING the hundred people present at the demonstration.  
 Zo'n tachtig, negentig, denk ik.  
 Such an eighty, ninety, think I.  
 'Towards/Up to a hundred people were present at the demonstration.  
 About eighty or ninety, I think.'
- b. Er waren richting de honderd mensen aanwezig bij de demonstratie.  
 There were RICHTING the hundred people present at the demonstration.  
 ?Zo'n vijftig, zestig, denk ik.  
 Such a fifty, sixty, think I.  
 'Towards/Up to a hundred people were present at the demonstration.  
 About fifty or sixty, I think.'
- (10) a. Sonja heeft tegen de honderd uitnodigingen verstuurd. Zo'n  
 Sonja has TEGEN the hundred invitations sent. Such an  
 tachtig, negentig, denk ik.  
 eighty, ninety, think I  
 'Sonja has sent close to/up to a hundred invitations. About eighty or  
 ninety, I think.'
- b. Sonja heeft tegen de honderd uitnodigingen verstuurd. ?Zo'n  
 Sonja has TEGEN the hundred invitations sent. Such a  
 vijftig, zestig, denk ik.  
 fifty, sixty, think I  
 'Sonja has sent close to/up to a hundred invitations. About fifty or  
 sixty, I think.'

*Richting* and *tegen* in (9) and (10) express on the one hand that the amount under discussion is between one and a hundred, which is equivalent to what *tot* and its English parallel *up to* convey, and on the other hand that the amount of people or invitations is close to one hundred. These sentences can be used felicitously in situations where the real amount is 95 or 85 or perhaps even 75, but not 50 or 60. This is why the continuations in the a-sentences of (9) and (10) are felicitous but the continuations in the b-sentences are not. Interestingly, it is my intuition that in the numerical domain as in the spatial domain, *tegen* expresses proximity more strongly than *richting*. That is, *richting de 100* is more compatible with 75 than *tegen de 100*.

In contrast to *tegen* and *richting*, *tot* is perfectly felicitous in the context of the b-sentences in (9)-(10), as can be observed in (11).

- (11) a. Er waren tot honderd mensen aanwezig bij de demonstratie.  
 There were TOT hundred people present at the demonstration.  
 Zo'n vijftig, zestig, denk ik.  
 Such a fifty, sixty, think I.  
 'Up to a hundred people were present at the demonstration. About  
 fifty or sixty, I think.'
- b. Sonja heeft tot honderd uitnodigingen verstuurd. Zo'n vijftig,  
 Sonja has TOT hundred invitations sent. Such a fifty,  
 zestig, denk ik.  
 sixty, think I.  
 'Sonja has sent up to a hundred invitations. About fifty or sixty, I

think.’

The second unique property of *tegen* and *richting* is a bit more subtle. As can also be observed in (9) and (10), both these expressions can be used in combination with the definite determiner *de*. They do not sound completely off when the determiner is removed, and neither does *tot* sound extremely odd when it is combined with a definite determiner, as in (12).<sup>1</sup> Judgments seem subtle and variable when it comes to this issue, but generally native speakers of Dutch seem to feel that sentences with *richting* and *tegen* sound better with a definite determiner, while those with *tot* sound better without one.

- (12) Er waren tot ((?) de) honderd mensen aanwezig bij de demonstratie.  
There were TOT the hundred people present at the demonstration.  
‘Up to a hundred people were present at the demonstration.’

A final characteristic *tegen* and *richting* share is the fact that they appear to combine more easily with high numbers than with low numbers. Sentences where *tegen* and *richting* modify high numbers such as a hundred, like (9) and (10), are completely felicitous, while examples with lower numbers such as (13) and (14) are much less acceptable.

- (13) ?Er zaten richting de vijf mensen in de metro.  
There sat RICHTING the five people in the metro.  
‘There were towards/up to five people on the metro.’

- (14) ?Isabel heeft tegen de drie koekjes gegeten.  
Isabel has TEGEN the three biscuits eaten.  
‘Isabel has eaten close to/up to three biscuits.’

Interestingly, *tegen* and *richting* can modify lower numbers when the lower number can be divided into smaller chunks, as is the case with months. This is exemplified in (15) and (16).

- (15) Jonas en Anouk gaan richting de vijf maanden rondreizen in  
Jonas and Anouk go RICHTING the five months travel around in  
Zuid-Amerika.  
South America.  
‘Jonas and Anouk are going to travel around South America for up  
to/close to five months.’

- (16) Jonas en Anouk gaan tegen de vijf maanden rondreizen in  
Jonas and Anouk go TEGEN the five months travel around in  
Zuid-Amerika.  
South America.

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<sup>1</sup>This is further evidence for the position that these numeral modifiers are still prepositions. As mentioned in Corver and Zwarts (2006), prepositional modified numerals often contain a definite article, while adverbial numeral modifiers cannot occur with a definite article, as shown in (i) and (ii) (examples from Corver & Zwarts, 2006).

- (i) Er waren rond / tegen de twintig deelnemers.  
There were round / against the twenty participants.  
‘There were around/close to twenty participants.’
- (ii) Er waren ongeveer / hoogstens (\*de) twintig deelnemers.  
There were approximately / at most (the) twenty participants.

‘Jonas and Anouk are going to travel around South America for up to/close to five months.’

Thus, it seems that it is not the modified number per se that matters but rather the scale the number creates. When a number can be divided into many sub-parts, the number of elements on its scale can be high even though the number itself is low. This is similar to the way the bottom-of-the-scale effect, discussed in the first part of this thesis, is sensitive to how fine-grained the scale is.

As can be observed in (17), other numeral modifiers that indicate proximity such as *bijna*, ‘nearly’, share this property with *tegen* and *richting*. Hence, this could be construed as a property of proximal numeral modifiers generally.

- (17) Er zaten bijna ?vijf / honderd mensen in de metro.  
 There sat nearly five / a hundred people in the metro.  
 ‘There were nearly five / a hundred people on the metro.’

To err on the side of caution, I will use the definite determiner *de* and higher or easily divisible numbers in the examples with *tegen* and *richting* in the remainder of this thesis. I will not use *de* in the examples with *tot*.

### 5.2.2 Properties of Dutch prepositional numeral modifiers

In this section, I will first discuss how these three numeral modifiers should be categorised according to Nouwen’s (2010b) classification. Then I will demonstrate that all three of these expressions also have the properties I have shown directional numeral modifiers to have across languages.

First, let us check whether the three expressions under discussion are class B numeral modifiers. As can be seen in (18), Dutch is sensitive to the A/B distinction. (18-b) is infelicitous because the class B modifier *maximaal* requires quantification over a range of values and cannot identify the specific cardinality of 150.

- (18) a. De Tweede Kamer heeft minder dan 160 zetels, namelijk  
 The House of Representatives has MINDER DAN 160 seats, namely  
 150.  
 150.  
 ‘The House of Representatives has fewer than 160 seats, namely 150.’  
 b. #De Tweede Kamer heeft maximaal 160 zetels, namelijk  
 The House of Representatives has MAXIMAAL 160 seats, namely  
 150.  
 150.  
 ‘The House of Representatives has maximally 160 seats, namely 150.’

As was discussed in chapter 3, *tot* is the Dutch equivalent to *up to* and therefore behaves exactly like it, class B effects included. However, both *tegen* and *richting* seem capable of indicating a specific cardinality.

- (19) a. #De Tweede Kamer heeft tot 160 zetels, namelijk 150.  
 The House of Representatives has TOT 160 seats, namely 150.  
 ‘The House of Representatives has up to 160 seats, namely 150.’  
 b. De Tweede Kamer heeft richting de 160 zetels, namelijk  
 The House of Representatives has RICHTING the 160 seats, namely

150.

150.

‘The House of Representatives has towards/up to 160 seats, namely 150.’

- c. De Tweede Kamer heeft tegen de 160 zetels, namelijk  
The House of Representatives has TEGEN de 160 seats, namely

150.

150.

‘The House of Representatives has close to/up to 160 seats, namely 150.’

This is an interesting twist, and one that will be the topic of much deliberation in the remainder of thesis. If these prepositions are indeed directional, it will be difficult to claim that the directionality of *tot* leads to a range requirement in the numerical domain, but the directionality of *tegen* and *richting* does not. As will become clear in the remainder of this chapter, *tegen* and *richting* both have all five properties that directional numeral modifiers share crosslinguistically. If they are locative in nature, what binds them to directional prepositions?

Now let us turn our attention to the five characteristics of directional numeral modifiers mentioned in section 3.1. First, I will consider the monotonicity properties of *tot*, *tegen*, and *richting*. As is shown in (20)-(22), none of the three directional numeral modifiers is downward entailing, thus following the crosslinguistic pattern.

- (20) a. Het conferentiecentrum heeft tot 500 nieuwe meubelstukken  
The conference centre has TOT 500 new pieces of furniture  
nodig.  $\not\Leftarrow$   
necessary.  
‘The conference centre needs up to 500 new pieces of furniture.’
- b. Het conferentiecentrum heeft tot 500 nieuwe tafels nodig.  
The conference centre has TOT 500 new tables necessary.  
‘The conference centre needs up to 500 new tables.’
- (21) a. Het conferentiecentrum heeft richting de 500 nieuwe meubelstukken  
The conference centre has RICHTING the 500 new pieces of furniture  
nodig.  $\not\Leftarrow$   
necessary.  
‘The conference centre needs towards/up to 500 new pieces of furniture.’
- b. Het conferentiecentrum heeft richting de 500 nieuwe tafels nodig.  
The conference centre has RICHTING the 500 new tables necessary.  
‘The conference centre needs towards/up to 500 new tables.’
- (22) a. Het conferentiecentrum heeft tegen de 500 nieuwe meubelstukken  
The conference centre has TEGEN the 500 new pieces of furniture  
nodig.  $\not\Leftarrow$   
necessary.  
‘The conference centre needs up to 500 new pieces of furniture.’
- b. Het conferentiecentrum heeft tegen de 500 nieuwe tafels nodig.  
The conference centre has TEGEN the 500 new tables necessary.  
‘The conference centre needs close to/up to 500 new tables.’

To compare, the non-prepositional class A numeral modifier *minder dan*; ‘fewer/less than’ and the non-prepositional class B numeral modifier *maximaal*, ‘maximally’, are downward entailing. This can be seen in (23) and (24).

- (23) a. Het conferentiecentrum heeft minder dan 500 nieuwe meubelstukken  
 The conference centre has MINDER DAN 500 new pieces of furniture  
 nodig.  $\models$   
 necessary.  
 ‘The conference centre needs fewer than 500 new pieces of furniture.’  
 b. Het conferentiecentrum heeft minder dan 500 nieuwe tafels nodig.  
 The conference centre has MINDER DAN 500 new tables necessary.  
 ‘The conference centre needs fewer than 500 new tables.’
- (24) a. Het conferentiecentrum heeft maximaal 500 nieuwe meubelstukken  
 The conference centre has MAXIMAAL 500 new pieces of furniture  
 nodig.  $\models$   
 necessary.  
 ‘The conference centre needs maximally 500 new pieces of furniture.’  
 b. Het conferentiecentrum heeft maximaal 500 nieuwe tafels nodig.  
 The conference centre has MAXIMAAL 500 new tables necessary.  
 ‘The conference centre needs maximally 500 new tables.’

In the same vein, none of the relevant expressions license NPIs. This is shown in (25)-(27) with the NPI *hoeven*.

- (25) \*Er hoeven tot 200 flessen wijn besteld te worden.  
 There need TOT 200 bottles wine ordered to be.  
 ‘Up to 200 bottles of wine need to be ordered.’
- (26) \*Er hoeven richting de 200 flessen wijn besteld te worden.  
 There need RICHTING the 200 bottles wine ordered to be.  
 ‘Towards/up to 200 bottles of wine need to be ordered.’
- (27) \*Er hoeven tegen de 200 flessen wijn besteld te worden.  
 There need TEGEN the 200 bottles wine ordered to be.  
 ‘Close to/up to 200 bottles of wine need to be ordered.’

As (28) and (29) show, *minder dan* and *maximaal* do license NPIs.

- (28) Er hoeven minder dan 200 flessen wijn besteld te worden.  
 There need MINDER DAN 200 bottles wine ordered to be.  
 ‘Fewer than 200 bottles of wine need to be ordered.’
- (29) Er hoeven maximaal 200 flessen wijn besteld te worden.  
 There need MAXIMAAL 200 bottles wine ordered to be.  
 ‘Maximally 200 bottles of wine need to be ordered.’

The third characteristic *tot*, *tegen*, and *richting* share with directional numeral modifiers in other language is the bottom-of-the-scale effect. None of these three expressions can be combined with a bottom-of-the-scale element. The versions with *richting* and *tegen*, expressions that sound awkward even with low numbers that are not at the bottom of the scale, sound even worse than the version with *tot*. This is demonstrated in (30)-(32).

- (30) #Tot één persoon is omgekomen bij het ongeluk.  
TOT one person is died at the accident.  
'Up to one person has died in the accident.'
- (31) #Richting de één persoon is omgekomen bij het ongeluk.  
RICHTING the one person is died at the accident.  
'Towards/Up to one person has died in the accident.'
- (32) #Tegen de één persoon is omgekomen bij het ongeluk.  
TEGEN the one person is died at the accident.  
'Close to/Up to one person has died in the accident.'

The non-spatial modifier *maximaal* can be used to modify a bottom-of-the-scale numeral, as (33) demonstrates.

- (33) Maximaal één persoon is omgekomen bij het ongeluk.  
MAXIMAAL one person is died at the accident.  
'Maximally one person has died in the accident.'

*Minder dan* sounds rather odd in this context, but this is due to the fact that, like *fewer than*, it is not inclusive. Therefore, *minder dan één* simply means *zero*, expressed in an unnecessarily complex way.

- (34) ?Minder dan één persoon is omgekomen bij het ongeluk.  
MINDER DAN one person is died at the accident.  
'Fewer than one person has died in the accident.'

As do *up to* and its crosslinguistic counterparts, *tot*, *tegen*, and *richting* have positive directivity. This can be observed in (35)-(37).

- (35) a. Ik kan gelukkig tot drie maanden vrij krijgen.  
I can fortunately TOT three months free get.  
'Fortunately, I can get up to three months off.'
- b. ?Die egoïstische gierigaard zal hier gelukkig tot €100 aan verdienen.  
That selfish miser will here fortunately TOT €100 on earn.  
'Fortunately, that selfish miser will earn up to €100 off this.'
- (36) a. Ik kan gelukkig richting de drie maanden vrij krijgen.  
I can fortunately RICHTING de three months free get.  
'Fortunately, I can get towards/up to three months off.'
- b. ?Die egoïstische gierigaard zal hier gelukkig richting de €100  
aan verdienen.  
on earn.  
'Fortunately, that selfish miser will earn towards/up to €100 off this.'
- (37) a. Ik kan gelukkig tegen de drie maanden vrij krijgen.  
I can fortunately TEGEN de three months free get.  
'Fortunately, I can get close to/up to three months off.'
- b. ?Die egoïstische gierigaard zal hier gelukkig tegen de €100 aan  
verdienen.  
earn.  
'Fortunately, that selfish miser will earn close to/up to €100 off this.'



The positive directivity of the three expressions makes them focus on the time off in the a-sentences and on the money that will be received in the b-sentences, rather than on the time off above three months the speaker did not get or the possible amount of money above €100 the miser will not receive. Assuming that it is desirable to get time off work and undesirable for a selfish miser to earn a great deal of money, *fortunately* corresponds to the meaning of the a-sentences but clashes with the content of the b-sentences.

Due to their negative directivity, the judgments are reversed when *minder dan* and *maximaal* are used instead of one of the relevant prepositional numeral modifiers. This can be observed in (38) and (39).

- (38) a. ?Ik kan gelukkig minder dan drie maanden vrij krijgen.  
 I can fortunately MINDER DAN three months free get.  
 ‘Fortunately, I can get fewer than three months off.’  
 b. Die egoïstische gierigaard zal hier gelukkig minder dan €100  
 That selfish miser will here fortunately MINDER DAN €100  
 aan verdienen.  
 on earn.  
 ‘Fortunately, that selfish miser will earn less than €100 off this.’
- (39) a. ?Ik kan gelukkig maximaal drie maanden vrij krijgen.  
 I can fortunately MAXIMAAL three months free get.  
 ‘Fortunately, I can get maximally three months off.’  
 b. Die egoïstische gierigaard zal hier gelukkig maximaal €100  
 That selfish miser will here fortunately MAXIMAAL €100  
 aan verdienen.  
 on earn.  
 ‘Fortunately, that selfish miser will earn maximally €100 off this.’

A final characteristic *tot*, *tegen*, and *richting* share with the crosslinguistic class of directional numeral modifiers is that the upper bound they set is cancellable. This property is exemplified in (40)-(42).

- (40) a. Er waren tot dertig mensen op het feest.  
 There were TOT thirty people at the party.  
 ‘There were up to thirty people at the party.’  
 b. Ik denk zelfs dat het er tweeëndertig waren.  
 I think even that it there thirty-two were.  
 ‘I think there might even have been thirty-two people there.’
- (41) a. Er waren richting de dertig mensen op het feest.  
 There were RICHTING the thirty people at the party.  
 ‘There were towards/up to thirty people at the party.’  
 b. Ik denk zelfs dat het er tweeëndertig waren.  
 I think even that it there thirty-two were.  
 ‘I think there might even have been thirty-two people there.’
- (42) a. Er waren tegen de dertig mensen op het feest.  
 There were TEGEN the thirty people at the party.  
 ‘There were close to/up to thirty people at the party.’  
 b. Ik denk zelfs dat het er tweeëndertig waren.  
 I think even that it there thirty-two were.  
 ‘I think there might even have been thirty-two people there.’

The b-sentences are good continuations of the a-sentences in all three cases, which shows that the upper bound of all three expressions is cancellable.

Again, as can be seen in (43) and (44), the non-prepositional *minder* and *maximaal* do not follow this pattern.

- (43) a. Er waren minder dan dertig mensen op het feest.  
 There were MINDER DAN thirty people at the party.  
 ‘There were fewer than thirty people at the party.’  
 b. ??Ik denk zelfs dat het er tweeëndertig waren.  
 I think even that it there thirty-two were.  
 ‘I think there might even have been thirty-two people there.’
- (44) a. Er waren maximaal dertig mensen op het feest.  
 There were MAXIMAAL thirty people at the party.  
 ‘There were maximally thirty people at the party.’  
 b. ??Ik denk zelfs dat het er tweeëndertig waren.  
 I think even that it there thirty-two were.  
 ‘I think there might even have been thirty-two people there.’

### 5.3 Interim conclusion

In this section, I introduced three prepositions that double as numeral modifiers in Dutch: *tot*, *tegen*, and *richting*. In the spatial domain, *tot* can only be used directionally, while *tegen* and *richting* have both a directional and a locative sense. In the numerical domain, *tot* belongs in class B, while *tegen* and *richting* are class A numeral modifiers. Furthermore, when *tegen* and *richting* are used locatively in the spatial domain or when they occur in the numerical domain, they display proximity effects; *tegen* more so than *richting*. All three prepositions clearly belong in the class of directional numeral modifiers defined in the first part of this thesis.

All directional numeral modifiers that were discussed in the first chapters of this thesis belong in class B. As has already been mentioned, this seems natural enough, considering that a range can be seen as a path on a numerical scale. They also share the same bundle of five properties discussed in section 3.1. However, we have now come across two lexical items that have both a locative and a directional use in the spatial domain and the five properties of directional numeral modifiers but not class B effects in the numerical domain.

This complicates matters. It is no longer possible to claim that being a directional preposition leads a numeral modifier to have both class B effects and the five properties discussed in section 3.1. Apparently, it is possible to have one but not the other, meaning the class defined in the first part of this thesis can no longer be said to be a subclass of class B. Moreover, it is unclear why *tegen* and *richting* have the five characteristics that directional numeral modifiers share crosslinguistically if they are not clearly directional. If, on the other hand, they are directional, the fact that they do not display class B effects is a mystery.

To untangle this clutter of puzzles, it is essential to establish how *tegen* and *richting* should be categorised in the spatial domain. Only then will it be possible to determine how the spatial meaning of these prepositions can be translated to the numerical meaning. There are three theoretical possibilities

for the spatial meaning of these two lexical items: <sup>2</sup>

1. *Tegen* and *richting* are directional prepositions that can be used locatively in some cases.
2. *Tegen* and *richting* are locative prepositions that can be used directionally in some cases.
3. *Tegen* and *richting* are ambiguous between a directional and a locative meaning.

Finding out which possibility is the correct one will be the aim of the following chapter. In chapter 7 I will attempt to reconcile the spatial meaning of *tegen* and *richting* with their numerical meaning.

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<sup>2</sup>Another possibility is that their nature is not alike: *tegen* could be locative while *richting* is directional, for example. However, as their behaviour in both the spatial and in the numerical domain is very similar, I see no reason to assume this.

## Chapter 6

# Classifications of directional prepositions

In this section, I will explore the position of *tot*, *tegen*, and *richting* in the spatial domain. The aim of this endeavour is twofold. First, while it is obvious that *tot* is directional in nature, it is not evident whether *tegen* and *richting* are locative, directional, or ambiguous between the two. As I discussed at the end of the previous section, the answer to this question is an essential link in the story about how the meaning of prepositions is transferred to the numerical domain.

Aside from uncovering the nature of *tegen* and *richting*, another objective I pursue here is to attain a more fine-grained idea of the semantics of the three prepositions under discussion in the spatial domain. Clearly, there is more to the meaning of prepositions than the parameter of directionality. Uncovering the specific properties of *tot*, *tegen*, and *richting* in the spatial domain can serve as a basis to shed some light on the behaviour of these expressions in the numerical domain, and more specifically on the contrasts between *tot* on the one hand and *tegen* and *richting* on the other.

This chapter will show that the matter of whether *tegen* and *richting* are locative, directional, or ambiguous between the two is not straightforward, but that *tot* and the directional versions of *tegen* and *richting* do fit neatly in categories of directional prepositions. These results will serve as a starting point for the discussion on the connection between the spatial and numerical uses of these three prepositions in chapter 7.

The remainder of this chapter is organised as follows. In the following section, I will discuss the classification of prepositions in English put forward in Svenonius (2010). Then I will consider the classification of directional prepositions put forward in Zwarts (2008) and one of the modifications of Zwarts's account proposed by Pantcheva (2011).

### 6.1 Svenonius's classification of prepositions in English

In this section, I will discuss Svenonius's (2010) classification of prepositions in English. Although it is primarily syntactic in nature and geared towards the

English prepositional system, I believe it will prove to be helpful for the current purposes. As some of Svenonius’s prepositional classes are inherently directional while others lack this feature, using Svenonius’s system is a useful tool to find out whether *tegen* and *richting* are directional, locative, or ambiguous.

Before diving into Svenonius’s classification, it will be useful to introduce two concepts used by Svenonius to describe different elements of sentences with prepositional phrases. The *figure* is the object whose location is described. In (1), the figure is the elephant. The *ground* is the reference point for the location under discussion, such as the boat in (1) (terminology by Talmy, e.g. 1983, 2000).

- (1) The elephants remained in the boat.

The four classes distinguished by Svenonius are projective prepositions, bounded prepositions, extended prepositions, and particles. As the role of particles is irrelevant here, I will only discuss the first three categories. The first class contains prepositions which express locational relations, such as *behind* and *outside*. Here, the relation between figure and ground is always that a certain region with respect to the ground is selected, and the figure is in that region. These prepositions are not directional in nature.

The second category of bounded prepositions consists of prepositions that also have a locative meaning, but unlike projective prepositions, they impose a more complex relationship between the figure and the ground. In some cases, such as in the case of *between* and *among*, there is a complex relation between figure and ground. In other cases, a short distance (*beside*, *next to*) or contact (*against*, *upon*) is implied.

Extended prepositions, unlike projective and bounded prepositions, include a path or directional component in their meaning. For this reason, they are usually interpreted directionally in contexts where prepositions of the first two categories are interpreted locatively. Examples of members of this class are *around*, *through*, *along*, and *past*. The complete list of projective, bounded, and extended prepositions provided by Svenonius is given in table 6.1.

Projective	Bounded	Extended
behind	among	around
in front of	between	through
inside	next to	across
outside	beside	along
above	upon	over
below	near	under
beyond	against	past

Table 6.1: Svenonius’s classification of prepositions in English

In the following section, I will discuss the ways in which Svenonius proposes to determine which prepositions belong in which category. In section 6.1.2, I will investigate whether Svenonius’s system could work for Dutch. In section 6.1.3, I will explore what categories *tot*, *tegen*, and *richting* should be placed in in Svenonius’s classification.

### 6.1.1 Properties of prepositions in English

In what follows, I will first discuss some properties projective prepositions have according to Svenonius. Then I will explore the differences between projective prepositions and bounded prepositions and the differences between projective prepositions and extended prepositions Svenonius discusses.

The first characteristic of projective prepositions is that PPs that contain them can occur as the complement of stative verbs expressing location, such as *to remain*, *to be located*, and *to stand*. This is exemplified in (2).

- (2) The boat was located inside the cave.

As can be seen in (3), they can also be used as a locative adjunct when the verb does not imply motion.

- (3) The boat was painted in front of the palace.

Verbs can be categorised into obligatory direction verbs (*to go*), optional direction verbs (*to fly*), and non-direction verbs (*to stay*). For an optional direction verb, the PP plays an essential role in determining whether motion is expressed in the sentence. When such an optional direction verb is combined with a projective preposition, the most natural interpretation is a locative one, although a directional reading is often available as well. This is demonstrated in (4).

- (4) a. The plane flew behind the trees.  
b. The rabbit jumped inside the cage.  
c. The revelers danced in front of the palace.

A third property of projective prepositions is that they can be the complement of the preposition *from*. This is illustrated in (5).

- (5) a. The boat drifted from behind the hill.  
b. The boat drifted from below the bridge.  
c. The boat drifted from above the dam.

A final property of projective prepositions discussed by Svenonius is that they can occur as restrictive modifiers of nouns, as can be seen in (6).

- (6) a. The boat inside the cave.  
b. The boat beyond the city limits.  
c. The boat in front of the palace.

A difference between projective and bounded prepositions is that projective but not bounded prepositions can be modified by measure expressions. This contrast is illustrated in (7) and (8).

- (7) a. We remained sixty feet in front of the palace.  
b. My clothes are ten meters below the bridge.

- (8) a. \*They came from six feet between the trees.  
b. \*They opened the door one meter next to the stage.

Another contrast between these two categories is that the ground can sometimes be omitted in expressions with projective prepositions but not in expressions with bounded prepositions. This is exemplified in (9) and (10).

- (9) a. As the group approached the final summit, Espen stayed behind (them).  
 b. There was a beach. Above (it), the cliffs swarmed with birds.
- (10) a. As the group approached the final summit, Espen stayed among \*(them).  
 b. There was a beach. Next \*(to it), the cliffs swarmed with birds.

For the prepositions for which omission of the ground is possible, *there* can generally be used as the ground, as shown in (11).

- (11) a. Get behind/inside/in front of/?below/?above/?beyond there.  
 b. \*Get among/upon/between/beside/next to there.

A difference between projective prepositions and extended prepositions is that while we have seen that the former usually lead to a locative interpretation when they are combined with optional direction verbs, the latter favour a directional interpretation in this context. This is illustrated in (12).

- (12) a. The plane flew around the trees.  
 b. The rabbit jumped through the cage.  
 c. The mountaineers climbed over the dam.

A second difference between these two classes is that when they are used as restrictive modifiers of non-path, non-vehicular nouns, projective prepositions are generally interpreted as locative, while a directional reading is favoured for extended prepositions. This contrast is demonstrated in (13) and (14).

- (13) a. The climb above the dam was arduous.  
 b. A dive below the bridge would be refreshing.  
 c. Kari's flip in front of the mat brought applause.
- (14) a. The climb over the dam was arduous.  
 b. A dive under the bridge would be refreshing.  
 c. Kari's flip across the mat brought applause.

### 6.1.2 Transferring Svenonius's classification to Dutch

The previous section demonstrated the workings of Svenonius's classification in English. In this section, I will attempt to see if his system can be applied to Dutch. To do this, I will select five prepositions that I think unambiguously belong in the class of projective prepositions and four that clearly seem to be extended prepositions. I will choose these prepositions on the basis of how closely they resemble their English counterpart. I will test how these prepositions fare in Svenonius's contexts for projective and extended prepositions to find out whether the same kinds of prepositions occur in the same contexts in Dutch as in English. If I am successful, I will use the same method to determine how *tot*, *tegen*, and *richting* should be classified in Svenonius's system.

Before doing this, however, I should note that Svenonius's tests for bounded prepositions do not appear to work in Dutch. The first difference between projective and bounded prepositions Svenonius mentions is that measure expressions can modify the former but not the latter. As can be seen in table 6.1, the full list of bounded prepositions Svenonius gives consists of the expressions *among*, *between*, *next to*, *beside*, *upon*, *near*, and *against*. Although the tests works for the Dutch translations of *between* and *near* — *tussen* and *dichtbij* —

the rest of these items are either difficult to translate (*upon*), can be modified by a measure phrase in Dutch (*naast*, ‘beside’), or are problematic for another reason. This the case for *onder*, the translation of *among*, which also means *under* and is therefore difficult to test. Considering the test only appears to work for two bounded prepositions in Dutch, I feel it should be discarded.

The second contrast Svenonius touches upon is that projective but not bounded prepositions can occur without overt mention of the ground or with the word *there* for a ground. However, omission of the ground is never possible in Dutch. Prepositions can occur with the anaphoric prefix *er* as a ground, as can be observed in (15), but taking this to be the Dutch equivalent of the omission of the ground or the replacement of the ground by *there* that can occur in English seems rather presumptuous and far-fetched.

- (15) A: Waar is de afstandsbediening?  
Where is the remote control?  
B: Je zit erop.  
You sit there-on.  
‘You’re sitting on it.’

Thus, it appears to be impossible to test for boundedness in Dutch using Svenonius’s method for English.

Now let us turn to projective and extended prepositions. The Dutch prepositions I have selected as candidates for membership of these categories are given in (16) and (17).

- (16) **Projective prepositions**  
*achter* behind  
*binnen* inside  
*buiten* outside  
*boven* above  
*voor* in front of

- (17) **Extended prepositions**  
*door* through  
*over* over  
*langs* along  
*voorbij* past

First, let us test the potential projective prepositions. The first context in which these should be able to occur is as complements of stative verbs expressing location, such as *to remain*, *to be located*, and *to stand*. Good Dutch equivalents of these verbs seem to be *blijven*, *zich bevinden*, and *staan*. As can be observed in (18), all prepositions from (16) can occur in this context.

- (18) Marie { blijft / bevindt zich / staat } { achter / binnen /  
Marie { remains / finds REFL / stands } { behind / inside /  
buiten / boven / voor } het huis.  
outside / above / in front of } the house.

The second way to recognise a projective preposition in Svenonius’s system is by checking if it can be used in a locative adjunct to a non-direction verb. (19) shows that the prepositions in (16) satisfy this requirement.



- (19) De boot werd { achter / binnen / buiten / boven / voor }  
 The boat was { behind / inside / outside / above / in front of }  
 het paleis geverfd. The boat was painted behind / inside / outside  
 the palace painted.  
 / above / in front of the palace.

Projective prepositions can also be the complement of the preposition *from*. As can be observed in (20), the prepositions in (16) can occur in this position.

- (20) De boot kwam van { achter / binnen / buiten / boven / voor }  
 The boat came from { behind / inside / outside / above / in front of }  
 } de grot.  
 } the cave.

Furthermore, projective prepositions can occur as restrictive modifiers of nouns. The prepositions in (16) satisfy this requirement, as is shown in (21).

- (21) De boot { achter / binnen / buiten / boven / voor } de  
 The boat { behind / inside / outside / above / in front of } the  
 grot.  
 cave.

A way to distinguish between projective and extended prepositions is to combine them with optional direction verbs. The preferred reading of projective prepositions in this context is a locative reading. This is indeed the preferred reading of the examples in (22) with the optional direction verbs *vliegen*; ‘to fly’, and *zwemmen*; ‘to swim’.

- (22) De vogel vliegt / springt { achter / binnen / buiten / boven /  
 The bird flies / jumps { behind / inside / outside / above /  
 voor } het huis.  
 in front of } the house.

These tests show that the prepositions in (16) are unambiguously projective prepositions. Now let us consider the prepositions in (17). If these are extended prepositions, their preferred reading in the context of (22) should be directional. This is indeed so for the examples in (23).

- (23) De vogel vliegt / springt { door / over / langs / voorbij } het  
 The bird flies / jumps { through / over / along / past } the  
 huis.  
 house.

A second way to determine if prepositions belong in the category of projective or extended prepositions is to observe their behaviour when they are used as a restrictive modifier of a non-directional noun. Again, the preferred reading for projective prepositions is a locative one, while the preferred reading for extended prepositions is directional. The prepositions in (24) and (25) do indeed show this contrast.

- (24) Kari's salto { achter / binnen / buiten / boven / voor } het  
 Kari's flip { behind / inside / outside / above / in front of } the

huis was spectaculair.  
house was spectacular.

- (25) Kari's salto { door / over / langs / voorbij } het huis was  
Kari's flip { through / over / along / past } the house was  
spectaculair.  
spectacular.

In sum, although the ways Svenonius presents to recognise prepositions of different categories do not work for bounded prepositions, they do work for projective and extended prepositions. Because the former is locative and the latter is directional in nature, it will be worthwhile to investigate what category *tot*, *tegen*, and *richting* should be placed in, even though there is no way to check if they could be bounded prepositions. This is what I will do in the following section.

### 6.1.3 *Tot*, *tegen*, and *richting* in Svenonius's classification

In this section, I will investigate what category *tot*, *tegen*, and *richting* fall into according to the classification of Svenonius. To start with, let us see if we can place the relevant prepositions in the category of projective prepositions.

First, let us see if these prepositions can occur in sentences with stative location verbs. As was mentioned in the previous section, the Dutch equivalents of *to remain*, *to be located* and *to stand* are *blijven*, *zich bevinden*, and *staan*. As (26) demonstrates, *tot* cannot be combined with any of these verbs. The use of these verbs with *tegen* and *richting* leads to grammatical and felicitous sentences.

- (26) a. De ladder \*blijft / \*bevindt zich / \*staat tot het huis.  
The ladder remains / finds REFL / stands TOT the house.  
'The ladder remains / is / stands up to the house.'
- b. De ladder blijft / ?bevindt zich / staat tegen het huis.  
The ladder remains / finds REFL / stands TEGEN the house.  
'The ladder remains / is / stands into/against the house.'
- c. De auto blijft / bevindt zich / staat richting het centrum.  
The car remains / finds REFL / stands RICHTING the centre.  
'The car remains / is / stands towards/near the centre.'

Although the combination of *tegen* with *zich bevinden* appears problematic, this is again due to the two readings of *tegen* discussed in section 5.1. In (26-b), the prominent meaning of *tegen* is the one where there is physical contact between the ladder and the house. When the closeness reading is used, *zich bevinden* and *tegen* are compatible. This is demonstrated in (27).

- (27) Het restaurant bevindt zich tegen het centrum van Amsterdam.  
The restaurant finds REFL TEGEN the centre of Amsterdam.  
'The restaurant is located right near the centre of Amsterdam.'

Now let us see how these prepositions fare when they are combined with optional direction verbs such as *vliegen*; 'to fly', and *springen*; 'to jump'. While the previous test suggested that *tegen* and *richting* may belong to the class of projective prepositions, (28) suggests otherwise.

- (28) a. De vogel vliegt / springt tot de boom.  
 The bird flies / jumps TOT the tree.  
 ‘The bird flies/jumps up to the tree.’
- b. De vogel vliegt / springt tegen de boom.  
 The bird flies / jumps TEGEN the tree.  
 ‘The bird flies/jumps into the tree.’
- c. De vogel vliegt / springt richting de boom.  
 The bird flies / jumps RICHTING the tree.  
 ‘The bird flies/jumps towards the tree.’

All three of these sentences have a clear directional interpretation. A locative reading is available for (28-b) and (28-c), but it is not easy to see. It is of course possible that the sentence with *tegen* has this interpretation because it is difficult to imagine a bird flying or jumping ‘against a tree’. However, what is clear is that the directional interpretation is freely and easily available in this context. Furthermore, this argument does not hold for the sentence with *richting*: (28-c) could have the interpretation of a bird flying or jumping close to the tree, which is not a strange thing for a sentence to express, but the preferred reading is definitely the directional one.

Now let us see whether *tot*, *tegen*, and *richting* can be the complement of *van*, ‘from’. As is demonstrated in (29), this construction with *tot* results in ungrammaticality. *Tegen* and *richting* sound anomalous in this context, but interpretable and not ungrammatical.

- (29) a. \*De boot kwam van tot de rand van het meer.  
 The boat came from TOT the edge of the lake.  
 ‘The boat came from up to the edge of the lake.’
- b. ?De boot kwam van tegen de kade.  
 The boat came from TEGEN the quay.  
 ‘The boat came from against the quay.’
- c. ?De boot kwam van richting de zee.  
 The boat came from RICHTING the sea.  
 ‘The boat came from towards/close to the sea.’

The final context in which projective prepositions can occur in English is as restrictive modifiers. Again, *tot* clearly cannot be used in this construction. *Tegen* and *richting*, on the other hand, can be used here without any problems. This is exemplified in (30).

- (30) a. \*De boot tot de zee.  
 The boat TOT the sea.  
 ‘The boat up to the sea.’
- b. De boot tegen de kade.  
 The boat TEGEN the quay.  
 ‘The boat against the quay.’
- c. De boot richting het eiland.  
 The boat RICHTING the island.  
 ‘The boat towards/close to the island.’

Thus, out of the four ways in which projective prepositions are normally used according to Svenonius, *tot* can be used in none, meaning it clearly does not

belong in this category. *Tegen* and *richting* display projective preposition-like behaviour in the first and fourth context but not in the second. The third test do not lead to a clear result.

Now let us consider whether *tegen* and *richting* behave like extended prepositions. The first environment in which projective prepositions display different behaviour than extended prepositions is in a sentence with an optional direction verb. We have seen in (28) that in this regard, *tot*, *tegen*, and *richting* all behave like extended prepositions.

The second property of extended prepositions is that expressions in which they occur as a restrictive modifier of a non-path, non-vehicular noun, these expressions are most naturally interpreted as directional expressions. Interestingly, *tot*, *tegen*, and *richting* all behave like extended prepositions in this context. This is shown in (31).

- (31) a. De duik tot de bodem.  
 The dive *tot* the bottom.  
 ‘The dive up to the bottom.’  
 b. De duik tegen het koraalrif.  
 The dive *TEGEN* the coral reef.  
 ‘The dive into the coral reef.’  
 c. De duik richting de bodem.  
 The dive *RICHTING* the bottom.  
 ‘The dive towards the bottom.’

Although it seems clear that *tot*, which could occur in none of the environments projective prepositions appear in, is directional, the categorisation of *tegen* and *richting* remains opaque. While these expressions display extended preposition-like behaviour when they are combined with optional direction verbs and when they occur as restrictive modifiers of non-directional nouns, they also appear to fare quite well in the tests for projective prepositions, especially in comparison to *tot*.

Thus, the three possibilities I listed at the end of the previous section remain open: *tegen* and *richting* could be ambiguous between a directional and a locative meaning, they could be directional prepositions that can receive a locative reading through certain operations, or vice versa.

In the following section, I will move on to the question of how *tot* and directional *tegen* and *richting* can be categorised in a more specific way. To this end, I will discuss Zwarts’s (2008) classification of directional prepositions and a few modifications proposed by Pantcheva (2011).

## 6.2 Zwarts’s classification of directional prepositions

In this section, I will discuss the classification of directional prepositions posited in Zwarts (2008). Zwarts assumes that the meaning of directional prepositions is based on paths, and that a directional prepositional phrase denotes a set of paths. A path is taken to be a sequence of points in space. He further distinguishes seven classes of directional prepositions. I will discuss these classes in turn.

The first type of prepositions Zwarts discusses are source prepositions, such as *out of* and *from under*. These determine the initial part of the path. Source prepositions involve a change of state and divide their path into two parts: a positive part and a negative part. In the case of (32), the positive part includes points that are under the bridge and the negative part contains points that are not under the bridge. Zwarts represents this as in (33).

(32) A dog emerged from under the bridge.

(33) + + + + + - - - - -  
0 1

Goal prepositions such as *into* and *up* are the mirror image of source prepositions. Thus, a PP such as *into the house* can be represented as in (34), with the plus signs signifying the part of the path that is in the house and the minus sign representing the part that is outside the house.

(34) - - - - - + + + + +  
0 1

The third kind of prepositions Zwarts distinguishes pose a condition not on the beginning or end of the path but on the middle part. Examples are *via* and *over*. The PP *over the fence*, for instance, is visualised in (35). The pluses represent the part of the path that is above the fence, while the minuses stand for the rest of the path.

(35) - - - - - + + + + - - - -  
0 1

For some prepositions, the relevant path does not include the location that is the argument of the preposition. These prepositions convey that the end point of the path is closer to the argument location than the starting point. Zwarts refers to this class of prepositions as *comparative prepositions*, and represents them as in (36). Examples of such prepositions are *towards* and *up* (as in *up the hill*).

(36) + + + + + + + + + + +  
0 1

A fifth class Zwarts distinguishes is the class of constant prepositions. Prepositions like *through* and *along* belong in this category. They are characterised only by a positive part: every point on the path is a part of the location the argument expresses. For the PP *through the forest*, for instance, all points on the relevant path are in the forest.

(37) + + + + + + + + + + +  
0 1

The preposition *around* belongs to the class of geometric prepositions. These are more complex than the other classes discussed so far in that their starting point is also their goal and there is a point of the path on every part of the object. For this reason, a simple phase diagramme cannot represent the meaning of this class. Zwarts does propose a formal definition of *around*, but as it is not directly relevant here, I refer the reader to Zwarts (2008) for this.

The final category Zwarts defines is that of periodic prepositions, which are characterised by repetition. Examples are *around and around* and *up and down*. Zwarts represents this as a pattern X that is repeated, as can be observed in (38).

$$(38) \quad \begin{array}{cccccccccccc} X & X & X & X & X & X & X & X & X & X & X & X \\ 0 & & & & & & & & & & & 1 \end{array}$$

A summary of Zwarts’s categorisation is given in table 6.2 (from Zwarts, 2008).

Class	Phase diagramme	Example
Source prepositions	+ + + + + + - - - - - - - -	from
Goal prepositions	- - - - - - - - + + + + + +	into
Route prepositions	- - - - - + + + + - - - - -	over
Comparative prepositions	+ + + + + + + + + + + +	towards
Constant prepositions	+ + + + + + + + + + + +	through
Geometric prepositions	N/A	around
Periodic prepositions	X X X X X X X X X X X X	around and around

Table 6.2: Zwarts’s classification of directional prepositions

Turning back now to the three prepositions under discussion, *tot*, *tegen*, and *richting*, it seems that this classification can give us some insights on the behaviour of these expressions in the spatial domain. All three expressions seem to be oriented towards their goal rather than their source. Furthermore, *tot* and the directional version of *tegen* seem to belong in the category of goal prepositions, while *richting*, which can be translated rather accurately by *towards*, appears to be in the class of comparative prepositions.

Pantcheva (2011) proposes a few modifications of Zwarts’s classification, one of which is relevant for the current purposes. Within the class of transitional prepositions — that is, prepositions that convey a change of state: source, goal, and route prepositions — she distinguishes between purely transitional prepositions and so-called delimited prepositions. According to her, the difference between these two classes is that the latter are more explicit about the boundary of the movement. Delimited prepositions with an end point, such as *up to*, ‘set the end of the path at the first point where the location to which the path relates is reached’ (Pantcheva, 2011, p. 24). That is, while in (39), there is a possibility that once Mary has reached the house, she continues her path by walking into the house, in (40), her path stops at the point where she reaches the house.

(39) Mary walks to the house.

(40) Mary walks up to the house.

This is represented in the phase diagramme in (41). The phase diagramme of a delimited preposition with a starting point such as *starting from* is given in (42). Pantcheva calls these *egressive* prepositions, while those with an end point are referred to as *terminative* prepositions.

$$(41) \quad \begin{array}{cccccccccccc} - & - & - & - & - & - & - & - & - & - & - & + \\ 0 & & & & & & & & & & & 1 \end{array}$$

$$(42) \quad \begin{array}{c} + \text{-----} \\ 0 \qquad \qquad \qquad 1 \end{array}$$

Taking this into account, it seems fit to place both *tot* and the directional version of *tegen* in the category of terminative paths. *Tot* appears to be a perfect synonym of *up to* in this regard. *Tegen*, too, is clearly terminative. As *tegen* expresses physical contact between the moving object and the end point, clearly it is impossible for the object to continue moving beyond the end point.

In sum, according to the categorisation of Zwarts (2008) and Pantcheva’s (2011) modification thereof, it appears that *tot* is a terminative preposition, as is *tegen* when used directionally, and the directional version of *richting* falls in the category of comparative prepositions.

### 6.3 Interim conclusion

In this chapter, I discussed three different classifications of prepositions. First, I explored Svenonius’s (2010) categorisation of prepositions in English. The use of *tegen* and *richting* resulted in grammatical and felicitous sentences in the majority of the contexts in which the non-directional projective prepositions are said to occur as well as in all environments in which the directional extended prepositions can normally be found according to Svenonius.

Then I discussed Zwarts’s (2008) classification of directional prepositions and one of Pantcheva’s (2011) revisions thereof. This did lead to a clear result: *tot* and the directional version of *tegen* are terminative, while *richting* is comparative when it is used directionally. If *tegen* and *richting* are directional in nature, these differences may influence their meaning in the numerical domain.

In sum, if the literature suggests anything, it seems to suggest that *tegen* and *richting* are ambiguous between a directional and a locative meaning, and that in their directional sense, they are terminative and comparative respectively.

However, there are two other factors that need considering before a definitive conclusion on the meaning of the spatial versions of *tegen* and *richting* is reached. The first is that locative prepositions can be used in directional contexts in some circumstances. Likewise, directional prepositions can be used locatively through certain operations. This means that if there are arguments to assume that *tegen* and *richting* are not ambiguous, it may still be possible to explain their seemingly ambiguous behaviour. These arguments may come from the numerical domain, which brings me to my next point.

The second relevant factor is the fact that while I have assumed throughout this thesis that the spatial use of *tegen* and *richting* can tell us something about their behaviour in the numerical domain, the meaning they have when they are used as numeral modifiers may also tell us something about their sense in the spatial domain.

Hence, rather than simply assuming that ambiguity is the answer, a more in-depth discussion of all three possibilities and their consequences in both the spatial and the numerical domain is called for. This will be the topic of the following chapter.

## Chapter 7

# Reconciling the spatial and numerical behaviour of Dutch prepositional numeral modifiers

In the previous chapter, I discussed the classifications of prepositions proposed by Svenonius (2010), Zwarts (2008), and Pantcheva (2011), and explored where *tot*, *tegen*, and *richting* belong in these classifications. What came out of this discussion is that while *tot* is clearly directional, *tegen* and *richting* seemed to have both directional and locative characteristics. Furthermore, *tot* seems to belong to the class of terminative prepositions, as does *tegen* when it is used directionally. *Richting*, on the other hand, appears to be a comparative preposition.

As it stands, then, several puzzles remain unsolved. First, the nature of *tegen* and *richting* remains obscure. They may be directional prepositions that are sometimes used locatively, locative prepositions that have a directional use, or they may simply be ambiguous between a directional and a locative reading. If this is the case, it is unclear whether it is the locative or the directional sense of *tegen* and *richting* or perhaps a mixture of both that is transferred to the numerical domain. Another issue concerns the origin of the proximity effects of *tegen* and *richting* in both the spatial and the numerical domain. A third puzzle is created by the fact that *tot* belongs in class B, while *tegen* and *richting* are class A numeral modifiers.

In this section, I will attempt to reconcile the directional and numerical behaviour of directional numeral modifiers taking all of these issues into consideration. I will do so by considering the hypotheses that *tegen* and *richting* are directional, that they are locative, and that they are ambiguous in turn.

An assumption I will make in the following sections is that it is the primary meaning of these prepositions in the spatial domain that is transferred to the numerical domain. As will become obvious in what follows, there are operations through which directional prepositions can be used locatively and vice versa. However, positing that the meaning of these prepositions in the numeri-



cal domain is the result of an operation applied to the preposition in the spatial domain seems unnecessary and far-fetched.

## 7.1 *Tegen* and *richting* as directional prepositions

As the numeral modifiers discussed in the first part of this thesis are all directional in nature, it may be wise to first consider the hypothesis that *tegen* and *richting* share this property. As I showed in the previous chapter, both *tegen* and *richting* seem to express directionality when they are combined with an optional directional verb. This was shown in (28), repeated here as (1). While (1-a) conveys that the bird flies or jumps forward until it hits the tree, (1-b) expresses that it flies or jumps in the direction of the tree.

- (1) a. De vogel vliegt / springt tegen de boom.  
The bird flies / jumps TEGEN the tree.  
'The bird flies/jumps into the tree.'
- b. De vogel vliegt / springt richting de boom.  
The bird flies / jumps RICHTING the tree.  
'The bird flies/jumps towards the tree.'

In the right context, it is possible to see a meaning where the bird flies or jumps while continually touching the tree for (1-a) and a reading where it flies or jumps around somewhere near the tree for (1-b), but these meanings are certainly not the most salient ones. As was also shown in the previous section, the same result ensues when they are used as restrictive modifiers of non-path, non-vehicular nouns such as *dive*.

Furthermore, *richting* seems to correspond very well with Zwarts's (2008) definition of comparative prepositions. In fact, Zwarts uses the example *towards* to illustrate this category, and *towards* seems to be quite a literal translation of *richting*. The form *richting* can also be a noun meaning *direction*, which makes it rather counterintuitive to argue against its directionality.

Before turning to the numerical domain, let us consider the ramifications of this stance for the spatial domain. It is clear that *tegen* and *richting* are sometimes used in a locative way. If they are directional in nature, there must be a way to obtain the locative meaning from the directional meaning.

There is an operation in the literature that does precisely this. This operation is referred to as *end-point focus* (Lakoff, 1987), the *ON* function (Jackendoff, 1983) or *G-Locations* (Cresswell, 1978; Svenonius, 2010). I will adopt this last term. As discussed in Cresswell (1978), (2) has the locative meaning that a band is playing on the other side of the meadow, despite the fact that the meaning of *across* is normally directional.

- (2) A band is playing across the meadow.

Cresswell therefore posits a function *G*, which maps a path onto its end point. *Across a meadow*, then, means something like *at the end of a journey across a meadow*.

However, as remarked by Zwarts (p.c.) and Svenonius (2010), this function can only be used for route prepositions. Thus, source and goal prepositions

are excluded from this operation. This is demonstrated in (3) (example from Svenonius, 2010).

- (3) a. A band is playing from the town hall.  
 b. A band is playing into the town hall.

While these sentences are grammatical and felicitous, they do not mean that a band is playing at the end of a journey from or into the town hall. Thus, the meaning that would result from the application of the G-function is not available for source and goal prepositions.

If *tegen* and *richting* are to be regarded as directional prepositions, this fact is problematic. Both of these expressions are clearly goal prepositions and not routes, even though the goal is not guaranteed to be reached in the case of *richting*.

As it stands, then, there are two possibilities. One would be to accept that, considering that *tegen* and *richting* can be used locatively and there is no operation to turn goal prepositions into locative prepositions, these expressions must not be directional. Another would be to claim that there is an operation that turns these prepositions into locative prepositions, either by expanding the reach of the G-function or by proposing a new operation.

As I mentioned in the beginning of this chapter, I am assuming that it is the original meaning of the preposition and not the meaning that is altered by a function that is transferred to the numerical domain. Therefore, instead of searching for the primary meaning of *tegen* and *richting* in the spatial domain and then comparing this to the meaning they have in the numerical domain, perhaps a way out here would be to turn things around. It may be possible to gain some insights on the core meaning of *tegen* and *richting* by observing their behaviour as numeral modifiers.

*Tegen* and *richting*, unlike *tot*, are both class A modifiers, as I showed in (19) in chapter 5, repeated here as (4).

- (4) a. #De Tweede Kamer heeft tot 160 zetels, namelijk 150.  
 The House of Representatives has TOT 160 seats, namely 150.  
 ‘The House of Representatives has up to 160 seats, namely 150.’  
 b. De Tweede Kamer heeft richting de 160 zetels, namelijk  
 The House of Representatives has RICHTING the 160 seats, namely  
 150.  
 ‘The House of Representatives has towards/up to 160 seats, namely  
 150.’  
 c. De Tweede Kamer heeft tegen de 160 zetels, namelijk  
 The House of Representatives has TEGEN de 160 seats, namely  
 150.  
 ‘The House of Representatives has close to/up to 160 seats, namely  
 150.’

As was discussed at the beginning of this thesis, what characterises class B numeral modifiers is that they need to quantify over a range of values. Directional prepositions create a path. If a directional preposition such as *tot* is used in the numerical domain and it behaves as it does in the spatial domain, it would be

expected to produce a path there as well. So just as *tot* creates a path from the original location of the pig to the stable in (5-a), it creates a path from 1 to 50 in (5-b).

- (5) a. Het varken loopt tot de stal.  
 The pig walks TOT the stable.  
 ‘The pig walks up to the stable.’  
 b. Er zijn tot vijftig plekken beschikbaar.  
 There are TOT fifty places available.  
 ‘There are up to fifty places available.’

The path produced by the numeral could then serve as the range that class B modifiers need. This could be the reason that the directional *tot* belongs in class B.

Being class A modifiers, this reasoning cannot be applied to *tegen* and *richting*. This constitutes an argument against the idea that *tegen* and *richting* are directional. If they were directional and required a path, one would expect them to require a path in all domains.

Besides being class A modifiers, another property of *tegen* and *richting* in the numerical domain is the proximity effects they impose. This can be observed in (6) and (7), repeated from (9) and (10) from chapter 5.

- (6) a. Er waren richting de honderd mensen aanwezig bij de demonstratie.  
 There were RICHTING the hundred people present at the demonstration.  
 Zo’n tachtig, negentig, denk ik.  
 Such an eighty, ninety, think I.  
 ‘Towards/Up to a hundred people were present at the demonstration.  
 About eighty or ninety, I think.’  
 b. Er waren richting de honderd mensen aanwezig bij de demonstratie.  
 There were RICHTING the hundred people present at the demonstration.  
 ?Zo’n vijftig, zestig, denk ik.  
 Such a fifty, sixty, think I.  
 ‘Towards/Up to a hundred people were present at the demonstration.  
 About fifty or sixty, I think.’
- (7) a. Sonja heeft tegen de honderd uitnodigingen verstuurd. Zo’n  
 Sonja has TEGEN the hundred invitations sent. Such an  
 tachtig, negentig, denk ik.  
 eighty, ninety, think I  
 ‘Sonja has sent close to/up to a hundred invitations. About eighty or  
 ninety, I think.’  
 b. Sonja heeft tegen de honderd uitnodigingen verstuurd. ?Zo’n vijftig,  
 Sonja has TEGEN the hundred invitations sent. Such a fifty,  
 zestig, denk ik.  
 sixty, think I  
 ‘Sonja has sent close to/up to a hundred invitations. About fifty or  
 sixty, I think.’

As these examples show, *richting/tegen de honderd* can only refer to a number that is relatively close to a hundred: eighty is acceptable, but fifty is not. As was shown in (5) and (8) of the same chapter, repeated here as (8) and (9), this

proximity effect also occurs in the spatial domain.

- (8) Lisa woont richting Den Haag.  
Lisa lives RICHTING The Hague.  
'Lisa lives in the direction of/close to The Hague.'
- (9) Lisa woont tegen Den Haag.  
Lisa lives TEGEN The Hague.  
'Lisa lives (very) close to The Hague.'

Crucially, the proximity effects in the spatial domain only arise when *tegen* and *richting* are used locatively. When they are used directionally, they do not have the meaning that the moving object is already quite close to its goal. This is another indication that it is the locative meaning and not the directional meaning of *tegen* and *richting* that is transferred to the numerical domain. Consequently, if it is assumed — as it is here — that the transferred meaning of these expressions is the core meaning and not the meaning that is altered by some operation, the meaning of *tegen* and *richting* in the spatial domain would then be locative as well.

Thus, the properties of being class A numeral modifiers and having proximity effects in the numerical domain suggest that the primary meaning of *tegen* and *richting* is locative and not directional, and that this meaning is transferred to the numerical domain. This possibility is further explored in the following section.

## 7.2 *Tegen* and *richting* as locative prepositions

In the previous section, I discussed the possibility that *tegen* and *richting* are directional prepositions. This turned out not to be compatible with the class B and proximity properties these prepositions display in numerical contexts. If we take these expressions to be locative at their core, class B and proximity effects are more easily explained. Moreover, taking this stance means it is unnecessary to explore why a terminative and a comparative preposition have virtually the same meaning in the numerical domain. Furthermore, the question of how the locative meaning comes about in spite of the fact that the G-function does not apply to goal prepositions does not have to be asked.

However, a matter that does arise is the question of how the directional meaning of *tegen* and *richting* comes about if we take them to be locative expressions. Fortunately, it turns out that in certain environments, such as those with a direction verb, locative prepositions can freely be used as end-points of paths. This is shown in (10) for English (examples from Svenonius, 2010).

- (10) a. The boat drifted behind the hill.  
b. The boat drifted below the bridge.  
c. The boat drifted beyond the city limits.

In Dutch, adpositions can often be used directionally by using them as postpositions rather than prepositions. This is shown in (11) and (12).

- (11) a. Jan liep in het huis.  
John walked in the house.

- ‘John walked inside the house.’
- b. Jan liep het huis in.  
John walked the house in.  
‘John walked in to the house.’
- (12) a. Marie liep door de tuin.  
Mary walked through the garden.  
‘Mary walked (around) through the garden.’
- b. Marie liep de tuin door.  
Mary walked the garden through.  
‘Mary traversed the garden.’

However, prepositional locative adpositions can also be interpreted as end-points of paths. The translations of Svenonius’s examples for English result in sentences that can be interpreted both locatively and directionally in Dutch, as can be observed in (13).

- (13) a. De boot dreef achter de heuvel.  
The boat drifted behind the hill.  
‘The boat drifted (to) behind the hill.’
- b. De boot dreef onder de brug.  
The boat drifted below the bridge.  
‘The boat drifted (to) below the bridge.’
- c. De boot dreef voorbij de stadsgrens.  
The boat drifted beyond the city limits.  
‘The boat drifted (to) beyond the city limits.’

Svenonius posits a null TO, similar to Jackendoff’s (1983) TO function, to explain this phenomenon. This element creates a path and has the same meaning as overt *to*. A sentence like (13-a) is then interpreted as *the boat drifted to behind the hill*, with the location denoted by the PP being the end point of the path.

As all locative prepositions appear to be able to take on a directional meaning in this way, this solves the problem of how *tegen* and *richting* can be used directionally if they are locative in meaning.

Other arguments for the locativity of *tegen* and *richting* are their compatibility with certain stative verbs such as *to stand* and *to stay*. They can also occur in other environments where Svenonius’s locatives, projectives, typically occur. Sometimes they sound slightly awkward in these contexts, but this awkwardness is nothing compared to the blatant ungrammaticality that ensues when *tot* is used in these environments.

However, it is undeniable that the preferred reading of expressions with *tegen* and *tot* and an optional direction verb is a directional one, and that this is clearly not the case for (other) locative prepositions in Dutch. In fact, as I said of the locative prepositions used in (11)-(13), the preferred reading of locative prepositions is normally the non-directional one. This is the case when locative prepositions are combined with optional direction verbs, and, as I mentioned above, it is even the case when they occur with actual direction verbs. The behaviour of *tegen* and *richting* in this regard seems very atypical indeed.

Moreover, it is hard to deny that *richting* literally translates to *direction*. When *richting* is used locatively, the intuitive interpretation is that the location identified by the PP is at the end of a path. That is, a person uttering (14)

appears to ask the hearer to imagine going to Bussum and stopping at a forest somewhere near Bussum.

- (14) We hebben een wandeling gemaakt in een bos richting Bussum.  
We have a walk made in a forest RICHTING Bussum.  
'We went for a walk in a forest in the direction of Bussum.'

The fact that locative *richting* has a deictic meaning — the forest mentioned in (14) has to be on the same side of Bussum as the conversationalists — only increases the magnitude of this problem. When a location denoted by a PP depends on the geographic placement of the speaker, it is almost impossible not to imagine a path from the speaker to that location.

One might say it would be possible to try to account for this by positing that the numerical meaning of *richting*, although virtually the same as that of *tegen*, comes about through a different route. However, this would only bring us back to section 7.1 and all the problems it contains.

A final problem that occurs if we take *tegen* and *richting* to be locative concerns the definition of the class I introduced in the first part of this thesis. If being directional does not provide numeral modifiers with a membership card to this class, what does? One might say that being a preposition is enough to be granted access. However, the preposition *onder*; 'under,' can be used as a numeral modifier with an upper bound yet it lacks all of the five properties I discussed in section 3.1 to define the new class.

### 7.3 Tegen and richting as ambiguous prepositions

A solution that may offer a way out is that *tegen* and *richting* are truly ambiguous prepositions that carry both a directional and a numerical meaning, and a kind of hybrid form of these prepositions is transferred to the numerical domain.

The directional part of the meaning makes *tegen* and *richting* qualify for membership of the category of directional numeral modifiers, while the locative part determines other important parts of the meaning of these prepositions in the numerical domain. That is, the directional part contributes the five properties of directional numeral modifiers to the meaning, while the locative part causes *tegen* and *richting* to fall in class A and to display proximity effects.

This solution seems to be the only one that does not run into serious problems. Furthermore, ambiguity appears to be what Svenonius's (2010) tests indicate. If *tegen* and *richting* are truly ambiguous between a locative and a directional meaning, more research is needed to discover what determines which meaning they receive in a given spatial context. For example, why do they behave as directionals when they are combined with an optional motion verbs instead of being ambiguous in these contexts? Moreover, it remains unclear why their directionality makes them have the same five properties as UP TO but the locative aspect of their meaning causes the proximity effect and the lack of a range requirement in the numerical domain. It could just as well have been the other way around: the locativity of *tegen* and *richting* could have prevented them from having UP TO properties, while their directionality could have contributed most of their meaning in the numerical domain (class B effects, but no

proximity effect). I will leave these questions unanswered.

## 7.4 Interim conclusion

To conclude, when the behaviour of *tegen* and *richting* in the numerical domain is considered, it seems that the meaning these expressions convey corresponds to the locative meaning they have in the spatial domain. More specifically, the fact that *tegen* and *richting* do not display class B effects but do bring about proximity effects suggests that their meaning does not contain a range but does involve closeness, as it does when these prepositions are used non-directionally.

However, Svenonius's two tests to separate his class of prepositions that have a path element to their meaning from his categories of prepositions that are locative both seem to suggest that *tegen* and *richting* are in fact directional. This is rather worrisome, as is the fact that both the form and the deictic nature of *richting* appear to suggest the existence of a path in its meaning. Therefore, the most likely solution seems to be that *tegen* and *richting* are ambiguous between a directional and a locative meaning.

As I discussed in the previous section, this still does not answer all questions, and I will not resolve these matters in this thesis. However, I hope to have put the issues in more clear terms by placing it in the context of the numerical domain and providing arguments for and against all three positions. In the final chapter of this thesis, I will reflect on the consequences of the considerations presented here and in the rest of this thesis for the meaning of prepositions used as numeral modifiers as well as the connection between form and meaning in general.

## Chapter 8

# Summary and conclusion

The primary aim of this thesis was to show that the form of numeral modifiers affects their meaning in a more radical way than has thus far been shown. More specifically, the fact that certain numeral modifiers are prepositions has far-reaching consequences for their meaning in the numerical domain. The fact that prepositional numeral modifiers differ greatly in their behaviour from other numeral modifiers shows that they have retained the status and core meaning of a preposition.

The first part of this thesis contains crosslinguistic evidence for this position. In chapter 2, I discussed Nouwen's (2010b) classification of numeral modifiers into class A and class B modifiers, the second of which lack the ability to identify a specific cardinality. I demonstrated that, while this classification naturally makes a distinction between numeral modifiers originating from different areas of the grammar, some forms that are entirely different from one another still occur in the same category. Because directional numeral modifiers are a prime example of this phenomenon, I argued they should be placed into a separate category.

In chapter 3, I first discussed five characteristics of directional numeral modifiers that make them different from other numeral modifiers. Three of these properties — non-downward entailingness, the failure to licence NPIs, and the bottom-of-the-scale effect — were first proposed as properties of *up to* by Schwarz et al. (2012). The other two characteristics I discussed — positive directivity and a cancellable upper bound — are my own. I then argued for my position that directionality is at the core of this bundle of differences by presenting data from 13 languages in which directional prepositions that double as numeral modifiers differ from other numeral modifiers in exactly the same way that *up to* in English contrasts with the rest of class B.

Chapter 4 contains three different accounts of the semantics of numeral modifiers: Nouwen's (2010b) account for class A and class B numeral modifiers, Schwarz et al.'s (2012) account for *up to*, and my account for directional numeral modifiers. The objective of my account was to explain the characteristics that are specific to directional numeral modifiers by positing that the only difference between AT MOST and UP TO is the fact that the former has an upper bound as its primary meaning, while the core meaning of the latter is a lower bound.

The aim of the second part of this thesis was to take a closer look at how



the meaning of directional prepositions is transferred to the numerical domain. To this end, I studied the workings of three prepositional numeral modifiers in Dutch: *tot*, *tegen*, and *richting*. Following Corver and Zwarts (2006), I assumed that the basic meaning of prepositions is the same across domains.

Chapter 5 introduced the spatial and numerical versions of the three relevant prepositions. While *tegen* and *richting* proved to have both a directional and a locative use in the spatial domain, *tot* was shown to be unambiguously directional. In the numerical domain, *tot* displays class B effects. *Tegen* and *richting*, on the other hand, turned out to be class A numeral modifiers. Furthermore, these last two prepositions show proximity effects in both the spatial and the numerical domain.

The remainder of the thesis was dedicated to the matter of how the differing behaviour of *tot*, *tegen*, and *richting* in the spatial and the numerical domain can be reconciled. The main issue here was that if *tegen* and *richting* are taken to be directional, their lack of class B effects cannot be explained. If, on the other hand, they are locative in nature, the issue of what makes a prepositional numeral belong to the class defined in the first part of the thesis remains a mystery. The third possibility that was considered was that *tegen* and *richting* are ambiguous between a locative and a directional meaning.

The literature I discussed in chapter 6 did not offer a definitive answer to the question on the nature of *tegen* and *richting* in the spatial domain. According to the tests relating to the classification of prepositions put forward in Svenonius (2010), *tegen* and *richting* behave like locative prepositions in some cases and like directional prepositions in others.

Before concluding that ambiguity is the answer, I felt it was necessary to consider all three possibilities and their consequences in both the spatial and the numerical domain in turn. The seventh chapter of this thesis was dedicated to a discussion of these possibilities. Arguments for all three positions ensued. While the class A and proximity effects of *tegen* and *richting* point towards a locative outcome, it is difficult to deny that both prepositions behave suspiciously like directional prepositions in certain spatial contexts. What is more, if *tegen* and *richting* are not directional, it is unclear how the separate class discussed in the first part of this thesis should be defined. In the end, I concluded that the most likely solution is that *tegen* and *richting* are ambiguous, while admitting that this approach is not without its own issues.

Clearly, this thesis has an open ending. A selection of the many things that remain obscure are the role of the core and secondary meaning in the semantics of UP TO and AT MOST, the question of what parameter makes a numeral modifier have the five properties I discussed in section 3.1 and how this parameter relates to the semantics I presented in chapter 4 — and if the parameter is indeed that of directionality, meaning *tegen* and *richting* are sufficiently directional to have the five properties I discussed, why do these numeral modifiers not display class B effects like all other directional numeral modifiers?

Nevertheless, I think there is one thing that is clear as day, and that is the fact that the prepositional nature of certain numeral modifiers has a profound effect on the way they behave in the numerical domain. It is not a coincidence that directional prepositions from fourteen different languages all share the same five properties; properties that non-prepositional numeral modifiers simply do not have.

Furthermore, it is not an accident that the meaning of prepositions in the

spatial domain closely corresponds to their meanings in the numerical domain. This can be shown in a very obvious way on a coarse-grained level: *from* indicates a starting point and *up to* specifies an end point in both the spatial and the numerical domain. It can still be observed when we zoom in a little more, and we see that *up to* does not display proximity effects in any domain, and *richting* and *tegen* display them in both the spatial and the numerical domain. On an even more fine-grained level, a subtle difference between *tegen* and *richting* can be detected in both the spatial and the numerical domain: the proximity effect of *tegen* is a little stronger than that of *richting*. If such subtle differences between prepositions occur in the spatial and in the numerical domain, it is undeniable that the meaning of prepositions remains constant across domains.

Thus, even though many things remain obscure at the end of this thesis, I believe that the fundamental idea that the form of numeral modifiers affects their meaning in a very profound way still holds, and that investigating the way meanings correspond across domains is a useful tool to determine the essence of these meanings.

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# Appendices: data

## A Class B effects

See chapter 2 and section 3.3.1.

### Dutch

- (1) a. Een driehoek heeft minder dan 11 zijden.  
A triangle has fewer than 11 sides.  
b. #Een driehoek heeft tot 10 zijden.  
A triangle has up to 10 sides.  
c. #Een driehoek heeft maximaal 10 zijden.  
A triangle has maximally 10 sides.

### Romanian

- (2) a. Un triunghi are mai puțin de 11 fețe.  
A triangle has fewer than 11 sides.  
b. #Un triunghi are până la 10 fețe  
A triangle has up to 10 sides.  
c. #Un triunghi are cel mult 10 fețe.  
A triangle has at most 10 sides.

### Turkish

- (3) a. Ucgenin 11 den az kenari vardır.  
Triangle-GEN 11 from less sides has.  
'A triangle has fewer than 11 sides.'  
b. #Ucgenin 10 kadar kenari vardır.  
Triange-GEN 10 up to sides has.  
'A triangle has up to 10 sides.'  
c. #Bir ucgenin en çok 10 kenari vardır.  
A triangle at most 10 sides has.  
'A triangle has at most 10 sides.'

### French

- (4) a. Un triangle a moins de 11 côtés.  
A triangle has fewer than 11 sides.  
b. #Un triangle a jusqu'à 10 côtés.  
A triangle has up to 10 sides.

- c. #Un triangle a au plus 10 côtés.  
A triangle has at most 10 sides.

### Danish

- (5) a. En trekant har færre en 11 sider.  
A triangle has fewer than 11 sides.  
b. #En trekant har højst 10 sider.  
A triangle has at most 10 sides.  
c. #En trekant har op til 10 sider.  
A triangle has up to 10 sides.

### Greek

- (6) a. Ena trighono ehi lighoteres apo edeka plevres.  
A triangle has fewer than 11 sides.  
b. #Ena trighono ehi mehri dheka plevres.  
A triangle has up to 10 sides.  
c. #Ena trighono ehi to poli dheka plevres.  
A triangle has at most 10 sides.

### Farsi

- (7) a. Yek mosalas kamtar az 11 zel darad.  
A triangle fewer than 11 sides has.  
'A triangle has fewer than 11 sides.'  
b. #Yek mosalas ta 10 zel darad.  
A triangle up to 10 sides has.  
'A triangle has up to 10 sides.'  
c. #Yek mosalas hade aksar 10 zel darad.  
A triangle at most 10 sides has.  
'A triangle has at most 10 sides.'

### German

- (8) a. Ein Dreieck hat weniger als 11 Seiten.  
A triangle has fewer than 11 sides.  
b. #Ein Dreieck hat bis zu 10 Seiten.  
A triangle has up to 10 sides.  
c. #Ein Dreieck hat maximal 10 Seiten.  
A triangle has maximally 10 sides.

### Italian

- (9) a. La mia macchina fa esattamente 20km con un litro, quindi fa  
The my car covers exactly 20km on a litre, so covers  
meno di 30km con un litro.  
less than 30km on a litre.  
'My car covers exactly 20km on a litre of fuel, so it covers less than  
30km on a litre of fuel.'

- b. #La mia macchina fa esattamente 20km con un litro, quindi fa  
 The my car covers exactly 20km on a litre, so covers  
 fino a 30km con un litro.  
 up to 30km on a litre.  
 ‘My car covers exactly 20km on a litre of fuel, so it covers up to 30km  
 on a litre of fuel.’
- c. #La mia macchina fa esattamente 20km con un litro, quindi fa  
 The my car covers exactly 20km on a litre, so covers  
 al massimo 30km con un litro.  
 at most 30km on a litre.  
 ‘My car covers exactly 20km on a litre of fuel, so it covers at most 30km  
 on a litre of fuel.’

### Polish

- (10) a. Trojkat ma mniej niz 11 bokow.  
 Triangla has fewer than 11 sides.  
 ‘A triangle has fewer than 11 sides.’
- b. #Trojkat ma do 10 bokow.  
 Triangle has up to 10 sides.  
 ‘A triangle has up to 10 sides.’
- c. #Trojkat ma najwyzej 10 bokow.  
 Triangle has at most 10 sides.  
 ‘A triangle has at most 10 sides.’

### Hungarian

- (11) a. A háromszögnek kevesebb mint 10 oldala van.  
 A triangle fewer than 10 sides is.  
 ‘A triangle has fewer than 10 sides.’
- b. #A háromszögnek közel 10 oldala van.  
 A triangle near 10 sides is.  
 ‘A triangle has up to ten sides.’
- c. #A háromszögnek legfeljebb 10 oldala van.  
 A triangle at most 10 sides is.  
 ‘A triangle has at most 10 sides.’

### Spanish

- (12) a. Un triángulo tiene menos de 11 lados.  
 A triangle has fewer than 11 sides.
- b. #Un triángulo tiene hasta 10 lados.  
 A triangle has up to 10 sides.
- c. #Un triángulo tiene como mucho 10 lados.  
 A triangle has at most 10 sides.

### Russian

- (13) a. Treugol'nik imeet men'she 11 storon.  
 Triangle has fewer 11 sides.  
 ‘A triangle has fewer than 11 sides.’

- b. #Treugol'nik imeet do 10 storon.  
Triangle has up to 10 sides.  
'A triangle has up to 10 sides.'
- c. #Treugol'nik imeet ne bolee 10 stororon.  
Triangle has at most 10 sides.  
'A triangle has at most 10 sides.'

## B Downward entailment

See sections 3.1.1 and 3.3.2.

### Dutch

- (14) a. Er roken maximaal drie studenten.  $\models$   
There smoke maximally three students.  
'At most three students smoke.'
- b. Er roken maximaal drie studenten sigaren.  
There smoke maximally three students cigars.  
'At most three students smoke cigars.'
- (15) a. Er roken tot drie studenten.  $\not\models$   
There smoke up to three students.  
'Up to three students smoke.'
- b. Er roken tot drie studenten sigaren.  
There smoke up to three students cigars.  
'Up to three students smoke cigars.'

### Romanian

- (16) a. Cel mult trei studenți fumează.  $\models$   
At most three students smoke.
- b. Cel mult trei studenți fumează trabuc.  
At most three students smoke cigars.
- (17) a. Până la trei studenți fumează.  $\not\models$   
Up to three students smoke.
- b. Până la trei studenți fumează trabuc.  
Up to three students smoke cigars.

### Turkish

- (18) a. En çok üç sigara icilmesine izin veriliyor.  $\models$   
At most three cigarette being smoked permission is given.  
'It is allowed to smoke at most three cigarettes.'
- b. En çok üç Kuba sigarası icilmesine izin veriliyor.  
At most three cigarette Cuban being smoked permission is given.  
'It is allowed to smoke at most three Cuban cigarettes.'
- (19) a. Üç sigaraya kadar icilmesine izin veriliyor.  $\not\models$   
Three cigarettes up to being smoked permission is given.  
'It is allowed to smoke up to three cigarettes.'



- b. Uc Kuba sigarasina kadar icilmesine izin veriliyor.  
Three Cuban cigarettes up to being smoked permission is given.  
'It is allowed to smoke up to three Cuban cigarettes.'

### French

- (20) a. John a mangé au plus 3 fruits.  $\models$   
John has eaten at most 3 pieces of fruit.  
b. John a mangé au plus 3 pommes.  
John has eaten at most 3 apples.
- (21) a. John a mangé jusqu'à trois fruits.  $?? \models$   
John has eaten up to 3 pieces of fruit.  
b. John a mangé jusqu'à trois pommes.  
John has eaten up to 3 apples.

### Danish

- (22) a. Højst tre elever ryger.  $\models$   
At most three students smoke.  
b. Højst tre elever ryger cigarer.  
At most three students smoke cigars.
- (23) a. Op til tre elever ryger.  $\not\models$   
Up to three students smoke.  
b. Op til tre elever ryger cigarer.  
Up to three students smoke cigars.

### Greek

- (24) a. I Skandhinavi trone psari to poli tris fores ti mera.  $\models$   
The Scandinavians eat fish at most three times the day.  
'Scandinavians eat fish at most three times a day.'  
b. I Skandhinavi trone solomo to poli tris fores ti mera.  
The Scandinavians eat salmon at most three times the day.  
'Scandinavians eat salmon at most three times a day.'
- (25) a. I Skandhinavi trone psari mehri tris fores ti mera.  $\not\models$   
The Scandinavians eat fish up to three times the day.  
'Scandinavians eat fish up to three times a day.'  
b. I Skandhinavi trone solomo mehri tris fores ti mera.  
The Scandinavians eat salmon up to three times the day.  
'Scandinavians eat salmon up to three times a day.'

### Farsi

- (26) a. Hadde aksar se daneshamooz minevisand.  $\models$   
At most three students write.  
b. Hadde aksar se daneshamooz dastan minevisand.  
At most three students stories write.  
'At most three students write stories.'
- (27) a. Ta se (ta) daneshamooz minevisand.  $\not\models$   
Up to three (up to) students write.

- b. Ta se (ta) daneshamooz dastan minevisand.  
Up to three (up to) students stories write.  
'At most three students write stories.'

### German

- (28) a. John hat maximal drei Früchte gegessen.  $\models$   
John has maximally three pieces of fruit eaten.  
'John has eaten at most three pieces of fruit.'  
b. John hat maximal drei Äpfel gegessen.  
John has maximally three apples eaten.  
'John has eaten at most three apples.'
- (29) a. John hat bis zu drei Früchte gegessen.  $?? \models$   
John has up to three pieces of fruit eaten.  
'John has eaten up to three pieces of fruit.'  
b. John hat bis zu drei Äpfel gegessen.  
John has up to three apples eaten.  
'John has eaten up to three apples.'

### Italian

- (30) a. I danesi mangiano pesce al massimo tre volte al giorno.  $\models$   
The Danish eat fish at most three times a day.  
'The Danish eat fish at most three times a day.'  
b. I danesi mangiano salmone al massimo tre volte al giorno.  
The Danish eat salmon at most three times a day.  
'The Danish eat salmon at most three times a day.'
- (31) a. I danesi mangiano pesce fino a tre volte al giorno.  $\not\models$   
The Danish eat fish up to three times a day.  
'The Danish eat fish up to three times a day.'  
b. I danesi mangiano salmone fino a tre volte al giorno.  
The Danish eat salmon up to three times a day.  
'The Danish eat salmon up to three times a day.'

### Polish

- (32) a. Najwyżej trzy studenci pala.  $\models$   
At most three students smoke.  
b. Najwyżej trzy studenci pala cygara.  
At most three students smoke cigars.
- (33) a. Do trzech studentów pali.  $\not\models$   
Up to three students smoke.  
b. Do trzech studentów pali cygara.  
Up to three students smoke cigars.

### Hungarian

- (34) a. Legfeljebb 100 diák dohányzik.  $\models$   
At most 100 students smoke.

- b. Legfeljebb 100 diák dohányzik cigarettázik.  
At most 100 students smoke cigars.
- (35) a. Közel 100 diák dohányzik.  $\neq$   
Close to 100 students smoke.  
'Up to a hundred students smoke.'
- b. Közel 100 diák dohányzik cigarettázik.  
Close to 100 students smoke cigars.  
'Up to 100 students smoke cigars.'

### Spanish

- (36) a. Como mucho tres estudiantes fumaron.  $\models$   
At most three students smoke.
- b. Como mucho tres estudiantes fumaron puros.  
At most three students smoke cigars.
- (37) a. Hasta tres estudiantes fumaron.  $\neq$   
Up to three students smoke.
- b. Hasta tres estudiantes fumaron puros.  
Up to three students smoke cigars.

### Russian

- (38) a. Ne bolee treh studentov kurjat.  $\models$   
At most three students smoke.
- b. Ne bolee treh studentov kurjat sigary.  
At most three students smoke cigars.
- (39) a. Do treh studentov kurjat.  $\neq$   
Up to three students smoke.
- b. Do treh studentov kurjat sigary.  
Up to three students smoke cigars.

## C Negative polarity items

See sections 3.1.1 and 3.3.3.

### Dutch

NPI: *hoeven*

- (40) a. Er hoeven maximaal vijf studenten te komen.  
There must maximally five students to come.  
'At most five students have to show up.'
- b. \*Er hoeven tot vijf studenten te komen.  
There must up to five students to come.  
'Up to five students have to show up.'

### Romanian

—

(See footnote 9 in section 3.3.3.)

### Turkish

NPI: *hicbir*

- (41) a. \*En çok 5 kişinin hiçbir elması var.  
At most 5 people any apples have.  
'At most five people have any apples'  
b. \*5 kadar kişinin hiçbir elması var.  
5 up to people any apples have.  
'Up to five people have any apples.'

### French

NPI: *qui que ce soit*

- (42) a. ?Trois personnes au plus ont vu qui que ce soit.  
Three persons maximally have seen anyone.  
'At most three people have seen anyone.'  
b. \*Jusqu'à trois personnes ont vu qui que ce soit.  
Up to three persons have seen anyone.

### Danish

NPI: *nogensinde*

- (43) a. Højest fem personer har nogensinde været her.  
At most five people have ever been here.  
b. \*Op til fem personer har nogensinde været her.  
Up to five people have ever been here.

### Greek

NPI: *kanena*

- (44) a. To poli pede atoma dhen ehun fai kanena milo.  
At most five people NEG have eaten any apples.  
'At most five people have eaten any apples.'  
b. \*Mehri pede atoma dhen ehun fai kanena milo.  
Up to five people NEG have eaten any apples.  
'Up to five people have eaten any apples.'

### Farsi

NPI: *hichkas*

- (45) a. \*Hadeaksar panj nafar hichkas ra dideand.  
At most five persons anyone have seen.  
'At most five people have seen anyone.'  
b. \*Ta panj nafar hichkas ra dideand.  
Up to five persons anyone have seen.  
'Up to five people have seen anyone.'

## German

NPI: *jemals*

- (46) a. Maximal fünf Leute waren jemals hier.  
Maximally five people were ever here.  
At most five people have ever been here.
- b. \*Bis zu fünf Leute waren jemals hier.  
Up to five people were ever here.  
'Up to five people have ever been here.'

## Italian

NPI: *mai*

- (47) a. ?Al massimo 10 persone hanno mai scalato questa montagna.  
At most 10 persons have ever climbed this mountain.  
'At most 10 people have ever climbed this mountain.'
- b. \*In questo luogo possono mai entrare fino a cinque persone.  
In this place can ever enter up to five persons.  
'Up to five people can ever enter this place.'

## Polish

NPI: *zadny*

- (48) a. \*Najwyzej piec osob ma zadnej.  
At most five people have anything.
- b. \*Do piecu osob ma zadnej.  
Up to five people have anything.

## Hungarian

NPI: *semmi*

- (49) a. \*Legfeljebb 100 ember nem látott semmit.  
At most 100 man not saw nothing.  
'At most 100 people saw anything.'
- b. \*Közel 100 ember nem látott semmit.  
Close to 100 man not saw nothing.  
'Up to 100 people saw anything.'

## Spanish

NPI: *ningún*

- (50) a. \*Como mucho cinco personas no tienen ninguna manzana.  
At most five persons NEG have any apples.  
'At most five people have any apples.'
- b. \*Hasta cinco personas no tienen ninguna manzana.  
Up to five persons NEG have any apples.  
'Up to five people have any apples.'

## Russian

NPI: *niskol'ko*

- (51) a. \*Ne bolee pjati čelovek imejut niskol'ko jablok.  
At most five people have any apples.  
b. \*Do pjati čelovek imejut niskol'ko jablok.  
Up to five people have any apples.

## D The bottom-of-the-scale effect

See sections 3.1.2 and 3.3.4.

## Dutch

- (52) a. Bij het ongeluk is maximaal één persoon omgekomen.  
In the accident is maximally one person died.  
'At most one person died in the accident.'  
b. #Bij het ongeluk is tot één persoon omgekomen.  
In the accident is up to one person died.  
'Up to one person died in the accident.'

## Romanian

- (53) a. ?Cel mult o persoană murit în accident.  
At most one person died in accident.  
'At most one person died in the accident.'  
b. #Până la o persoană murit în accident.  
Up to one person died in accident.  
'Up to one person died in the accident.'

## Turkish

- (54) a. Kazada en çok bir insan oldu.  
In accident at most one person died.  
'At most one person died in the accident.'  
b. #Kazada bir insana kadar oldu.  
In accident one person up to died.  
'Up to one person died in the accident.'

## French

- (55) a. Au plus une personne est morte dans l'accident.  
At most one person is died in the accident.  
'At most one person has died in the accident.'  
b. #Jusqu'à une personne est morte dans l'accident.  
Up to one person is died in the accident.  
'Up to one person has died in the accident.'

## Danish

- (56) a. Højest én person døde ved sammenstødet.  
At most one person died in the accident.

- b. #Op til én person døde ved sammenstødet.  
Up to one person died in the accident.

### Greek

- (57) a. To poli ena atomo skotothike sto trakarisma.  
At most one person died in the crash.  
b. #Mehri ena atomo skotothike sto trakarisma.  
Up to one person died in the crash.

### Farsi

- (58) a. Hadde aksar yek nafar dar tasadof mord.  
At most one person in the crash died.  
'At most one person died in the crash.'  
b. #Ta yek nafar dar tasadof mord.  
Up to one person in the crash died.  
'Up to one person died in the crash.'

### German

- (59) a. Maximal eine Person ist bei dem Unfall gestorben.  
Maximally one person is at the accident died.  
'At most one person died in the accident.'  
b. #Bis zu eine Person ist bei dem Unfall gestorben.  
Up to one person is at the accident died.  
'Up to one person died in the accident.'

### Italian

- (60) a. Nello schianto potrebbe essere morta al massimo una persona.  
In crash may have died at most one person.  
'At most one person may have died in the crash.'  
b. #Nello schianto potrebbe essere morta fino a una persona.  
In crash may have died up to one person.  
'Up to one person may have died in the crash.'

### Polish

- (61) a. Najwyzej jedna osoba zginela w wypadku.  
At most one person died in crash.  
'At most one person died in the crash.'  
b. #Do jednej osoby zginelo w wypadku.  
Up to one person died in crash.  
'Up to one person died in the crash.'

### Hungarian

- (62) a. Legfeljebb egy ember halt meg az autóbalesetben.  
At most one man died PREVERB the car accident.  
'At most one person died in the crash.'  
b. #Közél egy ember halt meg az autóbalesetben.  
Up to one man died PREVERB the car accident.  
'Up to one person died in the crash.'

### Spanish

- (63) a. Como mucho una persona murió en el accidente.  
At most one person died in the accident.  
b. #Hasta una persona murió en el accidente.  
Up to one person died in the accident.

### Russian

- (64) a. ?Ne bolee odnogo čeloveka pogiblo v avarii.  
At most one person died in crash.  
'At most one person died in the crash.'  
b. #Ne bolee odnogo čeloveka pogiblo v avarii.  
Up to one person died in crash.  
'Up to one person died in the crash.'

## E Positive directivity

See sections 3.1.3 and 3.3.5.

### Dutch

- (65) a. Gelukkig kan ik tot vijf dagen vrij krijgen.  
Fortunately can I up to five days off get.  
'Fortunately, I can get up to five days off.'  
b. ?Gelukkig zal die vreselijke zanger tot vijf liedjes zingen.  
Fortunately will that horrible singer up to five songs sing.  
'Fortunately, that horrible singer will sing up to five songs.'
- (66) a. ?Gelukkig kan ik maximaal vijf dagen vrij krijgen.  
Fortunately can I maximally five days off get.  
'Fortunately, I can get at most five days off.'  
b. Gelukkig zal die vreselijke zanger maximaal vijf liedjes zingen.  
Fortunately will that horrible singer maximally five songs sing.  
'Fortunately, that horrible singer will sing at most five songs.'

### Romanian

- (67) a. Din fericire, pot lua până la cinci zile libere.  
Fortunately, I can take up to five days off.  
b. ?Din fericire, acel cântăreț groaznic va cânta până la cinci melodii.  
Fortunately, that singer awful will sing up to five songs.  
'Fortunately, that awful singer will sing up to five songs.'
- (68) a. ?Din fericire, pot să iau cel mult cinci zile libere.  
Fortunately, I can take at most five days off.  
b. Din fericire, acel cântăreț groaznic va cânta cel mult cinci melodii.  
Fortunately, that singer awful will sing at most five songs.  
'Fortunately, that awful singer will sing at most five songs.'



### Turkish

- (69) a. Sansliyim ki isten 5 gun kadar izin alabiliyorum.  
I am lucky that from work 5 day up to days off I can take.  
'I am lucky that I can take up to five days off from work.'
- b. ?Sanliyim ki o berbat sarkici 5 sarki kadar soyleyecek.  
I am lucky that that horrible singer 5 songs up to he will sing.  
'I am lucky that that horrible singer will sing up to five songs.'
- (70) a. ?Sanliyim ki isten en cok 5 gun izin alabiliyorum.  
I am lucky that from work at most 5 day days off I can take.  
'I am lucky that I can take at most five days off from work.'
- b. Sanliyim ki o berbat sarkici en cok 5 sarki soyleyecek.  
I am lucky that that horrible singer at most 5 songs he will sing.  
'I am lucky that that horrible singer will sing at most five songs.'

### French

- (71) a. Heureusement, je peux obtenir jusqu'à 5 jours de congé.  
Fortunately, I can get up to 5 days of time off work.  
'Fortunately, I can get up to 5 days off work.'
- b. ?Heureusement, ce mauvais chanteur va chanter jusqu'à 5 chansons.  
Fortunately, that bad singer will sing up to 5 songs.
- (72) a. ?Heureusement, je peux obtenir au plus 5 jours de congé.  
Fortunately, I can get at most 5 days of time off work.  
'Fortunately, I can get up to 5 days off work.'
- b. Heureusement, ce mauvais chanteur va chanter au plus 5 chansons.  
Fortunately, that bad singer will sing at most 5 songs.

### Danish

- (73) a. Heldigvis kan jeg få fri fra arbejde i op til fem dage.  
Fortunately can I get free from work for up to five days.  
'Fortunately, I can get up to five days off work.'
- b. ?Heldigvis vil den skrækkelige sanger synge op til fem sange.  
Fortunately will that horrible singer sing up to five songs.  
'Fortunately, that horrible singer will sing up to five songs.'
- (74) a. ?Heldigvis kan jeg højst få fri fra arbejde i fem dage.  
Fortunately can I at most get free from work for five days.  
'Fortunately, I can get at most five days off work.'
- b. Heldigvis vil den skrækkelige sanger synge højst fem sange.  
Fortunately will that horrible singer sing at most five songs.  
'Fortunately, that horrible singer will sing at most five songs.'

### Greek

- (75) a. Eftihos, boro na paro mehri pede meres adhia.  
Fortunately I can get up to five days off.
- b. ?Eftihos, aftos o traghikos traghudistis tha pi mehri pede traghudhia.  
Fortunately, that horrible singer will sing up to five songs.
- (76) a. ?Eftihos, boro na paro to poli pede meres adhia.  
Fortunately I can get at most five days off.

- b. Eftihos, aftos o traghikos traghudistis tha pi to poli pede  
 Fortunately, that horrible singer will sing at most five  
 traghudhia.  
 songs.

### Farsi

- (77) a. Khoshbakhtane mitoonam ta 5 rooz morakhasi begiram.  
 Fortunately I can up to five days get time off work.  
 b. ?Khoshbakhtane un khanandeye etezah ta 5 (ta) ahang mixanad.  
 Fortunately that singer horrible up to 5 (up to) songs sing.  
 'Fortunately, that horrible singer will sing up to five songs.'
- (78) a. ?Khoshbakhtane mitoonam hade aksar panj rooz morakhasi begiram.  
 Fortunately I can at most five days get time off work.  
 b. Khoshbakhtane un khanandeye etezah hade aksar 5 ta ahang  
 Fortunately that singer horrible at most 5 to songs  
 mixanad.  
 sing.  
 'Fortunately, that horrible singer will sing at most five songs.'

### German

- (79) a. Glücklicherweise kann ich bis zu fünf Tage frei kriegen.  
 Fortunately can I up to five days off get.  
 'Fortunately, I can get up to five days off.'  
 b. ?Glücklicherweise singt dieser schlechte Sänger bis zu fünf Songs.  
 Fortunately sings that bad singer up to five songs.  
 'Fortunately, that bad singer will sing up to five songs.'
- (80) a. ?Glücklicherweise kann ich maximal fünf Tage frei kriegen.  
 Fortunately can I maximally five days off get.  
 'Fortunately, I can get at most five days off.'  
 b. Glücklicherweise singt dieser schlechte Sänger maximal fünf Songs.  
 Fortunately sings that bad singer maximally five songs.  
 'Fortunately, that bad singer will sing at most five songs.'

### Italian

- (81) a. Fortunatamente, posso prendere fino a cinque giorni di ferie.  
 Fortunately, I can take up to five days of time off.  
 'Fortunately, I can get up to five days off.'  
 b. ?Fortunatamente, quel pessimo cantante canterà fino a cinque canzoni.  
 Fortunately, that bad singer will sing up to five songs.
- (82) a. ?Fortunatamente, posso prendere al massimo cinque giorni di ferie.  
 Fortunately, I can take at most five days of time off.  
 'Fortunately, I can get at most five days off.'  
 b. Fortunatamente, quel pessimo cantante canterà at most cinque canzoni.  
 Fortunately, that bad singer will sing at most five songs.

### Polish

- (83) a. Na szczescie, moze dostac do pieciu dni wolnego.  
Fortunately, I can get up to five days off.  
b. ?Na szczescie, ten okropny wokalista bedzie spiewac do pieciu  
Fortunately, that horrible singer will sing up to five  
piosenek.  
songs.
- (84) a. ?Na szczescie, moze dostac najwyzej piec dni wolnego.  
Fortunately, I can get at most five days off.  
b. Na szczescie, ten okropny wokalista zaspiewa najwyzej piec piosenek.  
Fortunately, that horrible singer will sing at most five songs.

### Hungarian

- (85) a. Szerencsére közel 5 nap szabadságot kaphatok.  
Fortunately close to 5 days free I get.  
'Fortunately, I can get up to 5 days off.'  
b. ?Szerencsére ez a borzasztó énekes közel 5 dalt fog elénekelni.  
Fortunately this the horrible singer close to 5 songs will sing.  
'Fortunately, that horrible singer will sing up to 5 songs.'
- (86) a. ?Szerencsére legfeljebb 5 nap szabadságot kaphatok.  
Fortunately at most 5 days free I get.  
'Fortunately, I can get at most 5 days off.'  
b. Szerencsére ez a szörnyű énekes legfeljebb 5 dalt fog elénekelni.  
Fortunately the this horrible singer at most 5 songs will sing.  
'Fortunately, that horrible singer will sing at most 5 songs.'

### Spanish

- (87) a. Afortunadamente, puedo coger hasta cinco días libres (del trabajo).  
Fortunately, I can take up to five days free (of work).  
'Fortunately, I can get up to five days off work.'  
b. ?Afortunadamente, este horrible cantante cantará hasta cinco canciones.  
Fortunately, that horrible singer will sing up to five songs.
- (88) a. ?Afortunadamente, puedo coger como mucho cinco días libres (del  
Fortunately, I can take at most five days free (of  
trabajo).  
work).  
'Fortunately, I can get at most five days off work.'  
b. Afortunadamente, este horrible cantante cantará como mucho cinco  
Fortunately, that horrible singer will sing at most five  
canciones.  
songs.

### Russian

- (89) a. K sčast'ju, ja mogu vzjat' do pjati vyhodnyh.  
To happiness I can take up to five days off.  
'Fortunately, I can take up to five days off.'

- b. ?K sčast'ju, tot užasnyj pevec spoet do pjati pesen.  
To happiness, that horrible singer will sing up to five songs.  
'Fortunately, that horrible singer will sing up to five songs.'
- (90) a. ?K sčast'ju, ja mogu vzjat' ne bolee pjati vyhodnyh.  
To happiness I can take at most five days off.  
'Fortunately, I can take at most five days off.'
- b. K sčast'ju, tot užasnyj pevec spoet ne bolee pjati pesen.  
To happiness, that horrible singer will sing at most five songs.  
'Fortunately, that horrible singer will sing at most five songs.'

### Brazilian Portuguese

- (91) a. Felizmente, eu posso pegar até 5 dias de folga.  
Fortunately, I can get up to 5 days of time off.  
'Fortunately, I can get up to 5 days off.'
- b. ?Felizmente, aquele cantor horrível vai cantar até 5 músicas.  
Fortunately, that singer horrible will sing up to 5 songs.
- (92) a. ?Felizmente, eu posso pegar no máximo 5 dias de folga.  
Fortunately, I can get at most 5 days of time off.  
'Fortunately, I can get at most 5 days off.'
- b. Felizmente, aquele cantor horrível vai cantar no máximo 5 músicas.  
Fortunately, that singer horrible will sing at most 5 songs.

## F Cancellable upper bound

See sections 3.1.4 and 3.3.6. In this section, the judgments for the b-sentences reflect whether or not they are good continuations of the a-sentences.

### Dutch

- (93) a. Er waren tot dertig mensen op het feest.  
There were up to thirty people at the party.
- b. Ik denk zelfs dat het er tweeëndertig waren.  
I think even that it there thirty-two were.  
'I think there might even have been 32 people there.'
- (94) a. Er waren maximaal dertig mensen op het feest.  
There were maximally thirty people at the party.
- b. ?Ik denk zelfs dat het er tweeëndertig waren.  
I think even that it there thirty-two were.  
'I think there might even have been 32 people there.'

### Romanian

- (95) a. Până la trezeci de persoane au venit la petrecere.  
Up to thirty of persons have come to the party.  
'Up to thirty people showed up at the party.'
- b. De fapt, cred că au venit trezeci și două de persoane.  
In fact, I think that have come thirty-two of persons.  
'In fact, I think that thirty-two people showed up.'

- (96) a. Cel mult trezeci de persoane au venit la petrecere.  
At most thirty of persons have come to the party.  
'At most thirty people showed up at the party.'
- b. ?De fapt, cred că au venit treizeci și două de persoane.  
In fact, I think that have come thirty-two of persons.  
'In fact, I think that thirty-two people showed up.'

### Turkish

- (97) a. Partiyeye 30 kadar insan geldi.  
To party 30 up to person came.  
'Up to thirty people showed up at the party.'
- b. Sanırım 32 insan geldi.  
I think 32 person came.  
'I think 32 people showed up.'
- (98) a. Partiyeye en çok 30 insan geldi.  
To party at most 30 person came.  
'At most thirty people showed up at the party.'
- b. ?Sanırım 32 insan geldi.  
I think 32 person came.  
'I think 32 people showed up.'

### French

- (99) a. Jusqu'à 30 personnes sont venues à la fête.  
Up to 30 people have come to the party.  
'Up to 30 people showed up at the party.'
- b. En fait, je crois qu'il y en avait 32.  
In fact, I believe that there were thereof 32.  
'In fact, I believe that there were 32 people.'
- (100) a. Au plus 30 personnes sont venues à la fête.  
At most 30 people have come to the party.  
'At most 30 people showed up at the party.'
- b. ?En fait, je crois qu'il y en avait 32.  
In fact, I believe that there were thereof 32.  
'In fact, I believe that there were 32 people.'

### Danish

- (101) a. Op til tredive personer mødte op til festen.  
Up to thirty people showed up at the party.
- b. Jeg tror faktisk at der var toogtredive personer der.  
I think actually that there were thirty-two people there.  
'I actually think there were thirty-two people there.'
- (102) a. Højest tredive personer mødte op til festen.  
At most thirty people showed up at the party.
- b. ?Jeg tror faktisk at der var toogtredive personer der.  
I think actually that there were thirty-two people there.  
'I actually think there were thirty-two people there.'

### Greek

- (103) a. Mehri triada atoma irthan sto parti.  
Up to 30 people came to the party.  
b. Ya tin akrivia, pistevo oti itan eki triada dhio atoma.  
For the preciseness I believe that were there 30 2 people.  
'In fact, I believe there were thirty-two people there.'
- (104) a. To poli triada atoma irthan sto parti.  
At most 30 people came to the party.  
b. ?Ya tin akrivia, pistevo oti itan eki triada dhio atoma.  
For the preciseness I believe that were there 30 2 people.  
'In fact, I believe there were thirty-two people there.'

### Farsi

- (105) a. Ta si nafar dar mehmani hozur dashtand.  
Up to thirty people at the party showed up.  
'Up to thirty people showed up at the party.'  
b. Dar haqiqat, fekr konam si va do nafar anja budand.  
In fact, I believe thirty-two people there were.  
'In fact, I believe there were thirty-two people there.'
- (106) a. Hade aksar si nafar dar mehmani hozur dashtand.  
At most thirty people at the party showed up.  
'At most thirty people showed up at the party.'  
b. ?Dar haqiqat, fekr konam si va do nafar anja budand.  
In fact, I believe thirty-two people there were.  
'In fact, I believe there were thirty-two people there.'

### German

- (107) a. Bis zu 30 Leute waren auf der Party.  
Up to 30 people were at the party.  
'Up to 30 people showed up at the party.'  
b. Tatsächlich glaube ich, dass es sogar 32 Leute waren.  
Actually believe I, that there even 32 people were.  
'Actually, I believe there were even 32 people there'
- (108) a. Maximal 30 Leute waren auf der Party.  
Maximally 30 people were at the party.  
'At most 30 people showed up at the party.'  
b. ?Tatsächlich glaube ich, dass es sogar 32 Leute waren.  
Actually believe I, that there even 32 people were.  
'Actually, I believe there were even 32 people there'

### Italian

- (109) a. Questa macchina percorre fino a 20 chilometri con un litro di carburante.  
This car covers up to 20 kilometres on a litre of fuel.  
b. Ieri con due litri ho fatto 50 chilometri.  
Yesterday on two litres I drove 50 kilometres.  
'Yesterday I drove 50 kilometres on two litres.'

- (110) a. Questa macchina percorre al massimo 20 chilometri con un litro di  
This car covers at most 20 kilometres on a litre of  
fuel.  
b. ?Ieri con due litri ho fatto 50 chilometri.  
Yesterday on two litres I drove 50 kilometres.  
'Yesterday I drove 50 kilometres on two litres.'

### Polish

- (111) a. Na imprezie zjawilo sie do 30 osob.  
At party showed up up to 30 people.  
'Up to 30 people showed up at the party.'  
b. Wlasciwie, mysle ze bylo tam 32 osob.  
Actually, I think that were there 32 people.  
'Actually, I think there were 32 people there.'
- (112) a. Najwyzej 30 osob zjawilo sie na imprezie.  
At most 30 people showed up at party.  
'At most 30 people showed up at the party.'  
b. ?Wlasciwie, mysle ze bylo tam 32 osob.  
Actually, I think that were there 32 people.  
'Actually, I think there were 32 people there.'

### Hungarian

- (113) a. Közel 30 ember jelent meg a partin.  
Near 30 man showed up PREVERB the party.  
'Up to 30 people showed up at the party.'  
b. ?Valójában azt hiszem, 32 ember volt ott.  
In fact it believe 32 man was there.  
'In fact, I believe there were 32 people there.'
- (114) a. Legfeljebb 30 ember jelent meg a partin.  
At most 30 man showed up PREVERB the party.  
'At most 30 people showed up at the party.'  
b. ?Valójában azt hiszem, 32 ember volt ott.  
In fact it believe 32 man was there.  
'In fact, I believe there were 32 people there.'

### Spanish

- (115) a. Hasta treinta personas vinieron a la fiesta.  
Up to thirty people came to the party.  
b. De hecho creo que había treinta y dos personas ahí.  
In fact I believe that there were thirty and two people there.  
'In fact, I believe that there were thirty-two people there.'
- (116) a. Como mucho treinta personas vinieron a la fiesta.  
At most thirty people came to the party.  
b. ?De hecho creo que había treinta y dos personas ahí.  
In fact I believe that there were thirty and two people there.  
'In fact, I believe that there were thirty-two people there.'

## Russian

- (117) a. Do tridcati ljudej prišlo na večerinku.  
Up to thirty people came on party.  
'Up to thirty people showed up at the party.'
- b. Na samom dele, ja dumaju čto tam bylo 32 čeloveka.  
In fact, I think that there were 32 people.  
'In fact, I believe there were 32 people there.'
- (118) a. Ne bolee tridcati ljudej prišlo na večerinku.  
At most thirty people came on party.  
'At most thirty people showed up at the party.'
- b. ?Na samom dele, ja dumaju čto tam bylo 32 čeloveka.  
In fact, I think that there were 32 people.  
'In fact, I believe there were 32 people there.'