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by

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**Scope, Scalarity, and Polarity in Aspectual Marking:
The case of English ‘until’ and Spanish ‘hasta’**

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The case of English ‘until’ and Spanish ‘hasta’**

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For my parents, my sister, and my husband.

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Abstract

**Scope, Scalarity, and Polarity in Aspectual Marking:
The case of English ‘until’ and Spanish ‘hasta’**

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The University of Texas at Austin, 2017

Supervisors: John Beavers and Gennaro Chierchia

This dissertation explores how languages express durations of time and the significant cross-linguistic variation displayed in words describing temporal duration with otherwise quite similar meanings. Specially, I examine ‘until’-like phrases that bound events in time. These phrases are puzzling because across languages they typically only modify atelic predicates and not telic predicates. Yet they are acceptable with telic predicates if the predicate is negated, and in that case they furthermore generate a factive inference that the event described by the predicate must

come about at a future time. Additionally, some languages, like Greek, use two distinct lexical words, one for atelic predicates and one for telic predicates. Three major prior proposals have been posited: (i) a lexical ambiguity account wherein there is a positive ‘until’ and a negative ‘until’, (ii) a monosemy account wherein ‘until’ is a type of universal quantifier over times that interacts scopally with negation, and (iii) a monosemy account wherein ‘until’ is a type of measure phrase over an existentially-quantified event. However, each approach fails to generalize appropriately. I revisit these three theories by examining the behavior of English *until*-phrases *vis-à-vis* durative *for*-adverbials, as well as ‘until’ counterparts in languages that acquire a superset or a subset of the interpretations of English *until*, such as Spanish *hasta* and Greek *mehri*. I propose a monosemy account that draws on insights from all three prior analyses. The key insight is that there is parameterization in the quantification that ‘until’ words in different languages exhibit. English *until* is universal in nature subject to a scope economy constraint. Spanish *hasta* is existential in nature subject to a plurality constraint in positive environments. Both universal and existential ‘until’ allow for negated telic predicates but the latter admits a wider set of readings and also permits lexical specialization of ‘until’ under negation, as found in Greek. Ultimately, irrespective of their quantification, English *until* and Spanish *hasta* activate temporal scalar alternatives that I argue derive factive inferences as an epiphenomenon of independent scopal interactions between the alternatives, polarity, and covert exhaustification-based operators of the inferential mechanism.

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Chapter 1

Introduction

1.1 The fundamental puzzle

In this dissertation I explore the ways we talk about time, more particularly how events are described as bounded in time and the expressions of such temporal boundaries. Time being one instantiation of a scale (building on Krifka 1998, Beavers 2008a, 2012), the overarching goal of this thesis is to develop a unified theory for words that describe delimitation, taking the notion of scalarity and scalar reasoning as it manifests itself in various pragmatic and semantic domains as a starting point. Such a theory accounting for atelic measure phrases in the temporal domain could ultimately be extended to other scalar domains, such as scales of spatial distance, and likelihood.

The chief object of study are ‘until’-like phrases that mark duration of events as in *John studied until 2 pm*, on the basis of data primarily from English and Spanish. My proposal takes into account the syntactic, semantic, and pragmatic con-

straints on such particles regarding polarity and the inferential system to address the question whether languages have one or two *untils*. This is known in the literature as the puzzle of punctual *until*, which has received a fair amount of attention, from e.g. Karttunen's (1974) and Mittwoch's (1977) pioneering work to Giannakidou's (2002) and Condoravdi's (2008) recent proposals. Consider, for example, the sentences in (1).

- (1) a. John studied **until 2 pm**.
b. # John arrived **until 2 pm**.

An atelic predicate as in (1a) accepts an *until*-phrase to indicate when the eventuality stopped holding, whereas a telic predicate as in (1b) does not. The felicitous use of *until* in positive environments marking the duration of an atelic event has accordingly received the name 'durative *until*.' By contrast, when negation is present, both atelic and telic predicates can be modified by *until*-phrases, as shown in (2).

- (2) a. John did **not** study **until 2 pm**.
b. John did **not** arrive **until 2 pm**.

What is furthermore surprising about the use of *until* with negative telic predicates in (2b) is that in spite of the presence of negation it conveys the occurrence of the relevant event, i.e. John's arrival at 2 pm. This use has been referred to in the literature as 'punctual *until*.' It is important to observe that such an implication is not cancellable, as illustrated in (3).

- (3) John did **not** arrive **until 2 pm**. #In fact, he never arrived

The fact that *until* with a negated telic predicate licenses a non-defeasible 'factive'

inference, i.e. the actualization of the event at or after the time denoted by *until*, poses a challenge for how we can explain both the durative and punctual uses of *until* in a unified fashion. Note that the factive property puts *until* in a different class from other temporal durative adverbials, such as *for*-adverbials. For example, negative *for*-phrases yield cancellable implicatures of the occurrence of the event: *John didn't arrive for 2 hours* suggests that he arrived after those 2 hours, but that implication appears to be cancellable (*John didn't arrive for two hours, and in fact he never arrived*).

The empirical data on *until* above has been explained in two main different ways. On the one hand, on a scopal account, e.g. in the spirit of Mittwoch (1977), there is only one lexical item that corresponds to English *until*: punctual *until* is durative *until* above negation. However, accounts such as these cannot readily explain why the implicature associated with the punctual use of *until* is non-cancellable. This has led to the other set of accounts (e.g. Karttunen 1974, Giannakidou 2002, Condoravdi 2008) that account for this puzzle in a radically different way by diverging from general approaches to durative adverbials such as Dowty (1979) and Krifka (1998): punctual *until* is a wholly distinct lexical item from durative *until*. It is instead a negative polarity item whose meaning already expresses the occurrence of the relevant event and can only be licensed under the use of negation. This latter view is based on evidence from languages like Greek, which distinguish such uses lexically, as observed in (4).¹

¹Thanks to Despoina Oikonomou for the data and judgements in Greek.

- (4) a. *O Gianis diavase mehri/*para mono (s)tis dio.*
 the Gianis read until/ but only (at)the.PL two
 ‘Gianis studied **until** two.’
- b. *O Gianis den eftase para mono/?*mehri (s)tis dio.*
 the Gianis not arrived but only/ until (at)the.PL two
 ‘Gianis didn’t arrive **until** two.’ (but arrived at some point after two)

Greek uses two different words: *mehri* in (4a) corresponds to durative *until*, while *para mono* in (4b) corresponds to their punctual *until*. A simple scopal account cannot readily capture the contrast in (4). Nevertheless, the lexical ambiguity approach fails to explain why the majority of languages studied, such as English and Spanish, do not make any lexical distinction between the two uses. Therefore, previous accounts of these phenomena fail to generalize appropriately.

A second puzzle is how words meaning *until* can differ cross-linguistically in their semantics. For instance, Spanish *hasta* has more temporal readings than English does. The use of Spanish *hasta* in (5) sounds perfectly fine, whereas the use of English *until* sounds strange.

- (5) *Treinta/muchas/algunas personas llegaron hasta las 2.*
 thirty/many/some people arrived until the 2
 # ‘Thirty/many/some people arrived **until** 2.’

The English examples in (5) are odd because they induce a distributive interpretation that the same group of people kept arriving over and over. Surprisingly, the corresponding examples in Spanish are acceptable and receive a ‘cumulative reading’, namely, a total of 30/many/some people arrived non-simultaneously over the course of an interval that ended at 2 pm. To my knowledge, this contrast in the meanings of closely related ‘until’s’ has been neglected in the literature to date.

A third and final puzzle is that, in certain languages, words meaning *until* can have additional meanings outside the temporal domain. For example, Spanish *hasta* can mark the endpoint of a path in space by introducing the goal of a motion construction (e.g. Beavers 2008a, Bassa-Vanrell 2013), as observed in (6a), and can also act as a scalar additive particle with a meaning similar to English *even* in more abstract domains (e.g. Schwenter and Vasishth 2000), as in (6b).²

- (6) a. *Juan vino **hasta** la fiesta con nosotros.*
 Juan came until the party with us
 ‘Juan came **up to** the party with us.’
- b. *Juan vino **hasta** [a la fiesta]_F con nosotros.*
 Juan came until at the party with us
 ‘Juan **even** came [to the party]_F with us.’

This multi-functionality across domains is not specific of Spanish *hasta*. Rather, it is common in synchrony and/or diachrony cross-linguistically. For example, Portuguese *até*, Japanese *-made*, and Korean *-kkaci* embody all the same temporal, spatial, and ‘even’ functions as Spanish *hasta*. Even though synchronically English *until* only occurs in the temporal dimension, diachronically, *until* was also used to delimit space in the spatial domain (Harper 2001). This makes us also wonder why ‘until’-like markers often embody, *prima facie*, such unrelated functions in other domains. Beavers (2008a) offers an initial explanation regarding why ‘until’-like words like Japanese *-made* may embody functions in both the temporal and spatial domains. Beavers (2008a) proposes that *-made* must denote the final point on some ordered object that is theta-related to the event *e*, but leaves open what kind of ob-

²[]_F indicates the focal-stress bearing element: such an ‘even’ function of *hasta* is sensitive to the placement of focal stress.

ject it is (a temporal object or a spatial object), so that the type of its complement will fix that. In this way ‘until’ admits both temporal and spatial uses. However, this approach cannot appropriately account for the cases in which ‘until’ can mean *even* since the kinds of alternatives being described there do not obviously form an entity theta-related to the event in any way. The type of analysis I provide in this dissertation will ultimately be able to generalize further over different functions.

Overall, previous works have only centered around a subset of the functions that temporal ‘until’ markers may acquire, since certain patterns had not yet been noticed or were neglected (e.g. the ability of ‘until’ words to give rise to scopeless cumulative readings in certain languages). Furthermore, for the vast majority of issues concerning punctual *until*, *until*-phrases have been studied independently from other durative adverbials, so that strong parallelisms with measure adverbs in general, like *for*-adverbials, have been mostly ignored. However, the answers to these puzzles of ‘until’ in the temporal domain (and other domains) can only come from closely examining the functions of *until*-phrases *vis-à-vis* other temporal measure phrases such as *for*-adverbials as well as *until*-phrases *vis-à-vis* other ‘until’ words in other languages that show a superset or a subset of the interpretations of English *until*, such as Spanish *hasta* or Greek *mehri*. Only then we will be able to decipher the above puzzles in a unified fashion so as to fully understand (i) how events are bounded, (ii) the quite significant cross-linguistic variation in how ‘until’-like words with otherwise quite similar meanings behave, and (iii) how this relates to and unifies different notions of scalarity and their interactions with polarity and inferential systems.

1.2 The basic proposal

I first show that a monosemy account of English (and other languages that do not make a lexical distinction) in the spirit of Mittwoch's (1977) original work is possible by articulating (in a new form) Dowty's (1979) insight that *for*-adverbials, and *per* extension *until*-phrases, are universal quantifiers over time intervals for which the relevant predicate must hold. I hence address *for*- and *until*-phrases on a par. I show that if we furthermore assume that a verb's event variable is bound at the verb level (in a Champollion 2015-style of event semantics) and that right-adjoined durative adverbials are low VP adverbs contingent on a semantic economy constraint limiting the possibility of raising (reminiscent of Fox 1995), a variety of interpretive facts about *for* and *until* automatically follow. The crucial difference in behavior between *until* and *for* regarding factive inferences can be captured by considering their temporal scalar nature within a system of obligatory scalar implicatures, as in many recent proposals (e.g. Chierchia 2013). The temporal scalar alternatives associated with *until*-phrases are always 'active' (as if *until* were inherently focus-marked), and must thus be exhaustified, which explains the non-cancellability of their inferences. In contrast, the scalar alternatives associated with *for*-adverbials are only optionally factored into meaning, which explains the corresponding cancellable nature of their inferences. All in all, I propose that the punctuality and factivity of *until* turns out to be a byproduct of independent scope issues within a system that interacts with covert exhaustification-based operators.

Second, I suggest that there is parameterization in the quantification that 'until' words in different languages exhibit. While in English it represents universal

quantification over times, in some languages like Spanish it can instead represent existential quantification over times, and this explains the fact that *hasta*-phrases can receive cumulative readings. The analysis I propose for Spanish *hasta*-phrases is a modified version of Krifka's (1998) account of measure phrases where temporal adverbs are existential time-frame adverbials that 'measure out' atelic events. I advance an account where atelicity is defined in connection with plural morphology, following e.g. Spector's (2007) work. Crucially, the distinct meanings that I put forth between existential and universal quantification of 'until' words is found across languages and not within one language. The multiple temporal meanings of *hasta*-phrases in Spanish can all be derived from one lexical word: existential *until* (as opposed to universal *until* in English). Finally, because of the existential quantification languages like Spanish lend themselves naturally to the possibility of separate lexicalization of the negative-polarity-item version (on the basis of e.g. Krifka 1995, Chierchia 2004, 2006), thus explaining languages like Greek.

1.3 Outline of the thesis

The structure of the dissertation is as follows. I begin in Chapter 2 by providing a descriptive and empirical overview of the puzzle of punctual *until* and previous approaches to this puzzle so as to gauge their strengths and weaknesses. Then I introduce the close parallelism between *until*-phrases and *for*-adverbials in English, where their strong resemblance cannot be ignored and must play a crucial role in the theory we are building for *until*-like phrases. In particular, I outline how both *until*-phrases and *for*-adverbials present highly restricted scopal behavior. Next, I

review two major accounts on *for*-adverbials, which could potentially be extended to *until*-phrases: Dowty's (1979) approach and Krifka's (1998) approach. Dowty's universal approach seems more appropriate for deriving a general scopal account of durative adverbials for the case of English.

In Chapter 3, I flesh out the details of a scopal account of this sort for English *for/until*-phrases within a framework of quantification and event semantics à la Champollion (2015). I clarify and make more precise the constrained scopal behavior of right-adjoined durative adverbials and establish their scopal-base position in contrast with other universal adverbials like *every*-phrases. I propose that *for/until*-phrases are low VP adverbs subject to a condition I call Maximize Strength, an economy constraint where extraposition of the durative adverbial to a higher position is only possible if it does not lead to a weaker interpretation (defined in terms of logical entailment relations). Such a scopal account will predict the restriction of punctual uses of *until* to downward-entailing environments, including in particular negation.

In Chapter 4, I turn to the question of the factivity of punctual *until*. I focus on the scalarity of time and offer an exhaustification-based account where *until*-phrases obligatorily activate scalar alternatives that must be factored into meaning and hence exhaustified. Two covert exhaustification operators may intervene, one based on focus-sensitive *only* and another based on focus-sensitive *even*. This will provide a rather elegant and unified account of the various inferences that the different uses of *until* can trigger. It will furthermore explain the major contrast between *for*-adverbials and *until*-phrases contingent on a simple parametric measure: having

‘inactive’ vs. ‘active’ alternatives, respectively.

In Chapter 5, I return to Krifka’s (1998) approach to durative adverbials to account for the nature of *hasta*-phrases in Spanish. I propose that these are existential (and not universal) time-frame adverbials subject to a pluractional condition. I build this pluractional condition in the form of a scalar implicature (rather than in the form of a presupposition, contra Krifka), reminiscent of recent work on plural morphology on DPs by e.g. Spector (2007). Plurality of an existential time-frame adverbial furthermore opens up the possibility that adverbs can acquire cumulative interpretations. I further offer an exhaustification-based account of the temporal scalar alternatives of *hasta*-phrases, where we obtain the same type of non-defeasible scalar inferences as for English *until*. I finally argue that the existential analysis can derive a rather natural negative-polarity-item counterpart, overtly realized in languages like Greek.

I conclude the discussion in Chapter 6, pointing to future directions for the application of the present framework developed in this dissertation. For example, I briefly sketch how to extend the proposed theory to the spatial and scalar additive cases of *hasta* in Spanish.

Chapter 2

Lay of the land: The comparative structure of English *for-* and *until*-phrases

2.1 Introduction

Even though my main object of study is temporal *until*-type phrases, their strong resemblance to *for*-adverbials cannot be ignored. The main objective of this chapter is to review the close similarity between English *until* and *for*-adverbials so as to bring into the picture previous accounts of durative adverbials, which will shed some light on the puzzle of punctual *until*.

As introduced in Chapter 1, the cross-linguistic behavior of *until*-phrases in the temporal domain is still puzzling and controversial since most languages do not

overtly distinguish its durative from its punctual use lexically. One early analysis (e.g. Mittwoch 1977) relied on scope ambiguity to explain the difference, claiming that the difference between durative and punctual uses was that punctual *until* was simply durative *until* outscoping negation. However, such approaches contrast with a more recent set of accounts (e.g. Giannakidou 2002, Condoravdi 2008) that claim that the distinct behaviors attributed to temporal *until* are due to lexical ambiguity that posits the existence of a different lexical item, namely, Negative Polarity Item (NPI)-*until*.

Nevertheless, one of the aspects the ambiguity analysis leaves unexplained is the strong parallelism between *for* and *until*, since nothing like a punctual *for* has been proposed in the literature. The empirical scopal facts that *until*-phrases and *for*-adverbials share suggest that, perhaps, their scope limitations could explain their restriction to a reduced set of environments when modifying telic predicates without having to stipulate a positive vs. a negative lexical item. The scopal ambiguity theory may thus better account for the scopal constraints that seem to affect not only *until*-phrases but also other adverbials that embody similar durative properties.

The outline of this chapter is as follows: in §2, I review the striking behavior of *until* which underlies the puzzle of punctual *until*. In §3, I review the general characteristics of the two previous major approaches to punctual *until*—the scopal ambiguity approach and the lexical ambiguity approach—by emphasizing where they differ, and then I review some data from Greek, Dutch, and German that supposedly support a lexical ambiguity analysis. In §4, I suggest that no available theory as it stands can account for the phenomenon of punctual *until* cross-

linguistically. Instead, I argue for an approach that builds on the scopal ambiguity approach for the most part and yet incorporates aspects from both accounts, with the aim of capturing the broader typological picture. In §5, I present a series of shared features between temporal *until*-phrases and durative *for*-adverbials in terms of their (i) durative/atelic aspect, (ii) behavior under negation, and (iii) scopal constraints that support my hypothesis. Finally, in §6, I introduce two classical competing approaches to measure phrases: the measure function analysis *à la* Krifka (e.g. 1998) and the universal quantification approach *à la* Dowty (1979), ultimately adopting the latter as a starting point for understanding English *until* as parallel to *for*-adverbials.

2.2 The puzzle of punctual *until*

2.2.1 The difference between punctual and durative *until*

Despite being realized as the single form *until*, it is often assumed that there are two temporal *untils* in English, a durative *until* as in (1a), and a punctual *until* as in (1b).

- (1) a. John slept/didn't sleep until 5 pm.
b. John didn't arrive until 5 pm.
c. # John arrived until 5 pm.

[Adapted from Ürögdi 2013: 307, ex (5)]

Example (1a) contains a durative predicate (one that can extend throughout a period of time), whereas (1b) involves a punctual predicate (one that cannot be extended

and iterated over the course of an interval), hence the names of ‘durative’ vs. ‘punctual’ *until*. Punctual *until* requires the use of negation to be felicitous, as contrasted between (1b) and (1c). Note, however, that the terms ‘durative’ and ‘punctual’ as used in the literature on ‘until’ are technically inaccurate since, even though accomplishments are durative, in general they cannot combine with durative *until* in positive environments, as illustrated in (2a).¹ However, when negated, they can also be modified by punctual *until*, as in (2b).

(2) a. # John loaded ten bales of hay onto the wagon until 5 pm.

b. John didn’t load ten bales of hay onto the wagon until 5 pm.

Accomplishments, however, are still telic in the sense of having a definable stopping point and cannot be iterated within a given time frame (e.g. several loadings—and unloadings—of the same object onto the wagon). Thus, the crucial distinction is that only atelic predicates (statives and activities) and telic predicates on iterated readings (e.g. semelfactives like *cough*) can combine with durative *until*-XPs in both positive and negative environments, whereas a telic predicate on non-iterated readings (non-iterative achievements and accomplishments) seem to require the use of negation in order to license an *until*-phrase, hence the oddness in (1c) and (2a). I will continue to use the traditional terminology in the literature here despite this.

A second key difference is that punctual *until* elicits a non-cancellable inference that the event described by the non-negated predicate must occur after the time indicated by the complement of *until*, as in (3a). In the remainder of the disserta-

¹I assume acquaintance with Vendler’s (1957) four aspectual classes of *statives*, *activities*, *accomplishments*, and *achievements*. States and activities are atelic, but only states are considered “static.” Achievements and accomplishments are telic, but only achievements are regarded as punctual.

tion, I refer to this implication as a *factive* inference—also sometimes described in the literature as *switch-reading* or *actualization implication* (cf. Giannakidou 2002, Condoravdi 2008, Ürögdi 2013). This type of factive inference does not necessarily arise from the use of durative *until* with a negated atelic predicate, as in (3b).

- (3) a. John didn't arrive until 5 pm.
→ John arrived at 5 (or shortly after).
- b. John didn't sleep until 5 pm.
→ John slept after 5 pm **OR**
→ John stopped sleeping before 5 pm.

The factive inference appears to be non-defeasible in (3a) with a negated punctual predicate. By contrast, in (3b), when *until* modifies an atelic predicate in a negative environment, the factive inference is not obligatory. Instead, two readings are possible: that John stopped sleeping before 5 pm, or that he did not sleep at all until 5 pm. Additionally, there is a debate regarding the nature of the factive inference that originates from the use of punctual *until*: is it a conversational implicature (e.g. Mittwoch 1977), a presupposition (Karttunen 1974, Declerck 1995), an entailment (Giannakidou 2002), some sort of scalar inference (Condoravdi 2008),² or something else?

Last but not least, if we look into other languages, we sometimes find a lexical distinction between the durative and punctual uses. This is discussed next.

²Condoravdi (2008) calls it a scalar assertion following Krifka's (1995) theory of polarity items and scalar assertions. Underlyingly it ends up being similar to a scalar inference as a result of scalar alternatives that have been added into the lexical meaning of punctual *until*.

2.2.2 Languages that lexically distinguish punctual and durative ‘until’

Some languages such as Greek overtly use two distinct lexical items for durative and punctual ‘until’ (e.g. Giannakidou 2002, Condoravdi 2008). For example, Greek *mehri* ‘durative *until*’ seems to only be acceptable with atelic event descriptions in positive and negative contexts, as exemplified in (4a, b), and unacceptable with telic event descriptions in positive contexts, as reflected in (4c), thus behaving so far as expected from a durative adverbial.

- (4) a. *Itan thimomenos mehri htes.*
was angry until yesterday
‘He was angry until yesterday.’
- b. (*Mehri htes*) *dhen itan thimomenos (mehri htes).*
until yesterday not was angry until yesterday.
‘He was not angry until yesterday.’
- c. **I vomva ekseraghi mehri htes.*
the bomb exploded until yesterday
‘The bomb exploded until yesterday.’

[Adapted from Condoravdi (2008), ex. (14)]

Furthermore, when the telic predicate in (4c) is negated, *mehri* remains ungrammatical, as shown in (5a). It is precisely in these conditions—i.e. a negated telic predicate—when *mehri*’s negative counterpart *para mono* is used, as exemplified in (5b) (e.g. Giannakidou 2002, Condoravdi 2008).³

³Condoravdi (2008) further notes that durative *mehri* with negation becomes an option when the negated telic predicate is used in the imperfective aspect with the present or past perfect tense (instead of being in the perfective past tense form, as in (5a)). I illustrate this puzzling data point in

- (5) a. ?**I vomva dhen ekseraghi mehri htes.*
the bomb not exploded until yesterday
‘The bomb didn’t explode until yesterday.’
- b. *I vomva dhen ekseraghi para mono htes.*
the bomb not exploded but only yesterday
‘The bomb didn’t explode until yesterday.’

[Adapted from Condoravdi (2008), ex. (14)]

According to Giannakidou (2002) and Condoravdi (2008), *para mono* would be the direct translation of punctual *until*. In addition, the use of *para mono* triggers a non-cancellable factive inference. For instance, in (5b) *para mono* necessarily expresses that the eventuality actually occurred, and hence negating the explosion of the bomb results in a contradiction.

Furthermore, the factive inference seems to emerge with the use of *para mono* independently of the type of predicate that it combines with. A Greek consultant corroborated the following data in (6), which shows how when the actualization of the event is intended, *para mono* and not *mehri* must be used even with an atelic predicate.

(i).

- i. *I vomva dhen ihe ekseraghi mehri htes.*
the bomb not had exploded until yesterday
‘The bomb had not exploded until yesterday.’
[Adapted from Condoravdi (2008), ex. (14)]

This contrast in acceptability of durative *mehri* in negative environments between perfective, as in (5a), and imperfective aspect, as in (i), is beyond the scope of this dissertation and is instead left for future research.

(6) [Gianis does not become angry either during or after the conference.]

- a. *O Gianis den itan thimomenos mehri to telos tu*
the Gianis not was angry-PRTC until the end the.GEN
sinedriou.
conference-GEN
'Gianis wasn't angry until the end of the conference.'
- b. # *O Gianis den itan thimomenos para (mono) sto telos tu*
the Gianis not was angry-PRTC but (only) at-the end the.GEN
sinedriou.
conference-GEN
'Gianis wasn't angry until the end of the conference.'

In (6a), whether or not Gianis becomes angry after the end of the conference is left open. By contrast, in (6b), the eventuality must take place, since following such a sentence by something like *and he never became angry* would result in contradiction.⁴

In the same way that Greek *mehri* is strictly durative in that it measures the duration of an event and does not necessarily give rise to any inference about the actualization of the event when combined with an atelic predicate in a negative environment, German *bis* and Dutch *tot* also seem to lack the punctual use and do not give rise to obligatory factive inferences when modifying negated atelic predicates. For instance, Decklerk (1995), Giannakidou (2002), and Condoravdi (2008) note that these languages do not have a negative punctual *until* counterpart and use a Positive Polarity Item (henceforth, PPI) instead to express the actualization of the event: Dutch *pas*, as in (7b), and German *erst*, as in (8a) below, which are focus-

⁴According to my Greek consultant, even though *para mono* works with the stative 'be angry' in (6b), it would be more natural to use the achievement *thimono* 'get angry', which is a possible alternative in Greek.

sensitive items, roughly equivalent to English ‘only.’

- (7) a. **Marie kwam tot 9 uur (niet) aan.*
Marie came until 9 hour (not) on
‘Mary did(n’t) arrive until 9.’
- b. *Marie kwam pas om 9 uur aan.*
Marie came only at 9 hour on
‘Mary only arrived at 9.’

[Adapted from Giannakidou (2002), ex. (47)]

In (7), the Dutch durative adverbial *tot* cannot modify a negated telic predicate. If the actualization of the punctual event is intended, i.e. the fact that Marie must have arrived at some point, then the PPI *pas* as in (7b) must be used instead.⁵

Likewise, German PPI focus particle *erst* can focus times and express that the event occurred at a certain time, as shown in (8a). By contrast, German *bis* ‘until’ is strictly durative and hence at most gives rise to an ignorance (cancellable) implicature about the actualization of the event when combined with a negated telic predicate. This is corroborated by the fact that actualization implicatures that would emerge in (8b)-(8d) are cancellable and also the acceptability of a sentence such as (8e), which would require Mary getting married after dying.⁶ Possible contexts to

⁵Very interestingly in Dutch, similarly to Greek, when the present perfect instead of the perfective is used in a negative environment, the strictly durative adverbial *tot* may be slightly more acceptable with negative telic predicates, as shown in (i).

- i. ?*Marie is tot 9 uur niet aangekomen.*
Marie is until 9 hour not come
‘Mary hasn’t arrived until 9.’

Even so, the sentence in (i) would not entail the actualization of the event. Rather, all that is known is that Marie has not arrived by 9.

⁶The sentence in (8e) might sound a bit stilted out of the blue to some native speakers for other reasons, namely what I believe to be a lack of pragmatic motivation for the *bis*-phrase since it does not appear to add any new information.

the German examples in (8b,c) that establish no actualization of the event are given in brackets.

- (8) a. *Die Bombe ist erst gestern explodiert.*
 the bomb is only yesterday exploded
 ‘The bomb exploded only yesterday.’ [Condoravdi (2008), ex. (8a)]
- b. **[As of now, the bomb has not exploded yet]**
Die Bombe ist bis heute nicht explodiert.
 the bomb is until today not exploded
 ‘Up to the present day the bomb hasn’t exploded.’
- c. **[As of now, the bomb has not exploded yet]**
Die Bombe ist bis gestern nicht explodiert.
 the bomb is until yesterday not exploded
 ‘The bomb didn’t explode until yesterday.’
- d. *Bis gestern ist die Bombe noch nicht explodiert — wie es weitergegangen ist, weiss ich nicht..*
 continued aux, know I not
 ‘The bomb hadn’t exploded until yesterday yet, as for today I don’t know.’
- e. ? *Mary hat bis zu ihrem Tod nicht geheiratet.*
 Mary aux until to her death not married
 ‘Mary didn’t get married until she died.’

All in all, Greek, German, and Dutch are often reported in the literature as languages that overtly use a different lexical item from durative *until* to convey the actualization of a telic predicate at a certain point, either as an NPI combined with a negated telic predicate as in Greek or a PPI combined with a positive telic predicate

as in Dutch and German. At first sight, it seems that what the corresponding durative *untils* in all these languages have in common is their inability to generate non-cancellable factive inferences when construed with a telic predicate in a negative environment.⁷

A crucial question that arises here is the following: do these data justify that a lexical distinction between a durative and a punctual *until* is universal, i.e. applies to all languages? I next review the two main accounts for these empirical puzzles regarding durativity, factivity, and lexical ambiguity of *until*.

2.3 Scopal vs. lexical ambiguity in English

This section reviews two major accounts of the puzzle of punctual *until*, which, as they stand, cannot separately capture the cross-linguistic picture. The main disagreement is whether the answer to the puzzle stems from lexical or scopal ambiguity. I will ultimately propose that a combination of both is needed.

2.3.1 A lexical ambiguity approach

2.3.1.1 The basic intuition of the analysis

I begin with the lexical ambiguity approach (e.g. Horn 1970, 1972, Karttunen 1974, Declerck 1995, Giannakidou 2002, and Condoravdi 2008), because it has recently

⁷Another issue that arises is the question of aspect, left for future research. Independent of whether a factive inference is obligatorily generated or not, the durative *until* counterpart in these languages might not even be able to combine with a negated telic predicate to begin with. This is generally the case when the perfective aspect, instead of the imperfective, is used.

received more attention and support. This approach claims that durative *until* behaves differently from punctual *until* simply because they are not the same *until*, though in languages like English or Spanish the two separate lexical items are realized by the same form.

Condoravdi (2008), a fairly recent version of this approach, claims that durative *until* combines with an atelic event description (states and activities) in positive and negative contexts and simply asserts that an eventuality extends (or does not extend) throughout a certain time interval. Furthermore, in a negative environment, durative *until* with atelic predicates leads to two ambiguous readings: a ‘not-throughout’ (neg > until-XP) and a ‘throughout-not’ (until-XP > neg) reading, depending on whether negation scopes above or below the *until*-XP, respectively. Under Condoravdi’s approach, in line with Giannakidou’s (2002) analysis, any inference that durative *until* modifying atelic predicates may give rise to is a conversational implicature, which could easily be cancellable. In this way, a ‘throughout-not’ interpretation of a sentence as in (9) is predicted to be consistent with a context in which John remains not angry after 2 pm and never becomes angry at all.

(9) John was **not** angry **until 2 pm**.

- i ‘**Not-throughout**’ reading (neg>*until*-XP): John was angry, but it is not the case that John was angry until 2 pm. This conversationally implicates that John stopped being angry before 2 pm.
- ii ‘**Throughout-not**’ reading (*until*-XP>neg): Throughout the interval in question that ended at 2 pm, John was not angry. This conversationally implicates that John got angry after 2 pm.

The cancelability of an implicature about the actualization of the event from a ‘throughout-not’ interpretation, though, is debatable.^{8,9}

Instead, Giannkidou (2002) and Condoravdi (2008) predict that a non-cancelable inference about the actualization of the event only follows from punctual *until*, which modifies telic predicates (achievements and accomplishments) as long as negation is present.¹⁰ The essence of the argument is that punctual *until* is a completely distinct lexical item from durative *until*, whose use is licensed only under negation, since it is a Strong NPI (henceforth, SNPI). Very broadly speaking, SNPIs are items licensed only under a subset of downward-entailing operators, like negation (e.g. see Gajewski 2008, 2011, Chierchia 2013). As a consequence, the meaning given to punctual *until* is drastically different from durative *until* in that, in one way or another, it is lexically specified to be able to take a telic event description when scoping under negation so that it can then obligatorily locate such a described punctual eventuality (e.g. John’s becoming angry) in a time interval that starts after the time denoted by the temporal complement of punctual *until* (e.g. from 2 pm onwards). This is schematized in (10).

⁸The judgments from my English consultants differ in this regard, since they agree in that John is still expected to become angry after 2 pm for the ‘throughout-not’ interpretation in (9).

⁹Previous variants of such an approach, e.g. Karttunen (1974) and Declerck (1995), support the view that the inference is always non-cancellable as long as negation is present, regardless of the telicity of the predicate.

¹⁰Condoravdi (2008) further notes that the factive reading comes with the implication that the actualization of the event could well have occurred earlier: we expected the event to have taken place earlier. These types of inferences will be dealt with in Chapter 4.

- (10) a. * John became angry **until 2 pm.**
 (Ungrammatical because it is not a SNPI licensing context.)
- b. John **didn't** become angry **until 2 pm.**
 (Only 1 reading: neg>*until*-XP, since it is a SNPI &
 Non-cancellable inference that John became angry after 2 pm.)

As observed in (10), the use of punctual *until* would not depend on a scope-based relation with negation, since it is only triggered under the negation operator, hence making any scope ambiguity impossible, unlike durative *until*. Finally, punctual *until* would somehow incorporate the actualization of the event already in its meaning—e.g. via presuppositional content (Karttunen 1974 and Declerck 1995), an entailment (Giannakidou 2002), or as a sort of scalar inference added to the assertion (Condoravdi 2008)—with the common purpose of ensuring that the factive inference cannot be cancelled.

2.3.1.2 Shortcomings of the lexical ambiguity approach

Under the lexical ambiguity approach, the meaning given to punctual *until* drastically differs from the denotation of the durative version, as they are considered two distinct lexical items with contrastive functions. The overall claim is that punctual *until* in English can only scope below negation because of its SNPI nature, and when it does it gives rise to a non-cancellable inference about the actualization of the telic event description. The strongest piece of evidence that supports such an account is the fact that some languages, such as Greek, lexically distinguish the punctual from the durative uses of *until* overtly.

Nevertheless, such an account fails to explain why the majority of languages studied in prior literature (e.g. English, all Romance languages, Japanese, Korean) do not make such a lexical distinction. I illustrate this below for Portuguese in (11), Catalan in (12), Japanese in (13), and Korean in (14).¹¹ For each language, I give the paradigm consisting of their ‘until’ counterpart modifying a durative predicate such as ‘study’ in both positive and negative environments, as well as modifying a punctual predicate such as ‘arrive’ in both positive and negative environments. Note that they use the same lexical word for all uses. Further observe that the punctual predicate can only be modified by the ‘until’-XP in negative environments and under those conditions it also gives rise to the factive inference that John arrived at some point after two.

- (11) a. *O João estudou até as duas da tarde.*
 the John studied until the two of.the afternoon
 ‘John studied until two in the afternoon.’
- b. *O João não estudou até as duas da tarde.*
 the John not studied until the two of.the afternoon
 ‘John didn’t study until two in the afternoon.’
- c. # *O João chegou até as duas da tarde.*
 the John studied until the two of.the afternoon
 ‘John arrived until two in the afternoon.’
- d. *O João não chegou até as duas da tarde.*
 the John not arrived until the two of.the afternoon
 ‘John didn’t arrive until two in the afternoon.’
- (This implicates that John arrived after two.)

¹¹I would like to thank Ayaka Sugawara for the Japanese examples, and Jungsoo Kim for the Korean ones.

- (12) a. *El Joan va estudiar fins a les dues de la tarda.*
 the John AUX study until to the two of the afternoon
 ‘John studied until two in the afternoon.’
- b. *El Joan no va estudiar fins a les dues de la tarda.*
 the John not AUX study until to the two of the afternoon
 ‘John didn’t study until two in the afternoon.’
- c. # *El Joan va arribar fins a les dues de la tarda.*
 the John AUX arrived until to the two of the afternoon
 ‘John arrived until two in the afternoon.’
- d. *El Joan no va arribar fins a les dues de la tarda.*
 the John not AUX arrived until to the two of the afternoon
 ‘John didn’t arrive until two in the afternoon.’
- (This implicates that John arrived after two.)
- (13) a. *John-wa gogo ni-ji-made benkyoo-sita.*
 John-TOP afternoon two-o’clock-until study-did
 ‘John studied until two in the afternoon.’
- b. *John-wa gogo ni-ji-made benkyoo-si-nak-atta.*
 John-TOP afternoon two-o’clock-until study-do-NEG-PAST
 ‘John didn’t study until two in the afternoon.’
- c. *John-wa gogo ni-ji-made toochaku-sita.*
 John-TOP afternoon two-o’clock-until arrival-did
 ‘John arrived until two in the afternoon.’
- d. *John-wa gogo ni-ji-made toochaku-si-nak-atta.*
 John-TOP afternoon two-o’clock-until arrival-do-NEG-PAST
 ‘John didn’t arrive until two in the afternoon.’
- (This implicates that John arrived after two.)

- (14) a. *John-i ohwu twu-si-**kkaci** kongpwuha-yess-ta.*
 John-NOM afternoon two-hour-until study-PST-DECL
 ‘John studied until two in the afternoon.’
- b. *John-i ohwu twu-si-**kkaci** kongpwuha-ci*
 John-NOM afternoon two-hour-until study-CONN
anh-ass-ta.
 NEG.do-PST-DECL
 ‘John didn’t study until two in the afternoon.’
- c. # *John-i ohwu twu-si-**kkaci** tochakha-yess-ta.*
 John-NOM afternoon two-hour-until arrive-PST-DECL
 ‘John arrived until two in the afternoon.’
- d. *John-i ohwu twu-si-**kkaci** tochakha-ci*
 John-NOM afternoon two-hour-until arrive-CONN
anh-ass-ta. → John arrived after two.
 NEG.do-PST-DECL
 ‘John didn’t arrive until two in the afternoon.’
 (This implicates that John arrived after two.)

This lack of an overt lexical distinction across languages suggests that it cannot be an accidental lexical coincidence that occurs in all of these languages. More specifically, an analysis that relies on lexical ambiguity between the two *untils* is unable to account for this recurring syncretism cross-linguistically since there is no apparent correlation between the meanings given to durative *until* and punctual *until*, as one meaning does not appear to be directly derivable from the other one. For example, Condoravdi (2008) treats durative *until* similarly to a time-frame adverbial with universal quantification over time intervals for which the predicate must hold. On the other hand, punctual *until* has an existential—and not universal—force, which, when combined with negation, states that there is no instantiation of an event within

the time interval denoted by the temporal complement of *until*. Only the latter gives rise to the factive inference, which is incorporated as part of the assertion.¹²

Taking all of these weaknesses into account, the lexical ambiguity approach calls for further revision, to say the least. There was, in fact, an earlier story, which did not have to stipulate an NPI-*until*: i.e. the scopal ambiguity approach, which treats both durative *until* and punctual *until* as the same unique lexical item, though such an approach faces its own difficulties on explaining other facts that the lexical ambiguity approach can more easily account for, as discussed next.

2.3.2 A scopal ambiguity approach: One *until*

2.3.2.1 The basic intuition of the analysis

The scopal ambiguity approach (e.g. Klima 1964, Heinämäki 1974, Mittwoch 1977) was put forward for those languages that use the same word for both durative and punctual functions, such as English. Punctual *until* is simply durative *until* above negation. In essence, *until* looks for an atelic predicate (or a telic predicate on an iterated reading), explaining why it cannot modify a non-iterative telic predicate in a positive environment. However, whenever such a predicate is negated, then *until* can scope above it, since negation is a predicate modifier that can turn a telic predicate into one that satisfies the durative requirement of *until*. Whenever the predicate is already atelic, *until* can modify it in both positive and negative environments.

The range of scopal possibilities for atelic (or iterative telic) predicates is

¹²See Condoravdi (2008) for a detailed description of the formalization specifications of durative *until* vs. punctual *until*.

illustrated in (15). Note how in negative environments, the *until*-XP can scope either below or above negation, as shown in (15b) and (15c), respectively.

- (15) a. *until*-XP (atelic predicate)
- b. Not (*until*-XP (atelic predicate))
- ‘**Not-throughout**’ reading with an atelic (or iterative telic) predicate.
- c. *until*-XP (Not (atelic predicate))
- ‘**Throughout-not**’ reading with an atelic (or iterative telic) predicate:
Only conversationally implicates the actualization of the event after x.

Instead, the range of scopal possibilities for non-iterative telic predicates is much more reduced, as in (16), where the *until*-XP can only scope above a negated non-iterative telic predicate. Further note how, in opposition to the lexical ambiguity approach, the structure in (16b) is assumed to be disallowed (since punctual *until* is no longer considered a SNPI licensed under negation), whereas the structure in (15c) (what would be punctual *until* outscoping negation) is assumed to be acceptable.

- (16) a. * *until*-XP (telic predicate)
- Disallowed because the *until*-XP wants an atelic (or iterative telic) predicate.
- b. * not (*until*-XP (telic predicate))
- Disallowed because the *until*-XP wants an atelic (or iterative telic) predicate.

c. until-XP (Not (telic predicate))

- **‘Throughout-not’ reading with a non-iterative telic predicate:**

Only conversationally implicates the actualization of the event after XP.

[Adapted from Condoravdi (2008), ex. (10-11)]

An additional contrast between the lexical and scopal ambiguity approaches is that under the scopal approach the factive inference appears for both atelic and telic predicates under the ‘throughout-not’ interpretation, as indicated in (15c) and (16c). However, unless any other machinery is added, it originates as a simple conversational implicature from the fact that the negated predication no longer holds when the time interval ends. Hence, the scopal ambiguity approach predicts that the actualization of the event should in principle be cancellable even with punctual predicates, contrary to many native speaker judgements.

2.3.2.2 Shortcomings of the scopal ambiguity approach

An approach in the spirit of Mittwoch (1977) attributes any difference in acceptability of *until*-phrases between telic and atelic predicates solely to the atelic prerequisite of *until* and its scope relation with respect to negation, if present.

Even though the scopal ambiguity approach may sound more appealing since it treats both durative and punctual *until* as the same, it still faces some challenges. First, the scopal theory as it stands does not have a good explanation for why the conversational implicature obtained from *until* scoping above negation may not be canceled. Traditionally, in Gricean pragmatics (e.g. following Grice 1975, 1989), such inferences are generally understood as being easily defeasible or cancellable.

This calls at least for a refinement of the mechanism that generates such implicatures. Second, this analysis alone cannot account for a system which overtly does have an additional lexical item, e.g. an NPI-*until* as in Greek. This suggests that we want a scopal theory that could in principle admit the existence of a different lexical item, one whose meaning can ideally easily derive from its durative counterpart, and it just happens to be the case that it lexicalizes differently under negation. This would consist of a simple PPI/NPI-*until* contrast.

2.4 Towards a universal theory

As discussed above, a flaw in one theory ends up being a promising aspect in the other. As a consequence, neither of the two theories described alone can readily capture the typology of *until*-phrases in the temporal domain, though this discussion does highlight the factors that require improvement. For instance, how can the lexical ambiguity approach account for the straightforward scopal ambiguity between a ‘not-throughout’ and a ‘throughout-not’ reading without having to posit distinct lexical entries for durative and punctual *until*? How can the scopal ambiguity approach ensure the factivity of punctual *until* (i.e. when *until* outscopes negation)? And how can it explain the genuine lexical distinction in languages like Greek?

I will propose a new theory that integrates insights from both accounts that provides a more general typological picture. I will ultimately claim the distinction between one type of *until* or another should be stated in terms of a universal adverbial vs. an existential time-frame adverbial. Contra Condoradvi (2008), this lexical contrast is not found within one language, but rather across languages. The exis-

tential version will be able to derive PPI to NPI lexemes in languages that make a lexical distinction. The choice between which type of *until* (universal or existential) a language employs appears to be a parametric choice of Universal Grammar.

A purely scopal analysis of a durative *until* would be most economical for languages that do not have two items, such as English. Thus I begin by looking into English *until*, for which I show that a refinement of the scopal analysis together with a system that gives rise to obligatory, hence non-cancellable, scalar implicatures (as in many current proposals) seems to be on the right track. The formal details of such an analysis will be given in Chapters 3 and 4. First, however, in the next sections I review the strong similarities of *until*-phrases with *for*-adverbials and their traditional accounts, which bolster a case for a scopal analysis of *until* as a universal adverbial in English.

2.5 Parallelism between temporal *until* and *for*: Empirical generalizations

In this section, I illustrate the parallelisms between temporal *until*-phrases and *for*-adverbials, both of which introduce a time interval that specifies how long an event described by the modified predicates goes on. Despite their strong resemblance, the literature on *for* has focused mostly on its restriction to certain aspectual classes of modified predicates and scopal interactions of *for* adverbials with other scopal elements in the sentence, while the literature on *until* has focused mainly on the distinction between durative and punctual *until* and the relationship of the latter to

negation. This divergence has led to radically different analyses of the two prepositions. However, given the strong parallelism that I demonstrate between the two prepositions, I argue instead for a more unified analysis. I begin my argument by discussing three core similarities between the two prepositions: (i) both select for a durative predicate, (ii) when scoping above negation both implicate that the eventuality described by the predicate begins after the relevant time interval ends, and (iii) both are subject to the phenomenon of *Differentiated Scope*, which I define below.

2.5.1 Durativity

The first similarity between *for*-adverbials and *until*-phrases is based on the widely held assumption that measure adverbials modify “atelic, durative predicates” (Deo and Piñango 2011: 1). Besides *measure adverbials*, they have also been called *aspectual adverbials* or *durative adverbials* when they refer to time rather than space (Champollion 2010).

Durative adverbials indicate that an eventuality extends over a certain time interval. This is exemplified in (17), where *until* and *for* are both acceptable when modifying the stative *be angry*, since it can hold throughout a period of time.

(17) John was angry for 2 hours/until 2 pm.

By contrast, both *for* and *until* are incompatible with a non-iterative telic event description such as *become angry* in a positive environment, as in (18) (leaving possible iterative interpretations in (18) aside for now).

(18) # John became angry for 2 hours/until 2 pm. (continuously and not repeatedly)

On the whole, the contrast in (17) and (18) further confirms why, since at least Verkuyl (1972, 1989), durative adverbials of the type ‘for x time’ have been widely used as one of the most reliable diagnostics of atelicity (Champollion 2010).¹³

There are some known exceptions to this generalization. Under certain circumstances a durative adverbial may also be able to modify a telic predicate in a positive environment: (i) when the telic predicate does not necessarily entail that the event described is complete (e.g. accomplishments like *read a book*)¹⁴ or (ii) when the telic predicate (usually punctual/ semelfactive) receives an iterative interpretation (e.g. *cough* multiple times within a described time interval) (Marín and McNally 2011). In this respect, the behavior of *for*-adverbials and *until*-phrases is again identical, as illustrated in (19).

- (19) a. John read a book for 2 hours/until 2 pm.
b. John coughed for 2 hours/until 2 pm.

In (19a), the interpretation that arises with the accomplishment *read a book* is that

¹³When I assert that durative adverbials serve as an indicator of atelicity I am disregarding their *result state-related* interpretation (as named in Piñón 1999, via Champollion 2010, and also discussed in Dowty 1979 under the name of “internal reading”) because on that reading both *until*-phrases and *for*-adverbials could combine with punctual predicates on a positive environment without the event acquiring a continuous (or iterative) reading. Under those circumstances what the duration of the interval introduced by *for/until* modifies is the result state of the event and not the event itself. For instance, in (i), the interval does not refer to how long John took to open the window but indicates how long the window stayed open after John opened it.

- i. a. John opened the window for 2 hours.
b. John opened the window until 2 pm. [based on Piñón 1999, via Champollion 2010]

It is also worth noting that not everyone gets these result interpretations with equal ease.

¹⁴According to Krifka (1998) what makes *read a book* special is a generic type of incrementality that allows for re-reading parts of the book, unlike other types of accomplishment such as *eat a slice of cake*. Another circumstance in which accomplishments become modifiable by durative adverbials could be via aspectual coercion (see Dowty 1979, Krifka 1998, de Swart 1998, Rothstein 2004).

the event described is unfinished in that the whole book has not yet been read. The punctual predicate *cough* in the latter case is interpreted on an iterated reading: e.g. John coughs not only once but again and again throughout a period of time. However, this iteration cannot be ongoing throughout a temporal stretch without gaps between each coughing instantiation. This is in line with van Geenhoven's (2004, 2005) claim that the ability of a punctual predicate to acquire a frequentative interpretation with gaps is key in the acceptability of a durative adverbial so that it can satisfy the adverbial's atelicity precondition.

Therefore, a first parallelism between *for*-adverbials and *until*-phrases is their restriction to durative predicates. This durativity may be satisfied in specific ways: (i) when the *for/until*-XP modifies an atelic predicate; (ii) when it modifies a telic predicate, usually an accomplishment, which does not necessarily entail that the event described has culminated; or (iii) when it combines with a telic predicate that can have an iterative interpretation.

2.5.2 Behavior with negation

The next property is the ability of *until*-phrases to take scope above and below negation, which may lead to an ambiguity between a 'throughout-not' and a 'not-throughout' reading, respectively (the former seems to be the only possible interpretation with a telic predicate). In this regard, *for*-adverbials also mirror *until*-phrases (Smith 1975, cf. Champollion 2011), as shown in the parallelism in (20).

- (20) a. John was **not** angry **for 2 hours**.
- i ✓ **‘Throughout-Not’ reading:** For 2 hours, John wasn’t angry.
 - ii ✓ **‘Not-Throughout’ reading:** It is not the case that John was angry for 2 hours (e.g. he was angry only for one hour).
- b. John was **not** angry **until 2 pm**.
- i ✓ **‘Throughout-Not’ reading:** Until 2 pm, John wasn’t angry.
 - ii ✓ **‘Not-Throughout’ reading:** It is not the case that John was angry until 2 pm. (e.g. he was angry only until 1 pm.).

Such an ambiguity disappears with a non-iterative telic predicate. This follows from scope: when *for*-adverbials and *until*-phrases are combined with a telic predicate, a ‘throughout-not’ interpretation is the only available reading since the durative selectional requirement of the durative adverbial can only be satisfied when the asserted telic predication is negated.

- (21) a. John did **not** become angry **for 2 hours**.
- i ✓ **‘Throughout-Not’ reading:** For 2 hours, John didn’t become angry.
 - ii ✗ **‘Not-Throughout’ reading:** *It is not the case that John became angry for 2 hours.

- b. John did **not** become angry **until 2 pm**.
 - i ✓ **‘Throughout-Not’ reading**: Until 2 pm, John didn’t become angry.
 - ii ✗ **‘Not-Throughout’ reading**: *It is not the case that John became angry until 2 pm.

Both (a) and (b) sentences are acceptable and unambiguous. Moreover, whether the *for*-adverbial is outscoping negation in (21a) is not under debate. Instead, whether the *until*-XP in (21b) is outscoping negation is what is under debate. Leaving this controversy aside, the most important aspect to note here is that the ambiguity does or does not arise for both *for*-adverbials and *until*-phrases in a parallel fashion. When they are placed in negative environments they also fully resemble one another.

In addition to the scopal interaction with negation, *for*-adverbials also seem to share the property of giving rise to the factive inference with *until*-phrases under the ‘throughout-not’ interpretation. This point is illustrated in (22) with both an atelic and a telic type of predicate.

- (22)
- a. John was not angry **for 2 hours**. ?In fact, he never became angry.
 - b. John didn’t become angry **for 2 hours**. ?In fact, he never became angry.
 - c. John was not angry **until 2 pm**. ? In fact, he never became angry.
 - d. John didn’t become angry **until 2 pm**. # In fact, he never became angry.

To some extent, both *for*-adverbials and *until*-phrases seem to generate the factive inference when uttered out of the blue. Nevertheless, with appropriate contextual

support, the degree of cancelability of this inference may vary between them. Consider the following context in (23), in which it is possible to cancel the implicature arising with *for* but not with *until*.

(23) **[I arrived at the bus stop at 1:40 pm. I started to wait there for John so we could take the bus together]**

- a. John didn't arrive **for 20 minutes**. At that point I called him and he told me not to wait for him, so I took the bus by myself.
- b. John didn't arrive **until 2 pm**. #At that point I called him and he told me not to wait for him, so I took the bus by myself.

In (23), it appears that the inference originated by the use of *until* is stronger than the inference originated by the use of *for*.

All in all, despite the fact that *for*-adverbials mirror the behavior of *until*-phrases in that they also require the obligatory presence of negation when construed with a telic predicate, as well as their predisposition to generate a factive inference, no such a thing as a different lexical item, i.e. a punctual *for*, has been proposed in the literature. Such a parallelism thus weakens the supposed uniqueness of punctual *until* and calls into question its status as a separate lexical item for English-like languages.

2.5.3 Differentiated Scope Phenomena

A third commonality between *until*-phrases and *for*-adverbials has to do with their identical scope behavior with regard to quantificational elements in the clause. I present three main empirical observations about scope: (i) their strict tendency to

present narrow scope with respect to other scope-bearing elements in the clause, which may be suspended (ii) in the presence of another scope-bearing element (including negation) or (iii) whenever an iterative (or frequentative) temporal distribution is made available. This restricted scopal behavior has been known and discussed since Carlson (1977a, b) (cf. Chierchia 1998). A more recent discussion is also found in Zucchi and White (2001), van Geenhoven (2004), Kratzer (2008), Champollion (2010), and Deo and Piñango (2011), among others, for *for*-adverbials. Here I display *for*-adverbials along with *until*-phrases on a par to continue the argument for their close parallelism.

2.5.3.1 Narrow scope behavior for right-adjoined durative adverbials

First of all, a quantified object or indefinite DP must take wide scope with respect to *for*-adverbials and *until*-phrases, except in a very limited set of cases that will be discussed in the sections below. This behavior for indefinite DPs is observed in (24a), where the (weak) indefinite¹⁵ can only be interpreted with wide scope, which explains its deviance as it describes a rather unusual state of affairs with a non-iterative telic predicate: there is a rabbit that was repeatedly killed by John over and over again within the given time frame. This contrasts with bare plurals (or mass nouns), which take narrow scope with respect to the durative adverbial and thus acquire a natural reading, as the acceptability of (24b) illustrates: over the course of the given interval there are several rabbits that were each killed (once) by John. To

¹⁵The weak-strong contrast of indefinites refers to whether it presupposes the existence of individuals satisfying their restriction (Milsark 1974 via Chierchia 1998). Strong indefinites do whereas weaker indefinites do not.

the extent that bare plurals are understood as having existential force, their scope behavior clearly differs from the behavior of weak indefinites (which is problematic for theories that treat them equally):

- (24) a. # John killed a rabbit for 2 hours/until 2 pm.
b. John killed rabbits for 2 hours/until 2 pm.

Such a constrained scope behavior exemplified in (24) was originally observed in Carlson (1977a, b) and is known as *Differentiated Scope*.

It is crucial to note here that the contrast in (24) primarily derives from scope, and not from, say, a durative requirement of the temporal adverbial. A wide scope interpretation of a right-adjoined time adverbial is systematically absent, even when the temporal adverb modifies an achievement predicate that is actually iterable (e.g. *dial a wrong phone number*) or an atelic predicate (e.g. *pet a dog*), which would overcome any durativity/telicity impediment. In (25), the wide scope reading of the indefinite DP is still the only possible interpretation.

- (25) a. John dialed a wrong phone number for 5 minutes/until 5 pm.
[Adapted from Kratzer (2008), ex. (23a)]
b. John pet a dog for 2 hours/until 2 pm.

In (25a), the same wrong phone number is the one being dialed over and over again throughout the specified time interval. There is nothing about the meaning of the other *a priori* potential scope interpretation—i.e. the indefinite DP taking narrow scope—that could justify why such a reading is not available, a reading that would be interpreted as *John dialed different wrong phone numbers over the course of five*

minutes (Champollion 2010). Likewise, in (25b), even though John petting different dogs over the course of the interval in question would potentially be a natural interpretation, one infers that it is one single dog who got pet for the given duration.

Further note that the only possible interpretation that arises from an indefinite DP is one that essentially resembles the meaning obtained if the object were a referential-DP instead. Compare the readings in (24a) and (25) to (26).

- (26) a. # John killed the rabbit for 2 hours/until 2 pm.
b. John dialed the wrong phone number for 5 minutes/until 5 pm.
c. John pet the dog for 2 hours/until 2 pm.

This narrow scope behavior is not exclusive to *for*-adverbials and *until*-phrases. Carlson (1977b) already noted that there are other time adverbials that behave in very much the same fashion, such as English *repeatedly*, *since*, and *all-time* adverbials, whenever they are right-adjoined, as illustrated in (27).

- (27) a. # John killed a rabbit **repeatedly**.
b. # John killed a rabbit **since 5**.
c. # John killed a rabbit **all last year**.

In (27), it must still be the weak indefinite which takes wide scope despite the fact that one could think that the trigger of the other scope reading would make sense as a repair strategy to save the strange state of affairs described in (27) (cf. Champollion 2010), resulting in a meaning similar to the one obtained with the corresponding bare plural direct object in the counterparts in (28).

- (28) a. John killed rabbits **repeatedly**.

- b. John killed rabbits **since 5**.
- c. John killed rabbits **all last year**.

The examples thus far have shown the narrow scope behavior of durative adverbials with respect to singular indefinites in object position. Yet this behavior also applies with respect to an indefinite DP in subject position as well as to other types of quantified-DPs (not only singular indefinites) in both object and subject positions (Zucchi and White 2001, Champollion 2010). This includes plural indefinites (other than bare plurals) and quantified DPs, as the following examples with the plural indefinites *some/many* and the numeral quantifier *thirty* demonstrate in both object and subject positions:

- (29) a. # John killed a rabbit/ some/many/thirty rabbits for 2 hours/until 2 pm.
- b. # A person/ some/many/thirty people reached the top for 2 hours/until 2 pm.

In (29a), the only available scope reading is one in which John spent the whole interval killing each of the rabbits at the same time over and over again, that is, a narrow scope interpretation of the durative adverbial. Likewise, in (29b), the only possible interpretation is one in which the same person or group of *some/many/thirty* people kept reaching the top over and over again, and hence the durative adverbial is also taking narrow scope with respect to the scope-bearing subject.

In sum, a quantified DP in subject or object position seems to have obligatory wide scope with respect to a right-adjoined temporal adverbial, even when this results in semantic oddness. Bare plurals or bare mass nouns instead seem to be able to scope below the durative adverbial, which results in a more natural reading

when the time adverbial modifies a non-iterative telic predicate. One might already hypothesize that a quantified-DP must obligatorily scope above the durative adverbial. However, this is not always the case, as there is a specific and limited set of exceptions, which is presented next.

2.5.3.2 Pluractionality and suspension of narrow scope behavior

Zucchi and White (2001) note that when another universal quantifier like *every day* intervenes, or other pluractional adverbials like *day after day* (cf. Beck and von Stechow 2007, Champollion 2016), the constraint of wide scope of the indefinite quantified DP seems to be relaxed, and the DP object may take narrow scope with respect to the right-adjoined time adverbial. This suspension of narrow scope behavior is also observed for *until*-phrases, as in (30), where the (a) sentences are pragmatically odd but the (b) sentences sound natural with the inclusion of the pluractional adverbial *every day*.

- (30) a. # John found a flea on his dog for a month/until yesterday.
b. John found a flea on his dog **every day** for a month/until yesterday.

[Adapted from Zucchi and White (2001), ex. (17b)]

The (a) examples in (30) are pragmatically odd because the only possible interpretation is the wide scope reading of the indefinite: *there is a flea that John found on his dog over the course of a one-month time interval*. By contrast, when an iterative adverbial intervenes, the indefinite *a flea* no longer has to outscope the right-adjoined time adverbial, hence allowing a much more natural sounding interpretation: *on every day over the course of a one-month time interval, John found a (different)*

flea on his dog (note that this is very much in line with the interpretation obtained with bare plurals and mass nouns, e.g. *John found fleas on his dog for a month/until yesterday*, Dowty 1979).

Moreover, suspension of a narrow scope reading of the right adjoined durative adverbial is also observed in the presence of negation. Recall that durative adverbials can take scope above and below negation, where a ‘throughout-not’ interpretation might be the only possible reading for a telic predicate. Under those conditions, the durative adverbial may also outscope an indefinite DP-object/subject in the clause. This is further exemplified in (31) for clarity.

- (31) John didn’t kill a rabbit for 2 hours/until 2 pm.
- i ✗ **‘Not-Throughout’ reading:** #It is not the case that John killed a rabbit for 2 hours/until 2 pm.
 - ii ✓ **‘Throughout-Not’ reading:** For 2 hours/until 2 pm, John didn’t kill a rabbit (≈ For 2 hours/until 2 pm, John didn’t kill rabbits)

Overall, quantified DP-subjects/objects can also obtain an interpretation similar to bare plurals in the presence of yet another scope-bearing intervener, like *every day* or negation. I call this phenomenon *suspension of Differentiated Scope*.

2.5.3.3 Context and suspension of narrow scope behavior

Finally, appropriate context may also suspend Differentiated Scope. For instance, the example in (32a), with a *for*-adverbial or an *until*-phrase, might make no sense when uttered out of the blue since John would be required to take the same pill again

and again. However, its acceptability greatly improves as in (32b) when placed in a context that discusses the daily intake of a pill by a patient (Moltmann 1991, cf. Champollion 2010): John no longer needs to take the same pill again and again, suggesting that *a pill* can then scope below the right-adjoined time adverbial.

- (32) a. # John took a pill for a month/until yesterday.
b. [**The doctor is wondering about John’s daily intake. The nurse replies:**]

John took a pill for a month/until yesterday.

[Adapted from Moltmann (1991) ex. (43) and Champollion (2010): 181, ex. (47)]

Such an observation is further corroborated in Deo and Piñango (2011), who claim that even though the wide scope reading of measure adverbials is rarely possible, if appropriate contextual information is made available, it may then be possible, thus allowing for “the distribution of the indefinite over parts of the measuring entity” (p. 303). Consider (33) in a context in which we know that a specific bicycle particularly designed to carry children changes owner every two years.

- (33) This bicycle carried three children for twenty years/until last year.

[Adapted from Rothstein (2004), cf. Landman and Rothstein (2009)]

The sentence in (33) is felicitous even though it does not need to be the same children over the course of the discussed twenty years, which would furthermore be impossible based on world-knowledge, as the children would no longer be children for some subinterval within the interval. Additionally, Deo and Piñango (2011) suggest that the distribution of the object needs to be regular over parts of the time interval

in question (e.g. every two years as previously suggested by contextual information). For this, they give another example that shows a similar point: sometimes world-knowledge (with no need for specific contextual information to be present) makes a regular distribution already salient, as in (34).

(34) We built a huge snowman in our garden for many years/until last year.

[Adapted from Deo and Piñango (2011), ex. (17b)]

The example in (34) is understood as involving several snowmen, presumably due to world knowledge, which would make the distribution over winter seasons salient.¹⁶

On the whole, there is a specific set of exceptions in which right-adjoined time adverbials, including both *for*-adverbials and *until*-phrases, can suspend their narrow scope behavior with respect to other scope-bearing elements in the sentence. They may not only do so in the presence of negation or an iterative adverbial such as *every day*, but also due to world knowledge or a supporting context that somehow specifies a distribution over parts of the time interval in question. Perhaps such a salient partition triggers a covert pluractional adverbial that acts in the same fashion as overt iterative adverbials like *every day*.

¹⁶As a blind reviewer pointed out to me there can be some poorly understood exceptions like the following: *A camera followed their activities for three days*, where *a camera* may be ambiguous between a narrow and a wide scope reading with respect to the durative adverbial. In the narrow scope interpretation of *a camera*, it is not obvious what the covertly salient distribution would look like. I hypothesize that this could be due to the contextual and thematic properties of the verb *follow*, where we might not care whether it is the same camera or different cameras as long as there is always one camera filming. Note however the contrast with *A policeman followed them for three days*, where *a policeman* more strongly favors a wide scope reading.

2.5.4 Summing up

By and large, *until*-phrases mirror *for*-adverbials with regard to three peculiar characteristics: (i) durativity in the sense of only applying to a predicate that somehow licenses an atelic reading, (ii) factivity under negation, and (iii) highly restricted scopal behavior subject to identical constraints. Yet while the existence of two *untils* has often been postulated—i.e. a durative and a punctual one—the existence of two *fors* has not. Instead, prior accounts have been scopal in nature. In view of these commonalities, it certainly appears worthwhile to consider a unified account of *for*-adverbials and *until*-phrases in English by revisiting the scopal account: their constrained scopal behavior together with their restriction to atelic and iterative telic predicates can account by itself for the NPI properties of punctual *until*. This takes us to the main difference between *for* and *until*: the issue of factivity. But even with respect to this property, we have observed that both of them in a negative environment under the ‘throughout-not’ interpretation can implicate, minimally, the actualization of the event at some point after the time interval introduced by the temporal phrase ceases to hold. As a starting point towards a unified account, I next review two influential theories of *for*-adverbials that could in principle serve as a starting point for an analysis of *until*.

2.6 Prior approaches to measure phrases

In this section, I outline in general terms two significant and competing proposals that have been put forward to understand the nature of durative adverbials, more

specifically, *for*-adverbials, with the purpose of not only implementing one of these analyses for *for*-adverbials but also extending it to English *until*, since *for* and *until* in English seem to share nearly all of their aspectual properties.

2.6.1 An overview of two prior proposals: universal quantification vs. temporal framing

The restriction of temporal measure phrases to durative predicates has led to two main analyses: (i) a measure function analysis over events *à la* Krifka (1986, 1989, 1992), and (ii) a universal quantificational analysis over time intervals *à la* Dowty (1979). As Deo and Piñango (2011) point out the difference between them lies in whether divisivity or atelicity is assumed to be a selectional requirement of *for* (Krifka’s approach) or, whether it is a consequence of *for*’s universal quantification as part of its meaning (Dowty’s approach), as illustrated in (35).

- (35) a. $\llbracket \text{For } x\text{-time} \rrbracket = \lambda P. \lambda e : \text{atelic}(P)[P(e) \wedge \tau(e) = x\text{-time}]$
 (\approx There is an atelic predicate and the duration of the event that it describes is *x-time*)

[Adapted from Champollion (2016), ex. (77)]

- b. $\llbracket \text{For } x\text{-time} \rrbracket = \lambda P. \lambda t [x\text{-time}(t) \wedge \forall t' [t' \subseteq t \rightarrow P(t')]]$
 (\approx There is an interval whose duration is *x-time* and for all the subintervals of such an interval the predicate holds)

[Adapted from Deo and Piñango (2011), ex. (11)]

A priori, (35a) assumes that the modified predicate is a predicate over events,

whereas (35b) assumes that it is a predicate over times. Another key difference, looking only at their assertive content, is that the durative adverbial in (35b) is considered a type of universal adverbial, whereas the durative adverbial in (35a) is treated as an existential adverbial of temporal framing—I call it *existential* in the sense that its assertion only contains existential force over the event it modifies, which becomes evident once the event variable is closed.

More specifically, the measure function analysis stipulates that durative adverbials can only measure out the duration of atelic predicates. This atelicity requirement is usually assumed to arise as lexical presuppositional content, so that its fulfillment is needed in order for the sentence to acquire a truth value. The analysis in (35a) thus represents a partial function that is defined only if the predicate is atelic. If defined, it specifies that the predicate holds and the running time of the event (indicated by the temporal trace function $\tau(e)$) is equivalent to the time expressed by the argument of *for*. This theory is found in various forms in e.g. Krifka (1986, 1989, 1992, 1998), and Champollion (2010, 2016). For instance, Krifka (1986) (via Champollion 2010), in a first variant of his work on *for*-adverbials, imposes the selectional requirement of both cumulativity—“a predicate P is cumulative if and only if whenever it holds of two things, it also holds of their sum”—and divisiveness—“a predicate P is divisive if and only if whenever it holds of something, it also holds of each of its proper parts” (Champollion 2010: 19)—for atelic predicates. Subsequently, Krifka (1989) requires that the predicate be “strictly cumulative or at least non-quantized” (via Champollion 2010: 134); by bearing in mind that a predicate P is “quantized if and only if no entity which is P can be a

proper subpart of another entity which is P'' (van Geenhoven 2004: 137, cp. Krifka 1992). Finally, Krifka (1998) requires the predicate to have divisive reference and contain proper parts.

By contrast, the analysis in (35b) represents *for*-adverbials—and per extension *until*-phrases—as universal quantifiers over all (relevant) subintervals of a continuous interval so that the predicate is required to hold at every subinterval described by the argument of *for/until*. If it does, the predicate must have the so-called *subinterval property*. It follows that state and activity predicates have the subinterval property, whereas achievements and accomplishments may acquire this property whenever the reading they give rise to permits a semantically and pragmatically coherent iterative interpretation. This theory corresponds to the influential account by Dowty (1979) and the main attempts along these lines are found in Moltmann (1991), Deo and Piñango (2011), and Champollion (2015), *inter alia*. Intuitively, such a proposal is appealing because the atelicity requirement is already derived from universal quantification as part of the assertive content. Nonetheless, in spite of their dissimilarities, are the two approaches exemplified in (35) really that different?

2.6.2 Parallelism between the two main proposals: Pluractionality

Despite the superficial differences pointed out above, both accounts impose some sort of pluractionality condition. An account in the spirit of Dowty (1979) does so via the subinterval property in the assertive content of the durative adverbial,

whereas an account in the spirit of Krifka (e.g. 1998) establishes a similar pluractional condition in the presuppositional content of the adverbial, which essentially looks at the divisiveness and non-quantized properties of the eventuality described by the predicate. Even though the former applies such a condition by looking into predicates of intervals and the latter into predicates of events, we know from a mereological perspective that time and event are related in a way that the two amount to more or less the same thing (e.g. building on Krifka 1998, Beavers 2008b, 2012). As will be explained in this section, both types of pluractionality conditions intrinsically share the same fundaments.

2.6.2.1 The subinterval property *à la* Dowty (1979)

The subinterval property *à la* Dowty (1979) requires that the predicate be able to universally quantify over subintervals of a time interval in question. Dowty (1979) illustrates this only for *for*-adverbials with the following contrastive pair:

- (36) a. # John discovered the buried treasure in his back yard for six weeks/until yesterday.
- b. John discovered crabgrass in his yard for six weeks/until yesterday.

[Adapted from Dowty (1979), Ch. 2, ex. (74) & (77)]

The sentence in (36a) ends up meaning something along the following lines: John has been discovering the same treasure over and over again in his back yard throughout a period of time, which seems “to entail that he has repeatedly not known and then come to know the very same fact, which is obviously a contradiction (barring memory loss)” (Dowty 1979: 80), hence its incoherence. By contrast, Dowty then

gives a Carlsonian (e.g. 1977a, b) explanation as to why the mass noun in (36b) does not give rise to oddness: bare plurals and mass nouns denote kind individuals that receive their existential interpretation from the stage-level verbs, e.g. *discover*, and are thus bound within the scope of the durative adverbial. Considering this, the sentence in (36b) can result in the pragmatically plausible meaning that “for six weeks [or until yesterday] John discovered there to be some x such that x is crabgrass and is in his yard” (Dowty 1979: 80), where the value of x differs from one subinterval to the next as it is existentially bound within the scope of the temporal universal quantifier.¹⁷

As Deo and Piñango (2011) put it, the acceptability of durative adverbials with a certain predicate—regardless of its classification as telic/atelic—just follows from the ability of “interpreting predicates [...] as being instantiated at regular intervals across the measuring interval”, which may then lead to iterative readings in the case of punctual verbs such as *cough* or ongoing interpretations of predicates traditionally classified as atelic, such as *run*. Assuming the interval-event mapping, such a universal quantification over intervals that gives rise to the iterative or ongoing interpretations could also be expressed at the events level by explicitly implicating universal quantification over events, along the following lines in (37b), where τ is a function that maps events to intervals and represents the temporal trace or *runtime*

¹⁷However, Dowty (1979) already observes that the predicate of e.g. *discovering crabgrass* in (36b) might not hold for literally every single moment of a specific interval, e.g. it seems impossible for John to come upon some new crabgrass for every subinterval throughout a six-week long period. Therefore, the moments over which the durational adverb quantifies must be something like “*relevant psychological moments* which are both vaguely specified and also contextually determined” (p. 81). This is more generally known in the literature as *the minimal parts problem* (e.g. Moltmann 1991, Vlach 1993).

of the event. In what follows, type *int* stands for intervals, *t* for truth values, and *v* for events.

- (37) a. $\llbracket \text{For } x\text{-time} \rrbracket = \lambda P_{\langle \text{int}, t \rangle}. \lambda t [x\text{-time}(t) \wedge \forall t' [t' \subseteq t \rightarrow P(t')]]$ (= (35b))
- b. $\llbracket \text{For } x\text{-time} \rrbracket = \lambda P_{\langle v, t \rangle}. \lambda e. \lambda t [x\text{-time}(t) \wedge \forall t' [t' \subseteq t \rightarrow \exists e' [e' \subseteq e \wedge P(e') \wedge \tau(e') = t']]]$

[Adapted from Deo and Piñango (2011), ex. (11)]

In (37b), note that the straightforward relation between subevents and subintervals is established by the trace function, where the duration of every subevent of the event in question must relate to a subinterval of the interval picked by the durative adverbial. The difference in the denotations in (37) would thus consist of a trivial difference in type.¹⁸ Taking (37b) into account, let us examine next what the atelic precondition established by an account in the spirit of Krifka looks like, since it is also event-oriented.

2.6.2.2 Divisiveness à la Krifka (1998)

The prerequisite of atelicity of the measure function analysis in (35a) indicated by the shorthand *atelic* is unfolded in (38) based on Krifka's (1998) most updated analysis of *for*-adverbials. The denotation of the measure phrase consists of an assertion and a presupposition, both of them given in their original form in (38) with the presupposition (which ensures *atelicity*) underlined in (38) for clarity, as this is the key to the present discussion.

¹⁸Assuming a traditional Davidsonian event semantics framework where the event variable is bound at sentence level, the pair in (37) would consist of one variant (event-oriented) as in (37b) that applies low and selects for a predicate of events, and then another variant (interval-oriented) as in (37a) that applies high and can pick a property of intervals.

$$(38) \quad \llbracket \text{For an hour} \rrbracket = \lambda R \lambda x, e [R(x, e) \wedge H'(e) = 1 \wedge \underline{\partial \exists e' \in U_E [e' <_{H'} e \wedge \forall e'' \in U_E [e'' \leq_{H'} e' \rightarrow R(x, e'')]}]]$$

[Krifka (1998), ex. (55)]

In the specifications above note that the measure function is H' , the number of hours is 1, $<_{H'}$ indicates the notion of part-of relation, which is construed based on time only, and the presupposition is indicated by ∂ . The adverbial has three arguments: a predicate R , an individual x , and an event e . The predicate R must hold for the arguments x and e , and the duration of the event must measure one hour. The presupposition in (38), which universally quantifies over subevents, requires that the event e (ultimately contributed by existential closure) have proper parts and that all parts fall under the predicate R . This ensures that the predicate R must not be telic with respect to its event argument. Thus, the presupposition essentially imposes the requirement that the predicate be divisive because the predicate denoted by the verb phrase must relate the subject to all the temporal subevents. Additionally, the event to which the predicate applies must contain temporally shorter subevents. As Champollion (2010) notes, the additional requirement of containing temporally shorter subevents is needed in order to exclude quantized telic predicates like *kill a rabbit* which vacuously satisfy the divisiveness condition, as the event to which the predicate applies has no proper parts and hence all of its parts would also be in the denotation of *kill a rabbit*.

All in all, Krifka's requirement of atelicity consists in selecting for a predicate that has divisive reference and is non-quantized. In this way, a predicate with a bare plural like *find fleas* is non-quantized, as a proper part of an event of finding

fleas may still be an event of finding fleas. For this to make sense the kind as a whole must be regarded as the theme of the event. On the other hand, its singular counterpart or a plural quantified DP is quantized because no proper part of an event of *finding a flea* or *finding three fleas* is still an event of finding a flea or finding three fleas, respectively.¹⁹

2.6.2.3 Comparing their pluractionality requirement via universal quantification

Ultimately, in one way or another, both accounts resort to universal quantification over subevents of the maximal event in question, be it in the presuppositional content, as in Krifka (1998), or in the assertive content, as demonstrated in the event-oriented variant *à la* Dowty (1979). The durative requirement of measure phrases seems to amount to the ability of the predicate to apply to all the subevents that relate to the subintervals of the interval introduced by the *for/until-XP*.

Yet universal quantification over events in the presuppositional content of the durative adverbial is not expected to directly interact scopally with any scope-bearing elements in the clause, unlike universal quantification in the assertive content of durative adverbials in an account in the spirit of Dowty (1979). Such a dis-

¹⁹Further note that under this view verbal predicates with plural kinds (e.g. *find fleas*) are in principle just treated as a plural set that stands in cumulative-like relation with the plural event. However, there are syntactic arguments to believe that kinds explicitly introduce individual instances in the semantic composition and behave as existential quantifiers (Chierchia 1998). The existential nature of bare plurals that receive a kind interpretation is *prima facie* ignored under the measure function approach as it only takes into account a cumulative-like relation in the atelic precondition. If bare plurals as well as quantified objects introduce existential quantifiers, it remains unexplained why verbal predicates with bare plurals pattern unlike verbal predicates with count individuals or plural indefinites modified by durative adverbials.

inction becomes crucial when telic predicates with indefinite plurals are brought into the picture, like *find some fleas*, which come out *atelic*, i.e. non-quantized, on Krifka’s approach—“an event of finding some fleas may have proper parts that are also events of finding some fleas” (Zucchi and White 2001: 231)—and yet they are problematic as complements of achievement/accomplishment verbs modified by durative adverbials, as in ??*John found some fleas on his dog for an hour* (Zucchi and White 2001, ex. (9), cp. van Geenhoven 2004) in opposition to *John found fleas on his dog for an hour*. An account *à la* Dowty (1979) can resort to a Carlsonian scopal analysis between the universal quantifier of the durative adverbial and the existential quantifier of the indefinite to explain such a contrast, where the existential quantifier of a kind object takes narrow scope with respect to the universal quantifier of the adverbial, while the existential quantifier of a plural indefinite takes wide scope instead. On the other hand, it is not so clear how such a contrast can be explained under Krifka’s (1998) approach. Zucchi and White (2001) propose a modified analysis of Krifka’s (1998) account, where the objects can be interpreted *in situ* and their quantized nature lies in the presence or absence of the determiner.²⁰

In sum, the restriction of durative adverbials to atelic predicates is encoded via universal quantification over subintervals or subevents in both approaches. Reference to such a pluractional condition of the event (whether it be in the assertion or the presupposition) is necessary for both accounts so that they can predict whether

²⁰In particular, the determiner would introduce maximal participants, which are the total sum of individuals instead of sums of events. In this way *some fleas* would refer to the maximality of all fleas that participated in the event at reference time, which will not be in the denotation of a subevent, hence failing to satisfy the non-quantized precondition of the durative adverbial. Such a maximality condition would be absent with no determiner in a predicate like *find fleas*. See Zucchi and White (2001) for further discussion and a formalization of the account.

the event described by the predicate can be modified by a measure adverbial. However, choosing one theory over the other one may require resorting to different assumptions regarding the nature of quantized vs. non-quantized predicates when it comes to distinguishing telic predicates with quantified DPs from verbal predicates with plural kinds.

2.6.3 Contrast between the two main proposals: Pluractionality under negation

2.6.3.1 A fusion-based treatment of negation instead of logical negation

A crucial distinction between the subinterval analysis and the measure function analysis arises when it comes to analyzing their interaction with negation, namely when capturing the ‘throughout-not’ reading. Remember that in the former approach durative adverbials take a predicate over intervals whereas in the latter they take a predicate over events. However, negation normally takes place above existential closure of events (e.g. Diesing 1992, Kratzer 1995, Carlson 2003). This makes it difficult for an account *à la* Krifka (1989, 1998) to explain how the durative adverbial can take scope above logical negation, where we would no longer have a predicate of events, hence theoretically predicting that a ‘throughout-not’ reading is in principle unavailable. By contrast, an account *à la* Dowty (1979), where the durative adverbial takes a predicate of intervals, can more easily explain a scopal interaction between the durative adverbial and negation above existential closure once we have a predicate of intervals so that the machinery is capable of equally

licensing both ‘throughout-not’ and ‘not-throughout’ interpretations.

This challenge for the measure function analysis was already noted in Krifka (1989), which resorted to a fusion-based treatment of negation so that there can be suitable “negative events” whose runtimes can be modified by durative adverbials, which can reproduce the ‘throughout-not’ interpretation under existential closure. In this way, Krifka (1989) characterizes negated expressions “with the help of maximal events, that is, the fusion of all events at a certain time” (p. 101), thus yielding the maximal eventuality relative to a specific time interval, as formulated in (39). The maximal eventuality at some time interval t is expressed by **FUSION** in the denotation. The subinterval relation is indicated as $\subseteq_{\mathcal{T}}$, and the subevent relation as \subseteq_E .

$$(39) \quad \llbracket \text{did not} \rrbracket = \lambda P. \lambda e. \exists t [e = \mathbf{FUSION}(\lambda e' [\tau(e') \subseteq_{\mathcal{T}} t]) \wedge \neg \exists e'' [P(e'') \wedge e'' \subseteq_E e]]$$

(\approx the fusion of all events within a time interval t that does not contain any event described by the predicate P)

[Adapted from Champollion (2011), ex. (18), c.p. Krifka (1989), ex. (D44-45)]

Following the analysis of negation in (39), a sentence like *John didn't laugh* is interpreted as describing the fusion of all the events that take place within some time interval and asserting that it does “not contain an event of John’s laughing” (Krifka 1989: 101). Then the duration of the fusion of all events as long as it does not contain John’s laughing could be specified by the measure phrase.

As Champollion (2011) observes, a fusion-based treatment of negation has

been both embraced and debated in the literature. For example, Zucchi and White (2001) and Condoravdi (2008) reformulate it to account for the scopal effects of *for*-adverbials and *until*-phrases, respectively. De Swart (1996) and de Swart and Molendijk (1999), among others, adopt this type of negation in support of the popular claim that negation is a stativizer. However, this treatment of negation has been disputed, e.g. see Csirmaz (2006, 2009), Giannakidou (2002), Condoravdi (2008), MacDonald and Ürögdi (2011) and Ürögdi (2013) for argumentation against the claim that negation stativizes. Considering the controversy that a fusion-based analysis of negation may arise, I believe it is better to adopt a treatment of durative adverbials within a syntactic, semantic, and/or pragmatic framework that does not have to commit to such a claim.

2.6.3.2 Punctuality under negation in relation to the debate on punctual *until*

In choosing between these two accounts of durative adverbials, another issue worth considering in relation to the puzzle of punctual *until* is whether negative telic predicates are not durative predicates after all, i.e. whether such adverbials lose their pluractionality requirement under negation.

More specifically, rather than treating negation as an aspectual operator that functions as a stativizer (e.g. de Swart 1996), negation could be regarded as an NPI-licenser. In that case the durative adverbial modifying a telic predicate would no longer be durative in nature but a punctual NPI, i.e. a different lexical item, licensed under negation. If we were to follow such a theory for languages like Greek, a theory that treats durative adverbials as existential adverbials of temporal framing, more

in line with Krifka's (1998), is particularly appealing with respect to punctual *until* because it could better explain why certain languages might overtly have an NPI-variant that realizes lexically different from their durative *until* counterpart under negation, since usually NPIs are interpreted as existential in nature (Krifka 1995, Chierchia 2004, 2006, 2013).²¹ A theory that treats *until* as a universal quantifier would have greater difficulty in explaining the origin of NPI variants, given the cross-linguistic rarity of NPIs with a 'universal' semantics or, for that matter, a universal morphology.

Nevertheless, for languages like English, in the case that an NPI-analysis of an existential *until* with punctual predicates were to apply only to *until*-phrases under negation (and the behavior of *for* were, on the other hand, to be explained in terms of scope with respect to negation), this leaves unexplained the otherwise strong parallelism between *for* and *until*. Thus, we will leave the NPI theory aside for now, and pursue a unifying account of durative adverbials in English.

2.6.4 Summing up

In conclusion, both classical approaches to durative adverbials posit some sort of pluractional condition on the predicate that is represented by the measure phrase universally quantifying over subevents/subintervals. Krifka's (1998) plural requirement belongs to the presuppositional content of durative adverbials and it quantifies over events, whereas Dowty (1979) embeds it in the assertive content of durative

²¹It could consist of a simple contrast like between *some* and *any*, both existential in nature, which would explain why a durative adverbial may give rise to an NPI counterpart. This idea will be further developed in Chapter 5.

adverbials and it quantifies over times.

Prima facie, there does not seem to be many substantial arguments for adopting one approach over the other one. For instance, either approach will have to inevitably end up positing a durative ‘until’ vs. a specialized NPI (or PPI) for telic predicates for languages like Greek that make a lexical distinction when the actualization of the event is intended. Yet the measure function analysis as it stands unavoidably runs into the controversial issue of having “negative events” so that they can be measured out by durative adverbials so as to capture the ‘throughout-not’ and ‘not-throughout’ readings. In order to avoid negative events, plus to have a cleaner unified scopal account between durative adverbials and logical negation, I believe it is worth further exploring the universal quantification approach *à la* Dowty (1979), while updating it to be compatible with an event semantics.

This constitutes the point of departure for our proposed analysis for English in Chapters 3 and 4, which will explain the durative, scopal, and factive behavior of both *for*-adverbials and *until*-phrases in a unified fashion. Nevertheless, these facts may not be universal. In Chapter 5, we will have to find what the relevant parameters are for Spanish and whether an account based on the universal quantification approach still holds for Spanish *hasta*. Ultimately, I will point out a difference unnoticed in the literature so far that virtually requires a development of the universal approach for English *until* and a modified version of the existential analysis for Spanish *hasta*, which challenges the necessity of a fusion treatment of negation.

2.7 Conclusions

The puzzle of punctual *until* might potentially be a broader phenomenon that affects other temporal measure phrases with similar durative properties and restricted scopal interactions with negation and other quantifiers in the clause. This seems to be the case for at least *for*-adverbials too, thus suggesting that it might all be an epiphenomenon of independent scope constraints. I propose that a refinement of Mittwoch's (1977) original insight of English punctual *until* as arising from the scope behavior of the durative adverbial with respect to negation is still possible. This is preferable to a lexical ambiguity account (e.g. Condoravdi 2008) where punctual *until* in English would be seen as an NPI. The key evidence suggesting this is (a) the lack of separate PPI and NPI words for *until* in English and (b) the extensive and nearly perfect parallelism of *until* and *for* adverbials, where for the latter the usual assumption in the literature is that there is just one *for*. As a prerequisite for formalizing my analysis in the next chapter, I offer a new defense of Dowty's (1979) universal quantification approach to temporal measure adverbials, which is proven to be to a certain extent more advantageous than the measure function account *à la* Krifka (1998) and more appropriate for a scopal account of the facts of *for/until* in English. However, a number of issues present themselves as challenges for such an approach, such as the prominent tendency of the universal quantifier to take narrow scope while still tolerating some exceptions, e.g. when scoping above verbal predicates with bare plural DPs like *find fleas* or above frequentative adverbials such as *every day*. For this, I show in Chapter 3 that embedding the subinterval approach within independently motivated assumptions, such as Champollion's (2015) event

semantics together with a syntactic and semantic scopal account, produce the right results.

Chapter 3

A unified scopal account of temporal *for*-adverbials and *until*-phrases in English

3.1 Introduction

The scopal approach I put forth is a refinement of Mittwoch's (1977) original insight that the crucial difference between durative and punctual uses of *until* is scopal and not lexical. Ultimately, the factive behavior of negative *until* will fall out from the scopal account together with an exhaustification-based approach to scalar inferences. The upshot is that the NPI behavior of punctual *until* and its factivity are derived as an epiphenomenon of independent scopal constraints, exactly in the same manner, by using the same machinery, as we derive the behavior of *for*-adverbials.

A translation of Mittwoch's (1977) earlier proposal in event semantics is possible nowadays thanks to the availability of a framework along the lines specified in this chapter, which makes two independently motivated assumptions: Champollion's (2015) analysis of event quantification and a Carlson/Chierchia approach to bare plurals. It emerges that special conditions on DP-quantifiers and event quantifiers interact with a simple scopal analysis of *for/until*-XPs as universal quantifiers *à la* Dowty (1979), rightly predicting the attested behavior. This scopal account will ultimately be combined with an exhaustification-based approach in the next chapter, fully predicting the 'special' behavior that has been attributed to *until*-phrases regarding factive inferences in particular.

The outline of this chapter is as follows. In §2, I introduce the basis of quantificational event semantics *à la* Champollion, a framework that I adopt together with a syntactic treatment of scope via quantifier raising. In §3, I give a scopal account of *for*-adverbials in a parallel manner to *until*-phrases. The basic cases in positive environments are presented, as well as the various downward-entailing and frequentative cases. This will lead to a hypothesis that right adjoined durative adverbials are low adverbs subject to an economy constraint on scope based on informativeness/logical strength. In §4, the conclusions of the proposed scopal analysis are discussed.

3.2 The framework: Quantificational Event Semantics

In this section, I present the basis of the theoretical semantic framework that I adopt so as to develop an analysis for temporal durative adverbials, where events and duration of events come into the picture. I follow the proposal in Champollion's (2015) framework, a version of 'quantificational event semantics', where the main difference from typical instantiations of Neo-Davidsonian event semantics is that verbs and their projections contain low existential quantifiers over events. In other words, the event variable is no longer bound at the sentence level, but is already bound in the lexical entry of the verb, so that it takes the lowest possible scope. The main reason for adopting this framework is to avoid the mereological treatment of negation. Such a framework also allows for a rather straightforward reconstruction of Dowty's (1979) scope theory within an event-based semantics. In the following subsections I outline the basic mechanism of the proposed framework, where independently motivated assumptions will conspire to produce the right results.

3.2.1 Event propositions and their modifiers

A major development since Dowty made his proposal about *for*-adverbials in 1979 has been the growth and common adoption of (neo-)Davidsonian event semantics. This derives from Davidson's (1967) original suggestion that the logical form of verbs contains an event variable and verbs denote relations between events and other individuals, as shown in (1b), in opposition to a more traditional account in

which a verb solely denotes a relation between its (non-event) arguments, as in (1a). The crucial contrast in (1) lies in whether e.g. a transitive verb denotes a two- vs. a three-place relation.¹

- (1) a. $\llbracket \text{kiss} \rrbracket = \lambda y. \lambda x. \mathbf{kissing}(x, y)$
 b. $\llbracket \text{kiss} \rrbracket = \lambda y. \lambda x. \lambda e. \mathbf{kissing}(e, x, y)$

A more modern view of Davidsonian event semantics, i.e. often referred to as ‘neo-Davidsonian’ (e.g. Parsons 1990, Landman 2000), treats the verb as a one-place predicate of eventualities and their arguments are introduced later via special rules or applicative heads that are event modifiers and stand in thematic relations to the event. On such an approach, verbs are not typed for how many arguments they take, and the contrast between arguments and modifiers is somewhat blurred.² In this model of neo-Davidsonian semantics a transitive verb such as *kiss* is represented in the following manner, in which an event fills the verb’s sole argument place:³

- (2) $\llbracket \text{kiss} \rrbracket = \lambda e. \mathbf{kissing}(e)$

In (2), verbs and all their projections up to the sentence level are treated as predicates of events of type $\langle v, t \rangle$ (with v the type of events). At the sentence level, after all the syntactic arguments of the verb have been introduced, a silent operator

¹From here onwards, I use boldfacing to indicate logical relations that look the same as English words.

²There are also mixed accounts, such as Kratzer (2003), which puts forward that only subjects are fed by applicative heads, whereas objects serve directly as arguments to the verb: e.g. $\llbracket \text{kiss} \rrbracket = \lambda y. \lambda e. \mathbf{kissing}(e, y)$. Another variant of neo-Davidsonian semantics could place the thematic relations as part of the denotation of the verb, where the verb takes its arguments directly but uses neo-Davidsonian roles: $\llbracket \text{kiss} \rrbracket = \lambda x. \lambda y. \lambda e. \mathbf{kissing}(e) \wedge \mathbf{agent}(y, e) \wedge \mathbf{patient}(x, e)$ (e.g. Hunter 2009).

³See, for instance, Borer (2005), for arguments supporting the view that all of a verb’s arguments are introduced in the syntax.

known as *existential closure* introduces an existential quantifier that binds the event variable so that the proposition ends up having value t .

Champollion (2015) introduces an alternative to this sort of Neo-Davidsonian account so as to accommodate the observation that in general “the existential quantifier that binds the event variable always takes lowest possible scope”, thus suggesting the hypothesis that it could already be “contained in the lexical entry of the verb” (p. 34).⁴ For example, the event quantifier always seems to take low scope with respect to fixed-scope operators like negation, as shown in (3), since the representation in (3b) is not an accurate interpretation of the sentence *John didn’t laugh*.

(3) [John didn’t laugh]

a. $\neg \exists e[\text{laughing}(e) \wedge \text{ag}(e) = \text{john}]$

“There is no event in which John laughs.” $\neg \gg \exists e$

b. $\exists e \neg[\text{laughing}(e) \wedge \text{ag}(e) = \text{john}]$

“There is an event in which John does not laugh.” $\exists e \gg \neg$

[Based on Champollion (2015), ex. (8-9)]

Champollion (2015) changes the value of the propositional nuclei to a generalized quantifier over events, i.e. predicates of sets of events \mathbf{V} of type $\langle vt, t \rangle$, by binding the event variable at the lexical entry of the verb, instead of treating them the usual way. This gives a way of elegantly avoiding ‘negative events’, that is, to avoid an interpretation as in (3b).

I first review the core of the proposed framework on the basis of Champol-

⁴I encourage the reader to see Champollion (2015) for a more detailed motivation and spelling out of this proposal regarding quantificational event semantics.

lion (2015). Under such an approach, verbs, as well as all their projections, are conceptualized as predicates of sets of events $\langle vt, t \rangle$, where f is a variable that ranges over predicates of events of type $\langle vt \rangle$. For instance, “it rains” is true of any set that contains a raining event, and the same reasoning is carried up to the sentence level.

$$(4) \quad \llbracket \text{rain} \rrbracket = \lambda f. \exists e [\mathbf{raining}(e) \wedge f(e)]$$

[Based on Champollion (2011), ex. (11)]

The idea behind (4) is the following. The event variable is bound off lexically. So how does a modifier of any sort get access to it? The trick is that although the variable is bound off the verb takes an argument f that is a predicate over events, and specifically over the bound event e . So anything that wishes to compose with the verb or its projection to add in new information about the event can take something of type $\langle vt, t \rangle$ (**V**) as an argument and then apply that to a function of type $\langle vt \rangle$ that imposes the right condition on e , and the effect will be to put it under the scope of the operator. Such a modifier will have to output a new thing of type $\langle vt, t \rangle$ to ensure that additional modification can apply, until eventually f gets closed off near the top of the clause. For instance, consider a simple event modifier *quietly*, as in (5), which takes a verbal meaning like (4) as input and outputs a new generalized quantifier over events with a new enriched f .

$$(5) \quad \text{a. } \llbracket \text{quietly} \rrbracket = \lambda V. \lambda f. V(\lambda e [f(e) \wedge \mathbf{quietly}(e)])$$

$$\text{b. } \llbracket \text{rain quietly} \rrbracket = \llbracket \text{quietly} \rrbracket(\llbracket \text{rain} \rrbracket) = \lambda f. \exists e [\mathbf{raining}(e) \wedge f(e) \wedge \mathbf{quietly}(e)]$$

As a consequence, this machinery will automatically derive the lowest possible scope of the event quantifier with respect to other scope-bearing elements,

like negation, leaving no room for scopal ambiguity between negation and the event quantifier.⁵ Hence, the present system is advantageous in that we can interpret negation in logical terms. Champollion (2015) gives the following denotation for *not*, as in (6), conforming to the semantic type $\langle\langle vt, t \rangle, \langle vt, t \rangle\rangle$ of all verbal arguments and modifiers in the present system to ensure that all verbal projections are formulated as predicates of sets of events.⁶

$$(6) \quad \llbracket \text{not} \rrbracket = \lambda V. \lambda f. \neg V(f) \quad \text{[Champollion (2015), ex. (28)]}$$

In this way, a negated sentence like *it did not rain quietly* as in (7d) (ignoring tense for the moment) can be given “a straightforward translation and does not involve reference to fusions” (Champollion 2015: 47). Nor does the scope-taking operator (negation in this case) need to raise above closure, as shown in the LF in (7a).

$$(7) \quad \begin{array}{l} \text{a. LF: } [_{VP} \text{ not } \llbracket \text{rain} \rrbracket \text{ quietly}] \\ \text{b. } \llbracket \text{not rain quietly} \rrbracket = \llbracket \text{not} \rrbracket(\llbracket (5b) \rrbracket) = \lambda f. \neg \exists e [\text{raining}(e) \wedge f(e) \wedge \\ \text{quietly}(e)] \end{array}$$

Even though existential closure of the event variable happens at the verb level, as illustrated in (7), a sentence-level operator—different from existential closure—is still required after all syntactic arguments and modifiers have been intro-

⁵As Champollion (2015) points out, to some extent this is reminiscent of Carlson’s (1977a, b) treatment of kinds, where existential quantification over bare plurals also ensures narrowest scope, an approach that I will adopt in this dissertation. Additionally, the machinery that updates the proposition nuclei by enriching f and putting a new f in the place of the original one also resembles certain versions of dynamic semantics on discourse update (Groenendijk and Stokhof 1991, Chierchia 1995).

⁶I also suggest the use of *Pos*, the identity function adjusted to the present framework, as the counterpart of *not* as in (i).

$$\text{i. } \llbracket \text{Pos} \rrbracket = \lambda V. \lambda f. V(f)$$

duced as a way of extracting the truth-conditional import of the sentence. Such a closure operator would be of type $\langle\langle vt, t \rangle, t\rangle$. It would take a propositional unit of type $\langle vt, t \rangle$, and the output would be something of type t . By adopting an anaphoric treatment of tense, Champollion (2015) suggests that the contribution of tense could be part of the closure operator. For example, [past-closure] could be given the following entry, as in (8), where reference time is written as t_r in its denotation, temporal inclusion as $\subseteq_{\mathcal{T}}$, and temporal precedence as \prec .

$$(8) \quad \llbracket \text{[past-closure]} \rrbracket = \lambda V [t_r \prec \mathbf{now} \wedge V(\lambda e [\tau(e) \subseteq_{\mathcal{T}} t_r])]$$

[Based on Champollion (2015), ex. (30)]

In (8), the past-closure operator asserts that besides a sentence being true of the world, its reference time corresponds to the past, i.e. precedes the present time. In order to illustrate what something at the sentence level looks like within the present framework thus far, note the meaning of a simple past sentence like *it did not rain quietly*—assuming that the verb *rain* has no semantically visible arguments—as in (9), building on (7b).⁷

$$(9) \quad \llbracket \text{[it did not rain quietly]} \rrbracket = \llbracket \text{[past-closure]} \rrbracket(\llbracket (7b) \rrbracket) = [t_r \prec \mathbf{now} \wedge \neg \exists e [\mathbf{raining}(e) \wedge \mathbf{quietly}(e) \wedge \tau(e) \subseteq_{\mathcal{T}} t_r]]$$

For the purposes of this dissertation, I follow Champollion’s treatment of tense by already including its meaning within the closure operator, though other implementations of tense could in principle also be adaptable to the present framework.

Having presented the fundamentals of Champollion’s (2015) framework and

⁷Champollion (2015) treats *did* as semantically vacuous, whose presence only morphologically signals past tense. I also ignore the semantics of the expletive *it*.

the interaction of proposition nuclei with event modifiers such as negation and adverbials like *quietly*, I focus next on the contribution of durative adverbials as event modifiers, which are central to the present discussion.

3.2.2 Translating *for*-adverbials and *until*-phrases

A major advantage of adopting and adjusting the subinterval analysis of durative adverbials within the framework of quantificational event semantics *à la* Champollion (2015) is that one can maintain that right-adjoined adverbials are low adverbs at the VP-level and derive a scopal account with respect to negation. No matter what (e.g. whether they are interpreted above or below negation) they will always outscope the event quantifier, since such a variable is already existentially quantified inside the verb.

Based on Champollion's (2015) denotation of *for*-adverbials, I put forth the translation of *for 2 hours* in (10), where durative adverbials are of type $\langle\langle vt, t \rangle, \langle vt, t \rangle\rangle$ after having combined with their temporal argument (a predicate of times). In this way, a durative adverbial takes the denotation of a verbal projection of type $\langle vt, t \rangle$ and returns another generalized quantifier over events, ensuring that all verbal projections are type $\langle vt, t \rangle$. Additionally, in its translation, I add a contextually supplied partition or *cover* \mathbf{C} as a placeholder for the minimal parts problem, as suggested by Moltmann (1991). This problem deals with the fact that the predicate may not hold at every smallest subinterval. For example, a sentence like *John jogged for two hours* is still true even when John stopped to drink water for a brief

moment (Deo and Piñango 2011).⁸ The cover \mathbf{C} below in (10) would determine how the predicate is distributed along relevant subintervals.⁹

$$(10) \quad \llbracket \text{for 2 hours} \rrbracket = \lambda V. \lambda f. \exists t [\mathbf{hours}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\mathbf{C}(t')(t) \rightarrow V(\lambda e [f(e) \wedge \tau(e) = t'])]]$$

[Adapted from Champollion (2015), ex. (31)]

In (10), the predicate must hold for each of its subintervals within a two-hour long interval, as suggested in Dowty (1979). Champollion (2015) also observes that $t \subseteq_{\mathcal{T}} t_r$ in the denotation is necessary because it prevents the time interval from being trivially verified outside of the reference time (p. 47). Moreover, $\mathbf{C}(t')(t)$ in the denotation represents that the subinterval t' is part of the contextually supplied cover \mathbf{C} of the interval in question t , that is, t' falls within a *contextually relevant* partition of t . Going back to the example *John jogged for two hours*, \mathbf{C} would make certain that the subintervals be regularly spread throughout the two-hour long interval and large enough to contain an instantiation of John's running, while at the same time allowing for pauses such as short breaks to stop and take a breath, taking into account contextual information. For instance, $\mathbf{C}(t')(t) = \text{true}$ if and only if

⁸Moltmann (1991), departing from an event-based semantics of Dowty's (1979) treatment of *for*-adverbials, appeals to the contextually determined concept of *relevant parthood*, labeled P , as in (i).

i. $\llbracket \text{For } x\text{-time} \rrbracket = \lambda P. \lambda t [x\text{-time}(t) \wedge \forall t' [t' \mathbf{P} t \rightarrow \exists e [P(e) \wedge \tau(e) = t']]]$
[Moltmann (1991), ex. (17), simplified]

Such a parthood relation limits the number of subintervals to 'relevant subintervals.' What determines which are the relevant parts is left unclear (cf. Zucchi and White 2001). I believe that the influential factors can be subsumed under two intermingled categories, which need to be taken into consideration together: a) the regular size of the event described by the predicate relative to the size of the interval and b) contextual/world knowledge information (cf. frequency adverbs like *occasionally* in Stump 1981 via Champollion 2010).

⁹See e.g. Schwarzschild (1990, 1996) and Landman (1996, 2000) for further discussion on how pluralities may distribute over subgroups or individualities.

t' is a sufficiently large part of t , where ‘sufficiently’ means large enough to contain a running event. For a simple demonstration of how such event modifiers can combine with a predicate like *rain*, observe the derivation in (11).

$$(11) \quad \llbracket \text{rain for 2 hours} \rrbracket = \llbracket \text{for 2 hours} \rrbracket(\llbracket \text{rain} \rrbracket) = \lambda f. \exists t[\mathbf{hours}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t'[\mathbf{C}(t')(t) \rightarrow \exists e[\mathbf{raining}(e) \wedge f(e) \wedge \tau(e) = t']]]$$

Finally, based on (10) and (11), and the close parallelism between *for* and *until*, we can give a denotation for *until* in (12). In what follows, t_0 is a contextually supplied left boundary and $[t_0, n]$ represents a closed time interval, where n stands for the temporal right boundary provided by the complement of *until*:

$$(12) \quad \llbracket \text{until 2 pm} \rrbracket = \lambda V. \lambda f. \exists t[\mathbf{hours}(t) = [t_0, 2] \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t'[\mathbf{C}(t')(t) \rightarrow V(\lambda e[f(e) \wedge \tau(e) = t'])]]$$

In (13), I give a simple illustration of a modified VP by an *until*-phrase.

$$(13) \quad \llbracket \text{rain until 2 pm} \rrbracket = \llbracket \text{until 2 pm} \rrbracket(\llbracket \text{rain} \rrbracket) = \lambda f. \exists t[\mathbf{hours}(t) = [t_0, 2] \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t'[\mathbf{C}(t')(t) \rightarrow \exists e[\mathbf{raining}(e) \wedge f(e) \wedge \tau(e) = t']]]$$

Even more relevant to the puzzle of punctual *until*, observe how the present framework allows for a durative adverbial such as *until 2 pm* to be a low adverb that scopes above or below negation, without resorting to non-standard treatments of negation, since negation always outscopes the event quantifier. I illustrate this in (14) (disregarding tense and closure for simplicity) for a sentence such as *it did not rain until 2 pm*, which is ambiguous between a ‘not-throughout’ reading, as in (14a), and a ‘throughout-not’ reading, as in (14b), since *rain* is an atelic predicate.

(14) a. ‘Not-throughout’ reading: It is not the case that it rained until 2 pm.

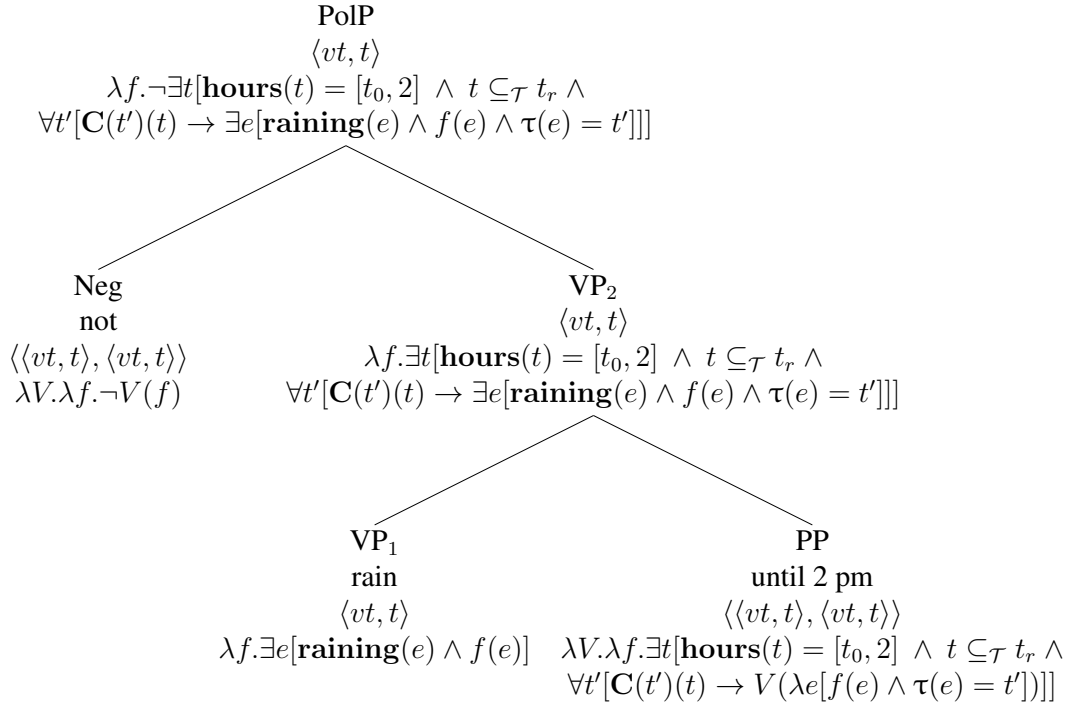


Fig. 3.1: LF for the ‘not-throughout’ reading of the predicate *not rain until 2 pm*

b. ‘Throughout-not’ reading: “Until 2 pm, it did not rain.”

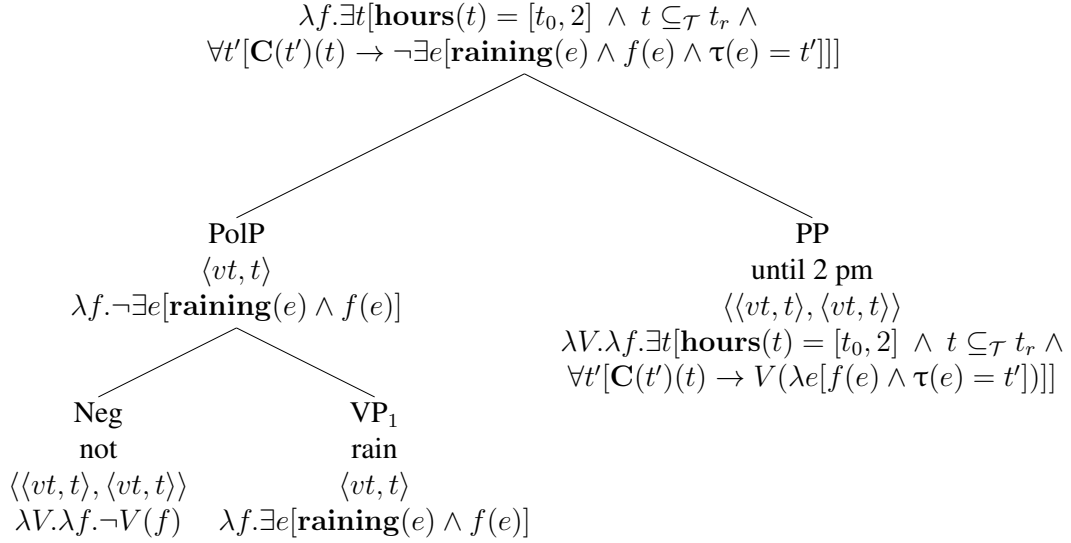


Fig. 3.2: LF for the ‘throughout-not’ reading of the predicate *not rain until 2 pm*

In (14a), it is not the case that there is a time interval that ends at 2 pm such that it rained for all of its relevant parts. In contrast, in (14b), there is an interval that ends at 2 pm during which (i.e. during all of its relevant parts) there is no event of raining. This ambiguity derived from using one single entry of *until* (instead of e.g. one event-oriented and another one interval-oriented) together with a standard treatment of logical negation could have not been achieved within previous frameworks of event semantics. The fact that the two LFs in (14) are possible will help us develop a uniform scopal account of the various functions of *until*.

3.2.3 Argument saturation

As introduced above, in a neo-Davidsonian account verbal arguments—other than the event argument tied to the verb—are introduced later in the syntax, which determines the order in which these are fed. But it could well be that thematic roles are introduced as part of verbal denotations by a verb selecting all its arguments itself. One can choose one’s favorite theory here. For comparison and uniformity across analyses, since the framework in Champollion (2015) uses applicative heads, and mostly for convenience, we are going to choose the former, and assure that thematic roles combine with verbal projections via separate syntactic heads.

However, a technical difference from Champollion’s (2015) analysis is that in our framework applicative heads operate on the verb first (instead of applying to the DP first), which will make the rule for scope assignment, namely quantifier raising (henceforth, QR) cleaner. These thematic role heads I propose cannot combine the verbal projection with a quantificational noun phrase, only with entities of type e . This forces QR of any quantificational DPs.¹⁰ Ultimately, as detailed in §3, our goal is that our syntactic theory of scope through quantifier raising will predict the right scope relations, e.g. between a theme argument and a right-adjoined durative adverbial.

Let us assume that thematic role heads take the denotation of a verbal projection, i.e. a generalized quantifier over events (i.e. predicate V), allow it to combine with a referential noun phrase type e , and finally return another generalized quantifier over events, conforming to the scheme of the present system. The applicative

¹⁰This is so that we do not have to unnaturally boost the types of the verbal phrase or its projections *in situ*, unlike Champollion (2015).

head type ends up being $\langle\langle vt, t \rangle, \langle\langle e \rangle, \langle vt, t \rangle\rangle\rangle$, as shown in (15).

- (15) a. $\llbracket[\text{TH}]\rrbracket(\textit{preliminary}) = \lambda V. \lambda x. \lambda f. V(\lambda e[f(e) \wedge \mathbf{th}(e) = x])$
 b. $\llbracket[\text{AG}]\rrbracket(\textit{preliminary}) = \lambda V. \lambda x. \lambda f. V(\lambda e[f(e) \wedge \mathbf{ag}(e) = x])$

An example is given in (16), where the syntactic head [TH] first combines with the verbal projection of *arrive* and then the output of this applies to the entity *John*, hence establishing a theme relation between this individual and the event denoted by the predicate.

- (16) a. $\llbracket[\text{TH}]\rrbracket(\llbracket[\text{arrive}]\rrbracket) = \lambda x. \lambda f. \exists e[\mathbf{arriving}(e) \wedge f(e) \wedge \mathbf{th}(e) = x]$
 b. $\llbracket(16a)\rrbracket(\llbracket[\text{John}]\rrbracket) = \lambda f. \exists e[\mathbf{arriving}(e) \wedge f(e) \wedge \mathbf{th}(e) = \mathbf{j}]$

In this way, the mechanism of applicative heads makes it easier to have a uniform analysis of thematic roles (both agent and theme) and to place constraints on the role of the thematic head without having to change the lexical entry of the verb.

At this point, it is worth considering what happens when the verbal argument that combines with a thematic head receives a kind-level reading. I assume that bare plural and mass noun phrases can make reference to kinds and be categorized as entities. Recall that bare DPs should not be treated on a *par* with a quantificational DP like *an N* or *some Ns*. Otherwise, there is no systematic way to account for the fact that a bare plural theme could take narrow scope with respect to a right-adjoined durative adverbial, whereas *an N* or *some Ns* can only take wide scope (e.g. *John killed rabbits for two hours* vs. *#John killed some rabbits for two hours*). The acceptability of the former reminds us of a kind reading (e.g. *John killed this type of animal for two hours*) (Carlson 1977a, b). Thus, bare plurals and mass nouns

must be treated differently from indefinite DPs, contra analyses such as Wilkinson (1991) and Diesing (1992) where “the source of existential quantification for bare NPs and indefinites of the form *an N* and *some Ns* is the same” (via Zucchi and White 2001: 269).

One way of differentiating bare/mass nouns from indefinites is by positing that kinds do not have a quantificational force of their own, since they basically denote entities that can be instantiated. On one approach, kinds behave in a similar way to individuals, in the sense that they are introduced directly into argument positions of the verbal phrase/applicative heads.¹¹ For example, an episodic sentence with a bare plural kind would be interpreted along the lines in (17) under this account.

$$(17) \quad \llbracket \text{Horses arrived} \rrbracket = \exists e[\text{arrive}(e) \wedge \text{th}(e) = \text{horses}]$$

On another approach, a variant of Carlson’s (1977a, b) original proposal advanced in Chierchia (1998) (see also Dayal 1992, 2004), kinds combine with verbs via Derived Kind Predication (henceforth, DKP), a type-shifting operation which, triggered by a type mismatch, inserts an existential quantifier that binds bare plural kinds in episodic contexts. DKP ensures that the existential quantificational force

¹¹By *kind* I mean the denotation of a ‘plural kind’, and not to a ‘singular kind.’ A potential concern worth highlighting is that there is a difference between kind readings of bare plurals and of singular definites. While the former are always good in episodic contexts, the latter are only good when what is expressed is somehow momentous for the life of the whole kind (e.g. Chierchia 1998). See the contrast in (i).

- i. a. ?? The horse arrived. (on the kind-level reading)
- b. The horse arrived in America with Columbus.

For ways of handling this contrast, see Kleiber (1990), Krifka *et al.* (1995), Chierchia (1998) and Dayal (2004).

that instantiates individuals of a kind in episodic contexts comes from a different and external source than the existential quantifier binding an indefinite. After applying DKP, a sentence such as *horses arrived* would acquire a meaning along the lines in (18).

$$(18) \quad \llbracket \text{Horses arrived} \rrbracket = \exists e \exists x [\text{horses}(x) \wedge \text{arrive}(e) \wedge \text{th}(e) = \mathbf{x}]$$

For our purposes these two approaches are equivalent, since they both account for how bare plurals differ from other weak indefinites, since they both predict narrow scope behavior of bare plurals with respect to right adjoined durative adverbials.¹²

I will pursue a version of the latter following Chierchia’s (2015) proposal in which if arguments are fed via applicative heads (which applies here), the effects of DKP may already arise from the definition of the applicative head itself. I first introduce the ‘up’-operator ‘ \cup ’, as defined in (19), which associates a kind, seen as a special type, with a special predicate over individuals that instantiates that type, which can be regarded “as the ‘predicativization’ of kinds” (Chierchia 1998: 349).

$$(19) \quad \cup \mathbf{x}: \text{it turns } x \text{ into a predicate over entities that instantiate that kind if } x \text{ is a kind: } P(\cup x) = \exists y[\cup x(y) \wedge P(y)].$$

Second, the predicativization of kinds in (19) can be built as part of the meaning of the thematic head where if the head combines with something of type e other than a kind then DKP does not obtain: $\cup x = \lambda y[y = x]$ if x is not a kind. This leads to the final denotations of thematic heads in the present framework, as given in (20).

¹²Nevertheless, in other phenomena, such as anaphora, binding, and control involving kinds, there are syntactic and semantic reasons that support the insertion of an existential quantifier; see Chierchia (1998, 2015) for examples of these. For even further independent motivation, see e.g. van Geenhoven (1996) and Zucchi and White (2001).

- (20) a. $\llbracket[\text{TH}]\rrbracket(\text{final}) = \lambda V. \lambda x. \lambda f. V(\lambda e[f(e) \wedge \exists y[\cup x(y) \wedge \mathbf{th}(e) = y]])$,
 where if x is not a kind, $\cup x = \lambda y[y = x]$
- b. $\llbracket[\text{AG}]\rrbracket(\text{final}) = \lambda V. \lambda x. \lambda f. V(\lambda e[f(e) \wedge \exists y[\cup x(y) \wedge \mathbf{ag}(e) = y]])$,
 where if x is not a kind, $\cup x = \lambda y[y = x]$

The basic idea behind (20) is that the existential quantifier that binds bare plurals and mass nouns that receive a kind interpretation in episodic contexts can already be provided by the applicative head. On the other hand, when the theme or agent argument of type e in the input of the applicative head is not kind interpretable, then no DKP effects unfold. For example, note the application of \cup to an individual like *John*:

- (21) a. $\llbracket[\text{TH}]\rrbracket(\llbracket[\text{arrive}]\rrbracket) = \lambda x. \lambda f. \exists e[\mathbf{arriving}(e) \wedge f(e) \wedge \exists y[\cup x(y) \wedge \mathbf{th}(e) = y]]$
- b. $\llbracket(21a)\rrbracket(\llbracket[\text{John}]\rrbracket) = \lambda f. \exists e[\mathbf{arriving}(e) \wedge f(e) \wedge \exists y[\cup \mathbf{j}(y) \wedge \mathbf{th}(e) = y]]$
 $= \lambda f. \exists e[\mathbf{arriving}(e) \wedge f(e) \wedge \exists y[\lambda z[z = \mathbf{j}](y) \wedge \mathbf{th}(e) = y]]$
 $= \lambda f. \exists e[\mathbf{arriving}(e) \wedge f(e) \wedge \exists y[y = \mathbf{j} \wedge \mathbf{th}(e) = y]]$
 $= \lambda f. \exists e[\mathbf{arriving}(e) \wedge f(e) \wedge \mathbf{th}(e) = \mathbf{j}]$

[Based on Chierchia (2015), ex. (2c)]

In (21), *John*, a referential entity of type e , does not qualify as a kind, since it refers to something instantiated just by one individual¹³, and hence we obtain the same expected results as with our preliminary (*common*) version of applicative heads, which ignored the effects of DKP. Otherwise, if the applicative head receives a kind

¹³It has been noted though that exceptionally there are kinds that can be instantiated only by one individual or not instantiated at all in the real world, such as *dodo*; see Chierchia (1998), e.g. p. 350, for further discussion.

as input then the effects of DKP are obtained. This is illustrated in (22) with the application of \cup to a kind like *horses*.

$$(22) \quad \llbracket (21a) \rrbracket (\llbracket \text{horses} \rrbracket) = \lambda f. \exists e [\text{arriving}(e) \wedge f(e) \wedge \exists y [\cup \text{horses}(y) \wedge \text{th}(e) = y]]$$

The applicative head, which already maps a kind into a corresponding property, directly combines with the kind *horses* in (22) and nothing else happens.

3.2.4 Quantified DPs and scope assignment

Unlike Champollion (2015), I do not treat all noun phrases (henceforth, DPs) as generalized quantifiers over individuals which can be interpreted *in situ* via type-lifting rules of the verb or verbal projection so that the verb can combine directly with a quantifier. Instead, I follow a syntactic theory of quantifier scope which utilizes quantifier raising for type reasons. For this, recall that after the thematic head operates on the verb, the verb phrase expects a non-quantificational argument.

3.2.4.1 DP arguments

In the present account, only proper names, referential DPs, pronouns, and kinds are type e , as exemplified in (23), and can be interpreted *in situ*.

$$(23) \quad \llbracket \text{John} \rrbracket = \mathbf{j}$$

On the other hand, I adopt the standard assumption that common nouns and predicate noun phrases are predicates of type $\langle et \rangle$. I use \mathbf{P} to refer to predicate of individuals, as in (24).

$$(24) \quad \llbracket \text{rabbit} \rrbracket = \lambda x. \text{rabbit}(x)$$

I also assume that quantified DPs are interpreted as generalized quantifiers over individuals of type $\langle et, t \rangle$, and **Q** stands for predicates of such a type, as in (25).

$$(25) \quad \llbracket \text{a rabbit} \rrbracket = \lambda P. \exists x [\text{rabbit}(x) \wedge P(x)]$$

3.2.4.2 (Extended) Quantifier Raising Rule

In the present framework we are changing the type of the propositional nuclei to $\langle vt, t \rangle$. One way of solving a type mismatch of a quantified DP with a verbal projection that expects something of type e is via quantifier raising. Let us assume, for the time being, that the only two admissible landing sites for a quantified DP are (i) TP (after closure) of type t , where a traditional QR rule following May (1977) may apply, and (ii) vP of type $\langle vt, t \rangle$, where an extended QR rule, as explained below, comes into play.

For the former, May (1977) posited a rule of QR that basically allowed a quantifier to adjoin to IP. Under May's QR approach, it follows that a raised quantifier can only sit in an adjunction site whose semantic type is t . This is only possible after closure applies in the present framework. We will be adopting Heim and Kratzer (1998) notation system and interpretable rules for QR (as discussed further below).

Nevertheless, considering that all verbal projections before closure are event propositions of type $\langle vt, t \rangle$, we may need to QR into the new propositional type, say at vP . Hence, I posit the following extended QR rule in (26).

$$(26) \quad \text{Extended QR-rule: } \llbracket \text{DP}_i vP \rrbracket = \lambda f_{\langle vt, t \rangle}. \llbracket \text{DP}_i \rrbracket (\lambda x_i. \llbracket vP \rrbracket (f))$$

The effect of the extended QR-rule is as follows, stated in procedural terms. First we apply the meaning of vP to a variable f of type $\langle vt \rangle$. We are then left with something of type t . We can now perform regular QR, where vP now of type t and the adjoined index are subject to Predicate Abstraction Rule, which assigns it a meaning of type $\langle e, t \rangle$. Then, the raised quantifier formerly adjoined to vP applies directly by function application. This yields something of type t . Finally, we reabstract f , giving us back something of type $\langle vt, t \rangle$, complying with any verbal projection within the current framework.¹⁴

3.2.5 Basic illustrations of the framework

On the basis of the principles of the suggested framework, below I show the derivations of three basic constructions: (i) an intransitive predicate; (ii) a transitive predicate with a quantified direct object; and (iii) an ambiguous transitive predicate with a quantified direct object in a negative environment. The first sentence in (27) involves only function application, as illustrated in Fig. 3.3.

¹⁴This operation is essentially the ‘Generalized Quantifying in’ rule of Rooth’s (1992), who suggests using this strategy known as *Pointwise Function Application* as the fundamental compositional rule in alternative semantics.

(27) John studied.

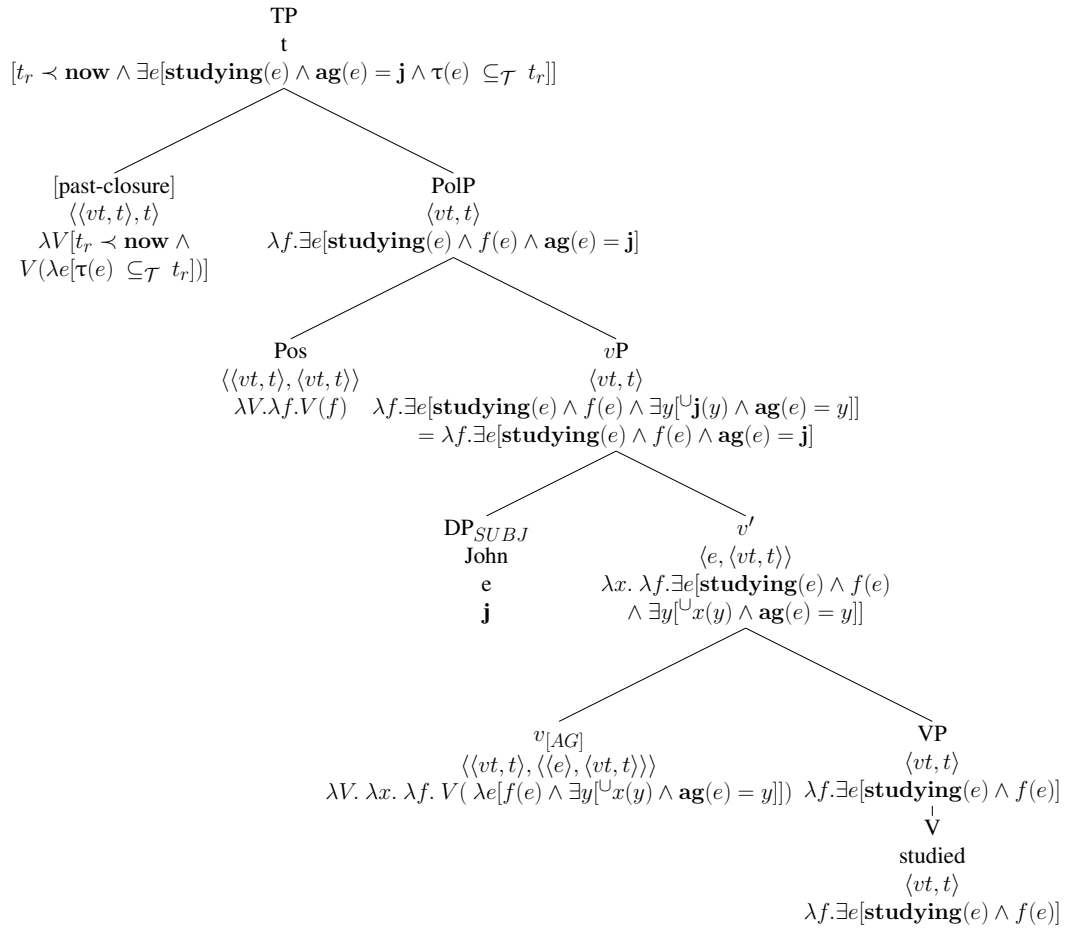


Fig. 3.3: LF for example (27): *John studied*

A slightly more complex construction is presented in (28), which contains a quantified object, thus requiring the application of QR (subject to our extended QR rule when QRing into vP) with movement and trace interpretation, as shown in Fig. 3.4, giving us the interpretation that *there is a rabbit such that John killed that rabbit*.

John killed that rabbit, i.e. an any-type interpretation comparable to *John didn't kill any rabbit*.

(29) John didn't kill a rabbit.

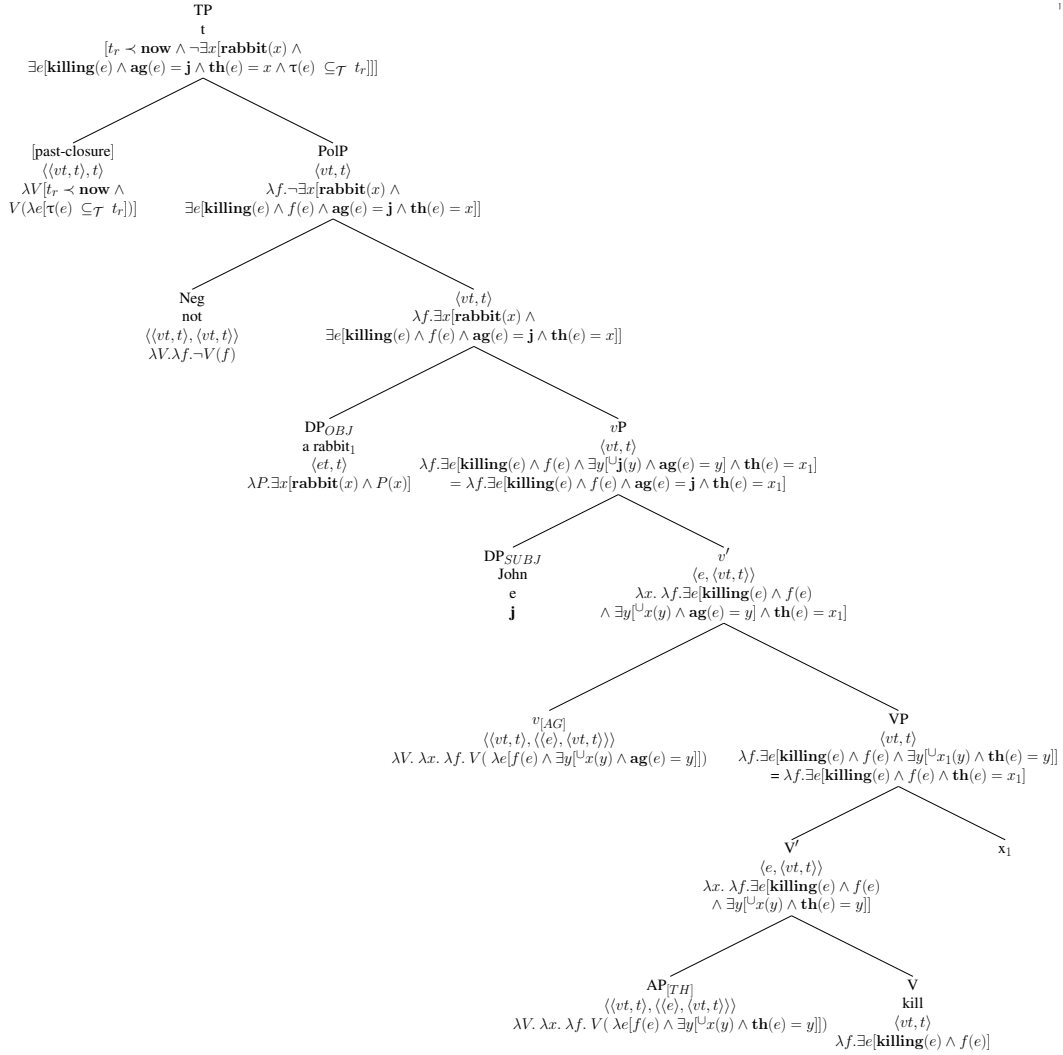


Fig. 3.5: LF-1 for example (29): *John did not kill a rabbit*

An alternative interpretation of (29) is obtained by regular QR-ing the quantified

of three basic sentences: *John studied*, *John killed a rabbit*, and the ambiguity in *John didn't kill a rabbit*.¹⁶

3.2.6 Summing up

In this section I have introduced the main characteristics of the quantificational event semantics framework *à la* Champollion (2015) together with some alterations, mostly due to the treatment of scope I have adopted. As a summary of the main formal specifications, see Table 3.1.

Category	Abbreviation	Semantic type	Example of denotation
Verb	V	$\langle vt, t \rangle$	$\llbracket \text{kiss} \rrbracket = \lambda f. \exists e [\text{kissing}(e) \wedge f(e)]$
Proper name	x	e	$\llbracket \text{John} \rrbracket = \mathbf{j}$
Common noun	P	$\langle et \rangle$	$\llbracket \text{rabbit} \rrbracket = \lambda x. \text{rabbit}(x)$
Quantified DP	Q	$\langle et, t \rangle$	$\llbracket \text{a rabbit} \rrbracket = \lambda P. \exists x [\text{rabbit}(x) \wedge P(x)]$
AP _[TH]	[TH]	$\langle \langle vt, t \rangle, \langle e \rangle, \langle vt, t \rangle \rangle$	$\lambda V. \lambda x. \lambda f. V(\lambda e [f(e) \wedge \exists y [\cup x(y) \wedge \text{th}(e) = y]])$, where if x is not a kind, $\cup x = \lambda y [y = x]$
$v_{[AG]}$	[AG]	$\langle \langle vt, t \rangle, \langle e \rangle, \langle vt, t \rangle \rangle$	$\lambda V. \lambda x. \lambda f. V(\lambda e [f(e) \wedge \exists y [\cup x(y) \wedge \text{ag}(e) = y]])$, where if x is not a kind, $\cup x = \lambda y [y = x]$
Negation	Neg	$\langle \langle vt, t \rangle, \langle vt, t \rangle \rangle$	$\llbracket \text{not} \rrbracket = \lambda V. \lambda f. \neg V(f)$
Pos		$\langle \langle vt, t \rangle, \langle vt, t \rangle \rangle$	$\llbracket \text{Pos} \rrbracket = \lambda V. \lambda f. V(f)$
Past-closure		$\langle \langle vt, t \rangle, t \rangle$	$\lambda V [t_r < \text{now} \wedge V(\lambda e [\tau(e) \subseteq_{\mathcal{T}} t_r])]$
For 2 hours		$\langle \langle vt, t \rangle, \langle vt, t \rangle \rangle$	$\lambda V. \lambda f. \exists t [\text{hours}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\text{C}(t')(t) \rightarrow V(\lambda e [f(e) \wedge \tau(e) = t'])]]$
Until 2 pm.		$\langle \langle vt, t \rangle, \langle vt, t \rangle \rangle$	$\lambda V. \lambda f. \exists t [\text{hours}(t) = [t_0, 2] \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\text{C}(t')(t) \rightarrow V(\lambda e [f(e) \wedge \tau(e) = t'])]]$

Table 3.1: A summary of the basic formal semantic specifications of our framework

3.3 A scopal account of *for*-adverbials and *until*-phrases

I put forward a syntactic and semantic account of quantifier scope of English durative adverbials *for* and *until* treated as universal quantifiers, so as to capture the following basic facts:

¹⁶From here onwards, for simplicity purposes, I will not show on trees the intermediate step in the derivation of the application of the \cup operator from an applicative head to an entity e other than a kind, as I have, for instance, illustrated at the vP and VP nodes in Fig. 3.6 above. I will give the result of composing the applicative head with a DP x of type e by taking into account that if x is not a kind, then $\cup x = \lambda y [y = x]$.

- i Affirmative non-iterative telic predicates (non-iterative achievements and accomplishments) cannot combine with a durative adverbial.¹⁷
- ii Telic predicates become acceptable with durative adverbials under negation and acquire a ‘throughout-not’ interpretation, whereas atelic predicates are ambiguous between a ‘not-throughout’ and a ‘throughout-not’ interpretation.
- iii DP quantifiers generally scope over right-adjoined durative adverbials unless another overt/covert distributive operator such as *every day* intervenes.

My scopal approach is a refinement of Mittwoch’s (1977) original insight in that the crucial difference between durative and punctual uses of a durative adverbial such as *until* is scopal and not lexical. I start by claiming that right-adjoined durative adverbials are low adverbs that attach as low as possible compatible with their type, as expected from their prevalent tendency to take narrow scope with respect to other scope bearing elements in the clause. The initial specifications of the analysis together with its preliminary predictions are described below. These are shown first for episodic sentences in upward entailing environments.

¹⁷Recall that sometimes an accomplishment predicate accepts a durative adverbial on what is often referred to as a *partitive reading* (e.g. Champollion 2013), or a *coerced imperfective interpretation* (e.g. in Krifka’s 1998 terms), because the predicate has not yet reached its completion, as in *John read a book for 2 hours/until 2pm*. Such interpretations are outside the scope of the present dissertation. But intuitively one could invoke some sort of partitioning operator (which maps potentially complete eventualities into incomplete ones through the mereological notion of incrementality, e.g. Krifka 1998, Beavers 2012) or a notion of partial theme (vs. complete theme) so as to account for such cases. For instance, see for discussion on this issue Krifka (1998) and Tatevosov and Inanov (2009).

3.3.1 The base position of *for/until*-XPs in positive episodic contexts

I first suggest that right-adjoined durative adverbials are low adverbs, i.e. the canonical attachment site for English *for* and *until* measure phrases is the VP, as expressed in (30).

(30) **Hypothesis #1** (*to be modified*): Right-adjoined durative adverbials are low adverbs whose canonical attachment site is the lowest possible XP, i.e. the VP, compatible with their type.

Considering that these adverbials are generated in a low position, a quantified subject will always scope over them. Furthermore, a quantified object cannot be interpreted *in situ* either, thus entailing that the object-DP must QR to some higher possible attachment site, say *v*P. In this way, through the assumption that right-adjoined durative-adverbials are low adverbs, their usual narrow scope behavior directly follows, as captured in the following examples. The temporal measure phrase chosen below just for illustrative purposes is *for*-adverbials, but exactly the same applies to *until*-phrases, considering that their denotations only differ in terms of the type of interval they pick to encode the duration of the event in question.

3.3.1.1 Atelic predicates

Below in (31) and Fig. 3.7, I give the LF and derivation of a simple example composed by an atelic predicate and a durative adverbial, which displays the durative adverbial generated low at the VP level. The fact that the *for*-XP can modify the atelic predicate simply follows from the subinterval property.

(31) John studied for 2 hours.

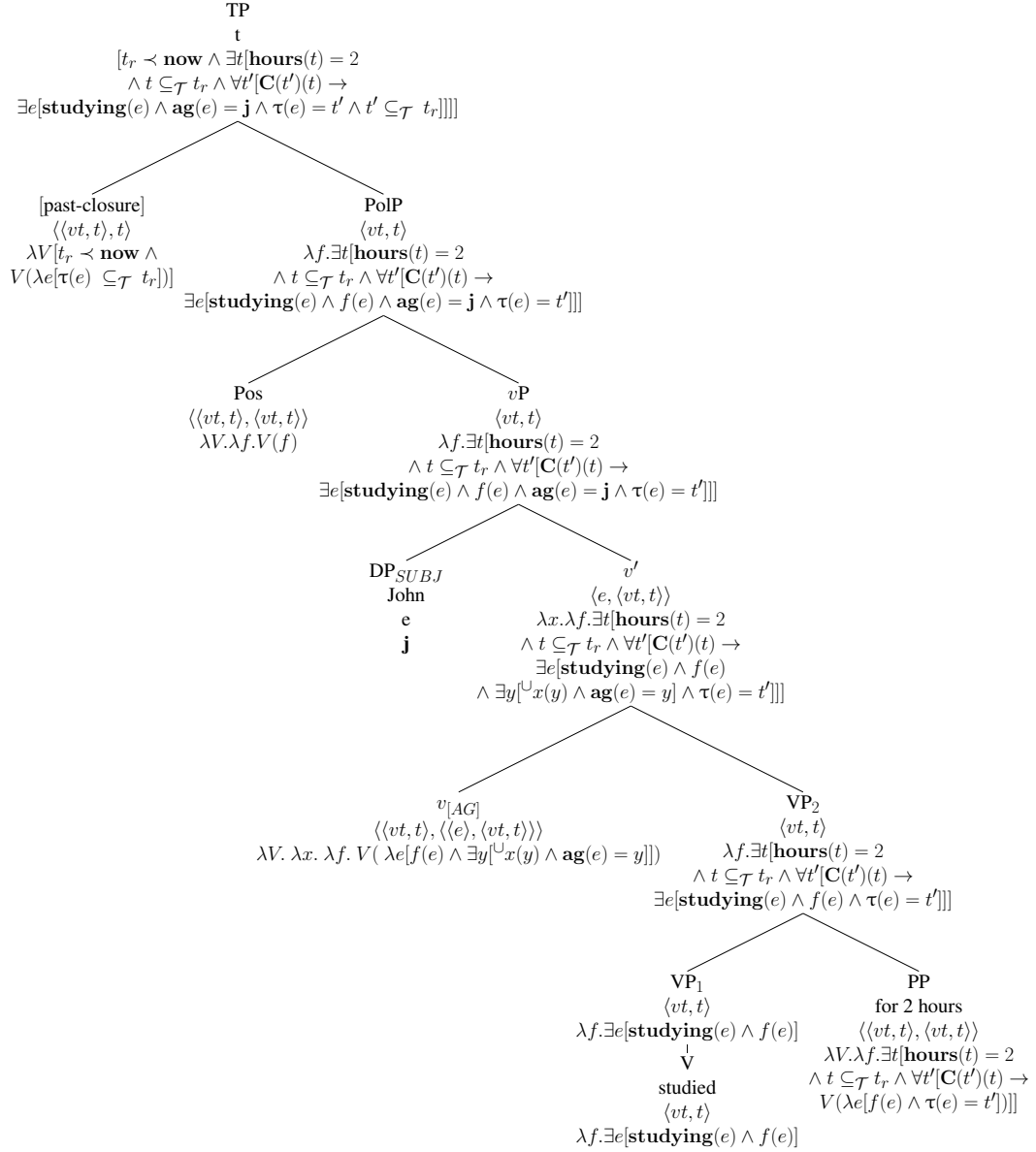


Fig. 3.7: LF for example (31): *John studied for 2 hours*

3.3.1.2 Punctual predicates with a referential object

The following example in (32) demonstrates a basic case of a telic predicate with a referential object of type *e*. The verb used is the punctual verb *kill*, which does not allow for iteration of the predicate, since the same object cannot be killed more than once. In Dowty's terminology, *kill* lacks the subinterval property (given that the predicate cannot hold at any subinterval of the interval of which it holds). Thus, the combination of *kill* with a durative adverbial turns out to be infelicitous.

(32) #John killed the rabbit for 2 hours.

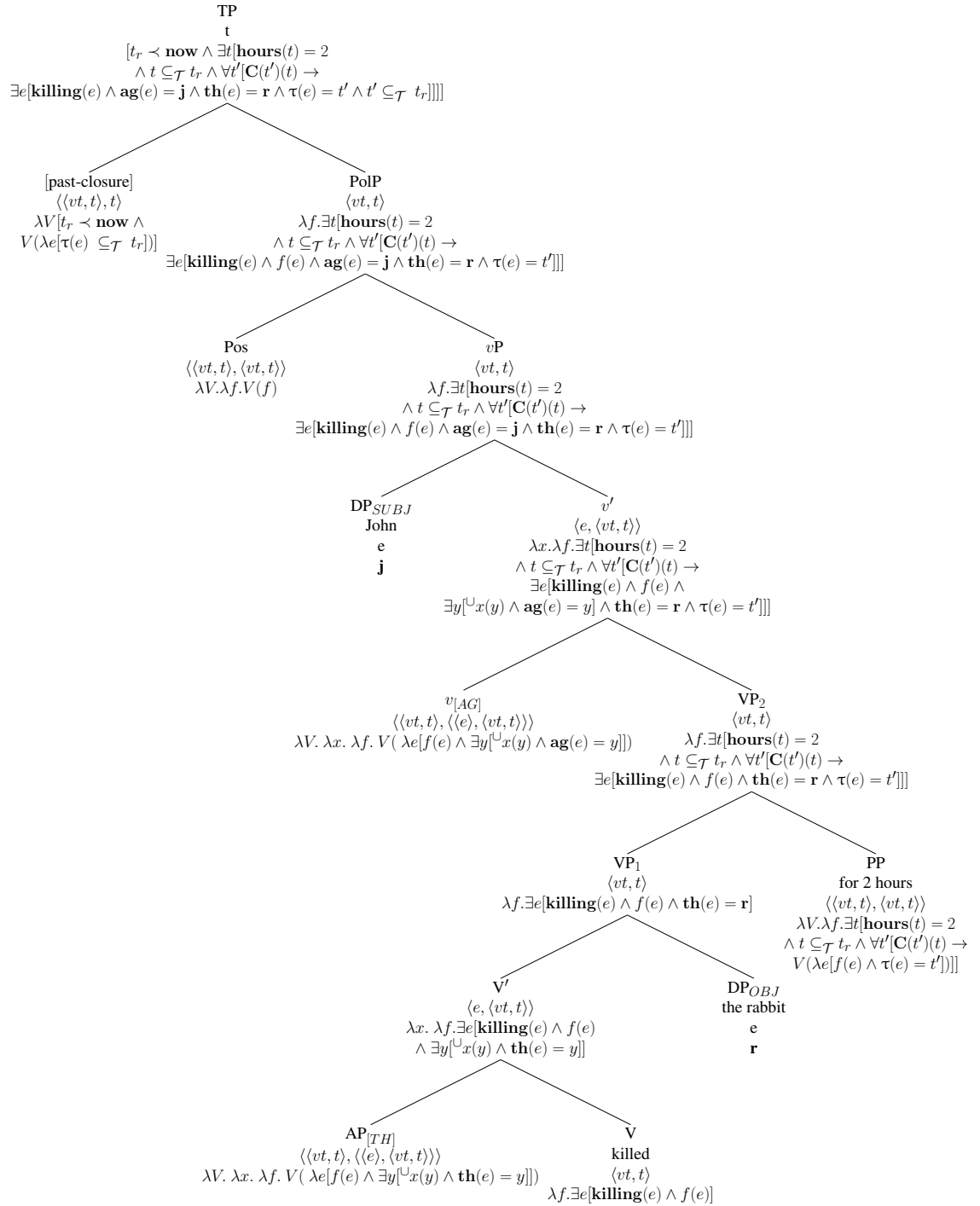


Fig. 3.8: LF for example (32): #John killed the rabbit for 2 hours

3.3.1.3 Punctual predicates with a kind object

The implausible scenario in Fig. 3.8 contrasts with a context in which the object may vary at each subinterval, e.g. when the direct object is a bare plural that receives a kind interpretation, as exemplified in (33) and Fig. 3.9 below. The intuition behind this is that when the object (e.g. *rabbits*) is perceived as a kind, the theme applicative head existentially binds the object *in situ*, which is then able to scope below the universal quantifier of the durative adverbial.

(33) John killed rabbits for 2 hours.

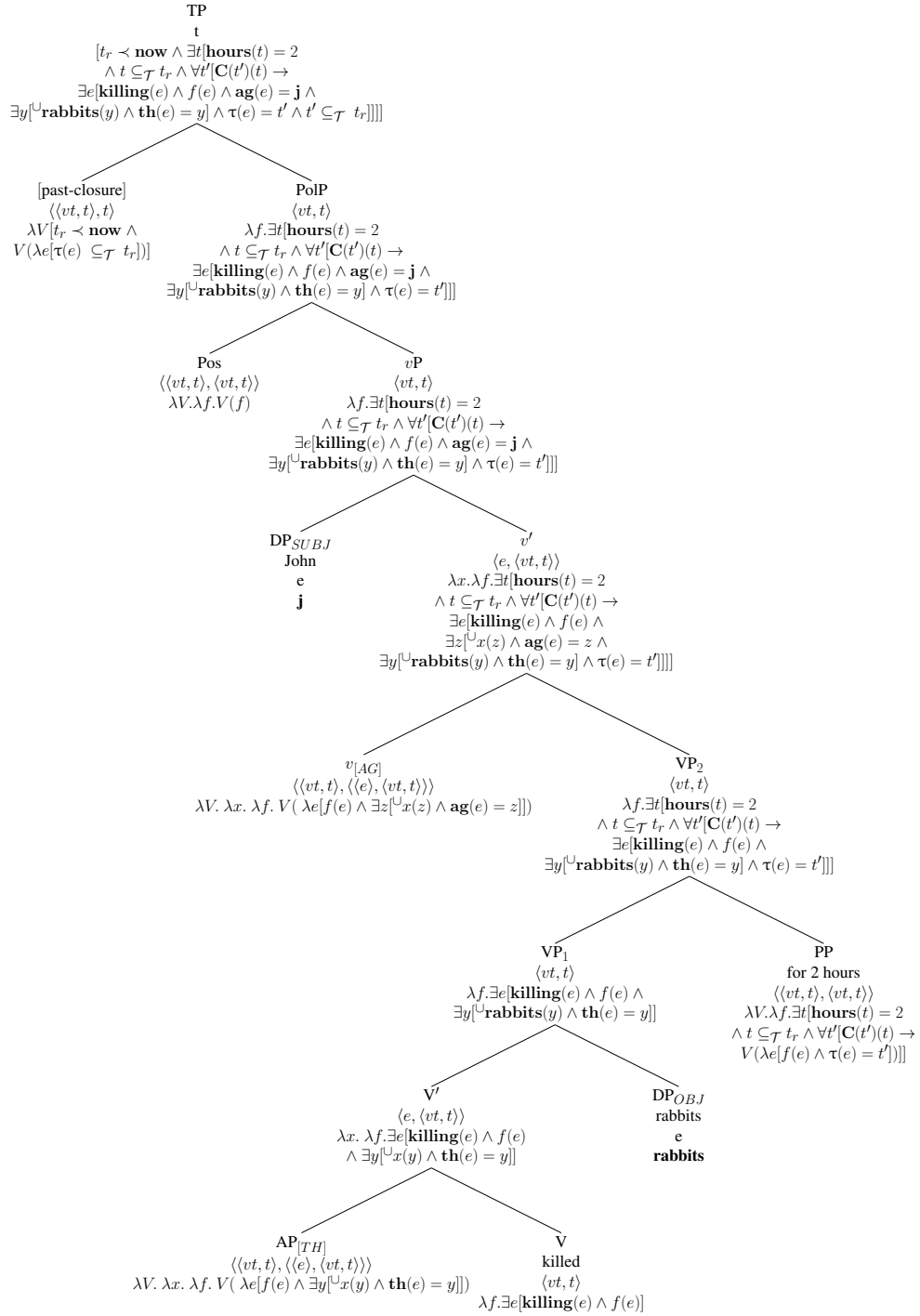


Fig. 3.9: LF for example (33): *John killed rabbits for 2 hours*

As a consequence, bare plurals or mass nouns on a kind-reading derive a felicitous interpretation with a durative adverbial even with punctual, non-iterative eventualities, in a positive environment, as illustrated in Fig. 3.9.

3.3.1.4 Punctual predicates with an indefinite/quantified object

On the other hand, a quantified-DP subject or object cannot combine directly with the applicative head due to type theoretic mismatch. As a result, it raises to a higher position, *vP*, where an interpretation is possible via our extended QR rule. This derives a wide scope reading of the indefinite/quantified DP since, after QR, the existential force of the DP ends up scoping above the universal quantifier of the durative adverbial. This is exemplified in (34) and Fig. 3.10 with a singular indefinite DP-object and the non-iterative telic predicate *kill*, which is infelicitous for the same pragmatic reasons as (32) is with a referential DP object, since the theme is kept constant and the predicate *kill* lacks the subinterval property.

- (34) # John killed a rabbit for 2 hours.

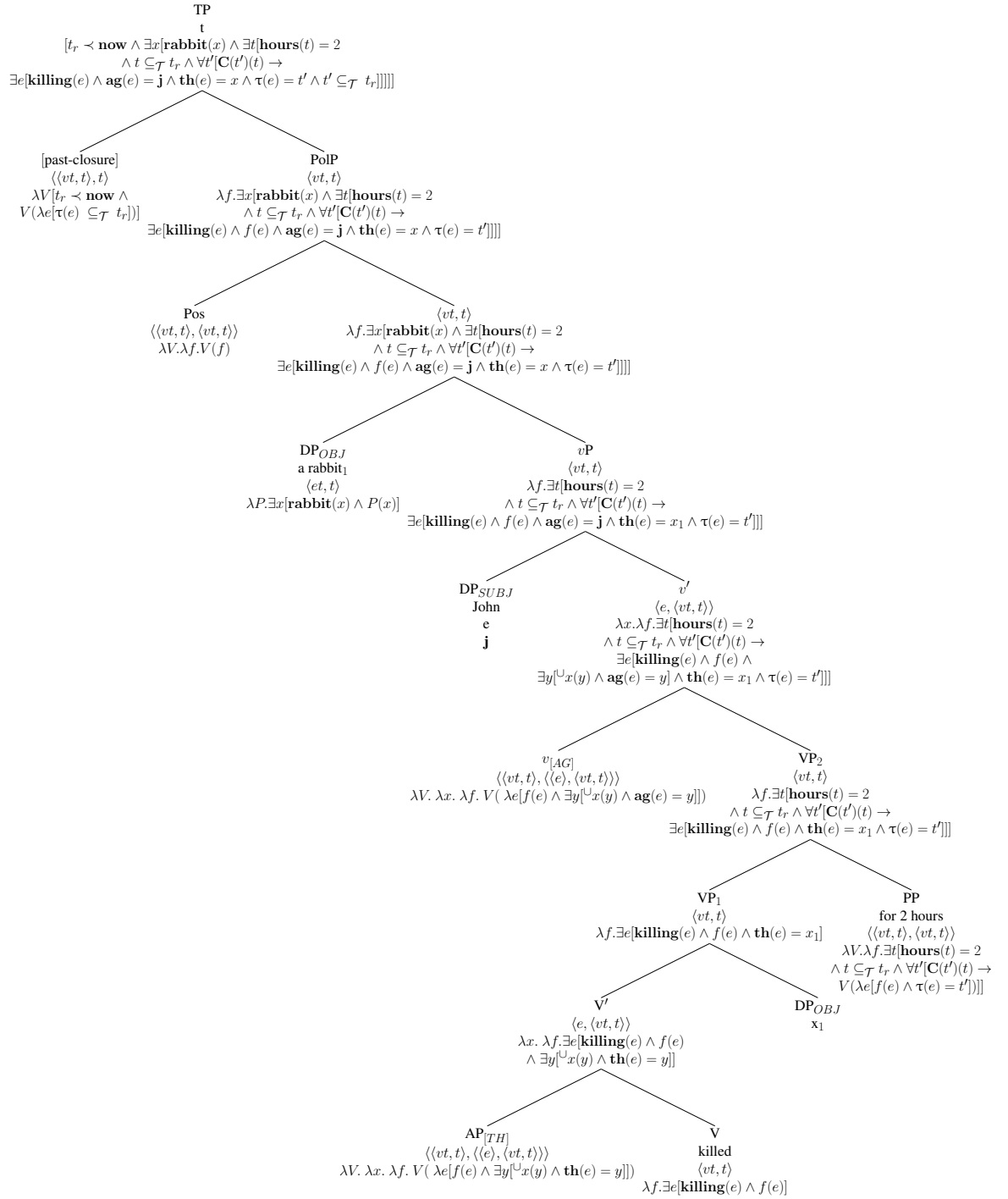


Fig. 3.10: LF for example (34): #John killed a rabbit for 2 hours

Therefore, the assumption that right-adjoined durative adverbials are event modifiers that attach low at the VP level is in line with their narrow scope tendency, as shown in the derivation in Fig. 3.10, which accounts for the anomaly of a sentence such as *#John killed a rabbit for 2 hours*. Now it is time to ask the question: Why is the universal quantification force of measure-phrases restricted to low scope? Even if *for/until*-phrases are generated ‘low’, why can they not raise and scope over the object, which would yield a natural reading?

3.3.1.5 Punctual predicates with an indefinite/quantified object: Unavailable alternative scenario

At this point, it is important to consider an alternative scenario in which the durative adverbial would attach to a higher position compatible with its type, say at PolP, right above a quantified raised-object. At first, there is nothing that should in principle be disallowing such a plausible scenario, say for the sentence as in (34), given again as (35).

(35) *# John killed a rabbit for 2 hours.*

If the durative adverbial were able to attach higher and scope above the indefinite in (35), the derivation would give rise to a perfectly plausible scenario, i.e. one in which John kept killing rabbits, one at a time, over the course of two hours, thus resembling the meaning of (33) with a bare plural object. However, such a reading, with the \forall scoping above the \exists , which would correspond to the derivation in Fig. 3.11 below, is simply not available.

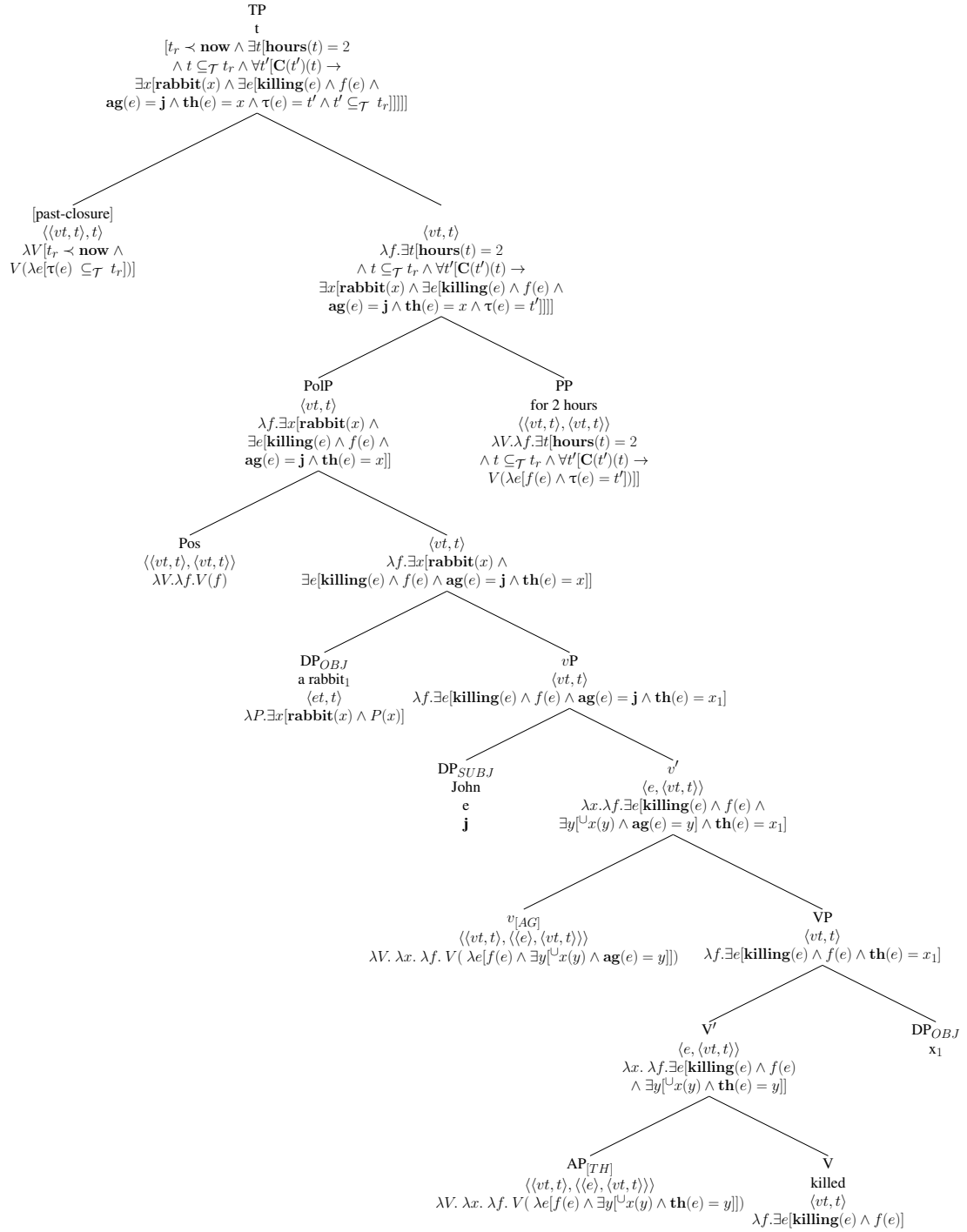


Fig. 3.11: Unavailable LF for example (35): #John killed a rabbit for 2 hours

The fact that the meaning derived in Fig. 3.11 is not available suggests that something must block this construal. Some constraint that blocks this configuration seems necessary on every approach. Therefore, note that such right-adjoined adverbials scope low, and this was my hypothesis for their base-position. But we can now ask the question of why they scope low, and furthermore address the question of whether there are any exceptions to this and when such exceptions occur and why. Below I will make a more concrete proposal.

3.3.1.6 Summing up

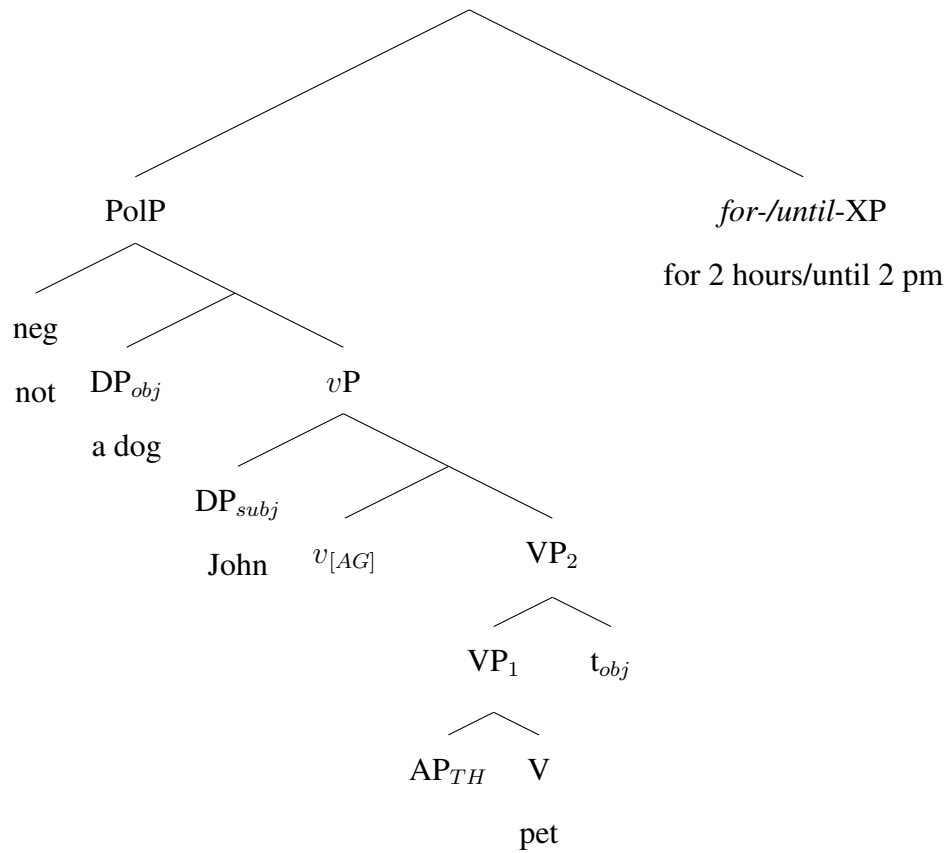
Up to this point, the major claim of this chapter about *for*- and *until*-XPs has been that they are event modifiers that attach as low as possible compatible with their type, i.e. at the VP-level. This captures their narrow scope behavior with respect to any indefinite/quantified DP subject/object in the clause in positive episodic sentences. As it turns out, however, this is not always the case: suspension of narrow scope of the durative adverbial is indeed possible under certain circumstances (e.g. with negation), suggesting that extraposition of the durative adverbial to a higher attachment site should still be allowed, yet restricted. This calls for a revision of our preliminary hypothesis.

3.3.2 Suspension of differentiated scope via *Maximize Strength*

In this section, I address the scopal behavior of right-adjoined durative adverbials so as to better understand the constrained behavior of their universal component, and how it may differ from other freer universals like *every day*.

So far I have proposed that right-adjoined durative adverbials have a low attachment site. However, I now argue that they can also be extraposed to a higher position in certain circumstances. For example, suspension of narrow scope behavior seems to be possible in the presence of negation. The configuration in (36b) is necessary for the ‘throughout-not’ reading.

- (36) a. John didn’t pet a dog for 2 hours/until 2 pm.
 (‘Throughout-not’ reading: for 2 hours/until 2 pm, John didn’t pet any dog)
- b.



In the configuration in (36b), a right-adjoined durative adverbial is extraposed, and right adjoined to PolP (i.e. Pos/NegP) from its position to the right. However, as discussed above, we generally need to block adjunction to PolP so as not to overgenerate. The durative adverb seems to be constrained to having narrow scope with respect to an object but it must be allowed to have wide scope with respect to negation. How do we resolve this paradox? Any theory dealing with right-adjoined durative-adverbials must tackle this puzzle, because contrary to what one would expect, they do not have free scopal behavior. Remember that this might be so even when the reading that would obtain from scoping out the adverbial would sound more natural; e.g. in *John dialed a wrong phone number for two hours*, the only possible interpretation is dialing the same wrong phone number over and over again, instead of dialing different wrong phone numbers. So what prevents extraposition of the adverb?

I propose that extraposition of *for/until*-phrases is subject to a version of a Maximize Strength Constraint, a constraint on the processing of possible clause-internal scope interpretations: these types of adverbials cannot scope out if they lead to a logically weaker reading. This is to be viewed as an economy condition reminiscent of (i) Fox's (1995) treatment of scope restriction in VP-ellipsis and of (ii) theories that posit that argument structure is sensitive to informativeness/strength (e.g. Horn 1972, 1989; Beavers 2010). I hence suggest replacing our former hypothesis given in (30)—repeated here as (37)—for (38).

(37) **Hypothesis #1:** Right-adjoined durative adverbials are low adverbs whose canonical attachment site is the lowest possible XP, i.e. the VP, compatible with their type.

(38) **Hypothesis #2: Maximize Strength** (*to be modified*): Right-adjoined durative adverbials are low adverbs whose canonical attachment site is the lowest possible XP, i.e. the VP, compatible with their type, **and they may not raise if it leads to weakening.**

I refer to “degree of informativeness” in terms of “logical strength.” Extraposition of the low adverbial to a higher position, say PolP or FreqP, is only permissible when it does not weaken the assertion, i.e. when it does not make the assertion less informative, along the lines specified below: “If ϕ asymmetrically entails ψ , then ϕ is more informative than ψ , simply because ϕ must be true in a proper subset of the situations(/worlds) in which ψ is true. In other words, ϕ rules out more ‘live options’ than any logically weaker proposition ψ ” (Chierchia 2013: 24).

Recent theories of scalar implicatures in grammar (Gajewski 2003, Chierchia 2006, 2013, 2017, Fox and Hackl 2006, Magri 2009) suggest that scalar implicatures and logical contradictions are computed prior to and blindly to pragmatic processes. Along similar lines, I propose that the logical entailment relation invoked by Maximize Strength “is checked at a level of representation where only logical operators are retained, while non-logical lexical entries are ignored, together with the common knowledge that they carry along” (Gajewski 2003 via Magri 2009: 260). In a nutshell, the argument has the following shape: Maximize Strength is computed blindly (ignoring content words). This will prevent extraposition in the basic cases (i.e. in positive episodic environments). Then, once content words come into play, the result will be deviant or not depending on the specific verbs and nouns and common knowledge. This is similar to cases of blind computation discussed in

the literature for scalar implicatures.¹⁸

More specifically, measure phrases, which can be legitimately analyzed as numbers, such as *for 2 hours/until 2 pm*, do count as logical words, whereas lexical entries of a verb, object, or subject count as content words, represented in (39) as **Ving**, **object**, and **subject**, respectively. The scopal outcome of applying Maximize Strength is computed ‘blindly’ to common knowledge, where the structure in (39a) is preferred to (39b) because the latter is weaker, since an $\exists > \forall$ -reading entails a $\forall > \exists$ -reading. Thus, (39b) is ruled out by Maximize Strength. Once (39b) is out of the picture, the result in (39a) is checked against common knowledge and if it clashes with it then deviance ensues.

- (39) a. **Base position** $\lambda f. \exists x [\text{object}(x) \wedge \exists t [\text{hours}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\mathbf{C}(t')(t) \rightarrow \exists e [\mathbf{Ving}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{subject} \wedge \mathbf{th}(e) = x \wedge \tau(e) = t']]]]$
- b. **Extraposed** $\lambda f. \exists t [\text{hours}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\mathbf{C}(t')(t) \rightarrow \exists x [\text{object}(x) \wedge \exists e [\mathbf{Ving}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{subject} \wedge \mathbf{th}(e) = x \wedge \tau(e) = t']]]]$

In other words, the derivation in (39a), which complies with Maximize Strength, is *per se* non-contradictory in logical terms (ignoring how the **lexical** words, **Ving**, **object**, **subject**, are replaced in the structure), but it can become a lexical contradiction

¹⁸Magri (2009) contributes to the claim that scalar implicatures must be derived within grammar, which can be used to provide a semantic account of grammatical facts. For instance, this would explain the oddness of a sentence such as *#a biological father of the victim arrived late* because of its strengthened meaning computed blindly to common knowledge, namely that the victim has more than one biological father, which then clashes with common knowledge and hence its deviance. If the scalar implicature were not computed blindly to common knowledge *#a biological father of the victim arrived late* would mean the same as *the biological father of the victim arrived late*, assuming a world in which people have only one biological father. See Magri (2009) for further discussion.

(not a logical one) once we insert particular content words and take into account world knowledge.

In more concrete terms, the structure in positive episodic environments represented in (39a) becomes deviant when the content words are filled in with a non-iterative telic predicate such as *kill a rabbit*, since according to world knowledge the same rabbit cannot be killed multiple times. On the other hand, deviance does not derive when the lexical items constitute an atelic predicate or a telic predicate that allows for iteration, such as *dial a wrong phone number*, because world knowledge allows for the same wrong phone number to be dialed multiple times, as contrasted in (40).

- (40) a. $\lambda f.\exists x[\mathbf{a\ rabbit}(x) \wedge \exists t[\mathbf{hours}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t'[\mathbf{C}(t')(t) \rightarrow \exists e[\mathbf{kill}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{John} \wedge \mathbf{th}(e) = x \wedge \tau(e) = t']]]]$
 (there is a rabbit that was killed over and over again for two hours)
- b. $\lambda f.\exists x[\mathbf{a\ wrong\ phone\ number}(x) \wedge \exists t[\mathbf{hours}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t'[\mathbf{C}(t')(t) \rightarrow \exists e[\mathbf{dial}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{John} \wedge \mathbf{th}(e) = x \wedge \tau(e) = t']]]]$
 (there is a wrong phone number that was dialed over and over again for two hours)

All in all, an economy condition based on logical strength, computed blindly to contextual knowledge along the lines specified in Maximize Strength, seems to be on the right track and capable of explaining why extraposition of the low adverbial is blocked in positive episodic sentences. However, logical strength reverses in downward-entailing environments, as explained next, and this will have conse-

quences in presence of scopal operators like negation that derive predictions that further support this analysis.

3.3.2.1 Negation

As seen above, when we have a positive episodic sentence, i.e. when PolP is filled with *pos*, only one of the two scopal possibilities can be derived because a narrow scope interpretation of the durative adverbial is logically more informative than a wide scope reading.

(41) Yesterday John pet **a dog** for 2 hours.

- a. $[\exists > \forall]$ [John pet **a dog** [for 2 hours]] (Base position)
- b. $[\forall > \exists]$ [[John pet **a dog**] for 2 hours] (Extraposited)

A $\forall > \exists$ -reading is weaker than an $\exists > \forall$ -reading since the latter asymmetrically entails the former. Thus, in (41), extraposition of the low adverbial to a higher position so that the time universal can outscope the existential object is disallowed, since it would weaken its meaning (no matter what the content words are).

As far as negative contexts are concerned, it is a general logical fact that downward-entailing items (like negation) reverse logical strength/ informativeness. More specifically, in the case of negation or a downward-entailing environment, if ϕ entails ψ (i.e. if ϕ is logically stronger, and hence more informative than ψ) and C is a downward-entailing environment, then ϕ in the environment of C does not entail ψ in the environment of C. This is exemplified in (42).

- (42) John didn't pet a dog for 2 hours.
- a. $[\neg\exists > \forall]$ [It is not the case that [John pet **a dog** [for 2 hours]]] (Base position)
 - b. $[\forall > \neg\exists]$ [[It is not the case that [John pet **a dog**]] for 2 hours] (Extraposed)

The meaning derived from the base structure in (42a), in which the universal scopes below negation, now does not entail the meaning derived from the extraposed structure in (42b), where the universal outscopes negation, since the former is compatible with situations in which the latter is not. Imagine a context in which John pet the dog for only one hour. This comes out true in the ‘not’-throughout reading, but false in the ‘throughout-not’ reading. In other words, a ‘throughout-not’ reading, which asserts that throughout a specific time interval an eventuality did not take place, is not entailed by a ‘not-throughout’ reading, which asserts that the eventuality did not take place only throughout a subset of the subintervals of the interval in question. The Maximize Strength constraint allows for both scopal possibilities in (42) because extraposition of the durative adverbial in (42b) does not weaken the logical meaning that arises from its base position in (42a) considering that it gives us an interpretation that is not entailed by the base position. Thus we predict that when a *for/until*-phrase modifies a negated predicate, the outcome should be ambiguous between a ‘not-throughout’ and a ‘throughout-not’ interpretation.

A case worth mentioning here is a sentence with a quantified DP *nobody*, which seems to also be able to take narrow scope with respect to a right-adjoined durative adverbial since it gives rise to a perfectly felicitous reading with a non-

iterative telic predicate. *Nobody* could be analyzed as an n-word by positing covert negation, e.g. following Zeijlstra (2009), which reverses logical strength, and extraposition of the durative adverbial is hence permitted because it does not lead to a weaker reading, similarly to the case discussed above in (42). Thus both scopal possibilities are in principle possible according to Maximize Strength. However, when content words are taken into account only the extraposed configuration gives rise to a natural interpretation if it involves a non-iterative telic predicate such as *kill a rabbit*, as shown in (43).

(43) Nobody killed a rabbit for 2 hours.

a. $[\neg\exists > \forall]$ #[it is not the case that [somebody killed **a rabbit**
[for 2 hours]]]

(Base position)

b. $[\forall > \neg\exists]$ [[it is not the case that [somebody killed **a rabbit**]
for 2 hours]

(Extraposed)

Nonetheless, the fact that the extraposed reading is possible at all follows from Maximize Strength for exactly the same reason it does with negation, providing further justification for this approach.

Thus far, based on Maximize Strength, right-adjoined durative adverbials in downward-entailing episodic environments can attach to a higher position, e.g. right-adjoining to PolP, provided that this does not weaken the meaning obtained from their low base-position.¹⁹ If the predicate can satisfy the subinterval property,

¹⁹I would like to thank Hans Kamp for all his insights on Maximize Strength. The key general-

this leads to ambiguity between a ‘not-throughout’ and a ‘throughout-not’ reading, otherwise the latter interpretation, i.e. the reading obtained via extraposition, is the only possibility.²⁰

3.3.2.2 Other downward-entailing environments

A significant question that arises at this point is the following: is it only (overt/covert) sentential negation that licenses extraposition of the durative adverbial, or are there other DE contexts, which also reverse logical strength, that trigger a higher attachment of the low adverbial? Maximize Strength predicts this to be the case, and as we will see here this prediction is borne out.²¹ This provides still further independent

ization of such a constraint is that a right-adjoined durative adverbial does not raise if it leads to an interpretation already entailed from the base position. It is not necessary for the wide scope reading to entail the interpretation obtained from the base position, i.e. raising need not lead to strengthening.

²⁰Further note that a predicate with an indefinite/quantified object may be ambiguous between three (and not only two) potential readings depending on the telic properties of the verb, plus where the DP attaches to after QR, as specified in (i) for the sentences *John didn’t kiss (durative)/ kill (punctual) a diplomat for two hours*:

- i. a. [_{PolP} not [a diplomat₁ [_{vP} was kissed/ killed x₁ for/until-XP]]]
there is no diplomat that was kissed/ ?killed for 2 hours.
Sensible or not depending on the telic properties of the event
- b. [for/until-XP [_{PolP} not [a diplomat₁ [_{vP} was kissed/ killed x₁]]]]
for 2 hours there was no diplomat that was kissed/killed
Sensible
- c. [a diplomat₁ [_{TP} past [for/until-XP [_{PolP} not [_{vP} John kissed/ killed x₁]]]]]
there exists a diplomat and for 2 hours John didn’t kiss/ ?kill such a diplomat
Sensible or not depending on the telic properties of the event
- d. [for/until-XP [_{PolP} a diplomat₁ [_{PolP} not [_{vP} was kissed x₁]]]]
for 2 hours there was a diplomat that wasn’t kissed

Unattested

This is the reason why we might have to stipulate that the only admissible landing sites for QR of a quantified object/subject are *vP* and *TP* (but not *PolP*).

²¹Non-logical predicates that create downward-entailing environments, such as *fail*, *deny*, and *avoid*, are predicted to systematically lack readings available with downward monotone logical operators and instead behave in the same manner as if they were upward entailing. This prediction

evidence for this approach.

Besides negation, there are other environments that can reverse the entailment properties, such as the case of adnominal *only* and DE plural quantified DPs. *Prima facie*, the anomaly of the examples in (44) suggests that extraposition of a *for*-adverbial above these types of phrases does not happen, contra what we would anticipate based on Maximize Strength. In the examples below the interpretation is that John or the same group of people kept arriving over and over again throughout a 2-hour long interval, similar to the readings that we would obtain with upward entailing quantified DPs like “thirty people/many people/some people”, which involve a strange state of affairs:

- (44) a. # Only John arrived **for 2 hours**.
b. # Few people arrived **for 2 hours**.
c. # Less than fifty people arrived **for 2 hours**.
d. # At most fifty people arrived **for 2 hours**.

Nevertheless, the sentences in (44) improve dramatically if the interval denoted by the argument of the *for*-adverbial is definite (e.g. *for the first 2 hours/ for those 2 hours* vs. *for 2 hours*) and can thus be more easily placed onto the referential temporal spectrum, suggesting that it is indeed possible for a right-adjoined durative adverbial to scope above such DE-quantified DPs, as predicted by Maximize Strength and shown in (45).

seems to be borne out as well as shown in #*John doubted that Bill killed a rabbit for 2 hours/until 2 pm*. Fully exploring the details of this remains for future work.

- (45) a. Only John arrived **for the first 2 hours**.
 b. Few people arrived **for the first 2 hours**.
 c. Less than fifty people arrived **for the first 2 hours**.
 d. At most fifty people arrived **for the first 2 hours**.

Additionally, observe in (46) the acceptability across the board with adnominal *only* and downward entailing DPs when the durative adverbial is an *until*-phrase instead, which might be due to the fact that the complement of *until* is always definite. The examples in (46) thus also conform to Maximize Strength.

- (46) a. Only John arrived **until 2 pm**.
 b. Few people arrived **until 2 pm**.
 c. Less than fifty people arrived **until 2 pm**.
 d. At most fifty people arrived **until 2 pm**.

Further note that the DE examples in (45) and (46) with both *for*-adverbials and *until*-phrases strongly trigger a factive inference in the same way as a ‘throughout-not’ reading does. Such an inference implicates that more people must have arrived afterwards, e.g. it is natural and, in fact, quite necessary to give such sentences a contextual interpretation along the lines of *At most fifty people arrived until 2 pm, which is when everybody else arrived*.²²

It is not clear to me, at present, why the interval selected by the durative adverbial must be definite in (45) and (46), other than as a description of the facts. One speculation lies in the fact that the factive implication about the actualization

²²I would like to thank Stephen Wechsler for pointing out to me the acceptability of these examples with DE-DPs and *until*-phrases as long as they trigger the factive reading.

of the event strongly emerges in such DE examples and hence must be placed at some point on the temporal spectrum, and thus the interval complement of *for/until* needs to be able to be interpreted contiguously so that the factive inference can easily emerge right after it ends. Observe that a crucial difference between *for*-adverbials and *until*-phrases is that the former can take an indefinite time interval and such an interval does not need to be contiguous. This was already noted in Dowty (1979): “the duration specified by the *for*-adverbial may be the duration of the union of several non-contiguous intervals: *John served on that committee for four years* (italics mine) can be true if he served four non-consecutive one-year terms” (p. 334). Definiteness and contiguity could be related. A definite contiguous interval referential to the temporal spectrum makes logical deductions in terms of entailment from the base and the extraposed positions easier, hence facilitating the application of Maximize Strength. This working hypothesis remains to be further explicated in future work.²³

Another observation worth noting is that the normal scope of adverbials is clause-bound (e.g. Cinque 2004). Therefore, adverbs cannot be topicalized across clause boundaries even when that movement would not weaken the meaning obtained from its base position, for instance, due to clause external operators that reverse polarity. A case in point is a durative adverbial whose base-position is in-

²³According to the native speakers I have consulted, if context makes the interval contiguous, the wide scope interpretation of the *for*-adverbial in a sentence such as *#Few people arrived for two hours* slightly improves, but that is still not enough. The interval really seems to have to be definite.

- i. [**I was sitting at home at 6 pm waiting for all the guests to show up at my birthday party. Two hours went by. It was 8 pm and most of the guests were not there yet.**]
 ??Few people arrived for 2 hours.

This could be an issue of markedness. This observation is left for future research.

side the antecedent of an *if*-clause. It follows that the adverb cannot cross the clause boundaries of the antecedent and scope above it. The only possible interpretation in (47) is the same person arriving again and again.

- (47) # If a person arrives **for the first 2 hours/until 2 pm**, they will find Mary inside.

Also note that the lack of raising to a higher clause is further explained by the mechanics of extraposition of the adverbial. Raised durative adverbials do not leave traces denoting variables in their base position; rather, their traces are better analyzed as identity functions and the effect of extraposition is to modify a higher structure. As a consequence, if it were to raise out of the clause where it is base generated and attach to another VP, it would end up modifying another event altogether as though it had been base generated in the higher clause to begin with. For instance, in the example in (47), the durative adverbial *for the first 2 hours/until 2 pm* attaching above the *if*-clause would end up modifying the duration of the ‘finding of Mary’ event instead. The fact that extraposition and high base generation would end up deriving the same semantics may explain why raising durative adverbials outside the clause boundary is disallowed. At any rate, for clarity purposes, I specify this general restriction on clause bounding of low right-adjoined durative adverbials in the Maximize Strength constraint.

- (48) **Hypothesis #3: Maximize Strength** (*to be modified*): Right-adjoined durative adverbials are **low clause-bound** adverbs whose canonical attachment site is the lowest possible XP, i.e. the VP, compatible with their type, and they may not raise if it leads to weakening.

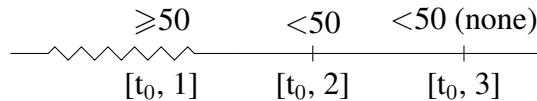
In the remainder of this section, I illustrate how Maximize Strength allows for the acceptability of the examples in (46) with a downward entailing DP-argument, bearing in mind that a DE context reverses the entailment patterns and a narrow scope interpretation of the durative adverbial is true in circumstances in which its corresponding wide scope reading is not. Thus the extraposed meaning is not entailed by the interpretation obtained from its base position. For example, consider a downward entailing plural quantified DP such as *less than fifty people* as subject of an atelic predicate such as *study*, so that the durative adverbial can give us a felicitous interpretation from both its base and extraposed positions. Simplified representations for the two scopal possibilities are provided in (49) and (50).²⁴ On the one hand, in (49a), I show a simplified meaning of *until* scoping below the DE-subject. Such a derived meaning allows for an interpretation in which a group larger than 50 people started studying during the beginning of the interval, say from t_0 until 1 pm, as long as less than 50 people of that group continued studying all the way until the end of the interval, from t_0 until 2 pm. It could further implicate that no more people studied beyond the right-boundary of the interval. Such a reading is schematized in the diagram in (49b).

²⁴This is a shorthand for the denotation of *until*-phrases. From here onwards, I will suppress the following aspects of the denotation of *untillfor*-phrases: tense, closure, the introduction of the interval in question and its cover, and the description of the predicate. Nothing changes; this is purely for notational and expository purposes.

(49) Less than 50 people studied until 2 pm. (**Base position**)

a. $\exists x$ [**less than 50 people** (x) $\wedge \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]$]²⁵

b. Potential interpretation: (In what follows, ≥ 50 stands for ‘more than or equal to 50 people’; < 50 stands for ‘less than 50 people’):

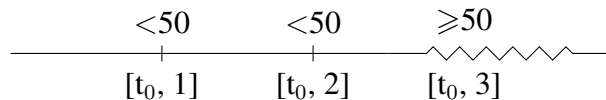


On the other hand, the interpretation in (49b) would have come out false if the durative adverbial had taken wide scope instead, i.e. by the adverb scoping above the downward entailing DP-subject. Such a wide scope reading is represented in (50), which only allows for a group of less than 50 people to be studying at all times from the very beginning of the interval in question, say t_0 , until the very end, 2 pm. Further note in (50b) that this interpretation carries the strong implication that after 2 pm more people started to study.

(50) Until 2 pm, less than 50 people studied. (**Extraposited**)

a. $\forall t'[t' \subseteq [t_0, 2] \rightarrow \exists x$ [**less than 50 people** (x) $\wedge P(t')]$]

b. Potential interpretation:



All in all, the fact that the wide scope interpretation of the adverbial in (50) is true in situations in which the narrow scope interpretation in (49) is false shows that (50)

²⁵Again, this is a simplified representation. The proper representation would be compatible with no people studying. But the main point here is not affected by that.

is not logically entailed by (49). Maximize Strength hence predicts that such a wide scope interpretation is possible, which is indeed borne out.

The same line of reasoning applies for all the other DE quantified DPs such as *at most 50 people* or *few people*, because likewise whenever the durative adverbial scopes above them, the meaning is not weakened. Similarly, whenever a right-adjoined durative adverbial is extraposed to outscope adnominal *only*, the resulting logical configuration is not entailed by the base position, thus allowing for both scope possibilities (depending on the telic properties of the predicate). Based on Horn (1969), the assertion of adnominal *only*—ignoring its existential presupposition component and alternative-based semantics²⁶—can be defined as a quantifier as in (51) where α is the syntactic restrictor of *only* (i.e. the sister of *only*, e.g. the DP *John*), P is a predicate over individuals, and the variable x ranges over all other possible relevant entities (e.g. Bill instead of John), which are linguistically and contextually determined. The denotation in (51) asserts that if the predicate holds for a relevant individual, then such an individual must be α .

$$(51) \quad \llbracket \text{Only } \alpha \rrbracket = \lambda P. \forall x [P(x) \rightarrow x = \alpha]$$

In our framework, it follows that such a quantified DP (e.g. *only John*) must QR so that it can later combine with a VP projection (e.g. of a predicate like *study*) via our extended QR rule. For example, we obtain the following meaning in (52).²⁷

²⁶Switching to a definition of *only* in alternative semantics (e.g. Rooth 1985, 1992; Wagner 2006) would not change this basic picture.

²⁷The presupposition content of *only*, which I am ignoring here as it is irrelevant to the present discussion, would ensure that there exists an x that studied.

$$(52) \quad \llbracket \text{Only John studied} \rrbracket = \lambda f. \forall x [\exists e [\mathbf{studying}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{x}] \rightarrow x = \mathbf{j}]$$

The representation in (52) ends up meaning that if there is any x in the relevant context under consideration that studied then x must be John. Let us now see what potential interpretations we may obtain when a durative adverbial such as *until 2 pm* modifies such a sentence: (53a) corresponds to the narrow scope interpretation of the adverbial with respect to the quantified DP *only John*, whereas (53b) represents a wide scope interpretation of the adverbial. As we will see, the former is true in situations in which the latter is false, thus showing that (53a) does not entail (53b).

$$(53) \quad \text{a. } \lambda f. \forall x [\forall t' [t' \subseteq [t_0, 2] \rightarrow \exists e [\mathbf{studying}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{x} \wedge \tau(e) = t']] \rightarrow x = \mathbf{j}]$$

(\approx if there is an x such that for all relevant subintervals within $[t_0, 2]$ x was studying, then x is John)

$$\text{b. } \lambda f. \forall t' [t' \subseteq [t_0, 2] \rightarrow \forall x [\exists e [\mathbf{studying}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{x} \wedge \tau(e) = t'] \rightarrow x = \mathbf{j}]]$$

(\approx for all the relevant subintervals within $[t_0, 2]$, if there is an x that studied at some point during such an interval then x is John)

The narrow scope interpretation of the adverbial in (53a) allows for a reading in which, for example, Bill also studied from say t_0 to 1 pm but only John studied throughout the whole interval in question, i.e. from t_0 to 2 pm. Such an interpretation comes out false when the durative adverbial outscopes adnominal *only*. In the latter case, John must be the only person that studied at some point within $[t_0, 2]$. Further note that the configuration in (53b) would be the only scope possibility that

would give rise to a felicitous reading, after taking into account the content words, if the predicate being modified were a non-iterative punctual predicate such as *arrive*.

In sum, Maximize Strength makes a significant prediction: wide scope readings of a durative adverbial should be possible (and give rise to factive inferences, as we shall see). *For/until*-XPs are not only allowed to scope above sentential negation but also above downward entailing DP-subjects/objects. What links all of these together is that a higher attachment of the adverbial gives rise to a configuration not entailed by its base position (regardless of what the content words are). This prediction is borne out with respect to (45) and (46), though not with respect to sentences like (44). We have no account for the latter, though the pattern suggests it may be related to definiteness of the relevant temporal interval. Overall, the data with downward entailing DP-arguments provides additional support for Maximize Strength beyond just the facts with negation, lending it independent justification.

Finally, a question I have not addressed here is what happens if the durative adverbial itself introduces a downward entailing operator as in *#John killed a rabbit for at most 2 hours*. These seem to lack a wide scope reading of the adverbial.²⁸ Unfortunately, I cannot address this fully here, but a key point is that the downward entailing environment itself is inside the durative adverbial. If the durative adverbial were to attach higher, it still weakens the meaning, which is disallowed by Maximize Strength. It would say that “for all times in the up to 2 hour cover there is a rabbit that John killed.” This is entailed by the meaning from its base position: “there is a rabbit which was (repeatedly) killed for all times in the up to 2 hour

²⁸I would like to thank David Beaver for pointing these examples out to me.

cover.” In the DE environments we have seen where raising of the right-adjoined durative adverbial is allowed, the crucial point is that the adverb moves out the DE context by raising over the DE operator, which results in an interpretation which is not entailed by the base position. However, here the DE environment would move up along with the adverbial, giving us a weaker interpretation. Therefore, these kind of examples wherein it is the durative adverbial itself that is downward entailing do not constitute counterexamples to the present Maximize Strength hypothesis. The economy constraint as it is correctly predicts that under these conditions raising is not possible. However, fully exploring the details of this is something I must leave for future work.

3.3.2.3 The presence of other distributive adverbials

The other environment that licenses a wide scope interpretation of a right-adjoined durative adverbial involves either a covert or overt frequentative-type operator of some sort like *every day* (cp. *John took a pill every day for two years* vs. *#John took a pill for two years* uttered out of the blue). In the same way that durative adverbials are analyzed as logical/functional words, frequentative-type phrases such as *every day* also plausibly constitute logical words. These are also traditionally translated as temporal universal quantifiers that express iteration of an event, e.g. every single day. At issue here is how the universal component of the durative adverbial combines with the universal component of a distributive phrase such as *every day*.

First, observe that in (54a) the interpretation obtained from the durative adverbial attaching low, below *every day*, results in a logical contradiction regard-

less of what the content words are since the interval denoted by the *for/until*-XP is greater than the temporal partition. In other words, a two-year long interval cannot be contained in a one-day partition. On the other hand, in (54b), one-day intervals can be included in a two-year long period of time.

- (54) a. [every day [[Y did X] for 2 years]] (#every day > for 2 years)
- **Example** (contradictory): It used to be the case every day that John pet a dog for two years.
- b. [for 2 years [every day [Y did X]]] (for 2 years > every day)
- **Example** (non-contradictory): For two years, it used to be the case every day that John pet a dog.

In this regard, note that depending on the temporal value of the complement of *for/until* and the duration of the temporal partition denoted by another distributive operator like *every day*, right-adjoined durative adverbials will only be able to attach either below or above the distributive operator, depending on which interval contains which. The example in (54) represents a case where the interval of the *for/until*-XP is greater than the temporal partition. On the other hand, whenever the interval of the *for/until*-XP is smaller than (or equal to) the temporal partition then the durative adverbial must attach lower, i.e. below the distributive operator, since staying lower does not result in a logical contradiction and the composition of the two universals receives a sensible meaning depending on the telic properties of the predicate. This is illustrated in (55).

- (55) a. [every day [[Y did X] for 2 hours]] (every day > for 2 hours)
- **Example** (non-contradictory): It used to be the case every day that John pet a dog for 2 hours.
- b. [for 2 hours [every day [Y did X]]] (#for 2 hours > every day)
- **Example** (contradictory): Throughout an interval of 2 hours, it used to be the case every day that John pet a dog.

Further note that switching the surface order of both universal elements around (e.g. *Y did X every day **for 2 hours*** vs. *Y did X **for 2 hours** every day*) does not give us a different scopal meaning between *every day* and *for 2 hours*, which demonstrates that their constrained scope interaction may stem from a more underlying logical relationship between the two universals.

In terms of logical strength, a logical contradiction is always stronger than any other assertion since it is never true. However, as it can never be true, it is also not a contingent statement, in that it does not depend on any state of the world. Therefore, I propose modifying the current Maximize Strength constraint to the following final version in (56).

(56) **Hypothesis #4: Maximize Strength** (*final*): Right-adjoined durative adverbials are low clause-bound adverbs whose canonical attachment site is **the lowest logically non-contradictory possible XP compatible with their type**, and they may not raise if it leads to weakening.

Crucially, in the new content in (56), we are redefining what the lowest base position of a right-adjoined durative adverbial may be. A durative adverbial attaches to the lowest possible XP, unless that leads to a logical contradiction. Its low base position

must result in a construction that can be judged true or false once we insert the lexical words in the clause and check the meaning against world knowledge. In this way, in (54b) (e.g. *John pet a dog every day for two years*), the lowest the durative adverbial can attach to is above the frequentative phrase *every day* so that it results in a well-formed truth-conditionally dependent construction.

I will now provide, in more formal detail, the type of denotation I am assuming for a frequentative-type operator like *every day*, which is also of type $\langle\langle vt, t \rangle, \langle vt, t \rangle\rangle$, so that it conforms to the type of the predicate modifiers in our present framework of quantificational event semantics. The denotation of *every* very much resembles the meaning of *for*-adverbials and *until*-phrases in that they both activate universal quantification over instants. *For two years* is given in (57b) for comparison.

$$(57) \quad \text{a. } \llbracket \text{every day} \rrbracket = \lambda V. \lambda f. \exists t [\mathbf{D}(t) \wedge \forall t' [\mathbf{1day}(t')(t) \rightarrow V(\lambda e [f(e) \wedge \tau(e) \subseteq t'])]]]$$

where $\mathbf{1day}(t')(t)$ means that t' falls within a daily partition of t . \mathbf{D} is a temporal domain, contextually supplied, i.e. the time frame throughout which the daily iteration occurs.

$$\text{b. } \llbracket \text{for two years} \rrbracket = \lambda V. \lambda f. \exists t [\mathbf{years}(t) = 2 \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\mathbf{C}(t')(t) \rightarrow V(\lambda e [f(e) \wedge \tau(e) = t'])]]]$$

where $\mathbf{C}(t')(t)$ means that t' falls within a cover measure of t . The \mathbf{C} measure is contextually supplied.

Despite their strong similarity, note the following essential differences. First, the time complement of *every* is universal in nature in that it gets universally iterated

(universal quantification occurs over 1-day long intervals in (57a)) and the period of time for how long this universal iteration takes place, i.e. **D**, has to be pragmatically fixed if not overtly stated. On the other hand, the complement of *for/until*-XPs is existential in nature (in that it gives us the total duration of the period of time which contains universal partitions based on a cover **C**), and the cover measure is left for pragmatics. A cover allows for overlapping among the subintervals, whereas the partition of the subintervals provided by *every* is fixed, e.g. they are all 1-day long subintervals which do not overlap. A second basic difference between the two types of universals is that the running time of the subevents modified by *every day* can be a subset or equal to the subintervals t' , e.g. as long as they fall within 1-day long partitions of a pragmatically supplied time frame (but they do not need to last the whole day). By contrast, the running time of the subevents modified by *for/until*-XPs must equal the total duration of the subintervals t' provided by the cover measure.

Based on the denotations in (57), I give as an example the following derivation of a predicate modified by both types of temporal phrases: *John took a pill every day for two years*, where the *for*-adverbial must outscope the *every*-phrase since the time intervals introduced by *every* are smaller (1-day long) and must be contained within the boundaries of the time interval introduced by the *for*-phrase (2 years).

- (58) a. John took a pill every day **for two years**. (Reading: Throughout two years every day there was a pill that John took.)
- b. $[t_r \prec \mathbf{now} \wedge \exists t_1[\mathbf{years}(t_1) = 2 \wedge t_1 \subseteq_{\mathcal{T}} t_r \wedge \forall t'_2[\mathbf{C}(t'_2)(t_1) \rightarrow \exists t_3[\mathbf{D}(t_3) \wedge \forall t'_4[\mathbf{1day}(t'_4)(t_3) \rightarrow \exists x[\mathbf{pill}(x) \wedge \exists e[\mathbf{take}(e) \wedge \mathbf{ag}(e) = \mathbf{j} \wedge \mathbf{th}(e) = x \wedge \tau(e) \subseteq t'_4 \wedge \tau(e) = t'_2 \wedge \tau(e) \subseteq_{\mathcal{T}} t_r]]]]]]]]]] \equiv$
- c. $[t_r \prec \mathbf{now} \wedge \exists t_1[\mathbf{years}(t_1) = 2 \wedge t_1 \subseteq_{\mathcal{T}} t_r \wedge \forall t'_2[\mathbf{C}(t'_2)(t_1) \rightarrow \exists t_3[\mathbf{D}(t_3) \wedge \forall t'_4[\mathbf{1day}(t'_4)(t_3) \rightarrow \exists x[\mathbf{pill}(x) \wedge \exists e[\mathbf{take}(e) \wedge \mathbf{ag}(e) = \mathbf{j} \wedge \mathbf{th}(e) = x \wedge \tau(e) = t'_2 \wedge t'_2 \subseteq t'_4 \wedge \tau(e) \subseteq_{\mathcal{T}} t_r]]]]]]]]]]$

The derivation in (58c) is equivalent to (58b), where we crucially obtain that $\tau(e)$ must fall within t'_4 and be equal to t'_2 . We know that t'_4 are 1-day-long partitions, which tells us that *John taking a pill* must be instantiated every day, and the duration of such a taking-a-pill event is equal to t'_2 , a measure provided by the contextually supplied cover. Then t_1 tells us the total duration of the time frame, i.e. that such an iteration of events took place over the course of 2 years. The composition of the two universal adverbials works under the assumption that $t_1 = \mathbf{D}$ (i.e. the 2-year frame provides the domain for the universal quantifier associated with *every day*), and, moreover, $\mathbf{C} \subseteq \mathbf{1day}$ (i.e. the contextually supplied cover takes on as maximal value the appropriate 1-day partition). This is not meant as an ultimate analysis, and one can for example conceive of ways of ‘binding’ the free variables \mathbf{D} , \mathbf{C} in the semantics (and not be left for pragmatics). But this would add complexities that are orthogonal to our present concerns.

The other example to consider is when the durative adverbial takes narrow

scope with respect to the *every*-phrase, which would have to happen when the interval introduced by *for* is smaller, as in (59), so that the *for*-XP can attach lower without generating a logical contradiction. No matter what the surface order of the temporal modifiers is, their respective semantic scope is the same: every day > for 2 hours.

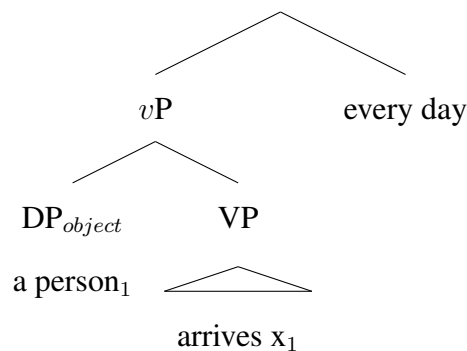
- (59) a. John pet a dog every day **for 2 hours**. (Reading: Every day there was a dog that John pet for two hours.)
- b. $[t_r \prec \mathbf{now} \wedge \exists t_1[\mathbf{D}(t_1) \wedge \forall t'_2[\mathbf{1day}(t'_2)(t_1) \rightarrow \exists t_3[\mathbf{hours}(t_3) = 2 \wedge t_3 \subseteq_{\mathcal{T}} t_r \wedge \forall t'_4[C(t'_4)(t_3) \rightarrow \exists x[\mathbf{dog}(x) \wedge \exists e[\mathbf{pet}(e) \wedge \mathbf{ag}(e) = \mathbf{j} \wedge \mathbf{th}(e) = x \wedge \tau(e) = t'_4 \wedge \tau(e) \subseteq t'_2 \wedge \tau(e) \subseteq_{\mathcal{T}} t_r]]]]]]]]]]]$
- ≡
- c. $[t_r \prec \mathbf{now} \wedge \exists t_1[\mathbf{D}(t_1) \wedge \forall t'_2[\mathbf{1day}(t'_2)(t_1) \rightarrow \exists t_3[\mathbf{hours}(t_3) = 2 \wedge t_3 \subseteq_{\mathcal{T}} t_r \wedge \forall t'_4[C(t'_4)(t_3) \rightarrow \exists x[\mathbf{dog}(x) \wedge \exists e[\mathbf{pet}(e) \wedge \mathbf{ag}(e) = \mathbf{j} \wedge \mathbf{th}(e) = x \wedge \tau(e) = t'_4 \wedge t'_4 \subseteq t'_2 \wedge \tau(e) \subseteq_{\mathcal{T}} t_r]]]]]]]]]]]$

Here the composition of the two universal adverbials works out if and only if $\mathbf{1day}(t'_2)(t_1)$ is true just in case $\mathbf{C}(t'_4)(t_3)$ is, where t_3 is a 2-hour interval within the time frame of t_1 (pragmatically provided by **D**) whose subintervals t'_4 are contained within t'_2 , the daily partitions. This comes out to saying that, in (59), the running time of *John petting a dog* must be at most 2-hour long and fall within daily partitions of t_1 , a time frame **D** pragmatically set.

3.3.2.4 Are *every*-phrases subject to Maximize Strength?

In sentences like *John pet a dog every day*, the object has different scope possibilities than *John pet a dog for two hours*, in spite of their both being universals. I take this as an indication of the fact that the attachment site of *every*-adverbials is higher than that of *for/until*-phrases, say *vP*. If *every*-phrases are adjoined at *vP* (which is, we assume, a scope site) a QR-ed object can be attached below them, as illustrated in the following structure in (60).

(60)



This would explain why objects can readily scope below *every*-phrases without having to appeal to scope economy. On the other hand, *for/until*-phrases are very low adverbials that attach at the lowest XP possible, i.e. making them VP adverbials. I assume that the semantic constraint on the processing of extraposed adverbials only affects very low right-adjoined durative adverbials (adverbials whose base position can in principle be at the VP-level). As a consequence, these must actually move to a higher position in order to take wide scope with respect to other scope-bearing arguments in the clause, e.g. so as to be able to outscope a QR-ed object or subject

within the *vP* domain.²⁹

3.3.2.5 Summing up

In sum, regardless of the theory of durative adverbials that one adopts, there must be some type of scopal constraint like Maximize Strength because without it nothing else independently explains the data. I suggest that the scopal behavior of right-adjoined *for*- and *until*-phrases is subject to a scope economy constraint to maximize their ‘informativeness.’ In particular, right-adjoined durative adverbials, such as *for/until*-phrases, are low adverbs that attach to the lowest possible XP compatible with their type that does not yield a logical contradiction. Such an attachment site is usually VP. However, when another (overt/covert) distributive operator is present in the sentence, like *every day*, the lowest logically non-contradictory attachment may be higher than VP, e.g. above such a distributive operator. The resulting logical structure must be able to receive a true or false value once the content words are inserted and the telic properties of the event are computed, i.e. it must be contingent on a state of the world.

Once their lowest base position is established, right-adjoined durative adverbials can only move to a higher position provided that this does not result in a weaker interpretation. In a positive episodic environment, low adverbials will produce stronger interpretations by taking narrowest scope. By contrast, in downward-entailing contexts, Maximize Strength correctly predicts that extraposition of the

²⁹This syntactic distinction between *for/until*-XPs and *every*-phrases might potentially bear on the inner aspect (within VP) and outer aspect (at *vP*) contrast concerned with telic/atelic and bounded/unbounded features (e.g. Slabakova 2001, Nossalik 2010).

low adverbial to a higher position, say above PoIP, will be allowed considering that such environments reverse logical strength, hence accounting for the potential ambiguity between a ‘not-throughout’ and a ‘throughout-not’ reading and the acceptability of non-iterative telic predicates with downward entailing DP-arguments (e.g. *few people arrived until 2* vs. *#many people arrived until 2*).

3.4 Conclusions

This chapter has offered a scopal account of the puzzle of punctual *until* for English, in close parallelism with *for*-adverbials, hence suggesting that such an account might be able to have broader applications, e.g. so as to capture the behavior of right adjoined durative adverbials in general. For this, I have updated Mittwoch’s (1977) original scopal proposal to event semantics within a framework based on Champollion’s (2015) analysis of event quantification, where the event variable is closed within the lexical entry of the verb, so that it takes lowest possible scope. It follows that within such an approach, we can only translate durative adverbials as universal quantifiers by following Dowty’s (1979) proposal (and not Krifka’s 1989, 1998 proposal). By doing so, and assuming a Chierchia/Charlson approach to bare plurals as kinds (with Derived Kind Predication or the idea that kinds can be directly merged at themes of events)—which are independently motivated assumptions—the basic cases simply follow from the supposition that right-adjoined durative adverbials are low VP adverbs. However, their scope behavior is conditional on a syntactic/semantic constraint, Maximize Strength, reminiscent of other scope economy conditions. Extrapolation of such low adverbs to a higher scopal position is

allowed if and only if it does not lead to a weaker interpretation in terms of logical strength, i.e. an interpretation already entailed by the base position. This predicts the acceptability of *until*-phrases with non-iterative telic predicates in negative environments without having to stipulate an NPI-*until*. But how do we capture the factive behavior of *until* under those circumstances? This question is tackled in the next chapter.

Chapter 4

A unified exhaustification-based account of temporal *for*-adverbials and *until*-phrases in English

4.1 Introduction

In Chapter 3 I offered a unified account of the scopal facts of *for*-adverbials and *until*-phrases. The theoretical system I proposed thus far predicts that right-adjoined durative adverbials can scope above negation, which explains why non-iterative telic predicates can be modified by durative adverbials in the presence of negation. Nonetheless, so far, nothing captures the non-defeasible factive inference that arises with the use of *until* under those circumstances (*John didn't arrive until 2 pm, #and in fact he never arrived*). This is what makes the use of punctual *until* in negative

environments theoretically unique, in contrast to the use of other durative adverbials like *for*-adverbials under the same conditions (*John didn't arrive for 2 hours, and in fact he never arrived*).

In this chapter, I propose an exhaustification-based approach that captures this difference between *for*-adverbials and *until*-phrases in terms of having 'inactive' vs. 'active' scalar alternatives, respectively. The relevant scalar alternatives that *until*-phrases obligatorily activate are factored into meaning and must be exhaustified, as in recent theories of scalar implicatures. Such a combined analysis of scope and scalarity will induce special scopal interactions between a durative adverbial and its alternatives, negation, and a covert exhaustification operator. Ultimately, this analysis will account for the emergence of the non-defeasible factive inference associated with *until* in the appropriate contexts, plus other interpretative facts I discuss below.

The outline of this chapter is as follows. In §2, I combine our scope-based account with an exhaustification-based approach that captures the difference between *for*-adverbials and *until*-phrases in terms of factivity. Other scalar inferences that durative adverbials may elicit will also be predicted via exhaustification. In §3, I offer a tentative account of the "later-than-expected" inference, another implication that has been claimed to be associated with the use of punctual *until* (e.g. Condoravdi 2008), but which is absent with the use of *for*. I suggest that this may be related to an underlying notion of probability triggered only by *until*-XPs, which, in turn, also prompts the use of another exhaustification operator. The conclusions of this chapter are summarized in §4.

4.2 How *until* becomes factive

In what follows, I further augment the scopal analysis outlined in Chapter 3 with an exhaustification-based approach that takes into account the scalar temporal nature of durative adverbials and their active scalar alternatives. This will account for the emergence of various inferences, including the factive inference, and their relative strengths both in the positive and negative environments.

4.2.1 The empirical data

So far we have analyzed *for*-adverbials and *until*-phrases in a unified fashion, since they share most of their properties, with one crucial exception: *until*-phrases when combined with negated telic predicates seem to give rise to a stronger inference than *for*-adverbials do about the actualization of the event. I have referred to this inference as the ‘factive inference’, which *until* exhibits more clearly, as the following contrast in (1) illustrates.^{1,2}

- (1) a. John didn’t get divorced from his wife **for all his life** → No divorce took place.
- b. # John didn’t get divorced from his wife **until he died** → John divorced his wife as a zombie.

¹I would like to thank Danny Fox for suggesting such minimal pairs to me.

²English has the expression ‘until the day I die’ which might look, at first, as a counterexample since it does not trigger factivity, as shown in (i).

- i. The pope will not resign until the day he dies.

However, I believe this is a fixed expression that means something like ‘ever/never’ and not a counterexample to the present theory. I would like to thank Stephen Wechsler for pointing that out to me.

The sentence in (1b) sounds odd because the factive inference (*John getting divorced from his wife* at some point after John's death) is non-cancellable, as opposed to (1a). For uniformity across *for*-adverbials and *until*-phrases, I still call such inferences factive inferences, the only difference being that the one generated by *until*-phrases seems to be non-defeasible (similar to what is traditionally known as an entailment), whereas the one that arises from the use of *for*-phrases is defeasible (similar to what is traditionally known as a conversational implicature).

Moreover, this non-defeasible factive inference is still licensed by *until*-XPs even within a context that explicitly refutes it, as in (2).

- (2) John was all set to cook, but then he got distracted and didn't start cooking **until 9 pm**. #At that point he changed his mind and went out for dinner.
→ John started cooking.

Thus, the inference generated by the use of *until* with negation and a telic predicate is indeed very strong, and it is impossible to cancel it even in extreme cases that involve epistemic uncertainty, such as when the *until*-XP is preceded by *at least*, as in (3).³

- (3) [A detective is trying to figure out whether John, the husband, poisoned his wife, who was found dead in their house. They estimate that she died around 2 pm. Before, they thought that John might have poisoned her by adding cyanide in her meal when cooking, but after finding new evidence the detective says the following:]

It's clear now that John didn't start cooking at least until 2 pm. In fact, this

³It might be also due to the fact that it is hard to epistemically construe a negative eventive.

new piece of evidence shows that ?? **he didn't cook at all**, so I now believe he's innocent.

In sum, negated telic predicates modified by both *for*-adverbials and *until*-phrases give rise to a factive inference. However, the factive inference is non-defeasible (non-cancellable) in the case of *until* and defeasible (cancellable) in the case of *for*.

But what happens with negated atelic predicates? The picture here is more complicated since we may have two different scopal interpretations: narrow scope of the durative adverbial with respect to negation (base position) or wide scope of the durative adverbial with respect to negation (extraposed subject to Maximize Strength). The extraposed configuration is the same as in the cases above with negated telic predicates, interpreted as 'throughout-not.' However, with the 'not-throughout' reading, no factive inference arises, as contrasted in (4).⁴

- (4) John didn't study until 2 pm.
- a. 'Throughout-not' [$\forall > \neg$] John didn't study until 2 pm.
→ ✓ Factive inference: John started studying after 2 pm.
 - b. 'Not-throughout' [$\neg > \forall$] John didn't study until 2 pm, but until 1 pm.
→ ✗ Factive inference.

If there is an inference under the 'not-throughout' reading in (4b) it is that the studying event stopped before 2 pm. Indeed, we might be able to even negate the

⁴Observe the contrast between (4) and (i), where the latter only acquires a high scope reading of the durative adverbial with a factive inference.

- i. John didn't study anything until 2 pm.
→ John started studying after 2 pm.

The object 'anything' in (i) disambiguates the sentence, where only a 'throughout-not' interpretation gives us a sensible meaning. This is similar to *John didn't study at all until 2 pm*.

fact that there was any studying event at all: *It is not the case that John studied until two, ?and in fact he didn't study at all.* Perhaps such an inference is non-defeasible as well, but it certainly is of a different character.

We are then left with an additional puzzle: (i) how is it that the non-defeasible factive inference emerges with the use of *until*-phrases (as opposed to a defeasible factive inference with the use of *for*-adverbials) and (ii) what it is that causes it to appear only under a specific set of conditions, e.g. under a ‘throughout-not’ reading. I claim that the nature of scalarity in *for*-adverbials and *until*-phrases gives us the factive inference, which is obligatory for the case of *until* and non-obligatory for the case of *for*. For this, I adopt the analysis that scalar inferences can be obtained as a form of exhaustification of the assertion, in some cases obligatorily, building on a view put forth in recent literature (e.g. Chierchia 2004, 2013, 2017, Fox 2007, Chierchia *et al.* 2012) that certain linguistic items can (and may always) introduce alternatives that must be factored into the meaning through exhaustification. I will show that such an analysis is advantageous over other ways of analyzing factivity (e.g. as an entailment or presupposition) in that it will provide one unique mechanism that explains all types of inferences with *for*-adverbials and *until*-phrases that may emerge in different scopal situations.

4.2.2 Scalar, *only*-based exhaustification analysis

In the remainder of this section I illustrate how the scalarity of universal time adverbials plays an essential role in the emergence of scalar inferences as a result of active alternatives that may be associated with the use of durative adverbials. Then

the grammar exhaustifies such alternatives via covert alternative-sensitive operators that must apply at some point in the derivation in order to ‘run through’ the active alternatives.

First of all, in the same way that numbers, such as modified numerals, are associated with a scale—something very much agreed upon—time is also scalar. Time is usually viewed of as linear and ordered, a key defining property of scales. Krifka (1998: 8) specifically defined temporal structures as a type of “one-dimensional directed path structure” and paths are widely regarded as defining a type of scale. Beavers (2012) in particular suggests that paths can serve as a general model of scales in lexical semantics. Therefore, it emerges from general properties of times and more specifically how they are treated in some literature that they are scalar in nature. If time is scalar then so are temporal adverbials, opening the possibility of them giving rise to quantity implicatures. With regard to modified numerals, consider the scale in (5), where Rooth (1985, 1992) claimed that the relevant alternatives are brought about in association with focus, where the focus semantic value consists of a set of alternatives.⁵

- (5) a. John studied [most]_F of the lessons.
- b. **Alternatives (ALT)**: {John studied a few of the lessons, John studied some of the lessons, John studied many of the lessons, John studied most of the lessons, John studied all of the lessons}
- c. **Scalar Inference (SI)**: John didn’t study all of the lessons.

Rooth refers to this set of alternatives in (5b) as C (a silent restrictor variable that

⁵[]_F indicates the focal-stress bearing element.

ranges over the alternatives), which I will refer to as *ALT*. This set of alternatives, which are contextually relevant to one another, are propositions obtained by replacing the focused expression with expressions of the same semantic type, and are ranked by entailment. The implicature is obtained by denying stronger alternatives. More formally speaking, it is obtained by applying an overt *only* or covert counterpart thereof, which returns something that states that the assertion (also known as *prejacent*, the sister to the focus-operator) is true and, moreover, any member of the set of alternatives which is true must be entailed by the prejacent. The meaning I am assuming for such a covert operator, labeled as *O*, is the following in (6).

$$(6) \quad \llbracket O_{ALT} \phi \rrbracket = \phi \wedge \forall p \in \phi^{ALT} [p \rightarrow [\phi \subseteq p]] \quad (\text{where } \subseteq = \text{entails})$$

(The prejacent ϕ is true and any alternative p in ALT not entailed by ϕ is false.)⁶

The operator *O* as in (6) takes the assertion ϕ as its input, which then returns as its output in addition to the negation of any non-entailed alternative by ϕ in ALT. In other words, *O* asserts that the prejacent is true and any member of the set of alternatives that is not entailed by the prejacent must be false, which thereby exhaustifies the meaning of the assertion. Note that a difference between overt and covert *only* is that *O* asserts rather than presupposes that its prejacent is true.

This variant of focus semantics gives us all the ingredients we need for an exhaustification-based approach to the factive inference of *until*. Nevertheless, focus is not a necessary condition for having active alternatives. Scalar items naturally

⁶Note that the set ALT in the denotation of *O* still contains both stronger and weaker relevant alternatives. All that (6) says is that if an alternative is true then that alternative must be weaker than the prejacent.

trigger quantity implicatures, as widely accepted for the elements that naturally constitute Horn-scales (since Horn 1972): <one, two, three...>, <a, many, most, every...>, <or, and>, etc. It could be argued that such items are already lexically predisposed to triggering alternatives ranked by entailment along a scale. Due to the scalarity of time, *for*-adverbials and *until*-phrase also form scales, whose alternatives are also naturally ranked to one another in terms of entailment: <for 1 hour, for 2 hours, for 3 hours...> and <until 1 pm, until 2 pm, until 3 pm...> (with the same contextually understood origin).

If the context is such that the alternatives are relevant, then they will be activated and factored into meaning via an exhaustification operator, which, in turn, is present if and only if the alternatives are active. Most importantly, at this point I posit a critical difference between *for*-adverbials and *until*-phrases, which is that the lexical semantics of *until* always carries an active set of alternatives, regardless of context, whereas *for*-adverbials optionally activate their alternatives depending on contextual relevance. This is all ultimately an issue of lexicalization (see §4.3.5. for why the alternatives to *for* may be optional).⁷ This explains why the factive inference is defeasible in the case of *for* but non-defeasible in the case of *until*. Semantically speaking, one can conceive of this difference by assuming that *until*-XPs are defined as long as the set of alternatives triggered by the time interval, i.e. the complement of *until*, is not a singleton so that it contains more than one alternative other than itself (since any lexical entry is an alternative to itself). Having an active

⁷Differently put, the alternatives associated with *for* may be ‘pruned’ in context, while those associated with *until* may not be pruned. For alternative ways of formalizing this, see e.g. Spector (2003, 2007), Fox (2007), Magri (2009), Chierchia (2013).

alternative different from the prejacent will make exhaustification of the assertion non-vacuous, hence obligatorily triggering inferential content. This is schematized in (7) below.⁸

- (7) $\llbracket \text{Until } 2 \text{ pm} \rrbracket^{ALT_{t_0}}$ is defined iff the set of alternatives triggered by the scalar item $[t_0, 2]$ is not a singleton.

(where $\llbracket \alpha \rrbracket^{ALT_{t_0}}$ is the set of temporal alternatives for any expression α)

In (7), the singleton constraint is essential because it forces *until*-phrases to have active alternatives other than the assertion itself, i.e. the prejacent. As a consequence, an exhaustification operator must obligatorily intervene at some point in the derivation, since the alternatives are operated on by O. The details of my implementation, which I keep very basic, remain fully negotiable. Syntactically speaking, we could adopt a syntax-driven account *à la* Chierchia (2013) in terms of feature checking/agreement, where O enters in some kind of agreement with its target. For instance, the scalar item *until 2 pm* could take a value “+” feature which must be checked off by O. The alternatives of the numeral in $[t_0, 2]$ would come with an obligatory feature that needs to be valued and is passed on to the phrase, which the operator O can then target (see Chierchia 2013 for details of an implementation along these lines). But there are other ways to implement this, e.g. see Fox (2007), where O is not always present in the architectural system. For the purposes of this chapter I will not give a fully complete formalization at the level of detail in the preceding chapter since many of these formal details will not matter for the point at hand. Rather, the key point is that exhaustification operators, be they present in the

⁸This is comparable to assuming that *until*-XPs take a third argument, similar to a presupposition, other than the interval and the predicate of sets of events—that is, a set of alternatives.

syntactic configuration or not, will figure into the meaning and this will derive the right results, and they will also interact with other scopal operators in interesting ways. The crucial idea is that *until*-XPs in one way or another obligatorily activate a set of canonical scalar alternatives that must be factored into meaning, and cannot be pruned. This contrasts with *for*-adverbials, where the set of alternatives is optional, and thus it acquires the appearance of a traditional Gricean implicature. With such an assumption, we are then able to capture the behavior of *until*-phrases (in contrast to *for*-adverbials) via exhaustification, as we shall see.

I have indicated the set of alternatives triggered by *until* in (7) above as ALT_{t_0} because they are of the form *until n time*, i.e. intervals that share the same contextually determined left boundary t_0 with the prejacent but differ as to when the right-boundary is set: such as *until one*, *until one thirty*, *until two*, *until three*, and so on and so forth. A representation of such a scale of alternatives triggered by *until*, which I call the *temporal scale* since it is provided by the already established scalarity of time, is given in (8). In what follows, n represents the time interval complement of *until*; $n+t$, a superset interval that shares the same left boundary; and $n-t$ a subset interval with also the same t_0 .

$$(8) \quad \textbf{Temporal Scale: } ALT_{t_0}(\textit{until } n) = \{\textit{until } n - t, \textit{until } n, \textit{until } n + t, \dots\}$$

It follows that in an upward-entailing context, subset intervals will be entailed by the prejacent while superset intervals will not. In more formal terms, the set of alternatives can be defined as follows, as in (9).

- (9) $\llbracket \text{Until 2 pm} \rrbracket^{ALT_{t_0}} = \{ \lambda V. \lambda f. \exists t [\mathbf{hours}(t) = [t_0, n] \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\mathbf{C}(t')(t) \rightarrow V(\lambda e [f(e) \wedge \tau(e) = t'])]] : n \geq 2 \text{ or } n < 2 \}$
 (defined iff the set of alternatives is not a singleton)

In (9), the alternatives are obtained by replacing the interval complement of *until* for supersets or subsets of the prejacent. In the remainder of the chapter I will be using the even more simplified formalization in (10) that omits the cover, referential time, $\tau(e)$, and the f argument. The specifications of our framework do not change. This is again a pure notational change for expository purposes.

- (10) $\llbracket \text{Until 2 pm} \rrbracket^{ALT_{t_0}} \text{ (simplified)} = \{ \lambda P [\forall t' [t' \subseteq [t_0, n] \rightarrow P(t')]] : n \geq 2 \text{ or } n < 2 \}$
 (defined iff the set of alternatives is not a singleton)

A final assumption before presenting the basic details of the execution of the analysis is that the temporal alternatives obligatory activated by *until* can only be exhaustedified by the covert operator O, as they may enter in agreement with such an operator. In other words, active temporal alternatives of right-adjoined durative adverbials cannot be picked out and consequently exhaustedified by other alternative sensitive operators, such as overt *only* and *also* (e.g. see Beaver and Clark 2008 for discussion on overt focus-sensitive operators applied within a framework of alternative semantics).

4.2.3 Execution of the O-exhaustification analysis

4.2.3.1 Upward-entailing contexts

Obligatory exhaustification of the active alternatives of *until* in an upward entailing context when it modifies an atelic or iterative telic predicate gives us what I refer to as the *interruption* inference, i.e. the predicate ceases to hold when the interval ends. This prediction is in line with what we would expect from natural facts about the physical world since an event cannot hold indefinitely. I illustrate this with an example in (11).

- (11) a. John studied until 2 pm^{ALT_{t₀}}.
- b. ALT_{t₀} (John studied until 2 pm): {John studied until 1 pm, John studied until 2 pm, John studied until 3 pm}⁹
- c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2] \curvearrowright [t_0, 3]$ (where the arrow shows the direction of entailment: $A \curvearrowright B$ means that B entails A)
John studied until 2 pm \subseteq *John studied until 1 pm* but $\not\subseteq$ *John studied until 3 pm*.

Notice that in a positive environment, such as in (11), earlier intervals that share the same contextually-determined left boundary (i.e. subset intervals) are entailed by the prejacent while later intervals that share the same left boundary (i.e. superset intervals) are not. Therefore, the assertion in (11a) does not entail that John also studied at any relevant time interval following 2 pm. Since the use of *until* obligatorily activates the relevant alternatives, these must be factored into meaning and

⁹From now onwards, in the examples, I am simplifying the notion of the alternatives by only looking at $n - 1$, n , and $n + 1$.

are consequently exhausted via covert O, which ensures that any alternative not entailed by the prejacent does not hold. The derivation of applying this exhaustification operator is sketched in (12c) and how the scalar inference comes about in (12d), in a simplified manner for clarification purposes.

- (12) a. $O_{ALT_{t_0}}$ (John studied until 2 pm ^{ALT_{t_0}})
- b. $ALT_{t_0}:\{\forall t'[t' \subseteq [t_0, 1] \rightarrow P(t')], \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')], \forall t'[t' \subseteq [t_0, 3] \rightarrow P(t')]\}$
- c. $O_{ALT_{t_0}}(\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]) = \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] \wedge \forall p \in ALT_{t_0} [p \rightarrow [[\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]] \subseteq p]$
- d. **SI** : $\neg \forall t'[t' \subseteq [t_0, 3] \rightarrow P(t')] \equiv \exists t'[t' \subseteq [t_0, 3] \wedge \neg P(t')]$

The mechanics of how to derive a scalar inference by negating non-entailed alternatives gives us that there must exist some subinterval within $[t_0, 3]$ where the predicate no longer holds. As we know that the assertion must hold for all the relevant subintervals until 2 pm, it is safe to conclude that at some point after 2 pm the predicate does no longer hold, i.e. John's studying event is interrupted. To put it more informally, *John studied until 2 pm* entails *John studied until 1 pm* but not *John studied until 3 pm*. Exhaustification under O negates the non-entailed alternatives while maintaining the truth of the prejacent *John studied until 2 pm*, deriving the interruption inference that John stopped studying at or after 2 pm as a sort of entailment arising from the scalar alternatives.¹⁰ How strong an inference one gets in positive cases depends on the 'granularity of the scale.'

¹⁰In an example as in (i), the relevant alternatives could be 'before the end of time', 'at the end of time', and 'after the end of time.'

- i. The universe exists until the end of time.

What do I mean by the granularity of the scale? If nothing else is specified, by default one infers that the interruption inference occurs right after the temporal right-boundary indicated by the complement of *until*, i.e. within the immediate superinterval of the interval denoted by *until*. Nevertheless, such a right-boundary introduced by *until* could in principle be stretched and set at some point later on the temporal spectrum, as shown in (13).

(13) **[Did John study until 2 pm]?**

Yes, indeed he studied **until 4 pm**.

In (13), the relevant scale in question could be formed by $\langle 2, 5... \rangle$ instead of an hourly scale such as $\langle 2, 3... \rangle$, where the degree of granularity varies from scale to scale. We are allowed to answer “yes” because even though it is true that John did study throughout $[t_0, 2]$, that assertion may not be exhaustive. Given the granularity of the relevant scale in question, an exhaustive answer could be that he studied until 4 pm. The interruption inference is then placed within the most immediate non-entailed relevant interval. If the relevant scale here is $\langle 2, 5... \rangle$, the interruption inference would be placed at 5 pm or afterwards. Despite the fact that the right-boundary may be ‘corrected’ depending on the granularity of the scale, what is not under discussion though is the obligatoriness of the interruption inference because at some point in time the event must stop holding, due to facts that follow from how the world works. In downward-entailing contexts, things change. We then need to

If ‘after the end of time’ is a relevant alternative to (i), the sentence obligatorily implicates that the universe will no longer exist after the end of time. If we do not consider anything else beyond the end of time as relevant, then the exhaustified assertive content in (i) simply conveys the meaning of the assertion itself, as all the other alternatives are entailed by the prejacent and exhaustification is rendered vacuous. This is again relative to what is relevant in context and the granularity of the scale in question.

consider different scopal cases, to be explicated below.

4.2.3.2 Downward-entailing contexts with telic predicates

Recall that Maximize Strength predicts that *until*-phrases can be extraposed in downward-entailing environments to scope above any DE operators within the clause, e.g. negation, because this does not give rise to a weaker interpretation. We have in principle two scopal possibilities: a low base position of the durative adverbial, and a higher extraposed position. Whether those scope configurations ultimately make sense or not will depend on the telic properties of the predicate being modified. In this section, we are focusing only on non-iterative telic predicates, such as *arrive*.

Let us consider first what happens if the *until*-phrase stays in its low base position, as illustrated in (14), and we try to exhaustify above negation. In what follows, \times indicates that exhaustification would be trivial:

$$(14) \quad \times O_{ALT_{t_0}} \neg (John\ arrived\ until\ 2\ pm^{ALT_{t_0}})$$

The result from exhaustification in (14) is always trivial with a non-iterative telic predicate and, thus ruled out, since a sentence such as *it is not the case that John (repeatedly) arrived until 2 pm* is tautologous as it is always judged true. We obtain a trivial result when we apply O to something already tautologous since by virtue of its logical content it is already ‘grammatically trivial’ and its alternatives and hence exhaustification, obviously, retain the same status. Another possibility could be exhaustifying below negation, since negation now gives us two scopal positions with respect to the O operator. Yet again exhaustification below negation of the *until*-XP alternatives with a non-iterative telic predicate is not necessary either. This is shown

in (15). In the derivation, before the application of O, the use of *until* already comes out deviant as *#John arrived until 2 pm* cannot satisfy the subinterval property. In the present theory, this deviance cashed out as an ‘ungrammatical contradiction’. More specifically, the iteration of a predicate such as *John arrived* for all relevant subintervals within a given interval clashes with common knowledge, generating a lexical contradiction.¹¹ Since the alternatives to the prejacent in (15) have the same shape as (15), exhaustifying with respect to them will still be contradictory.

$$(15) \quad \mathbf{X} \neg \text{O}_{ALT_{t_0}} (\text{John arrived until } 2 \text{ pm}^{ALT_{t_0}})$$

In (15), O is vacuous since *#John arrived until 2 pm* can never be true and hence we cannot add any scalar inference to the assertion to strengthen its meaning.

But this does not happen when *until* outscopes negation, since this scope configuration gives rise to a plausible and contingent meaning. It thus follows that exhaustification of a negated non-iterative telic predicate modified by *until* can only take place above negation once the *until*-phrase has already been extraposed, in line with Maximize Strength. This is the case we are considering next, as the structure in (16a) shows. The set of alternatives that is generated when *until* outscopes negation is exemplified in (16b), in a simplified form, where subset intervals are again entailed by the assertion whereas superset intervals are not, as the entailment pattern illustrates in (16c).

$$(16) \quad \text{a. } \checkmark \text{O}_{ALT_{t_0}} ([\text{until } 2 \text{ pm}^{ALT_{t_0}} [\text{John did } \mathbf{not} \text{ arrive}]] \equiv \\ \text{O}_{ALT_{t_0}} (\forall t' [t' \subseteq [t_0, 2] \rightarrow \neg P(t')])$$

¹¹A contradiction in the traditional sense, one that takes into account how the lexical terminal nodes are replaced in the structure.

- b. $ALT_{t_0}:\{\forall t'[t' \subseteq [t_0, 1] \rightarrow \neg P(t')], \forall t'[t' \subseteq [t_0, 2] \rightarrow \neg P(t')], \forall t'[t' \subseteq [t_0, 3] \rightarrow \neg P(t')]\}$
- c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2] \curvearrowright [t_0, 3]$
Until 2 pm, John didn't arrive \subseteq *Until 1 pm, John didn't arrive* but $\not\subseteq$
Until 3 pm, John didn't arrive.

In (16), if it is the case that by 2 pm John had not arrived, it is also the case that by earlier times he had not arrived. However, the prejacent leaves open the possibility of John's arrival after 2 pm. Since the alternatives are obligatory factored into meaning, they must be exhaustified: non-entailed alternatives (i.e. superintervals) are negated. As a result, this gives us the factive inference, i.e. the instigation of the event at some point within the most immediate relevant superinterval, e.g. $[t_0, 3]$, as derived in (17) below. It is important to note here that in this case the scalar inference (from $\neg P$ to P) cannot be rendered vacuous by the choice of granularity of the scale since P must occur.¹² Furthermore, pragmatic considerations may lead to set the switch from $\neg P$ to P close to the time mentioned in the *until*-phrase.

- (17) a. $O_{ALT_{t_0}}(\forall t'[t' \subseteq [t_0, 2] \rightarrow \neg P(t')]) = \forall t'[t' \subseteq [t_0, 2] \rightarrow \neg P(t')]$
 $\wedge \forall p \in ALT_{t_0} [p \rightarrow [(\forall t'[t' \subseteq [t_0, 2] \rightarrow \neg P(t')]) \subseteq p]]$
- b. **SI** : $\neg \forall t'[t' \subseteq [t_0, 3] \rightarrow \neg P(t')] \equiv \exists t'[t' \subseteq [t_0, 3] \wedge P(t')]$

After exhaustification, the scalar inference that winds up being added to the assertion maintains that there is an instantiation of the main event, i.e. *an arrival of John* within $[t_0, 3]$. As the prejacent asserts that there is no arrival of John within $[t_0, 2]$,

¹²The intuition behind this is that a switch from P to $\neg P$ as in the interruption inference could be vacuously satisfied, e.g. after John's natural death.

the truth of the prejacent is preserved while the actualization of the event is placed at some point after 2 pm within $[t_0, 3]$. This corresponds to the meaning of the factive inference. Obligatory O-exhaustification due to *until* having its alternatives ‘active’ (vs. *for*) thus accounts for *until*’s non-defeasible factivity. Even though such an inference cannot be cancelled, there is again a degree of granularity as to when the right-boundary of the non-entailed interval is set (though the choice of granularity cannot make this inference vacuous):

(18) John didn’t arrive until 2 pm, if not later. (#[...] indeed John never arrived)

The follow-up in the sentence in (18) shows that John does not need to arrive shortly after 2 pm and yet John’s arrival eventually must occur and cannot be cancelled. However, a certain degree of granularity may apply (as long as it is after the right boundary expressed by the prejacent). This depends on when the next relevant superinterval, alternative to the prejacent, is set along the granular scale.

All in all, negated telic predicates modified by *until* obligatory elicit the factive inference. We now turn to a consideration of atelic predicates. Does the hypothesis that *until* has obligatory active alternatives still hold? The scopal ambiguity between negated atelic predicates and *until* may seem, at first glance, to present a challenge, to say the least.

4.2.3.3 Negation with atelic predicates

The assumption that *until* obligatorily activates its alternatives is challenged when the durative adverbial modifies a negated atelic predicate, as demonstrated by the following data:

- (19) a. John didn't study until 2 pm. (✓Factive inference: He started after 2 pm)
- b. John didn't study until 2 pm, **but until 1 pm**. (He stopped before 2 pm)
- c. John didn't study until 2 pm, **but until 3 pm**. (He continued after 2 pm and stopped later)

The interpretation in (19a) is the one we expect, as it corresponds to the factive inference. This could be obtained in the same fashion as explained for telic predicates above by having the *until*-XP scoping above negation (*until 2 pm, John didn't study*) and the O-exhaustification operator applying even further above it (O (*until 2 pm, John didn't study*)). However, as already seen, atelic (or iterative punctual type of) predicates are ambiguous between a 'throughout-not' and a 'not-throughout' reading. How can we account for the at-first-sight contradictory interpretations in (19b, c), which seem to cancel one another, and as such suggest that whichever temporal scalar inference they trigger, it should in principle be defeasible (i.e. non-obligatory)? This challenges our current hypothesis in that *until*-XPs may have no obligatory implications after all.

However, the interpretations in (19b, c) are in fact predicted in our exhaustification-based analysis. They come from the LF $[\neg [\text{study } \textit{until}\text{-XP}]]$, corresponding to the 'not-throughout' reading. This LF opens up two exhaustification positions from the moment the *until*-phrase scopes below the negation operator: O-exhaustification of the alternatives generated by the *until*-XP can now apply (i) above negation, or (ii) below negation in the derivation, i.e. $[O\neg[\text{study } \textit{until}\text{-XP}]]$ or $[\neg O[\text{study } \textit{until}\text{-XP}]]$. O-exhaustification below negation is marked, that is, it

must be justified, e.g. by a continuation inconsistent with higher exhaustification. As Chierchia (2013) notes, it comes with a typical Hornian metalinguistic flavor.

I first demonstrate the interpretation that emerges from O-exhaustification above negation whenever the *until*-phrase stays in its low base position. The ‘not-throughout’ reading in (20) corresponds to the interpretation that *it is not the case that John studied until 2 pm*. The use of *until* obligatorily activates its temporal scalar alternatives, i.e. subset and superset intervals. If exhaustification applies above the downward-entailing operator, such as negation, while the *until*-XP is embedded below it, then the order of entailment of the alternatives is reversed, in comparison to their entailment pattern in a positive environment or whenever the *until*-XP scopes above negation. Thus, under these circumstances, superset intervals are entailed by the prejacent, whereas subset intervals are not. If John did not study for all relevant subintervals within $[t_0, 2]$, it follows that John didn’t study for all relevant subintervals within $[t_0, 3]$, but he may have still studied for all relevant subintervals within $[t_0, 1]$.

- (20) a. $O_{ALT_{t_0}} (\neg [\text{John studied until 2 pm}^{ALT_{t_0}}])$.
 b. $O_{ALT_{t_0}} (\neg \forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')])$
 c. $ALT_{t_0}: \{ \neg \forall t' [t' \subseteq [t_0, 1] \rightarrow P(t')], \neg \forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')], \neg \forall t' [t' \subseteq [t_0, 3] \rightarrow P(t')] \}$

d. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2] \curvearrowright [t_0, 3]$

(where $A \curvearrowright B$ indicates that A entails B)

It is not the case that John studied until 2 pm \subseteq *It is not the case that John studied until 3 pm* but $\not\subseteq$ *It is not the case that John studied until 1 pm.*

As the change in direction in the entailment relation in (20) illustrates, the relevant alternative that *it is not the case that John studied until 1 pm* is not entailed by the assertion and it must thus be negated in the exhaustification process, as outlined in (21).

- (21) a. $O_{ALT_{t_0}} (\neg \forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')]) = \neg \forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')]$
 $\wedge \forall p \in ALT_{t_0} [p \rightarrow [[\neg \forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')]] \subseteq p]]$
- b. **SI** : $\neg [\neg \forall t' [t' \subseteq [t_0, 1] \rightarrow P(t')]] \equiv \forall t' [t' \subseteq [t_0, 1] \rightarrow P(t')]$

The negation of the non-entailed subset interval gives us the following scalar inference for the ‘not-throughout’ reading: some instantiation of the event in question must have occurred, e.g. some studying of John must have taken place (in line with the common intuition that otherwise one would just say that *John didn’t study*, i.e. without overtly specifying any time interval). Such an interpretation correlates with one of the potential interpretations pointed out in (19)—e.g. *John didn’t study until 2 pm, but until 1 pm*—from which we deduce that the eventuality did not hold over the course of the whole interval, but only for a subset of such an interval. This reading is expected to be the default: it has the same alternatives as in the positive, just opposite entailment pattern.

Yet the continuation of ‘but until 3 pm’ in (19c) contradicts this state of

affairs. How can we get out of it? I posit that such an inference of John stopping before 2 pm can be voided by exhaustifying the assertion below negation. This is an option for (19c) because exhaustification above negation is incompatible with the common ground ‘but until 3 pm.’ In addition, it is only possible for atelic or iterative telic predicates (but not for non-iterative telic predicates) because the use of *until* without negation does not lead to a deviant interpretation before negation applies. As will be illustrated below, once negation applies above the exhausted assertion, this brings about the interpretation that John did not stop studying at 2 pm and carried on studying until a later time, consistent with the continuation in (19c). First I show in (22) the entailment relation among the active scalar alternatives when considered before the application of negation in the derivation.

- (22) a. $\neg O_{ALT_{t_0}}$ (John studied until 2 pm^{ALT_{t₀}).}
- b. $\neg O_{ALT_{t_0}} (\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')])$
- c. $\neg ALT_{t_0}: \{\forall t'[t' \subseteq [t_0, 1] \rightarrow P(t')], \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')], \forall t'[t' \subseteq [t_0, 3] \rightarrow P(t')]\}$

d. **Entailment Relation of ALT below negation:**

$$[t_0, 1] \curvearrowright [t_0, 2] \curvearrowright [t_0, 3]$$

John studied until 2 pm \subseteq *John studied until 1 pm* but $\not\subseteq$ *John studied until 3pm.*

When the O-exhaustification operator applies, later intervals (e.g. John studied until 3 pm) are not entailed by the asserted content, that is, we have the same entailment pattern as in the positive cases. Thus, (i) in the first place O-exhaustification gives us the interruption inference in the same way as it does in upward-entailing contexts,

and (ii) second, negation applies, which negates the conjunction of the asserted content with the interruption inference (e.g. *it is not the case that [John studied until 2 pm and stopped]*), as outlined in (23).¹³

- (23) a. $O_{ALT_{t_0}}(\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]) = \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]$
 $\wedge \forall p \in ALT_{t_0} [p \rightarrow [[\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]] \subseteq p]$
- b. **SI below negation:** $\neg \forall t'[t' \subseteq [t_0, 3] \rightarrow P(t')]$
- c. $\neg O_{ALT_{t_0}}(\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')) =$
 $\neg[\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] \wedge \neg \forall t'[t' \subseteq [t_0, 3] \rightarrow P(t')] \equiv$
 $\neg \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] \vee \neg[\neg \forall t'[t' \subseteq [t_0, 3] \rightarrow P(t')]] \equiv$
 $\neg \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] \vee \forall t'[t' \subseteq [t_0, 3] \rightarrow P(t')]$

As (23) shows, exhaustification occurs before negation applies in the derivation. In such a case, negation targets the already exhaustified assertion, where the interruption inference has been added to the assertive content (*John studied until 2 pm **and** stopped at 2 pm*). Second, negation applies. Since the first conjunct, which corresponds to the assertive content, cannot be denied, negation ends up refuting the second conjunct, which corresponds to the interruption inference, i.e. the interpretation that John no longer studied at time intervals after 2 pm, thus opening the possibility that John could have continued studying. This is roughly equivalent to

¹³As assumed in the recent literature on ‘obligatory implicatures’ (non-defeasible inferences), I also assume that after O intervenes obligatory exhaustified alternatives are conjoined into the asserted content, which can then be targeted by other operators, such as negation or other exhaustification operators. For instance, this is essential in cases of recursive exhaustification: when one exhaustifies with respect to pre-exhaustified alternatives. This is necessary to capture the range of interpretations of disjunction and what is known as the free choice effect, attested when a disjunctive sentence is embedded under an existential modal operator (e.g. *you may have ice cream or cake*). See e.g. Fox (2007) and Chierchia (2013) for further discussion.

saying the following: *John studied until 2 pm and it is not the case that he stopped then*, thus giving us back the last potential interpretation given in (19), i.e. *John didn't study until 2 pm, but until 3 pm*.

4.2.4 Summing up

In sum, I have proposed that exhaustification of the scalar alternatives is optional in the case of *for*-adverbials (depending on context)—eliciting a defeasible inference, similar to a Gricean quantity implicature—whereas it is obligatory in the case of *until*-phrases—giving rise to non-defeasible inferences.

Certain circumstances seem to challenge such a hypothesis. This is the case when superficially we seem to be able to cancel the obligatoriness of scalar implications triggered by a negated atelic predicate modified by *until* when *until* takes narrow scope—since we can say something like *but until 1 pm* and *but until 3 pm* for what looks like the same utterance on the surface. However, this is precisely what we would expect by having two exhaustification positions in the LF throughout the derivation process: (i) above negation, or (ii) below negation, even though the latter is a much weaker reading (because we are adding inferential material to the asserted content before negation applies) and requires a special context (such as a continuation or common ground that clashes with the result from O-exhaustification above negation). In either case, O-exhaustification of the obligatory active alternatives that *until* bears still takes place. What differs is the position where it occurs during the derivation, thus still conforming to our obligatory exhaustification-based analysis of *until*. In the case of negated telic and atelic predicates with *until* taking wide

scope, O-exhaustification clearly takes place, as it results in the non-defeasible factive inference. Finally, in positive environments, O-exhaustification simply gives us the interruption inference, which we would inevitably already expect from natural facts about the physical world. A table that summarizes the different possible inferences that derive from O-exhaustifying an atelic predicate modified by an *until*-XP in positive and negative environments is given below considering the relevant scale of $\langle 1 \text{ pm}, 2 \text{ pm}, 3 \text{ pm} \rangle$:

Scopal position	Type of inference	Example
O (John studied until 2 pm)	interruption inference	John studied until 2 pm and not until 3 pm.
\neg O (John studied until 2 pm)	\neg interruption inference	John didn't study until 2 pm, but until 3 pm.
O \neg (John studied until 2 pm)	inference from 'not-throughout' reading	John didn't study until 2 pm, but until 1 pm.
O (until 2 pm, John didn't study)	factive inference from 'throughout-not' reading	John didn't study until 2 pm, he studied after 2 pm.

Table 4.1: A summary of the various scopal possibilities of O-exhaustification of English *until*-XPs

However, there is one last question. Are there alternative analyses that would also make all the right predictions? For instance, one could capture the obligatoriness of the factive inference in more traditional terms by evaluating it as an entailment (or even a presupposition), as stated in previous literature for punctual *until* (e.g. Karttunen 1974) (which mostly focused on factivity with negated telic predicates). Nevertheless, there are several advantages of pursuing an exhaustification-based analysis, as sketched above. For one, we can predict the various inferences triggered by all uses of temporal *for*-adverbials and *until*-phrases in a unified fashion by using a unique machinery which gives rise to all of them—with the sole difference being whether O is obligatory or optional, and when it is present, where in the derivation it applies. Second, as an entailment (or even much worse as a presupposition) the factivity would have no scopal interaction with negation to capture

all potential readings. For example, if the meaning of *until 2 pm* were something like “ P throughout $[t_0, 2]$ and $\neg P$ after 2”, it might be able to give us the interruption inference in the positive cases and the factive inference in the negative cases with telic predicates. But it cannot predict the “but until 1 pm” or “but until 3 pm” implications from ‘not-throughout’ readings with atelic predicates. For that matter, the reversal of the scalar alternatives could not interact with the entailment of *until* to simply get the fact that the eventuality stopped before 2 pm. All in all, it is hard to see how, in such unified manner, alternative analyses (e.g. by building the factivity into the lexical content) could derive all (scope-sensitive) implications that right-adjoined durative adverbials may elicit.

4.3 Loose ends and issues for further research: Probability associated with temporal *until*

In addition to the factive inference, another inference often associated with the use of punctual *until* is the ‘later-than-expected’ inference, or as I call it, the ‘probability’ inference. For instance, on hearing *The bomb did not explode until 2 pm* we infer that the bomb was expected to explode before 2 pm. Note, otherwise, that if the bomb had been programmed to explode at 3 pm, the use of punctual *until* in the aforementioned sentence would be odd. This section is intended to shed some light on how this probability inference comes about, though there are aspects of the analysis that remain to be further examined. Here I posit a preliminary notion to be further developed. I will principally claim that such a probability inference

emerges from the intervention of another covert exhaustification operator, one based on the focus particle *even* (as also used in current exhaustification-based theories, e.g. Crnič 2012, Chierchia 2013). Eventually, as outlined in the conclusions, it will be very interesting to view this proposal against other uses of *until*-like particles in other languages. For example, recall that the counterpart of *until* in languages like Spanish can function as a scalar additive particle and mean something similar to English *even*:

- (24) *Hasta Juan vino a la fiesta.*
until Juan came at the party
'**Even** Juan came to the party.'

Furthermore, such *until*-like particles may also acquire an *even*-like connotation when modifying a goal in a motion construction to implicate that despite the odds, the subject was even able to reach the spatial goal (see e.g. Beavers 2008a and Bassa-Vanrell 2013 for further discussion on this). A chief objective for future research is to fully develop the connection between such temporal and spatial uses of 'until' to scalar additive *even* (see Chapter 6 for some additional discussion of these uses). These preliminary ideas will help us better understand how and why, across languages, it is a common development for temporal and spatial 'until' uses to be associated with *even*-like meanings, through which speakers may convey their perception of likelihood on the occurrence of events. All that said, this section consists of some unfinished speculation, which contains promising ideas and working hypotheses to be addressed in future cross-linguistic work on multi-functional 'until' words.

4.3.1 The puzzle

As noted above, another inference originating from the use of *until*-phrases, but not *for*-adverbials, is what Condoravdi (2008: 4) reports as “the time of occurrence could well have been earlier.” I refer to this inference as the *probability inference*. This inference is clearly present with negative telic predicates modified by *until*-phrases, unlike negative telic predicates modified by *for*-adverbials. For instance, consider the contrast in acceptability that arises in (25) with the use of *until*-phrases, but not with the use of *for*-adverbials.

- (25) a. **[Mary is 6 months pregnant. Mary’s due date is in 3 months, but she unexpectedly already goes into labor.]**
- i. Mary did not give birth **for** the first 6 months of pregnancy.
 - ii. # Mary did not give birth **until** her 6th month of pregnancy.
- b. **[Mary is 9.5 months pregnant. Mary’s due date was 2 weeks ago, and she finally goes into labor.]**
- i. Mary did not give birth **for** the first 9.5 months of pregnancy.
 - ii. Mary did not give birth **until** her 9.5 month of pregnancy.

In (25a.ii), the *until*-XP somehow comes with the inference that Mary’s giving birth after her 6th month of pregnancy is less expected/likely than Mary’s giving birth after, say, her 5th month of pregnancy, which explains the deviance of such an example, since she is not actually expected to go into labor until later. By contrast, such an inference is absent in (25a.i) with the use of the *for*-adverbial. On the other hand, whenever the context indicates that the eventuality was expected to occur

earlier but has not happened yet, then both *until*-phrases and *for*-adverbials are fine. In (25b.ii), the *until*-XP carries a probability inference along the following lines: Mary's giving birth was late and was expected to have already taken place. The fact that the use of *until* is constrained by the emergence of a probability inference in (25a.i) suggests that this kind of inference is also non-defeasible, as its obligatory projection would hinder the use of *until* in the (a) situation.

Therefore, we are addressing here an additional essential difference between *for*-adverbials and *until*-phrases when it comes to the type of inferences that they license. *Until*-phrases seem to obligatorily give rise to a probability inference on top of an obligatory factive inference. Instead, *for*-adverbials lack obligatoriness in both regards, and perhaps lack the probability inference all together. Finally, I would like to point out that probability inferences have received attention in the literature for other temporal adverbials as well, e.g. as a 'later-than-expected' inference for *still* and *yet* in English and *erst* and *noch* in German in opposition to an 'earlier-than-expected' inference for *already*, as discussed in Löbner (1989), van der Auwera (1993), Michaelis (1996), Krifka (2000), Ippolito (2007), and more recently Beck (2016), *inter alia*.

4.3.2 The probability scale and *even*-based exhaustification

I claim that in addition to a temporal scale *until* also activates a *probability scale*. The probability scale, as shown in (26), consists of linearly ordered alternatives that are subintervals of the interval introduced by the prejacent. I call such a set of alternatives ALT_P , which also share the same contextually determined left-boundary

t_0 with the prejacent and differ as to when the right-boundary is set, e.g. *until one*, *until one thirty*, *until two*, etc. Note that superintervals of the prejacent are not included along the scale in (26). In what follows t stands for a time interval measure, which is subtracted from the interval complement of *until*.

$$(26) \quad \textbf{Probability Scale: } ALT_P(\textit{until } n) = \{\textit{until } n - t, \textit{until } n\}$$

Such alternatives are clearly also scalar expressions, as time is ordered and scalar. Thus, the alternatives can be straightforwardly ordered according to entailment. For instance, whenever the *until*-XP is in an upward-entailing context, subset intervals (i.e. earlier times) in (26) will be entailed by the prejacent, while superset intervals are disregarded, since the interval introduced by the prejacent is the endpoint of the probability scale I am assuming in (26). The intuition behind this scale truncation is that whenever we associate *until* with some notion of probability, we only seem to consider its linearly ordered preceding alternatives. The use of *until* appears to indicate that the interval that it picks is more unlikely compared to its corresponding preceding times, as will be illustrated with examples below. So far this remains an observation to be further justified.¹⁴ For downward entailing contexts, the picture will be slightly more complicated (depending on the scope position of the exhaustification operator with respect to negation), which may posit a challenge due to the reversal in the order of entailment, to be dealt with in the sections below.

Before that, however, note that such alternatives are also obligatory factored

¹⁴“Scale truncation” of scalar alternatives has been justified for other scalar elements as an available strategy of handling scales for non-end-of-scale/indefinite NPIs, so that one can uniformly understand what scalar characteristics might, for instance, warrant NPI behavior (see e.g. Chierchia 2013). Along these lines, modulo ‘scale truncation’ we can explain why *until* may pick the least likely element that corresponds to an end of a scale, since otherwise a temporal scale is infinite and has no end *per se*.

into meaning, since the prejacent must activate probability alternatives other than itself, as further specified by the singleton condition in (27). Having an active alternative other than the prejacent will make exhaustification non-vacuous.

- (27) $\llbracket \text{Until } 2 \text{ pm} \rrbracket^{ALT_P}$ is defined iff the sets of alternatives triggered by the scalar item $[t_0, 2]$ is not a singleton.
 (where $\llbracket \alpha \rrbracket^{ALT_P}$ is the set of probability alternatives for any expression α)

In more formal terms, the set of probability alternatives, ALT_P , can be defined as follows:

- (28) $\llbracket \text{Until } 2 \text{ pm} \rrbracket^{ALT_P} = \{ \lambda V. \lambda f. \exists t [\mathbf{hours}(t) = [t_0, n] \wedge t \subseteq_{\mathcal{T}} t_r \wedge \forall t' [\mathbf{C}(t')(t) \rightarrow V(\lambda e [f(e) \wedge \tau(e) = t'])]] : n \leq 2 \}$
 (defined iff the set of alternatives is not a singleton)

In (28), the alternatives other than the assertion itself are obtained by strictly replacing the interval complement of *until* for subsets of the prejacent. In the remainder of the section I will be using the even more simplified formalization in (29), purely for expository purposes.

- (29) $\llbracket \text{Until } 2 \text{ pm} \rrbracket^{ALT_P} \text{ (simplified)} = \{ \lambda P [\forall t' [t' \subseteq [t_0, n] \rightarrow P(t')]] : n \leq 2 \}$
 (defined iff the set of alternatives is not a singleton)

Therefore, the obligatorily triggered probability alternatives need to be exhaustified, which calls for another alternative sensitive operator. Besides the exhaustification operator *O*, based on focus-sensitive *only*, there are other exhaustification operators available in the grammar. A covert operator based on focus-sensitive *even*, *E*, would be an instance of an exhaustification operator (e.g. Krifka 1995, Crnič 2012, Chier-

chia 2010, 2013) which naturally brings about a probability measure and seems to be the appropriate operator to generate probability inferences.

For example, observe a clear instance of a covert *even* in (30), where the focally stressed subject in B's assertion requires some kind of *even*-like operator, since an *only*-like operator would not be appropriate given the context of a successful party where many people showed up (and not only one person did).

(30) A: So how did the party go? Did many people show up?

B: Yes. Imagine that [my ex]_F came.

[Adapted from E-exhaustification in Chierchia (2013): 147, ex (7)]

B's assertion means something like *Yes. Imagine that **even** [my ex]_F came*. However, focus is not a prerequisite for the application of this covert alternative sensitive operator, in the same way as overt focus is not a precondition for the application of O-exhaustification as long as the scalar item is already lexically endowed with active alternatives that are factored into meaning. This would be the case for *until*-XPs. Additionally, I propose that the result from E-exhaustification via a covert operator in (30) expresses that the prejacent (ϕ) (e.g. *my ex came*) is the least likely among the alternatives (p) in ALT_P (e.g. *Bill came, Mary came, etc.*) with respect to some contextually relevant probability measure. Hence, the meaning I am assuming for E is along the lines described in (31).¹⁵

¹⁵Following Chierchia (2013), the additive presupposition of *even* in that some other alternative must be true has been omitted for simplicity. Chierchia (2013) also notes that the scalar component of the exhaustification operator E is given as part of the assertion, rather than being part of the presuppositional content, so that it is closer in resemblance to the semantics we have been assuming for O.

$$(31) \quad \llbracket E_{ALT_P} \phi \rrbracket = [\phi \wedge \forall p \in \phi^{ALT_P} [\phi <_{\mu} p]] \quad [E(\text{even})\text{-operator}]$$

where ‘ $\phi <_{\mu} p$ ’ says that the prejacent is less likely than p with respect to some contextually relevant probability measure μ .

As Chierchia (2013) points out, when a “set of alternatives is *totally* ordered by entailment, then it is also totally ordered with respect to *any* probability measure μ , for it must be the case that whenever $(\phi) \subseteq (\psi)$, $\mu(\phi) \leq_{\mu} \mu(\psi)$, for any μ . This might be regarded as a case of structural salience” (p. 153). In this regard, I believe that some probability measure condition of this sort is clearly salient with the use of *until* simply due to evident entailment relations between the alternatives. Moreover, there appears to be an additional *even* connotation associated with the use of *until*, mostly noticeable when *until* modifies negative telic predicates. Thus, the E-operator and *until*-XPs show all the properties that suggest that they are a natural fit. Finally, it is important to note that for purposes of this dissertation, I am assuming that E and O do not scopally interact.¹⁶ With the above pieces in place, the basic details of the execution of the analysis are illustrated next.

¹⁶An issue I leave for future research is to fully work out the details of O and E scopal interactions if they do interact. For the time being, if we assume that they do not scopally interact, it could be that two types of unrelated asserted content are created: the content with O but not E, and the content with E but not O. The core preposition P ends up being asserted twice but in conjunction it derives the different O and E scalar inferences. This could be reminiscent of Potts (2007), where expressive meaning is computed separately from asserted content.

4.3.3 Execution of the E-exhaustification analysis

4.3.3.1 Upward-entailing contexts

The alternatives that *until*-XPs trigger within ALT_P are all entailed alternatives in positive environments, since earlier times are entailed by the prejacent. It thus follows that the prejacent must be less likely than such alternatives, since the assertion will be true in fewer situations (e.g. Crnič 2012, Chierchia 2013). Even though in positive contexts such a probability inference may not be as salient, I argue that it is in fact still present (yet it may be seen as trivial).

The relevant active subset alternatives constitute the set in ALT_P and are exhaustedified by E. The inference that ends up being added to the assertion is that the prejacent is less likely than any of the alternatives in ALT_P , which conforms to natural facts about the physical world: any eventuality extending/holding for a longer period of time will usually be less likely or more noteworthy than one holding for a shorter period of time. The longer the interval in question is throughout which an eventuality holds, the more likely that something will happen that can interrupt that state of events. This is in line with the interruption inference that also emerges in positive contexts via O-exhaustification; as argued above, an event cannot hold indefinitely.

For example, the sentence *John studied until 2 pm* asserts that “for all relevant subintervals within $[t_0, 2]$ John studied” and implicates that “John’s studying until 2 pm is more notable than John’s studying until earlier times (e.g. 1:30 pm, until 1 pm, until noon, etc.)” The execution of the analysis is fairly automatic, as outlined in (32).

- (32) a. E_{ALT_P} (John studied until 2 pm ^{ALT_P})
 b. $ALT_P: \{\text{John studied until 1 pm, John studied until 2 pm}\}$
 c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2]$
John studied until 2 pm \subseteq *John studied until 1 pm*
 d. $E_{ALT_P} (\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]) = \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]$
 $\wedge \forall p \in ALT [[\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]] <_{\mu} p]$
 e. Probability inference (PI) : $\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] <_{\mu} \forall t'[t' \subseteq [t_0, 1] \rightarrow P(t')]$

Subset intervals must be less notable than the prejacent as they are true in more situations (e.g. *John studied until 2 pm* entails that *John studied until 1 pm*). After E-exhaustification, we obtain that the prejacent, *John studied until 2 pm*, is less likely than earlier relevant times, *John studied until 1 pm*. This corresponds to the probability inference associated with the use of *until* in positive contexts: the expectation that the longer an eventuality holds the more noteworthy it is in the sense that it is more likely that something could interrupt the eventuality. Next, I show how E-exhaustification captures the prominent probability inference associated with the use of *until* within negative environments.

4.3.3.2 Telic predicates with negation

As we previously saw with O-exhaustification, the only possible position where an exhaustification operator can apply whenever *until* modifies a negated telic predicate is above negation, since *until*, in turn, must also scope above the downward-entailing operator so that the outcome is a contingent utterance. Therefore, in this

section we are concerned with E-exhaustification applying last in the derivation of a ‘throughout-not’ reading.

First, recall the examples in (25) above about Mary’s not giving birth until a certain time, which carry the strong inference that Mary’s giving birth was expected to have occurred earlier. How such a probability inference comes about is outlined in (33), where preceding relevant times are also entailed by the prejacent. In (33) the prejacent indicates that Mary has not given birth by her 9.5th month of pregnancy. This entails that she has not given birth by, say, her 9th month of pregnancy. This alternative, when E-exhaustified, gives us back the expectation that the time of occurrence of the event in question was supposed to have taken place earlier: not having given birth at 9.5 months of pregnancy is less expected/likely than not having given birth at 9 months of pregnancy.

- (33) a. E_{ALT_P} ([Until her 9.5th month of pregnancy^{*ALT_P*} [Mary did not give birth]])
- b. ALT_P : {Until her 9th month of pregnancy, Mary did not give birth; Until her 9.5th month of pregnancy, Mary did not give birth}
- c. **Entailment Relation:** $[t_0, 9mo] \curvearrowright [t_0, 9.5mo]$
Until 9.5th month > Mary did not give birth \subseteq *Until 9th month > Mary did not give birth*
- d. $E_{ALT_P} (\forall t'[t' \subseteq [t_0, 9.5mo] \rightarrow \neg P(t')]) = \forall t'[t' \subseteq [t_0, 9.5mo] \rightarrow \neg P(t')] \wedge \forall p \in ALT [[\forall t'[t' \subseteq [t_0, 9.5mo] \rightarrow \neg P(t')]] <_{\mu} p]$
- e. **PI** : $\forall t'[t' \subseteq [t_0, 9.5mo] \rightarrow \neg P(t')] <_{\mu} \forall t'[t' \subseteq [t_0, 9mo] \rightarrow \neg P(t')]$

Roughly, the probability inference that the meaning of E-exhaustification contributes

states that Mary's not giving birth past 9.5 months of pregnancy is less likely than Mary's not giving birth earlier, say right after 9 months of pregnancy. This is in line with our expectations from world knowledge: giving birth after 9.5 months of pregnancy is considered too late and unlikely as the event is expected to occur around the 9 month due date. These expectations correlate with the meaning of the probability inference that winds up being added to the assertion, hence explaining its acceptability.

On the other hand, the emergence of such a probability inference predicts the strange state of affairs that derives from the use of *until* in contexts where the actualization of the event is expected to occur later, and not earlier. This is illustrated in (34). The assertion that Mary had not given birth by her 6th month of pregnancy activates subset intervals as probability alternatives, say, that Mary had not given birth by her 5th month of pregnancy, where the prejacent entails its alternatives. E-exhaustification states that the assertion is less likely than its alternatives, which results in oddness:

- (34) a. E_{ALT_P} ([Until her 6th month of pregnancy^{*ALT_P*} [Mary did not give birth]])
- b. ALT_P : {Until her 5th month of pregnancy, Mary did not give birth; Until her 6th month of pregnancy, Mary did not give birth}
- c. **Entailment Relation:** $[t_0, 5mo] \curvearrowright [t_0, 6mo]$
Until 6th month > Mary did not give birth \subseteq *Until 5th month > Mary did not give birth*

- d. $E_{ALTP} (\forall t'[t' \subseteq [t_0, 6mo] \rightarrow \neg P(t')]) = \forall t'[t' \subseteq [t_0, 6mo] \rightarrow \neg P(t')]$
 $\wedge \forall p \in ALT [[\forall t'[t' \subseteq [t_0, 6mo] \rightarrow \neg P(t')]] <_{\mu} p]$
- e. **PI** : $\forall t'[t' \subseteq [t_0, 6mo] \rightarrow \neg P(t')] <_{\mu} \forall t'[t' \subseteq [t_0, 5mo] \rightarrow \neg P(t')]$

The obligatory probability inference in (34) asserts that Mary's not giving birth by her 6th month of pregnancy is less likely than Mary's not giving by her 5th month of pregnancy. In other words, E-exhaustification expresses that our expectations are that Mary is likely to have already given birth by that date. However, this probability inference clashes with world knowledge, since the expectation is that the occurrence of the event should not occur for at least three more months, near the 9-month due date, which explains the strange use of the *until*-phrase in this example as it clashes with the inference that “the time of occurrence could well have been earlier.”

Thus far E-exhaustification confirms our expectations about the occurrence of an event modified by *until*: it gives rise to the inference that the eventuality may well have stopped earlier in upward entailing contexts (i.e. the interruption of the eventuality could well have happened) or that the actualization of the event may well have occurred earlier in ‘throughout-not’ interpretations (i.e. the instigation of the eventuality was expected to occur earlier). However, does E-exhaustification make the right predictions with atelic (or iterative telic) predicates when a ‘not-throughout’ interpretation is also possible?

4.3.3.3 E-exhaustification with ‘not-throughout’ interpretations

Recall from O-exhaustification that an LF that corresponds to a ‘not-throughout’ interpretation opens two exhaustification-based positions from where the alternatives,

obligatorily activated by *until*, could be exhaustified. The *until*-phrase attaches low in its base position at VP and is thus embedded in the downward-entailing context by scoping below negation. Under those conditions, the default position of the alternative sensitive operator is above negation. However, it could, in principle, also take place below negation. Even though exhaustification below negation is marked, it is justified if something clashes with higher exhaustification.

I show, first, the result from E-exhaustification above negation, which results in a contradiction. This justifies the need to try E-exhaustification below negation, which will be shown next. For this, I use the example *John didn't study until 2 pm* under the interpretation that *it is not the case that John studied for all the relevant subintervals until 2 pm*. The result from E-exhaustification above negation is shown in (35) where now previous alternatives along the probability scale are not entailed by the prejacent, as the entailment pattern has been reversed. E-exhaustification indicates that the prejacent is less likely than the alternatives that entail it, which is contradictory because the alternatives are true in fewer situations.

- (35) a. $E_{ALT_P} (\neg [\text{John studied until 2 pm}^{ALT_P}])$
- b. $ALT_P: \{\text{It is not the case that John studied until 1 pm, It is not the case that John studied until 2 pm}\}$
- c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2]$
It is not the case that John studied until 2 pm $\not\curvearrowright$ *It is not the case that John studied until 1 pm*
- d. $E_{ALT_P} (\neg \forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')]) = \neg \forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')]$
 $\wedge \neg \forall p \in ALT [[\forall t' [t' \subseteq [t_0, 2] \rightarrow P(t')]] <_{\mu} p]$

- e. **PI above negation** : $\neg\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] <_{\mu} \neg\forall t'[t' \subseteq [t_0, 1] \rightarrow P(t')]$

The derivation in (35) concludes that *it is not the case that John studied until 2 pm* is less likely than *it is not the case that John studied until 1 pm*. Since the latter entails the former, this yields a contradiction.

However, we are still left with another potential exhaustification position that could save the use of *until* in *it is not the case that John studied until 2 pm*. This is E-exhaustification below negation (where the entailment pattern has not been reversed yet). What happens when we attempt to exhaustify the alternatives below negation is illustrated in (36). The inference (*John studying until 2 pm is less likely than John studying until 1 pm*) is added by conjunction into the assertive content (*John studied until 2 pm*) before negation applies.

- (36) a. $\neg E_{ALT_P}$ (John studied until 2 pm^{ALT_P})
 b. $ALT_P: \{\text{John studied until 1 pm, John studied until 2 pm}\}$
 c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2]$
 John studied until 2 pm \subseteq *John studied until 1 pm*
 d. $E_{ALT_P} (\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]) = \forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] \wedge \forall p \in ALT [[\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]] <_{\mu} p]$
 e. **PI below negation** : $\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] <_{\mu} \forall t'[t' \subseteq [t_0, 1] \rightarrow P(t')]$

$$\begin{aligned}
\text{f. } \neg \text{E}_{ALTP} (\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')]) &= \neg[\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] \wedge \\
&\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] <_{\mu} \forall t'[t' \subseteq [t_0, 1] \rightarrow P(t')] \equiv \\
&\neg\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] \vee \\
&\neg[\forall t'[t' \subseteq [t_0, 2] \rightarrow P(t')] <_{\mu} \forall t'[t' \subseteq [t_0, 1] \rightarrow P(t')]]
\end{aligned}$$

After negation applies, we obtain that either it is not the case that John did not study until 2 pm or that it is not the case that John studying until 2 pm is less likely than John studying until 1 pm. Since the second disjunct cannot be true (the fact that a weaker alternative is less likely than a stronger alternative), we are left with the first disjunct, which corresponds entirely to the meaning of the ‘not-throughout’ reading. In other words, the probability inference obtained from E-exhaustification below negation with an atelic predicate is trivial since the inferential meaning added to the assertive content does not survive when negation applies above it and E-exhaustification ends up giving us back the meaning that corresponds to the ‘not-throughout’ reading. Most importantly, no contradiction arises, in line with the fact that a ‘not-throughout’ interpretation is felicitous. E-exhaustification would simply be trivial, which further correlates with the fact that probability inferences do not arise with ‘not-throughout’ readings. Hence, our hypothesis that *until* always activates its probability scale persists because probability inferences emerge in the right contexts (with ‘throughout-not’ readings), and are predicted to disappear in the contexts where they are absent (with ‘not-throughout’ readings).

4.3.4 Summing up

In sum, in this section I have put forth the idea that *until* also obligatorily triggers a probability scale, which consists solely of earlier relevant alternatives. Such alternatives are factored into meaning and thus must be exhaustified. I have suggested that exhaustification of probability alternatives happens via another alternative-sensitive operator, E, roughly equivalent to covert *even*.

Our assumption that *until* obligatorily activates a probability scale of alternatives, in addition to a temporal scale of alternatives does not get in the way in the outcome of any attested interpretation in both positive and negative contexts. In the less salient cases, i.e. in positive cases, the probability inference corroborates what we would already naturally expect from facts that follow from the physical world. In ‘not-throughout’ interpretations, such an inference does not survive negation and goes away. But, perhaps even more importantly, in ‘throughout-not’ readings, it gives us the salient inference that the actualization of the event was expected to occur earlier. This predicts the oddness of the use of *until*-XPs in contexts where the actualization of the event is not expected until later. Finally, I would like to emphasize again that this section mostly consisted of a series of ideas and speculations in progress. Of course, there is more to be said; for example, I have not discussed cases in positive environments in which our own perception of likelihood taking into account the semantics of a verb may interfere with the physical view that the more an event holds the more likely it is to be interrupted. This does not obviously fit into what I am saying here, but I leave these cases for future work.

4.3.5 *For*-adverbials and the lack of a salient probability/entailment measure

Before closing this chapter, I would like to acknowledge a larger question looming here: Why is it that *for*-adverbials, as opposed to *until*-phrases, may not obligatorily activate a probability scale? (Or even the temporal scale?) It is not clear to me, at present, what the answer is, but I would like to start by hypothesizing the following. The measure μ of likelihood is based on relations of entailment based on precedence and linear order on the temporal scale (e.g. subintervals vs. superintervals that share the same left boundary). An entailment relation of precedence is inconclusive when the prejacent of a *for*-adverbial is compared to its alternatives (e.g. longer or shorter intervals) without specifying its referential position on the temporal spectrum. The prejacent of a *for*-adverbial focuses on the measure of an interval but such an interval may consist of a sum of non-contiguous intervals, i.e. non-adjacent intervals (e.g. Dowty 1979). Such subintervals may simultaneously precede and follow a relevant alternative. This makes it difficult to automatically resort to a probability measure μ .

For example, imagine a context in which John studied from 2 pm to 3 pm and then again from 7 pm to 8 pm. Someone can say *John studied for two hours today* to refer to such a situation and this is still judged true. A relevant alternative may be John studying from 2 pm to 3:30 pm (i.e. an alternative with the same left boundary but shorter), and yet it is inconclusive whether such an alternative precedes or follows the prejacent, impeding the possibility of directly resorting to a contextually relevant probability measure μ .

All in all, the prejacent of *for*-adverbials may consist of a sum of non-contiguous intervals where, as a consequence, the alternatives (shorter or longer alternatives that share the same left boundary t_0) cannot be automatically classified as subsets or supersets *per se*. Such alternatives thus cannot be instinctively ordered in terms of entailment depending on a relation of precedence/succession along a temporal scale. I suggest that this may be intrinsically related to (i) the fact that *for*-adverbials do not activate probability alternatives, and (ii) the optional activation of their temporal scalar alternatives.¹⁷

4.4 Conclusions

In sum, if we put together the scopal account of right-adjoined durative adverbials built in Chapter 3 with an exhaustification-based approach to scalar alternatives put forth in this chapter (similar to current proposals of obligatory scalar implicatures), not only the factivity of punctual *until* but also other scalar inferences are predicted in a unified fashion. It is furthermore appealing that the difference in behavior between *for*-adverbials and *until*-phrases with regard to factivity consists of a simple parametric measure (the optional/obligatory choice): the temporal scalar alternatives associated with *until*-phrases are always ‘active’ and must be obligato-

¹⁷Note that other temporal adverbials that take definite, and what also looks like contiguous, time intervals as complements, such as *before 2 pm*, do not obligatorily give rise to factive readings either, suggesting that they also do not obligatorily activate their scalar alternatives: *John didn't arrive before 2 pm, and indeed he never arrived*. However, I believe that the definiteness and contiguity of the interval complement of *before* is not comparable to the case of *until*. The reason why *before* is not factive may be because it lacks the universal component to begin with. This is supported by the fact that *before* can modify non-iterative telic predicates in positive environments: *John arrived before 2 pm*. I would like to thank David Beaver and Daniel Margulis for discussion on this issue, which remains to be investigated in future work.

rily factored into meaning, whereas the temporal alternatives of *for*-adverbials do not necessarily need to be ‘active.’ As a result, the potential cancellability of the inferences triggered by *for*-adverbials is contingent on context. Finally, a combined scopal and exhaustification-based analysis is preferred for the case of *until* in English over any lexical ambiguity theory because we do not have to stipulate the existence of an NPI-*until*, for which English does not make any overt lexical distinction. A question that arises here is then the following: can we extend an analysis such as this to other languages that also do not make a lexical distinction between their *until*-counterpart uses? A language that falls into this category is Spanish, which is investigated in the next chapter.

Chapter 5

A plural implicature-based approach of Spanish durative adverbial *hasta* 'until'

5.1 Introduction

In this chapter I analyze the behavior of Spanish *hasta* in comparison to English *until* in the temporal domain.¹ At first sight, the characteristics of *hasta* seem quite parallel to *until*. Nevertheless, when taking a closer look at these two related forms, a number of critical differences emerge which have to date gone unnoticed in the literature, making it nonviable to pursue a uniform analysis of both Spanish *hasta*

¹*Hasta* in Spanish can also mark the goal of a motion construction, as in *Juan corrió hasta la tienda* 'Juan ran up to the store' or be used as a scalar additive particle similar to *even* as in *Hasta Juan vino a la fiesta* 'Even Juan came to the party', among other more abstract uses, such as function as a degree modifier. For the purposes of this chapter, I only focus on the uses of *hasta* in the temporal domain. See Chapter 6 for more on these other uses.

and English *until*, and, per extension, between Spanish *hasta* and *for*-adverbials.

I will propose that *hasta*-phrases are existential temporal frame adverbials that measure out plural events, instead of universally-based adverbials like English *until* (and *for*-adverbials). I will argue that the semantic contribution of the durative component of *hasta* is a non-defeasible multiplicity inference, as has been suggested for plural morphology on DPs (e.g. Spector 2007, Mayr 2015). Comparing the contrast between existential vs. universal types of *until* with the two major approaches to temporal measure-phrases we find in the literature, the analysis I suggest for *hasta* is a modified version of Krifka's (1998) analysis of durative adverbials (albeit one that does not involve a fusion-based treatment of negation), whereas the analysis I proposed for *until* in Chapter 3 and 4 consists of an updated version of Dowty's (1979) analysis of durative adverbials. Proposing two distinct types of 'until' has further cross-linguistic consequences when we expand our empirical focus. In particular, I will suggest that the existentially-based analysis can have a natural NPI-counterpart, which may be what is overtly realized in languages like Greek.

The outline of this chapter is as follows. In §2, I discuss the close resemblance between English *until* and Spanish *hasta*, which suggests a similar treatment for the two adverbials. However, in §3, I introduce crucial contrastive data that will make it impossible to maintain the same analysis for both. In §4, I put forth a novel analysis for Spanish *hasta*, which is reminiscent of Krifka's (1998) analysis of durative adverbials. *Hasta* is an existential plural modifier where the durative component of *hasta* is built in the form of a plural implicature. In §5, the

factivity of *hasta*, as well as other inferences, arise as scalar implicatures within an exhaustification-based system. Finally, in §6, I suggest a potential implication of the proposed analysis that arises when we expand the typological basis of the present work. The conclusions are given in §7.

5.2 Parallelism between English *until* and Spanish *hasta*

Durative English *until* and Spanish *hasta* share several well-known properties for measure-phrases in the temporal domain. First, just as English *until* only modifies durative predicates (statives, activities, and iterated telic predicates), Spanish *hasta* also seems to only modify atelic predicates (or iterated telic predicates), as in (1a), and appears to be unable to modify non-iterative punctual predicates in a positive context, as in (1b).^{2,3}

- (1) a. *Juan estudió hasta las 2.*
 Juan studied until the 2
 ‘Juan studied **until** 2.’
- b. # *Juan llegó hasta las 2.*
 Juan arrived until the 2
 # ‘Juan arrived **until** 2.’

A second parallelism with *until*-phrases is that whenever a predicate is negated, not only can atelic and iterative telic predicates be modified by *hasta*-phrases but also non-iterative telic predicates, as shown in (2).

²In §5.3. we will see that under special circumstances non-iterative punctual predicates may be modifiable by *hasta* when they can receive a cumulative interpretation.

³I simultaneously introduce the Spanish and English data for comparison, as I give the translations of the Spanish examples in English. I also indicate whether the English counterparts of the Spanish sentences are felicitous or not in the glosses for the Spanish examples.

- (2) a. *Juan no estudió hasta las 2.*
 Juan not studied until the 2
 ‘Juan didn’t study **until 2.**’
- b. *Juan no llegó hasta las 2.*
 Juan not arrived until the 2
 ‘Juan didn’t arrive **until 2.**’

Third, the use of *hasta* in (2b), similarly to punctual *until*, also gives rise to a non-cancellable factive inference about the actualization of the event (e.g. Juan’s arrival) at some point after the interval ceases to hold (e.g. after two), as indicated in (3).

- (3) *Juan no llegó hasta las 2. #De hecho, nunca llegó*
 Juan not arrived until the 2 of fact never arrived
 ‘Juan didn’t arrive **until 2.** #In fact he never arrived.’

Finally, in addition to the properties of durativity and factivity that *hasta*-phrases share with *until*-phrases, *hasta* also seems to take narrow scope with respect to other scope-bearing elements in the clause, such as a singular indefinite object. For example, in (4) the same wrong phone number must be dialed again and again throughout the given interval. Even though a narrow scope interpretation of the object would give rise to a natural reading, this reading is systematically absent.

- (4) *Juan marcó un número de teléfono errado hasta las 2.*
 Juan dialed a number of telephone wrong until the 2
 ‘Juan dialed a wrong phone number **until 2.**’

This narrow scope behavior of right-adjoined *hasta*-phrases explains the oddity of a sentence as in (5a) when the predicate is a non-iterative telic predicate that takes a singular indefinite object. The strange meaning obtained in (5a) resembles the interpretation in (5b), where the predicate takes a referential object instead: the

same rabbit is being killed over and over again. Hence, thus far, *hasta*-phrases show the same constrained scopal pattern as *until*-phrases, noticed since Carlson (1977a, b).⁴

- (5) a. # *Juan mató a un conejo hasta las 2.*
 Juan killed DOM a rabbit until the 2
 # ‘Juan killed a rabbit **until** 2.’
- b. # *Juan mató al conejo hasta las 2.*
 Juan killed DOM.the rabbit until the 2
 # ‘Juan killed the rabbit **until** 2.’

As predicted by Differentiated Scope (e.g. Carlson 1977b), the examples in (5) become acceptable when the object is a bare plural as in (6), which can be regarded as “scopally inert” following a Carlson/Chierchia approach to bare plurals.

- (6) *Juan mató conejos hasta las 2.*
 Juan killed rabbits until the 2
 ‘Juan killed rabbits **until** 2.’

The interpretation that arises in (6) is the acceptable meaning of different rabbits being killed over the course of an interval that ends at two.

Thus far the behavior of *hasta*-phrases in Spanish mirrors the behavior of *until*-phrases in English. This is not especially surprising since they are two cross-linguistically related forms, counterparts of each other in ‘close enough’ languages, which share their main function in the temporal domain, both indicating how long a durative eventuality holds. However, under closer scrutiny, *hasta* appears to be

⁴In the remainder of the dissertation, DOM in the glosses stands for Differential Object Marking in Spanish. For a recent discussion on the status of DOM in today’s European Spanish, see e.g. von Heusinger and Kaiser (2007, 2011), Bassa-Vanrell (2011), and Bassa-Vanrell and Romeu (2014).

more permissive in terms of the number of interpretations that it triggers than *until*. This is discussed next.

5.3 The puzzle: Contrast between English *until* and Spanish *hasta*

Recall that English *until* is unacceptable when a non-iterative punctual predicate takes a plural quantified theme in upward-entailing environments, as illustrated in (7).

- (7) # Thirty/many/some people arrived **until** 2 pm.
- Distributive reading: every member of the group kept arriving until 2 pm.

The sentences in (7) sound substandard because they acquire a distributive reading, wherein every member of the group (of e.g. 30/many/some people) kept arriving until 2 pm. This follows from the analysis of *until*-phrases (and other right-adjoined durative adverbials like *for*-phrases) as universal quantifiers that take narrow scope with respect to the quantified DP-subject/object.

We find a striking and unexpected contrast when comparing the sentences in (7) to their corresponding Spanish counterparts. In Spanish, such sentences are perfectly acceptable and receive a cumulative reading, as illustrated in (8).⁵

⁵“Cumulative” here is meant in opposition to a distributive reading, following e.g. Champollion (2016), not in the sense of “cumulative” of Krifka (1989).

- (8) *Treinta/muchas/algunas personas llegaron hasta las 2.*
thirty/many/some people arrived until the 2

‘Thirty/many/some people arrived **until** 2.’

- Cumulative reading: a total of 30/many/some people arrived non-simultaneously over the course of an interval that ended at 2 pm.

The cumulative interpretation in (8) corresponds to something along the following lines: ‘there was a plural arriving event whose cumulative theme is a set of thirty/many/some people that lasted until 2.’ This additional durative meaning of *hasta* is not predicted by a universal quantification approach of durative adverbials *à la* Dowty (1979), since, for instance, in every relevant time subinterval until 2 pm, thirty/many/some people should have arrived, which would result in deviance since it describes a nearly impossible situation wherein the same group of people kept arriving over and over again.

Another case where *hasta*-XPs seem to be more permissive is when modifying accomplishments, even when the eventuality described by the accomplishment predicate has culminated. For example, the following sentences in (9) are acceptable across the board in Spanish, while they may sound fairly odd in English, especially if a completed interpretation is intended as in (9b, c).

- (9) a. *Juan leyó un libro hasta medianoche.*
Juan read a book until midnight
‘Juan read a book **until** midnight.’
- b. *Juan construyó una casa hasta medianoche.*
Juan built a house until midnight
?? ‘Juan built a house **until** midnight.’

- c. *Juan bebió una botella de vino **hasta** medianoche.*
Juan drank a bottle of wine until midnight
?? ‘Juan drank a bottle of wine **until** midnight.’

It seems that in these examples *hasta* simply introduces the duration of the eventuality, where the accomplishment may have culminated or not: Juan may have finished the entire book or he may have read only part of it. On the other hand, the deviance of the English sentences is explained on a distributive reading of the predicate over all the subintervals of the interval in question because, for example, for all relevant subintervals Juan needs to completely build one house/drink one bottle of wine. But how can we explain the acceptability of the Spanish examples?

The more general question thus is the following: how do we accommodate the English vs. Spanish difference within the traditional approach to measure phrases, such as Dowty (1979) and Krifka (1998), which are meant to capture the behavior of English *until* but as they stand cannot predict the various ‘new’ durative meanings of Spanish *hasta*? In other words, what kind of parameter is responsible for this variation, and which of the available theories is better equipped to explain it? This constitutes the core questions of the next section.

5.4 *Hasta* as an existential adverbial of temporal framing

As a brief recap, recall that two major traditional approaches have been proposed for English *for*-adverbials (and per extension, *until*-phrases): (i) Dowty’s approach (cf. 10a), which treats measure phrases as universals (where the verbal predicate

must hold of all relevant subintervals), and (ii) Krifka’s approach, which translates them as existential adverbials of temporal framing with a divisiveness/pluractional selectional requirement (cf. 10b). (In what follows, t_0 is a contextually supplied left boundary, $[t_0, n]$ a closed time interval, and $\tau(e)$ the duration of the event e .)

- (10) a. Dowty’s (1979) approach: $\llbracket \text{until n-time} \rrbracket =$
 $\lambda P. \lambda t \llbracket [t_0, n] = t \wedge \forall t' [t' \subseteq t \rightarrow P(t')] \rrbracket$
- b. Krifka’s (1998) approach: $\llbracket \text{until n-time} \rrbracket =$
 $\lambda P. \lambda e : \text{atelic } (P) [P(e) \wedge \tau(e) = [t_0, n]]$

We opted for a scopal account of English *until* in Chapter 3 to capture the acceptability of telic predicates under negation, i.e. its punctual behavior. The original motivations for pursuing a scopal theory based on Dowty’s approach for English *until* were mainly (i) to include the universal component of *until* as part of its assertive content so as to naturally account for the durative requirement of the adverbial and (ii) for *until* to be able to uniformly scope below and above negation while avoiding a fusion analysis of negation. This would have not been possible if the universal component had been placed in the presuppositional content of *until*, constituting the pluractional selectional requirement, as proposed by Krifka (1998). However, it is not obvious how to extend such an approach to incorporate the additional atelic meanings of *hasta*, since if we do that the acceptable examples in (8) above (involving telic predicates with plural quantified DPs) will be predicted to be infelicitous. Let us therefore turn to the alternative, Krifka’s approach, and see whether that fares better. I begin by revising the pluractional condition imposed on *until*-XPs so that they can capture the essence of *hasta*-XPs while also challenging the need for a

fusion analysis of negation.

To start, I propose that Spanish *hasta*-XPs are existential temporal framing adverbials that simply place the eventuality within an interval and assert that there are events e (one or more) whose durations fall, for example, between t_0 and 2 pm, similar to the assertive content of durative adverbials *à la* Krifka (1998). Within our current framework, based on quantificational event semantics in the spirit of Champollion (2015), such a denotation for *hasta* would be the following:

$$(11) \quad \llbracket \textit{hasta las 2} \rrbracket \text{ (to be modified)} = \lambda V. \lambda f. [V(\lambda e. [f(e) \wedge \tau(e) \subseteq [t_0, 2]])]$$

However, this is not enough, as it overgenerates. For example, the sentences in (5) that describe a singular non-iterative punctual predicate, repeated here as (12), would be predicted to be felicitous, yet they are not.

- (12) a. # *Juan mató a un conejo hasta las 2.*
 Juan killed DOM a rabbit until the 2
 # ‘Juan killed a rabbit **until** 2.’
- b. # *Juan mató al conejo hasta las 2.*
 Juan killed DOM.the rabbit until the 2
 # ‘Juan killed the rabbit **until** 2.’

Specifically, *hasta las 2* as in (11) would just indicate that the killing-of-the-rabbit event falls between t_0 and 2, which is a plausible meaning, contrary to what the judgements for such sentences are:⁶

⁶Existential *hasta* already predicts a wide scope interpretation of the object *a rabbit* within the present framework, where the theme is just one rabbit due to lexical cumulativity even if the predicate *kill* were pluralized (i.e. there are one or more killings of the same rabbit). See, for example, Kratzer (2008: 19-24) for further discussion.

- (13) a. $\llbracket \text{Juan mató a un conejo hasta las 2} \rrbracket$ (to be modified) = $\lambda f. \exists x [\mathbf{a\ rabbit}(x) \wedge \exists e [\mathbf{killing}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{Juan} \wedge \mathbf{th}(e) = x \wedge \tau(e) \subseteq [t_0, 2]]]$
- b. $\llbracket \text{Juan mató al conejo hasta las 2} \rrbracket$ (to be modified) = $\lambda f. \exists e [\mathbf{killing}(e) \wedge f(e) \wedge \mathbf{ag}(e) = \mathbf{Juan} \wedge \mathbf{th}(e) = \mathbf{the\ rabbit} \wedge \tau(e) \subseteq [t_0, 2]]$

Instead, the (pragmatically bizarre) reading in (13) is that the same rabbit was killed over and over again. Therefore, *hasta*-XPs must still be subject to an atelic/plurality condition, which is responsible for its ‘durative’ requirement and explains why *hasta* cannot modify a unique punctual event (i.e. a punctual predicate that takes a singular DP-argument), as in (14a), while still allowing for plural punctual events (i.e. the sum of multiple punctual events, which occurs when a punctual predicate takes a plural DP-argument), as in (14b).

- (14) a. # *Juan llegó hasta las 2.*
 Juan arrived until the 2
 # ‘Juan arrived **until** 2.’
- b. *30 personas llegaron hasta las 2.*
 thirty people arrived until the 2
 # ‘Thirty people arrived **until** 2.’

I claim that *hasta*-XPs are inherently plural: they select for properties of events that are plural and state that there are several events (i.e. more than one) within the time frame. For this, let us assume that there are plurality of events, namely events that are durative and hence contain subevents, and *hasta* is a modifier of such a plural property. One way to capture the restriction of *hasta*-XPs to plural events would be by encoding plurality into the meaning, e.g. as a sort of atelic/pluractional prerequisite following Krifka (1998). However, we want this re-

striction to vanish under negation, in order to avoid the imposition of plural negative events. The example in (15) is interpreted as there not being any arrival of Juan between t_0 and 2, and not as there not being a plural/durative arrival of Juan between t_0 and 2, which would be a very weak interpretation and vacuously satisfied.

- (15) *Juan no llegó hasta las 2.*
Juan not arrived until the 2
'Juan didn't arrive until 2.'

Following current approaches to plural morphology on DPs, in particular Spector (2007) and Mayr (2015), the semantic contribution of plurality can instead be better formulated as a non-defeasible inference within a system of obligatory implicatures via exhaustification operators that negate non-entailed alternatives, similar to the one presented in Chapter 4 to account for the scalar inferences of English *until*. The reason for this is that the meaning of plural morphology in DPs does not behave like an entailment or a presupposition, as it also disappears under negation. In what follows, I first discuss plurality in event semantics in general. I then present the basic proposal of Spector (2007) on plurals, which will be comparable to our own analysis.

5.4.1 Plural event structures

Before I propose the main analysis of this chapter, I briefly present what I will be assuming about plurality and event structures. In the same way that we construe plural individuals as sums of atoms and we maintain that the domain of individuals, D_e , is closed under sum formation (e.g. following Link 1983), we will assume that

the domain of eventuality E is similarly closed under a join operator ‘ \cup .’ In other words, the domain of eventualities E forms a join-semilattice, partially ordered by a part-of relation ‘ \leq ’ and verb meanings are sublattices. We assume, furthermore, that eventualities get mapped into time intervals via a temporal trace function $\tau(e)$; for any e , $\tau(e)$ is the duration of e . An atom is defined in the usual way:

$$(16) \quad \mathbf{AT}(e) = \forall e'[e' \leq e \rightarrow e = e']$$

(an atom has no proper parts)

In connection to (16), the notion of P-atoms is also relevant to the present discussion, that is, an atomic event relevant to a predicate P , following Krifka (1998: 3 (5)). Note that things that are atoms are P-atoms but not all P-atoms are atoms:

$$(17) \quad \mathbf{P-AT}(e) = \forall e'[e' \leq e \wedge P(e') \rightarrow e = e']$$

(an atom with no proper parts of the relevant verb type⁷)

We do assume that E contains a set of atoms A . However, we leave it open whether E is wholly atomic (i.e. generated by A) or not as any given verb meaning may or may not be generated from a set of atoms (or P-atoms) and if all are, then E is as well. In particular, that depends on what one wants to do with activities, like *running*, or states, like *being on the roof*, and whether one wants to assume that there are singular/atomic running activities or states of being on the roof. Following primarily Kratzer (2008), I assume that all verbs denote sets of eventualities closed under \cup , regardless of their Aktionsart.⁸

⁷Recall that since we are assuming a Neo-Davidsonian framework, the denotation of the predicate excludes any arguments other than the event argument. Therefore, the subevents e' of e here are in relation to the verb type.

⁸For different accounts on atomicity of events and event plurality see e.g. Rothstein (2004, 2008).

In what follows, I illustrate with a few examples the minimal assumptions we will need for present purposes (i.e. spelling out the plural oriented nature of *until*-phrases). The simplest understanding is to assume that achievements (non-durative predicates) have an atomic structure. Thus, for instance, *arrive* will denote the closure under sum of a set of atomic events. In a world in which there are only three arrivals, two by John at different times ($e_{J,1}$, $e_{J,2}$ —where subscripted J indicates the theme) and one by Bill ($e_{B,3}$), the denotation of the verb *arrive* will be the following:

$$(18) \quad e_{J,1} \cup e_{J,2} \cup e_{B,3}$$

$$\llbracket \text{arrive}_w \rrbracket = \begin{array}{ccc} e_{J,1} \cup e_{J,2} & e_{J,1} \cup e_{B,3} & e_{J,2} \cup e_{B,3} \\ e_{J,1} & e_{J,2} & e_{B,3} \end{array}$$

A plural event in this setup is clearly defined and isomorphic to the notion of plural individuals. Furthermore, achievements may sometimes be coerced into accomplishments in context (often aided by the imperfective or progressive aspect) (Rothstein 2004) or via reconceptualization of paths as extended or not in context (Beavers 2012). One such interpretation is a “filmstrip” reading where you slow the event down at a finer granularity than normal and view it as unfolding over time. In that case what might have been thought of as an atomic event e in the denotation of the achievement is treated as decomposed into a series of events e_1, \dots, e_n . Therefore, those atoms in (18) might not be pure atoms relative to E for at least some achievements like *arrive* (but not for some like *notice* since for *notice* it may well be as it is usually thought not to be coercible). However, in the context of a non-coerced interpretation of the verb the smallest events in the denotation of the verb are P-atoms

(if not atoms) to say the least. From here onwards, I make the simplifying assumption that all achievements ground out in real atoms, but if one were to conceive that this is not quite right,⁹ we could exchange the notion of ‘atoms’ in the forthcoming discussion for ‘P-atoms’ and the key proposal of the analysis would not be altered.

With regard to other types of predicates, I am inclined to assume that the structure of durative eventualities, like accomplishments and activities, is somehow similar to that of *arrive*, with the important difference that atoms of running or reading are harder to determine (and some might argue that it is not knowable whether there are such). But for example one might imagine that readings by John are ordered in a manner similar to (18). Suppose that John read a sentence of three words, that recognizing parts of a word is not deemed reading, and that no other reading goes on. Then the denotation of *read* would be exactly isomorphic to (18), with readings of single words playing the role of atoms.¹⁰

All in all, I assume that a plural event is a sum of subevents of the same kind, and has proper parts in the sense of the algebraic structure *E*. Atelic predicates are, as it were, inherently plural, in a manner perhaps parallel to that of mass nouns, and will always be true of eventualities that typically have proper parts. By

⁹For instance, Beavers (2008b) defined the smallest events inside of achievements as consisting of two smaller subevents, corresponding to the initial and final states defining the transition. In that case, arguably both the initial and final state subevents would then be in *E*, even though they are not in the denotation of the achievement predicate. Furthermore, it may be argued that an arriving event that involves simultaneously moving across a threshold while holding down a button allowing the threshold to be crossed, also has subevents in *E* even if not in the denotation of the achievement predicate. Nevertheless, what matters is that in both circumstances while these subevents would be in *E* they are not P-atoms, i.e. they would not be in the non-coerced verb meaning so they are not significant for the present purposes.

¹⁰For example, Beavers (2012) suggests that this is possibly contextual, in that atoms are determined in context.

the same token, predicates that denote accomplishments, such as readings, which are also durative, will consist of events with proper subevents, down to their minimal components of the same type (i.e. which can still be regarded as readings). However, I assume that (non-coerced) achievements are strongly atomic and denote a set of atoms (or P-atoms) closed under sum formation, just like count nouns. Therefore, achievements such as *arrive* are generated by a set of atoms, and one can legitimately talk of singular arrivals.

5.4.2 Spector's (2007) implicature-based analysis of plurality

Spector (2007) offers an implicature-based account to capture the contrast in (19).

- (19) a. The homework contains difficult problems. → The homework contains **at least 2** difficult problems.
- b. The homework doesn't contain difficult problems. → The homework does not contain **at least 1** difficult problem (\approx not even 1 difficult problem).

[Adapted from Spector (2007), ex. (1)]

The puzzle in (19) is that the b) sentence is not equivalent to the logical negation of the a) sentence: (19a) conveys that the problem contains at least two difficult problems, whereas (19b) does not mean that the homework does not contain at least two difficult problems. Rather, it expresses that the homework does not contain even one single difficult problem. The plurality encoded by the morpheme *-s* in the DP *problems* in a positive environment disappears under negation. The goal is to compute such a plural meaning as an implicature.

Spector (2007) suggests that the semantic contribution of ‘DP-plural’ (e.g. *problems*) is calculated in comparison to ‘a DP-singular’ (e.g. *a problem*). In this way, the interpretation of plurality is strengthened by taking into account the meaning that would have been obtained from using indefinite singular morphology instead. For this, Spector (2007) assumes the scale $\langle DP_{pl}, a DP_{sg} \rangle$, where the use of ‘a DPsg’ gives rise to a stronger inference, ‘exactly one’, as in (20b). This stronger reading becomes an alternative to consider when using ‘DPpl’ that must be factored into its meaning and exhaustified.

- (20) a. The homework contains difficult problems.
- means that the homework contains one or more difficult problems.
 - implicates \rightarrow the homework contains **at least 2 difficult problems**.
- b. The homework contains **a** difficult problem.
- means that the homework contains one or several difficult problems.
 - implicates \rightarrow the homework contains **exactly 1 difficult problem**.

The implementation that Spector (2007) puts forth is a mechanism of higher-order implicatures because ‘DP-plural’ not only takes into account the literal meaning of its competitor ‘a DP-singular’, which would be something like *at least one difficult problem* in (20b), but also its strengthened meaning, i.e. its pragmatic import after its scalar implicatures have been computed into its meaning. For instance, in a Gricean framework, based on general conversational principles, upon hearing (20b), one infers that the homework contains exactly one difficult problem. Spector argues that this is so because we take into account the scale $\langle a, several \rangle$, another scale that ‘a DP-singular’ triggers (e.g. *the homework contains a difficult problem*

in opposition to *the homework contains several difficult problems*). This stronger meaning of ‘a DP-singular’ (‘exactly one’) is in turn an alternative to ‘DP-plural’, as it is the strengthened meaning from its only competitor. From here onwards, the take-home message on how plural implicatures are formulated is the following: the sentence in (21a) competes with the alternative in (21b), which is in turn derived via an implicature.

- (21) a. The homework contains difficult problems.
- b. The homework contains **exactly one** difficult problem.

By exhaustifying (21a) with respect to (21b), i.e. asserting (21a) and negating its stronger alternative in (21b), one gets the following meaning in (22), which corresponds to the at-least-2 reading originally stated for plural morphology in positive environments.

- (22) The homework contains **one or more** difficult problems **but not exactly one**. → The homework contains at least two difficult problems

This hypothesis for the semantic contribution of plural morphology on DPs makes a direct prediction: the at-least-2 implicature triggered by plural morphology in upward entailing contexts will disappear in the usual way in downward entailing environments due to the reversal of entailment patterns (e.g. the alternative *the homework doesn’t contain exactly one difficult problem* is now weaker than the preadjacent *the homework doesn’t contain difficult problems*). I suggest that something similar to the disappearance of plural meaning takes place with *hasta*-XPs under negation, which is why singular achievements are acceptable in such a context (e.g. *Juan no llegó hasta las 2* ‘Juan didn’t arrive until 2’). Thus I adopt the central claim in

Spector (2007) that plurality is a special kind of scalar implicature. In extending this approach to events, we assume that what makes an event-predicate plural is entering in competition with alternatives parallel to (21b). We will leave open how exactly such alternatives come about (i.e. whether through a higher order implicature, as Spector argues, or in some other way) as this is orthogonal to our present issue.

5.4.3 How *hasta* becomes plural

Natural languages are known to have operators that pluralize properties of events (e.g. Zimmermann 2002, Yang 2001, Kratzer 2008), even when these events do not have any plural DP-arguments. In other words, phrasal plurality is not necessarily associated with nominal plurality. Even though Spanish is not a language that has overt pluractional marking on the verb (unlike the overt singular/plural noun distinction with overt morphemes), there are languages that do present overt pluractionality, such as Karitiana, a language spoken in the Western Amazon. For instance, Karitiana makes use of pluractional markers that are verbal affixes that signal the occurrence of multiple events, e.g. via reduplication, and such a pluralization operation excludes singular atomic events. This is illustrated in (23), where reduplication has been used to express a plural lifting event.

- (23) a. * *Inacio namangatmangadn myhint Nadia ka'it.*
 Inacio lift-REDUPL one Nadia today
 'Inacio lifted Nadia once today.'

- b. *Inacio namangatmangadn Nadia ka'it.*
 Inacio lift-REDUPL Nadia today
 ‘Inacio lifted Nadia today (more than once).’

[Adapted from Sanchez-Mendes and Müller 2007, ex. (29-30)]

The pluralization operation in (23) clashes when applying to a singular event, but is allowed otherwise (Sanchez-Mendes and Müller 2007, cf. Lasersohn 1995, Sanchez-Mendes 2006). Similarly, German *jeweils* produces plural interpretations of sentences that do not contain any plural DPs at all (Kratzer 2008).

- (24) *Eine Kanne Milch hat jeweils ein Pfund Käse produziert.*
 one can milk has jeweils one pound cheese produced
 ‘On each occasion, one can of milk produced one pound of cheese.’

(Kratzer 2008, ex. (36))

The sentence in (24) refers to “the sum of multiple events where one can of milk produced one pound of cheese” (Kratzer 2008: 36). A similar phenomenon would be triggered by the use of *hasta* in Spanish. Based on the assumption that *hasta* is an event modifier whose plural component is couched as an implicature, *hasta*-XPs assert that events (one or more) have taken place within the given time frame, but end up implicating ‘not just one.’ Therefore, in light of a derived theory of plurality *à la* Spector, I propose that *hasta*’s plural semantic contribution comes from obligatorily activating (at the propositional level) an alternative of the form indicated in (25b), equivalent to there being ‘exactly one’ event, which competes with the meaning of there being events (one or more) of the preajcent in (25a). The subscript ‘_V’ in the subevent condition (‘ \leq_V ’) of the uniqueness clause in (25b) indicates that the subevents are restricted to those that are in the meaning of the

given verb as determined in context. Overall, the set of alternatives triggered by a plural event modifier *hasta*, which I refer to as ALT_{No} , is given in (25c), wherein singularity is only encoded in the meaning of the alternative. The plural component of *hasta* will have to be derived.

- (25) a. Assertion = $\exists e[P(e) \wedge \tau(e) \subseteq [t_0, n]]$
 b. Alternative (uniqueness clause) = $\exists e[P(e) \wedge \tau(e) \subseteq [t_0, n] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, n] \rightarrow e' = e]]$
 c. $ALT_{No} = \{\exists e[P(e) \wedge \tau(e) \subseteq [t_0, n]], \exists e[P(e) \wedge \tau(e) \subseteq [t_0, n] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, n] \rightarrow e' = e]]\}$

The assertion in (25a) states that there are events (one or more) in $[t_0, n]$. The alternative in (25b) indicates that all events e' in $[t_0, n]$ that are part or equal to the relevant event e in $[t_0, n]$ must be the same as e and cannot be a proper part of it. In general terms, the alternative ends up asserting that there is exactly one and only one unique event with no proper parts in the relevant interval. The alternative is clearly stronger, as (25b) entails (25a). For example, if there is exactly one single event between t_0 and 2, it is true that there is one or more events between t_0 and 2, but not the other way around. The assertion and uniqueness clause along the lines specified in (25a, b) compose the alternatives in ALT_{No} , a set obligatorily activated by *hasta*-XPs. As a consequence, I propose that this set cannot be a singleton in order for *hasta* to be defined, i.e. the uniqueness clause must be included other than the assertion itself.

The obligatory activation of singular alternatives induces a process of exhaustification in a way familiar to the theory of scalar implicatures by negating any

stronger, non-entailed, relevant alternatives (e.g. Spector 2007, Chierchia 2013). I suggest using our covert exhaustification operator modeled on *only* introduced in Chapter 4, and repeated here for illustrative purposes in (26) (where it combines with an assertion ϕ at the propositional level).

$$(26) \quad \llbracket \mathbf{O}_{ALT} \phi \rrbracket = \phi \wedge \forall p \in \phi^{ALT} [p \rightarrow [\phi \subseteq p]] \quad (\text{where } \subseteq = \text{entails})$$

(The prejacent ϕ is true and any alternative p in ALT not entailed by ϕ is false)

Let us first consider what happens in positive environments. I start by looking into non-iterative punctual predicates such as *llegar* ‘arrive’, for a sentence such as *#Juan llegó hasta las dos* ‘Juan arrived until two.’ The literal meaning of the assertion and its active singular alternative are displayed in (27).¹¹

$$(27) \quad \text{a. } \# \text{Juan llegó hasta las dos}^{ALT_{No}} \text{ (\#‘Juan arrived until two’)}$$

$$\text{b. } \mathbf{Assertion:} \exists e[\mathbf{arriving}(e) \wedge \mathbf{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]]$$

(*there was one or more arrivals of Juan between t_0 and 2: WEAKER interpretation*)

$$\text{c. } \mathbf{ALT}_{No}: \exists e[\mathbf{arriving}(e) \wedge \mathbf{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e' [e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$$

(*There was a unique arrival of Juan between t_0 and 2: STRONGER alternative*)

The alternative in (27c) is not entailed by the assertion, since (27b) can be true while

¹¹For simplification purposes, in all the illustrations of the derivations in this chapter I am ignoring tense/closure, but that should not interfere in any way in the results from derived plurality discussed in this chapter. When the alternatives come into play I am assuming that the f function has been closed already.

(27c) is false. Such an alternative, which is factored into the meaning of *hasta*, must be O-exhaustified, as illustrated in (28). O-exhaustification gives us back the semantic contribution of plurality: (28) asserts that there was one or more arrivals of the same person between t_0 and 2 and implicates not just one.

- (28) $O_{ALT_{No}}(\text{Juan llegó hasta las dos}^{ALT_{No}}) = (27b) \wedge \neg (27c)$
 $\equiv \exists e[\text{arriving}(e) \wedge \mathbf{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \neg \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$
 $\equiv \exists e[\text{arriving}(e) \wedge \mathbf{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \exists e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$
 e' is not identical to e but a proper part of e
 (There was one or more arrivals of Juan between t_0 and 2, **and not just one**)

As shown in (28), the implicature that winds up being added to the meaning of *hasta* refers to there being a plurality of events that are part of the same event. In other words, the relevant event contained in the interval must have proper parts of the relevant type. For punctual predicates such as in *Juan llegó hasta las dos* ‘Juan arrived until two’, the only way to satisfy this is if e consists of a sum of arrivals of Juan between t_0 and 2, call it e^* , whose proper parts e' are the individual arrivals of Juan.¹² For a non-iterative punctual predicate realized by the same subject/object this result is deviant, since it describes a nearly impossible situation.¹³ This deviance

¹²I would like to point out that I am using the term “punctual” with caution, since I do not want to suggest that it takes no time at all for someone to arrive. But such predicates are assumed to have no proper parts of the same type. The distinction between instants and intervals is outside the scope of this dissertation. See Beavers (2008b) for further discussion on how punctual events may be decomposed into subevents of different types.

¹³Further recall, as specified in §5.4.1., that I am assuming non-coerced readings for achieve-

of *hasta* with a non-iterative punctual predicate contrasts with the acceptability of *hasta* with an iterative punctual predicate (e.g. semelfactive) such as *Juan tosió hasta las dos* ‘Juan coughed until two’, as shown in (29).

- (29) a. *Juan tosió hasta las dos*^{ALT_{No}} (‘Juan coughed until two’)
- b. **Assertion:** $\exists e[\text{coughing}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]]$
 (there was one or more coughing events by Juan between t_0 and 2:
 WEAKER interpretation)
- c. **ALT_{No}:** $\exists e[\text{coughing}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$
 (there was a unique coughing event by Juan between t_0 and 2: STRONGER
 alternative)
- d. **O_{ALT_{No}}** (*Juan tosió hasta las dos*^{ALT_{No}}) = (29b) $\wedge \neg$ (29c)
 $\equiv \exists e[\text{coughing}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \neg \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$
 $\equiv \exists e[\text{coughing}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \exists e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$
 e' is not identical to e but a proper part of e
 (There was one or more coughing events by Juan between t_0 and 2, **and not just one**)

The uniqueness clause in (29c) is stronger than the assertion in (29b) and hence it

ments. Coerced achievements would be treated as accomplishments since from the moment they are durative they have proper parts of the relevant verb type and, as rightly predicted, are modifiable by *hasta* in Spanish: e.g. *Juan estuvo llegando hasta las dos* ‘John was arriving until two.’ However, coerced cases require the imperfective aspect in Spanish. This would take me too far afield and is outside the scope of this dissertation.

must be O-exhaustified. This gives us the plural implicature which is added to the meaning of the assertion in (29d): the coughing event between t_0 and 2 must consist of proper parts of the relevant verb type. In other words, it is the sum of multiple coughing events that occurred between t_0 and 2. In this case, the sum of more than one coughing event realized by the same subject within a specific time frame gives rise to a felicitous interpretation. Hence, so far, the plural implicature added to the assertion of *hasta*-XPs captures the fact that *hasta* can modify iterative punctual predicates but not a non-iterative punctual predicate.¹⁴

On the other hand, whenever a non-iterative telic predicate takes a non-atomic subject/object (i.e. a definite/indefinite plurally quantified DP-subject/object)

¹⁴Observe the following context, which might seem problematic at first:

- i. **[Juan arrived at his office at 1 pm, but then he realized that he had forgotten his planner in his car, so he went back to get it and arrived again at 1:30pm.]**

Juan llegó hasta las dos de la tarde.

Juan arrived until the two of the afternoon

‘Juan arrived until two in the afternoon.’

The fact that (i) is not acceptable given the aforementioned context might be surprising and potentially contradict the proposed plural analysis. For instance, the oddness in (i) contrast with the acceptability in (ii).

- ii. *Dos personas llegaron hasta las dos de la tarde.*

two people arrived until the two of the afternoon

‘Two people arrived until two in the afternoon.’

However, remember from Chapter 3 and Chapter 4 that we are following recent theories of scalar implicatures, such as Magri (2009), which put forth a system in which such implicatures are computed ‘blindly’ to common knowledge and if the result clashes with it then deviance ensues. The plural implicature would still be derived in (i) but that clashes with world knowledge of a non-iterative predicate such as *arrive*, which is that people either arrive or not arrive only once at a point in question within a bound interval. Despite the given context in (i), we assume that there is only one relevant arrival event, which mismatches with the plurality condition. This must be due to a deeper grammatical issue, similar to the unacceptability of *#John died for an hour*, even when the dying event lasted one hour. I would like to thank Aron Hirsch for discussion on this point.

as in *30 personas llegaron hasta las dos* ‘30 people arrived until two’, the singular alternative will always be analytically false (as the plural subject/object will have parts that are not identical to the whole). This proposed analysis automatically predicts the ability of existential *hasta*, unlike universal *until*, to give rise to cumulative readings since no distributive effect necessarily unfolds. All the plural implicature requires is the relevant event to have proper parts of the appropriate type: a cumulative event, call it e^* , will always have a subpart e' that is not identical to e^* but is instead a proper part of e^* , e.g. the arrival of person #1, the arrival of person #2, ..., the arrival of person #30.¹⁵ This is illustrated in (30).

- (30) a. *30 personas llegaron hasta las dos*^{ALT_{No}} (#‘30 people arrived until two’)
- b. **Assertion:** $\exists x \exists e [30 \text{ people}(x) \wedge \text{arriving}(e) \wedge \mathbf{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2]]$
- c. **ALT_{No}:** $\exists x \exists e [30 \text{ people}(x) \wedge \text{arriving}(e) \wedge \mathbf{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e' [e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$ ¹⁶
- d. **O_{ALT_{No}}** (*30 personas llegaron hasta las dos*^{ALT_{No}}) = (30b) $\wedge \neg$ (30c)
 $\equiv \exists x \exists e [30 \text{ people}(x) \wedge \text{arriving}(e) \wedge \mathbf{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2] \wedge \exists e' [e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$
 (There is at least a subevent e' of the arrival of the 30 people that is a proper part of it, i.e. e is a plural arriving event whose cumulative theme

¹⁵Under those circumstances, the achievement predicate *llegar* ‘arrive’ is behaving more like an accomplishment in the sense that it has proper parts of the relevant type. This is in line with Beavers (2012: 48-50) discussion about the ways that theme and scalar mereological complexity interact to derive whether a predicate of change temporally behaves like an achievement or an accomplishment.

¹⁶This is never true if an event is cumulative.

is 30 people)

Thus far, the proposal that *hasta* is an existential time-frame adverbial whose use leads to a plural implicature captures the main divergence between English *until* and Spanish *hasta*. It predicts the ability of *hasta* to modify a telic predicate that takes a plural quantified DP as an argument, since the plural DP-argument already gives us phrasal plurality while also implicating a cumulative reading.

The same line of reasoning applies in capturing the ability of *hasta*-phrases to modify accomplishments. Even though accomplishments are telic predicates in the sense that they have a definable endpoint, they are durative and thus they will always be composed of events that are proper parts of the main event in question. Hence, it follows that the singular alternative will also always be analytically false and will not interfere in the literal meaning of the assertion. An example is provided in (31).

- (31) a. *Juan leyó un libro hasta las dos*^{ALT_{No}} ('Juan read a book until two')
- b. **Assertion:** $\exists x \exists e [\mathbf{a\ book}(x) \wedge \mathbf{reading}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \mathbf{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2]]$
- c. **ALT_{No}:** $\exists x \exists e [\mathbf{a\ book}(x) \wedge \mathbf{reading}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \mathbf{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e' [e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$
- d. **O_{ALT_{No}}** (*Juan leyó un libro hasta las dos*^{ALT_{No}}) = (31b) $\wedge \neg$ (31c)
 $\equiv \exists x \exists e [\mathbf{a\ book}(x) \wedge \mathbf{reading}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \mathbf{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2] \wedge \exists e' [e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$
 (The reading-of-a-book event by Juan has proper parts)

Therefore, the plural inference of the relevant event consisting of subparts predicts

that accomplishment predicates are also modifiable by *hasta*, which is borne out.

As far as atelic predicates are concerned, since these are quintessentially durative, it automatically follows that *hasta* phrases will also be able to modify them since any event described by an atelic predicate can be decomposed into multiple subevents that are part of the main event. For example, for a sentence such as *Juan corrió hasta las dos* ‘Juan ran until two’, without presupposing anything about atelicity, the singular alternative would indicate that there is a unique atomic running event. In the hypothetical case that we can conceive of such a scenario, it would be a situation in which the *hasta* phrase introduces such a small interval that the contextual left boundary is placed, along the temporal spectrum, (almost) at the same spot where the right boundary is. When the assertion is exhaustified, this non-entailed alternative is negated, and we derive that the interval must be large enough to contain a plural instantiation of the atelic event, e.g. multiple runs of Juan that are proper parts of the maximal run by Juan between t_0 and 2, as shown in (32).

- (32) a. *Juan corrió hasta las dos*^{ALT_{No}} (‘Juan ran until two’)
- b. **Assertion:** $\exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]]$
- c. **ALT_{No}:** $\exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$
- d. **O_{ALT_{No}}** (*Juan corrió hasta las dos*^{ALT_{No}}) = (31b) $\wedge \neg$ (31c)
 $\equiv \exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \exists e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$
- (The running event by Juan has proper parts)

Atelic predicates are inherently plural and as such the agreement between *hasta*

phrases as plural modifiers and atelic predicates, as derived in (32), is straightforward.

5.4.4 The ‘abutment’ condition on plurality of *hasta*

Up to this point, the proposed analysis of plurality rightly predicts the behavior of *hasta* phrases in positive environments when it comes to the type of predicates that such durative adverbials can modify. While this seems to be on the right track, we may want to add a requirement about the distribution of events within the temporal frame identified by the adverbial.¹⁷ This would be in line with the tendency of pluralities to take up their available space (temporal, in such cases).¹⁸ The distribution of the multiple events within the interval of *hasta* is evenly spread all throughout. Something stronger than just saying that the events fall between t_0 and 2 must be going on. I suggest including an ‘abutting’ condition for non-atomic events, which does not affect the previous discussion, along the lines specified in (33). This is a simple way of accounting for this condition that suffices for our purposes.

$$(33) \quad \llbracket \textit{hasta las 2} \rrbracket (\text{final}) = \lambda V. \lambda f [V(\lambda e [f(e) \wedge \tau(e) \subseteq [t_0, 2] \wedge [\neg \mathbf{AT}(e) \rightarrow \tau(e) \text{ abuts } [t_0, 2]]])]]$$

¹⁷I would like to thank Irene Heim for suggesting to me the addition of a distributive condition.

¹⁸A property of plural predicates within an interval is that they take up the space of the interval in question evenly. Note, however, the contrast between *antes* ‘before’ and *hasta* ‘until’, as was pointed out to me by Irene Heim. Atelic predicates (intrinsically plural) do not necessarily show such a property with other temporal adverbials, like *antes*. In *Juan corrió antes de las dos* ‘Juan ran until two’, Juan does not need to have been running all throughout before two. Nevertheless, I would like to draw attention to the fact that *antes* may not be a closed interval on both sides, e.g. with no relevant left boundary, as non-iterative punctual predicates are modifiable by such an adverbial: *Juan llegó antes de las dos* ‘Juan arrived before two.’ This suggests that the plurality condition or universal quantification of *hasta/until*, respectively, do not apply here, and *before/until* (or *antes/hasta*) are not a ‘comparable’ pair in this regard. Further contrasts between the two are left for future research.

The abutting constraint in (33) ensures that instantiations of plural events must reach (or be very next to) the borders on both sides of the interval introduced by *hasta*. For instance, getting back to the example in (32), the maximal running event by Juan between t_0 and 2 must abut the interval $[t_0, 2]$, meaning that it must occupy the given space.¹⁹ As an example, since running is not atomic the final assertion of (32) is provided in (34).

- (34) a. *Juan corrió hasta las dos*^{ALT_{No}} (‘Juan ran until two’)
- b. **Assertion (final):** $\exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2]]$
- c. **Assertion + implicature (final):** $\exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2] \wedge \exists e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$

By contrast, only punctual telic predicates that take singular DP-arguments (but not plural DPs) satisfy the description of atomicity in (33). For example, as discussed above, Juan’s arrival has no proper parts of the relevant type. Therefore, the final denotation of a sentence such as *Juan llegó hasta las dos* ‘Juan arrived until two’ remains the same as in (27), given again in (35) together with its plural implicature. The result in (35c) warrants its deviance because there cannot be multiple arrivals of Juan, as already argued.

- (35) a. *#Juan llegó hasta las dos*^{ALT_{No}} (*#*‘Juan arrived until two’)
- b. **Assertion (final):** $\exists e[\text{arriving}(e) \wedge \mathbf{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]]$

¹⁹The ‘abutment’ condition is not factored into the meaning of the singular alternative (‘uniqueness clause’) as it would be trivial. Recall that this alternative to *hasta* refers to there being a singular atomic event within the interval in question, which, of course, cannot abut the interval considering that the ‘abutment’ condition can only come into play when there is more than one event of the relevant verb type. In the final denotation of *hasta*, this ‘non-atomic’ constraint is indicated by $\neg \mathbf{AT}(e)$.

- c. **Assertion + implicature (final):** $\exists e[\text{arriving}(e) \wedge \text{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \exists e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$

Finally, whenever a punctual telic predicate takes a plural DP-argument, as in the case of *30 personas llegaron hasta las dos* ‘Thirty people arrived until two’, then the ‘abutting’ condition also comes into play, as the event described is no longer ‘atomic.’ The final denotations of (30) above are given in (36).

- (36) a. *30 personas llegaron hasta las dos*^{ALT_{No}} (#‘30 people arrived until two’)
- b. **Assertion (final):** $\exists x \exists e[\mathbf{30\ people}(x) \wedge \text{arriving}(e) \wedge \text{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2]]$
- c. **Assertion + implicature (final):** $\exists x \exists e[\mathbf{30\ people}(x) \wedge \text{arriving}(e) \wedge \text{Th}(e) = x \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2] \wedge \exists e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]$

The use of *hasta* in (36) does not give rise to a reading in which all thirty people arrived at the very exact same time. A further consequence of the ‘abutting’ condition is that it appropriately rules out such a reading, in favor of a cumulative interpretation along the given time frame. The different thirty arrival events must apply distributively in the close interval.

In sum, I have claimed that *hasta* is a plural existential quantifier, where plurality is to be couched as an implicature. *Hasta*-XPs assert that one or more events of the same kind described by the predicate fall within an interval, and if more than one, the events abut such an interval. Additionally, its use obligatorily activates an alternative whose meaning is stronger in positive environments, as it

asserts that exactly one and only one event with no parts falls within the interval in question. When exhausted, *hasta*-XPs end up implicating that the relevant event must have proper parts of the appropriate type. For telic predicates with plural DPs, this gives us the scopeless cumulative interpretation, which *until*-phrases in English lack (e.g. Champollion 2010).

5.4.5 The behavior of *hasta*-XPs under negation

The reason we redefined how the plurality requirement is built in an account of durative adverbials in the spirit of Krifka (1998) now pays off. An important further consequence of the present approach is that it also predicts the acceptability of *hasta* with the presence of negation despite the type of predicate used. In particular, I show that the plural implicature disappears due to the reversal of entailment patterns, and hence no pragmatically deviant situations may arise. This is advantageous over a presuppositionally-based atelic/pluractional condition *à la* Krifka, which must resort to a fusion-based treatment of negation so that the adverbial can measure out an atelic ‘negative event’. I test such a derived prediction with a non-iterative telic predicate in (37) below.

Hasta-XPs cannot modify a non-iterative telic predicate in positive environments since the derived plural implicature requires there to be multiple instantiations of the event so that *hasta* can measure out the sum of those events. However, if negation is present, then no plural implicature arises since the strongest alternative becomes the weakest alternative and no deviance ensues with such predicates. This is shown in (37).

- (37) a. *Juan no llegó hasta las dos*^{ALT_{No}} ('Juan did not arrive until two')
- b. **Assertion:** $\neg\exists e[\text{arriving}(e) \wedge \text{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]]$
 (There was no arrival of Juan between t_0 and 2: STRONGER interpretation)
- c. **ALT_{No}:** $\neg\exists e[\text{arriving}(e) \wedge \text{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$
 (There was no unique arrival of Juan between t_0 and 2: WEAKER alternative)
- d. **Plural Implicature:** N/A

The alternative in (37c) is now entailed by the prejacent in (37b) and hence we do not need to exhaustify it. A plural implicature does not arise with other types of predicates either. An illustration of this with the atelic predicate *run* is provided below:

- (38) a. *Juan no corrió hasta las dos*^{ALT_{No}} ('Juan did not run until two')
- b. **Assertion:** $\neg\exists e[\text{running}(e) \wedge \text{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2]]$
 (There was no running event by Juan between t_0 and 2 [and that abuts t_0 and 2]:²⁰ STRONGER interpretation)
- c. **ALT_{No}:** $\neg\exists e[\text{running}(e) \wedge \text{Th}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]$

²⁰As we will see in §5, the ambiguity generated by the inclusion of the 'abutting' condition under negation will give us the ambiguity between 'throughout-not' and 'not-throughout' readings generated with atelic and iterative telic predicates in negative environments. Hence, the fact that *hasta* carries a distributive condition further predicts the emergence of the two readings with an existentially-based 'until'-like word.

(There was no atomic run of Juan between t_0 and 2: WEAKER alternative)²¹

d. **Plural Implicature:** N/A

The plural implicature will always vanish under negation. Such behavior resembles the semantic contribution of plural morphemes on DPs in §5.4.2, which was decisive in motivating that plurality is an implicature. As a consequence, when plurality is not a selectional precondition and emerges in the form of an implicature, we can use negation logically, instead of a fusion-based treatment of negation.

It is worth noting, however, that contra the behavior of plural morphology on DPs, the plural implicature does not seem to disappear in downward entailing environments other than negation (e.g. in the antecedent of an *if*-clause, inside the restrictor of an every phrase, in questions, etc.). These environments also reverse the entailment pattern and, as a result, in principle predict the absence of plurality. Yet, as the unacceptability of the examples in (39) illustrates, this is not the case since a plural implicature must still arise.²²

- (39) a. # *Si Juan llegase hasta las dos de la tarde, él vería a María.*
if Juan arrived until the two of the afternoon he would.see DOM
María.
María
‘If Juan arrived until two in the afternoon, he would see Mary.’
- b. # *Cada persona que llegó hasta las dos, será premiada.*
every person that arrived until the two will.be awarded
‘Every person who has arrived until two will be awarded.’

²¹This is always analytically true for a durative predicate.

²²I would like to thank Larry Horn for pointing out this issue to me.

- c. # *Llegó Juan hasta las dos de la tarde?*
 arrived Juan until the two of the afternoon
 # ‘Did Juan arrive until two in the afternoon?’

Furthermore, even constructions with neg-raising verbs disprefer the use of *hasta* with non-iterative punctual predicates, as in (40).

- (40) ?? *No creo que Juan llegara hasta las dos.*
 ?? not believe that Juan arrived until the two
 # ‘I don’t believe that Juan arrived until two.’

However, the data in (39) and (40) suggests a fairly simple analysis: O-exhaustification of the alternatives is locally constrained within the clause boundaries. In other words, the alternatives need to be checked very locally within the most immediate TP, and not beyond.^{23,24}

In sum, local (clause-internal) exhaustification of singular alternatives that *hasta*-XPs activate predicts that no plural implicature will emerge with sentential negation. This rightly captures that no matter what the type of predicate it is that is negated, *hasta* will be able to modify it. The ‘throughout-not’ and ‘not-throughout’ readings as well as the factive and other scalar interpretations that arise with the use of negation will be discussed in §5.²⁵

²³Such a locality constraint could be evidence for further pursuing a syntax-based implementation of exhaustification similar to feature-checking/agreement as these also show minimality/blocking effects. A more worked out implementation of such a system is outside the scope of this dissertation. See Chierchia (2013) for more details on how a version of this could be implemented.

²⁴Punctual *hasta* is not an NPI, but we would expect that if it were one it would be a ‘sufficiently’ strong one. Such an NPI-counterpart to ‘until’ should in principle be a strong NPI triggered by sentential negation (as has been reported in the literature). Nevertheless, we also seem to predict that such an NPI could potentially still be possible with downward-entailing quantified-DPs, such as *less than thirty people* or *few people* because the reversal of entailment patterns under those conditions occurs locally enough, within TP. Further investigation of the strong character and behavior of an overt NPI in languages like Greek remains for future research.

²⁵I would like to point out one open issue for future investigation (suggested to me by a blind

5.4.6 Extending the analysis: Definite DPs and distributivity

With regard to the main contrast between English *until* and Spanish *hasta*, so far we have examined the ability of Spanish *hasta* to give rise to cumulative readings when it modifies predicates that take plurally quantified DPs. A significant point to consider here is whether a contrast between *hasta* and *until* still holds whenever the plural DP-subject/object is definite. *Prima facie*, it appears to be the case that predicates that take plural definite DPs as in (41a, b) (vs. plural quantified DPs, as in (41c)) tend to be understood distributively (and not cumulatively).²⁶

reviewer), which has to do with the scopal interaction between a quantified DP-argument and negation. Negated punctual predicates that take quantified DPs sound relatively odd in Spanish, specially when these are not specific indefinites and are interpreted as taking scope under negation (e.g. $\neg >$ ‘30 people’). An example is given below:

- i. ? *Una persona/treinta personas no llegó/llegaron hasta las dos.*
A person/thirty people not arrived until the two
‘A person/thirty people did not arrive until two.’

If the interpretation in (i) is that no person arrived until 2 pm, corresponding to negation taking scope over the existential DP, the sentence sounds bizarre (*nadie llegó hasta las dos* ‘nobody arrived until two’ is preferable). Note that whenever we make the indefinites specific, and they take scope above negation, then the sentences improve:

- ii. *Una persona/treinta personas de las cincuenta inscritas no llegó/llegaron hasta las dos.*
A person/thirty people of the fifty registered not arrived until the two
‘A person/thirty people out of the fifty people registered did not arrive until two.’

Finally, it looks like this is a more general constraint not only exclusive to telic predicates, since similar arguments could be made about atelic predicates:

- iii. ? *Una persona no estudió hasta las dos.*
A person not arrived until the two
‘A person did not study until two.’

This interaction between quantified DP-arguments in subject position and negation remains to be further examined.

²⁶I would like to thank David Beaver for pointing out this issue to me.

- (41) a. # *Juan y María llegaron hasta las dos.*
 Juan and María arrived until the two
 # ‘Juan and María arrived until two.’
 (≈ Juan arrived until two and Mary arrived until two)
- b. ? *Ese grupo de personas llegaron/llegó hasta las dos.*
 that group of people arrived until the two
 # ‘That group of people arrived until two.’
- c. *Dos personas llegaron hasta las dos.*
 two people arrived until the two
 # ‘Two people arrived until two.’
 (≈ A total of two people arrived over the course of an interval that ended at two)

In this case, a cumulative reading in (41a) in Spanish seems to be absent, similar to English. Rather, the reason the examples in (41a) sound strange is because they are interpreted distributively (i.e. as two separate punctual arrival events each of which is modified by an *until*-phrase): Juan and María each arrived until two. This interpretation licenses the strange state of affairs of there being multiple arrivals of Juan as well as a plurality of arrivals of María between t_0 and 2. Whenever the definite DP-argument is interpreted cumulatively as a group, as in (41b), the acceptability of the Spanish example improves. Finally, indefinite plural DPs as in (41c) pose no problem, as already exemplified in §5.4.3.

Observe, however, that for Spanish *hasta*, unlike English *until*, a cumulative reading is still possible for telic predicates that take plural definite DPs: over the course of an interval that ended at two, Juan and María arrived. This conforms to the meaning that the plural implicature derives for punctual predicates, wherein

when a punctual predicate is plurally modified by *hasta* it must be able to consist of the sum of different atomic subevents, e.g. the arrival of Juan plus the arrival of María. Such a cumulative reading overrides the default distributive reading when the *hasta*-phrase is preposed, as in (42a), or with some sort of contextual support that triggers cumulativity, as shown in (42b)-(42e). For instance, this can be achieved by including an overt adverbial phrase, like the use of the adverbial *sucesivamente* ‘successively’, which makes it explicit that there are *at least* two different and relevant arrival events that are part of the main cumulative event being modified by *hasta*, as in (42b, c), or by including another predicate modifier (e.g. the sum of different locative XPs) that favors a summing interpretation of the different arrival events over a distributive reading, as shown in (42d, e).

- (42) a. *Hasta las dos, Juan y María llegaron. (Hasta las tres, los demás)*
 until the two, Juan and María arrived until the three the rest
 # ‘Until two, Juan and María arrived. (Until three, everyone else did)’
- b. *Juan y María llegaron sucesivamente hasta las dos.*
 Juan and María arrived successively until the two
 # ‘Juan and María arrived successively until two.’
- c. *Juan, María, Pedro y Susana llegaron (sucesivamente) hasta las dos.*
 Juan María Pedro and Susana arrived successively until the two
 # ‘Juan, María, Pedro and Susana arrived successively until two.’²⁷

²⁷When the number of participants of type *e* in a cumulative event increases, explicit contextual support does not seem to be as necessary. This remains to be further investigated.

- d. *Juan y María llegaron a sus **casas** hasta las dos.*
 Juan and María arrived at their homes until the two
 # ‘Juan and María arrived at their homes until two.’²⁸
- e. *Ese grupo de profesores llegaron a sus **oficinas** hasta las dos.*
 that group of professors arrived at their offices until the two
 # ‘That group of professors arrived at their offices until two.’

All in all, the data in (41) and (42) suggests that plural definite DPs, in opposition to plural quantified DPs, favor distributive readings of predicates modified by *hasta* over cumulative ones although a cumulative reading is still possible.

It is not clear to me at present why this is so, but for the time being I propose that definiteness of a DP by default activates the use of a distributive operator *D* (roughly equivalent to *each*), along the following lines in (43) (e.g. Link 1987, Gajewski 2005). Such a *D* operator is not obligatory, since it seems to be dispensable when a cumulative interpretation takes priority, as represented in the structures above in (42). This remains as an observation that will be investigated in future research. The distributive operator *D* as defined in (43) takes a definite DP (assuming that definite DPs are of type *e*) and returns a generalized quantifier over individuals. Furthermore, following Gajewski (2005), the presupposition in (43) states that whenever a distributive predicate is true or false, it is also true or false, respectively, for all of its proper parts.

$$(43) \quad \llbracket \mathbf{D} \rrbracket = \lambda x. \lambda P_{(e,t)} : \forall y \leq_{atom} x \rightarrow P(x) \text{ or } \forall y \leq_{atom} x \rightarrow \neg P(x). \forall y [y \leq_{atom} x \rightarrow P(y)]$$

(where $atom = \forall z [z \leq y \rightarrow y = z]$)

(Whenever a distributive predicate is true/false, it is true/false for all of its

²⁸I would like to thank Kate Davidson for suggesting this kind of example to me, involving the sum of a plural location.

proper parts)

The presupposition in (43) is needed to rightly capture the fact that whenever a predicate with a definite plural DP subject/object is negated, the negated predicate applies to each of the atomic members of the plural DP, as will be seen below.

Let us focus first on positive environments. I show the result from combining the distributive operator with a definite DP in a sentence such as *#Juan y María llegaron hasta las dos* *#‘Juan and María arrived until two.’* The definite DP, which combines with D and results in a generalized quantifier over individuals, QRs and adjoins to *vP*. This gives rise to the following interpretation in (44b), where the predicate applies to Juan and María each. Finally, when the assertion is exhaustified (after taking into account the uniqueness clause in (44c)), deviance ensues, because there must be a plurality of arrivals of Juan and a plurality of arrivals of María between t_0 and 2, as illustrated in (44d).

- (44) a. *#Juan y María llegaron hasta las dos*^{ALT_{No}} *#‘Juan and María arrived until two’*
 ($[_{vP'}[D(\text{Juan and María})]_1 [_{vP} [\text{arrived } x_1] \text{ until two}]]$)
- b. **Assertion:** $\forall y[y \leq_{atom} \mathbf{j} \cup \mathbf{m} \rightarrow \exists e[\mathbf{arrive}(e) \wedge \mathbf{Th}(e) = y \wedge \tau(e) \subseteq [t_0, 2]]]$
 (\approx There is one or more arrivals of Juan between t_0 and 2 and there is one or more arrivals of María between t_0 and 2)
- c. **ALT_{No}:** $\forall y[y \leq_{atom} \mathbf{j} \cup \mathbf{m} \rightarrow \exists e[\mathbf{arrive}(e) \wedge \mathbf{Th}(e) = y \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]]$
 (\approx There is a unique arrival of Juan and a unique arrival of María be-

tween t_0 and 2)

- d. $O_{ALT_{No}}$ (*Juan y María llegaron hasta las dos*^{ALT_{No}}) = (44b) \wedge \neg (44c)
 $\equiv \forall y[y \leq_{atom} \mathbf{j} \cup \mathbf{m} \rightarrow \exists e[\mathbf{arrive}(e) \wedge \mathbf{Th}(e) = y \wedge \tau(e) \subseteq [t_0, 2] \wedge$
 $\exists e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \wedge e' \neq e]]]$
 (\approx Juan and María each arrived multiple times between t_0 and 2)

On the other hand, in negative environments, the presence or absence of a distributive operator with definite DPs does not interfere with the overall acceptability of *hasta*-phrases. The alternative will also be weaker in such cases, and thus no plural implicature arises. The presupposition of D ensures that the universal quantifier of the distributive DP takes scope above negation. For example, a sentence like *Juan y María no llegaron hasta las dos* ‘Juan and María didn’t arrive until two’ is to be interpreted such that Juan and María each did not arrive until two, where neither of them arrived in the given interval, as specified in (45c). This contrasts with an unavailable interpretation in which either only Juan or only María did not arrive until two, as illustrated in (45b). Last, the singular alternative in (45d) is entailed by the assertion in (45c) and as such cannot be denied.

- (45) a. *Juan y María no llegaron hasta las dos*^{ALT_{No}} ‘Juan and María did not arrive until two’
 ([[D(Juan and María)]₁ [_{TP} \neg [_{vP} [arrived x₁] until two]]])
- b. **Unavailable Assertion** (ruled out by the presupposition of D):
 $\neg \forall y[y \leq_{atom} \mathbf{j} \cup \mathbf{m} \rightarrow \exists e[\mathbf{arrive}(e) \wedge \mathbf{Th}(e) = y \wedge \tau(e) \subseteq [t_0, 2]]]$
 (\approx It is not the case that there are arrivals of Juan and arrivals of María between t_0 and 2)

- c. **Assertion:** $\forall y[y \leq_{atom} \mathbf{j} \cup \mathbf{m} \rightarrow \neg \exists e[\mathbf{arrive}(e) \wedge \mathbf{Th}(e) = y \wedge \tau(e) \subseteq [t_0, 2]]]$
 (\approx There are no arrivals of Juan and no arrivals of María between t_0 and 2)
- d. **ALT_{No}:** $\forall y[y \leq_{atom} \mathbf{j} \cup \mathbf{m} \rightarrow \neg \exists e[\mathbf{arrive}(e) \wedge \mathbf{Th}(e) = y \wedge \tau(e) \subseteq [t_0, 2] \wedge \forall e'[e' \leq_V e \wedge \tau(e') \subseteq [t_0, 2] \rightarrow e' = e]]]$
 (\approx There is no unique arrival of Juan and no unique arrival of María between t_0 and 2)
- e. $O_{ALT_{No}}(\text{Juan y María no llegaron hasta las dos}^{ALT_{No}}) = \text{N/A}$

Regardless of the activation or absence of a D operator triggered by a plural definite DP-argument, the result is always felicitous in negative environments. Even if a D operator intervenes, the plural implicature does not emerge, since the alternative will always be entailed by the prejacent. Therefore, the insertion of a D operator that modifies plural definite DPs only makes a difference in the acceptability of *hasta*-phrases with non-iterative punctual predicates in positive contexts. When present, the result is predicted to be infelicitous even if the definite DP-argument taken by a non-iterative punctual predicate is plural.

All in all, in this section I have posited that a plural definite DP-subject/object in a clause being modified by *hasta* favors a distributive interpretation over a cumulative one. As a result, the plural definite DP by default triggers the use of a distributive operator, which ends up forcing the reading that the plural event being modified by *hasta* must apply for every atomic member of the DP. This results in deviance in positive environments when the predicate under consideration is a non-

iterative punctual predicate (unless contextual support overrides the use of such a distributive operator). The precise reasons why definiteness plays a role and how and when the implementation of D can be overridden are left for future research.

5.4.7 Summing up

Very generally speaking, I have so far proposed that while a version of the universal analysis of durative modifiers *à la* Dowty is right for English *until*, a version of the existential analysis *à la* Krifka is right for Spanish *hasta*. I suggest that the latter is an existential time-frame adverbial subject to a plurality condition. This plurality condition is derived as an implicature, which disappears under negation and rightly predicts the ability of durative *until* to modify any type of predicate in negative environments. On a higher level, this universal vs. existential cross-linguistic picture of durative *untils* (posited as a parametric choice across languages) produces two different cross-linguistic patterns. It opens up the possibility for durative *untils* to be able to license a scopeless cumulative interpretation in languages that choose the existential variant, and also apply to accomplishment predicates.

5.5 Scalar reasoning with *hasta*-phrases

In the same way that *until*-phrases in English derive scalar inferences, *hasta*-phrases in Spanish do so as well. Recall that the scalarity of time, and *per extension*, the scalarity of temporal adverbials, gives rise to quantity implicatures leading to the factive interpretation of *until* in English, as well as inferences about interruption. In

Chapter 4 I proposed that the nature of such inferences is non-defeasible for English *until*, which can be captured in a system where the temporal scalar alternatives are obligatorily factored into meaning and must be exhaustified via our exhaustification operator O. Likewise, I claim that the use of Spanish *hasta* comes with an active set of temporal alternatives, ALT_{t_0} , where the non-defeasible inferences are obtained via exhaustification of the assertion. This will account for *hasta*'s factivity with telic predicates in negative environments, and will also be able to explain other scalar inferences that derive from the use of atelic predicates in positive and negative environments, such as the interruption inference, as well as the 'not-throughout' and 'throughout-not' readings.²⁹

Further recall that the set of active alternatives cannot be singleton, since every prejacent has itself as an alternative. In other words, *hasta*-phrases must activate temporal alternatives other than itself. These alternatives are of the form $[t_0, n]$, i.e. relevant subintervals and superintervals, where n precedes or follows the time indicated by the complement of *hasta*, yet the contextually determined left boundary, t_0 , is kept constant. Thus, the temporal scale is the same as for the case of English, repeated here in (46).

$$(46) \quad \textbf{Temporal Scale: } ALT_{t_0}(\textit{until } n) = \{\textit{until } n - t, \textit{until } n, \textit{until } n + t, \dots\}$$

In more formal terms, the set of alternatives of *hasta*-XPs can be defined as follows:

²⁹Unlike for the case of universal *until*, the 'not-throughout' and 'throughout-not' readings under the existential approach are obtained via scopal interactions of negation with respect to the covert exhaustification operator O. Under the existential analysis, it does not matter whether the adverbial scopes above or below negation since, as defined, it always ends up taking lowest scope, because it simply introduces the time frame that modifies an already existentially-bound event.

- (47) $\llbracket \textit{Hasta las dos} \rrbracket^{ALT_{t_0}} = \{ \lambda V. \lambda f [V(\lambda e [f(e) \wedge \tau(e) \subseteq [t_0, 2] \wedge [\neg \mathbf{AT}(e) \rightarrow \tau(e) \text{ abuts } [t_0, 2]])] : n \geq 2 \text{ or } n < 2 \}$
 (defined iff the set of alternatives is not a singleton)

The basic details of the execution of the analysis are presented below.

5.5.1 Durative predicates in upward entailing environments

Recall that O-exhaustification of universal *until* in upward entailing contexts gives us the interruption inference: the predicate stops applying at intervals that follow the prejacent. This follows from the fact that later intervals are not entailed by the prejacent. Exhaustification negates the non-entailed alternatives while preserving the truth of the prejacent. The same line of reasoning applies for Spanish *hasta* since, despite it being existential, we observe the same entailment pattern when *hasta* modifies plural eventualities (e.g. stative, activities, accomplishments, and achievements with plural DP-arguments) in positive environments thanks to the application of the ‘abutting’ condition. The ‘abutting’ condition comes into play in positive environments because all predicates modifiable by *hasta* are considered plural. It follows that if plural eventualities abut a given interval, they do not necessarily abut any superinterval. I illustrate this with the atelic predicate *run* in (48).

- (48) a. *Juan corrió hasta las dos*^{ALT_{t₀}} ‘Juan ran until two.’
 b. $\exists e [\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2]]$

c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2] \curvearrowright [t_0, 3]$

(where the arrow shows the direction of entailment: $A \curvearrowright B$ means that B entails A)

plural running by Juan abuts $[t_0, 2] \subseteq$ *plural running by Juan abuts*
 $[t_0, 1] \not\subseteq$ *plural running by Juan abuts* $[t_0, 3]$

If a plural running event by Juan abuts $[t_0, 2]$ (in the sense of uniformly taking up the whole space of the given interval), then it also abuts $[t_0, 1]$, but there is no abutting on $[t_0, 3]$. This relevant non-entailed alternative is negated by the O-exhaustification operator, resulting in the interruption inference. In other words, O-exhaustification gives rise to the implication that no running event by Juan takes place at some point after the time denoted by the *hasta*-phrase. This is shown in (49), considering an hourly scale of $\langle 1, 2, 3, 4, \dots \rangle$, where the most immediate non-entailed superinterval by the prejacent is $[t_0, 3]$.

- (49) a. **Assertion:** $\exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2]]$
- b. **Non-entailed ALT_{t₀}:** $\exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 3] \wedge \tau(e) \text{ abuts } [t_0, 3]]$
- c. $O_{ALT_{t_0}}$ (*Juan corrió hasta las dos*^{ALT_{t₀}}) = (49a) $\wedge \neg$ (49b)
- $\equiv \exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2] \wedge \neg \exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 3] \wedge \tau(e) \text{ abuts } [t_0, 3]]]$
- $\equiv \exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \text{ abuts } [t_0, 2] \wedge [\neg \exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 3] \wedge \tau(e) \text{ abuts } [t_0, 3]] \vee \neg \exists e[\text{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \text{ abuts } [t_0, 3]]]]]$

As indicated in (49c), the truth of the prejacent is maintained while the meaning of the inference is added to it. The prejacent asserts that there are running events by Juan between t_0 and 2 and that about $[t_0, 2]$. The added inferential content asserts that either there is no running event at all within $[t_0, 3]$ or that the maximal running event does not about $[t_0, 3]$. The first disjunct clashes with the truth of the prejacent. Thus only the second disjunct of the added inferential material can be true, namely that the maximal running event does not extend up to 3. We hence obtain that the predicate ceases to apply at some point after two.

Last, remember that the interruption implicature is in line with facts about the physical world and will eventually be satisfied since the predicate will stop holding at some point. Facts about the world make the inference that P transitions to \neg P vacuous. As to when this transition will occur, it will depend on the granularity of the scale in question, as exemplified in §4.2.3.1 in Chapter 4. By default, we infer that the interruption inference applies right after the time indicated by the *hasta*-phrase.

5.5.2 Durative predicates under negation

The other crucial environments under consideration are with the presence of negation, where logical strength is reversed. When the predicate is durative, several interpretations may arise, as shown in (50).

- (50) a. *Juan no corrió hasta las dos, pero hasta la una.*
 Juan not ran until the two but until the one
 ‘Juan didn’t run until two, but until one.’

(‘not-throughout’ reading)

- b. *Juan no corrió hasta las dos. De hecho, no corrió para nada.*
 Juan not ran until the two in fact not ran at all
 ‘Juan didn’t run until two. ?In fact, he did not run at all.’

(‘throughout-not’ reading)

- c. *Juan no corrió hasta las dos, pero hasta la tres.*
 Juan not ran until the two but until the three
 ‘Juan didn’t run until two, but until three.’

The fact that we are able to say ‘but until one’, ‘not at all’, or ‘but until three’ posits a challenge to the obligatory status of the inferences, as these interpretations may cancel one another. However, as we shall see, they correspond to different scopal interpretations between negation and the O operator. The reading in (50a) can be obtained from what I have been referring to as the ‘not-throughout’ reading for English *until*. The interpretation in (50b) now follows from O-exhaustification below negation (unlike English *until*). Finally, in a way similar to English *until*, (50c) also derives from O-exhaustification below negation.

To start with, let us consider O-exhaustification above negation³⁰, where the entailment pattern has been reversed in comparison to the relation of *hasta* with respect to its scalar alternatives in positive environments as in (48) above. The assertion indicates that there is no running event by Juan that takes the whole interval between t_0 and 2. It thus follows that no running event by Juan abuts an even greater interval, e.g. from t_0 to 3. However, smaller intervals are not entailed, as illustrated in (51).

³⁰Remember that on an exhaustification-based account, O-exhaustification above negation is preferred over O-exhaustification below negation, where in the latter an implicature is added to the meaning of the assertion before negation applies, hence weakening its meaning (while O-exhaustification above negation leads to strengthening). See Chierchia (2013) for further discussion on this.

- (51) a. *Juan no corrió hasta las dos*^{ALT_{t₀}} ‘Juan didn’t run until two’ (but until one)
- b. $\neg\exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \mathbf{abuts} [t_0, 2]]$
- c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2] \curvearrowright [t_0, 3]$
no running by Juan abuts [t₀, 2] \subseteq no running by Juan abuts [t₀, 3] $\not\subseteq$ no running by Juan abuts [t₀, 1]

Since previous alternatives are not entailed, consider $[t_0, 1]$ to be the relevant non-entailed alternative, which must thus be exhaustified. The result from O-exhaustification is specified in (52).

- (52) a. **Assertion:** $\neg\exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \mathbf{abuts} [t_0, 2]]$
- b. **Non-entailed ALT_{t₀}:** $\neg\exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 1] \wedge \tau(e) \mathbf{abuts} [t_0, 1]]$
- c. **O_{ALT_{t₀}}** \neg (*Juan corrió hasta las dos*^{ALT_{t₀}}) = (52a) \wedge \neg (52b)
 $\equiv \neg\exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \mathbf{abuts} [t_0, 2]] \wedge \exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 1] \wedge \tau(e) \mathbf{abuts} [t_0, 1]]$

The interpretation in (52) asserts that Juan did not run all throughout until two, as the maximal running eventuality is not abutting $[t_0, 2]$. The relevant non-entailed alternative asserts that the maximal running eventuality is, to say the least, not abutting $[t_0, 1]$, which is not entailed by the prejacent. On negating such an alternative, the implicature that winds up being added to the assertion is that there was some running by Juan until a previous time, say abutting $[t_0, 1]$. This reading corresponds to the ‘not-throughout’ (‘but until 1’) interpretation exemplified in (50a).

We are now left with the readings in (50b) and (50c), and with another available exhaustification position for durative predicates, which we have not tried yet: O-exhaustification below negation. Since *hasta*-phrases can modify durative predicates (plural eventualities) in positive environments giving rise to a felicitous interpretation, such a felicitous reading could be O-exhaustified before negation applies. Remember that this exhaustification position requires some contextual support—since we are weakening the negated assertion by adding inference material to it before negation applies. The continuation of ‘not at all’ or ‘but until three’ in (50b) and (50c), respectively, would clash with common ground and with the speaker’s intentions if O-exhaustification applied above negation (as e.g. the example above could not give rise to such readings). Therefore, the default O-exhaustification position can be overridden and we can exhaustify below negation, as shown in (53).

- (53) a. • (i) *Juan no corrió hasta las dos, no corrió para nada* ‘Juan didn’t run until two, he did not run at all’ **OR**
- (ii) *Juan no corrió hasta las dos, pero hasta las tres* ‘Juan didn’t run until two, but until three.’
- b. $O_{ALT_{t_0}}(\textit{Juan corrió hasta las dos}^{ALT_{t_0}}) = \exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \mathbf{abuts} [t_0, 2] \wedge \neg \exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 3] \wedge \tau(e) \mathbf{abuts} [t_0, 3]]]$
- c. $\neg O_{ALT_{t_0}}(\textit{Juan corrió hasta las dos}^{ALT_{t_0}}) = \neg \exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2] \wedge \tau(e) \mathbf{abuts} [t_0, 2] \vee \exists e[\mathbf{running}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 3] \wedge \tau(e) \mathbf{abuts} [t_0, 3]]]$

O-exhaustification of the positive assertion gives us back the interruption inference,

which is added to the asserted content, as in (53b): Juan ran until 2 and he stopped running at 2. When we negate such a result, we obtain either that (i) it is not the case that there is a running event of Juan between t_0 and 2 abutting $[t_0, 2]$ or that (ii) there are running events within a larger interval that does not stop at 2. The former disjunct can give us the ‘not at all’ reading corresponding to the ‘throughout-not’ interpretation. In other words, if there is no running event by Juan at all it also follows that there is no running abutting $[t_0, 2]$. This first option conforms to the common ground of ‘in fact he didn’t run at all’ in (50b). On the other hand, the second disjunct in (53c) can give us the ‘but until 3’ interpretation when this is the one salient in context. The second disjunct in the resulting derivation expresses that there are instantiations of e within a larger interval, one that for example ends at 3. This corresponds to the reading in (50c): it is not the case that Juan ran until 2 and stopped at 2, since he continued until (say) 3.

In sum, the existential analysis of Spanish *hasta* can also capture the various interpretations that arise when a time-frame adverbial modifies durative predicates in negative environments. From O-exhaustification above negation we can obtain the inference that derives from a ‘not-throughout’ interpretation (e.g. ‘but until 1’). However, when necessary, taking into account the given common ground, we can also O-exhaustify below negation and end up negating either the existence of any eventuality at all (leading to a ‘throughout-not’ reading) or the interruption inference obtained from positive contexts (corresponding to a ‘but until 3’ reading). Observe that a further consequence of the existential analysis is that factivity does not obligatorily arise with durative predicates under ‘throughout-not’ interpretations.

At best, it is left as an ignorance inference. It could simply be obtained as a conversational implicature from the ‘throughout-not’ reading, in line with the fact that in Spanish we can easily follow with a ‘not at all’ interpretation.

5.5.3 Atomic punctual predicates under negation and factivity

With regard to atomic punctual predicates (i.e. punctual predicates that take singular DP-arguments), *hasta* can modify them in negative environments since the plural implicature disappears. Furthermore, recall that these do not trigger the ‘abutting’ condition as they satisfy the atomicity condition. When this is the case, the use of *hasta* gives rise to a factive inference, which is also non-defeasible in Spanish. The example in (54) sounds odd because Juan is somehow expected to get married after his death, indicating that the inference that arises cannot be canceled.

- (54) # *Juan no se casó hasta morir.*
 Juan not CL married until die
 # ‘Juan didn’t get married until he died.’

In (55) I exemplify how factivity comes about for a negated punctual predicate like *Juan no llegó hasta las dos* ‘Juan didn’t arrive until two.’ The assertion just states that there are no arrivals of Juan between t_0 and 2. The ‘abutting’ condition cannot apply here since the arriving event is atomic. The entailment pattern that we obtain with negated existential *hasta* and with the absence of the ‘abutting’ condition is that superintervals are not entailed by the prejacent whereas subintervals are, as shown below in (55).

- (55) a. *Juan no llegó hasta las dos*^{ALT_{t0}} ‘Juan didn’t arrive until two.’

- b. $\neg\exists e[\mathbf{arriving}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]]$
- c. **Entailment Relation:** $[t_0, 1] \curvearrowright [t_0, 2] \curvearrowright [t_0, 3]$
no arrival of Juan in $[t_0, 2] \subseteq$ no arrival of Juan in $[t_0, 1] \not\subseteq$ no arrival of Juan in $[t_0, 3]$

If there is no arrival of Juan between t_0 and 2, that entails that there is no arrival of Juan within any subset of the relevant interval, but there could be an arrival of Juan in a superinterval. Suppose $[t_0, 3]$ is such a relevant superinterval. Hence, the alternative ‘Juan didn’t arrive until three’ is factored into the meaning and must be obligatorily denied. Such a derivation is illustrated in (56).

- (56) a. **Negated Assertion:** $\neg\exists e[\mathbf{arriving}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]]$
- b. **Not entailed ALT_{t₀}:** $\neg\exists e[\mathbf{arriving}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 3]]$
- c. **Factive Inference:** $O_{ALT_{t_0}}(\text{Juan no llegó hasta las dos}^{ALT_{t_0}}) = (56a) \wedge \neg (56b)$
 $\equiv \neg\exists e[\mathbf{arriving}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 2]] \wedge \exists e[\mathbf{arriving}(e) \wedge \mathbf{Ag}(e) = \mathbf{j} \wedge \tau(e) \subseteq [t_0, 3]]$
- d.

$$\frac{\neg\exists \text{ arrival} \quad \neg\exists \text{ arrival} \quad \exists \text{ arrival}}{\begin{array}{c} | \quad | \quad \underbrace{\quad\quad\quad}_{\text{~~~~~}} \\ [t_0, 1] \supseteq O([t_0, 2]) \supseteq [t_0, 3] \end{array}}$$

A sentence such as *Juan no llegó hasta las dos* ‘Juan didn’t arrive until two’ indicates that there is no arrival of Juan between t_0 and 2. This does not entail that there is no arrival of Juan between t_0 and 3. When exhaustified, the assertion implicates that there is an arrival of Juan between t_0 and 3 placed at some point after 2 (since

the truth of the prejacent is maintained). Overall, the factive inference originates with punctual predicates that take singular DP-arguments under negation. The actualization of the negated punctual predicate is expected to occur at some point after the time indicated by the *hasta*-phrase. An exhaustification-based account for existential *hasta* is able to predict such an inference in the same way as universal *until* is but only for non-durative predicates, those for which the ‘abutting’ condition does not apply (as otherwise the ‘abutting’ condition reverses the entailment pattern, as illustrated in §5.5.2).

In contrast with durative predicates, exhaustification below negation is not an option for non-iterative punctual predicates that take singular DP-arguments since their assertion in positive environments already comes out deviant due to the fact that they cannot satisfy the plural implicature that winds up being added to their meaning. For instance, *Juan llegó hasta las dos* ‘Juan arrived until two’ is deviant. In the present theory, this cashes out as a contradiction because the plural implicature associated with it clashes with common knowledge. The alternatives will have the same shape as the assertion and exhaustifying with respect to them will still be contradictory (i.e. saying that ‘John arrived until two’ is the only relevant alternative that is true is clearly as contradictory as the prejacent). Exhaustification is hence trivial and ruled out. The symbol ‘ \mathcal{X} ’ below indicates that exhaustification below negation of a non-iterative punctual predicate modified by *hasta* is trivial:

(57) $\mathcal{X} \neg O_{ALT_{t_0}} (Juan\ llegó\ hasta\ las\ dos)$ ‘Juan arrived until two’

All in all, factivity of punctual predicates with singular DPs under negation directly follows from an exhaustification-based account of existential *hasta* and no

other inferences are predicted, conforming to the facts described above. A very interesting prediction about the existential setup is that factivity is only clear with punctual predicates. For example, the exhaustification-based analysis of Spanish *hasta* captures the factivity that arises with punctual predicates in a very straightforward manner, whereas the factivity with durative predicates is left open, as seen in §5.5.2 above. This is significant when compared against the literature on the puzzle of punctual *until*. Recall that an observation introduced in §2.2.1 in Chapter 2 was that in languages that seem to use a different lexical item to give rise to the factive inference, their durative *until* when combined with atelic predicates under negation is not factive in that the actualization of the event does not arise. This was illustrated for German, Dutch, and Greek. The behavior in these languages seems to parallel the predictions we are obtaining for an existential-type of ‘until.’

5.5.4 Summing up

An exhaustification-based account where relevant temporal alternatives of the pre-jacent are factored into meaning and exhaustified correctly explains the various meanings of factivity and interruption inferences based on scalar reasoning associated with *hasta*-phrases, where, for instance, factivity of *hasta* is a direct prediction. Finally, even though underlyingly the logical components of existential *hasta* are different from English *until*, we reach practically the same conclusions as with universal *until* when it comes to temporal scalarity and scalar reasoning. No matter whether durative *until* is expressed universally or existentially in a given language, it will give rise to almost the same temporal scalar inferences, which further explains

the close parallelism between English *until* and Spanish *hasta*. The only difference is that the factivity of Spanish *hasta* is not derived when O-exhaustifying negated durative predicates (in line with the fact that for those it seems to be cancellable since other interpretations may obtain, e.g. ‘but until 1’, ‘but until 3’, or even ‘not at all’). This suggests interesting cross-linguistic consequences between languages that have existential vs. universal quantification in their *untils* that remain to be further investigated in future work.³¹ A table summarizing the various inferences that can emerge from O-exhaustification of durative and punctual predicates modified by *hasta*-phrases is provided below with examples that suppose $\langle 1, 2, 3 \rangle$ to be the relevant scale:

Scopal position	Type of inference	Translated example
O (<i>Juan corrió hasta las 2</i>)	interruption inference	Juan ran until 2 (and not until 3 pm).
\neg O (<i>Juan corrió hasta las 2</i>)	\neg interruption inference	Juan didn't run until 2, but until 3.
OR \neg O (<i>Juan corrió hasta las 2</i>)	'not at all' reading	John didn't run until 2 pm, he didn't run at all.
O \neg (<i>Juan corrió hasta las 2</i>)	inference from 'not-throughout' reading	Juan didn't run until 2, but until 1.
O \neg (<i>Juan llegó hasta las 2</i>)	factive inference with singular punctual events	John didn't arrive until 2, he arrived after 2.

Table 5.1: A summary of the various possibilities of O-exhaustification of Spanish *hasta*-XPs

³¹Even though I have not included the inferences that would derive from an *even*-based exhaustification operator in the present discussion for Spanish *hasta*, a ‘later-than-expected’ inference is expected to also arise with punctual predicates. This would originate in the same way as it did for English *until* in Chapter 4, since the same entailment patterns between the prejacent and its relevant temporal alternatives hold under those circumstances.

5.6 A potential cross-linguistic prediction from existential vs. universal ‘until’

A final implication of positing a cross-linguistic contrast between languages that realize their corresponding durative *until* existentially, as in Spanish, vs. languages that embody it universally, as in English, is the prediction that languages that have an overt NPI counterpart, like Greek, may be restricted to those with the existential variant of durative *until*. For this, recall that NPIs are usually interpreted with existential semantics (e.g. Krifka 1995, Chierchia 2004, 2006, 2013). The contrast in Greek would ideally consist of a simple PPI/NPI contrast, where there is a natural variant that lexicalizes differently under negation (e.g. similar to *some/any*).

First, recall the overt Greek PPI/NPI contrast in (58), where Greek *para mono* ‘NPI variant’ is used instead of Greek *mehri* ‘PPI durative *until*’ with a punctual predicate such as *arrive* under negation.

- (58) a. *O Gianis diavase mehri/*para mono tis dio.*
 the Gianis read until/ but only the.Pl two
 ‘Gianis studied **until** two.’
- b. *O Gianis den eftase para mono/?*mehri (s)tis dio.*
 the Gianis not arrived but only/ until (at)the.Pl two
 ‘Gianis didn’t arrive **until** two.’ (but arrived at some point after two)

If it is indeed the case that Greek chooses to realize such an existential time-frame adverbial available at UG for durative *mehri* ‘until’, another immediate prediction follows: such a language should also not block cumulative readings. This prediction is indeed borne out, as observed in (59), where durative *mehri* allows for a

cumulative interpretation whenever the telic predicate takes a plural quantified DP-subject/object.

- (59) a. *Poli anthropi eftasan mehri tis dio.*
many people arrived until the.Pl two
‘**Many** people arrived **until** two.’
- b. *Trianta anthropi eftasan mehri tis dio.*
thirty people arrived until the.Pl two
‘**Thirty** people arrived **until** two.’

Such a prediction of at least this major cross-linguistic correlation calls for additional research, which is left for future work.

5.7 Conclusions

All in all, in this chapter we have observed that by comparing two closely related functions, such as English *until* and Spanish *hasta*, we still find significant variation in their behavior in logical terms to the point that a unified analysis of durative *until* and *hasta* is not viable.

Different logical terms are the basis of such variation. My proposal is that while *until* is indeed a universal quantifier as proposed by Dowty, Spanish *hasta* is an existential quantifier that modifies plural events, where plurality is to be couched as an implicature. The plurality requirement on *hasta*-phrases accounts for the impossibility of *hasta* combining with non-iterative punctual predicates that take singular DP-arguments. This has two further important consequences: (i) cumulative readings are possible and (ii) the plural implicature disappears under negation, ex-

plaining why punctual events are grammatical in such contexts. This predicts *at least* two major cross-linguistic patterns in the nature of durativity of *until*-XPs.

Finally, with the help of recent theories of scalar implicatures, and taking into account that time is scalar, the factive behavior associated with punctual predicates modified by *hasta* in negative environments can be automatically captured by assuming that temporal scalar alternatives are always ‘active’, and hence obligatorily factored into meaning. In a manner similar to the exhaustification-based approach to English *until*, different interpretations may obtain depending on whether exhaustification of the scalar alternatives takes place above or below negation. But, most importantly, regardless of whether the ‘atelic requirement’ is encoded in the assertive content via universal quantification or as a plural implicature that disappears under negation, practically the same scalar inferences can be derived for both English *until* and Spanish *hasta*. However, there is one crucial difference: under the existential analysis, factivity is only obvious with punctual predicates under negation. Hence, in choosing between the existential- and the universal-based versions of ‘until’, (i) cancellable factivity with atelic predicates under ‘throughout-not’ readings as well as (ii) a broader acceptability of durative meanings, such as the availability of scopeless cumulative interpretations, are factors at play.

Chapter 6

Conclusions & Extensions

6.1 General discussion

In this dissertation I have argued that a unified account of words that describe temporal delimitation, in particular ‘until’-like phrases that bound events in time, is desirable, and I have developed a monosemy theory that shows how this is possible. In order to do so, I argued that the ambiguity exhibited between durative *until* and punctual *until* intralinguistically is not lexical for languages like Spanish or English that do not make a lexical distinction, contra fairly recent accounts in the spirit of Giannakidou (2002) and Condoravdi (2008) proposing instead a scopal analysis. This analysis explained a range of facts about the properties of ‘until’ words across languages. For example, a well-known characteristic that these ‘until’ words typically have in common is their inability to modify non-iterative telic predicates save for in negative environments (e.g. *#John arrived until 2 pm* vs. *John didn’t arrive until 2 pm*). When negation is present, they furthermore trigger a factive inference

about the occurrence of the event described by the negated telic predicate in a future time (*John didn't arrive until 2 pm* entails John's arrival at 2 pm or sometime thereafter). However, when we compared this general assumption of 'until'-like phrases between English *until* and Spanish *hasta*, there emerged a few critical differences between the two, which suggest that the two words do not have the same meaning. Spanish *hasta* is less restrictive than English *until* in that it might be able to modify non-iterative telic predicates as long as they are durative, such as accomplishments, or achievements on scopeless cumulative readings (e.g. *30 personas llegaron hasta las 2* vs. #'30 people arrived until 2'). Despite all their other close similarities, this key distinction between these two closely related forms of 'until's made it non-viable to give them exactly the same denotation in logical terms. This led us to conclude that within the monosemy theory there must be parameterization in the quantification that 'until' words in different languages exhibit. Such a conclusion has interesting consequences cross-linguistically, which I outline next.

On the one hand, English *until* can be articulated in terms of universal quantification over time intervals for which the modified predicate must hold following an account in the spirit of Dowty (1979). For this, I refined an account such as this within a framework of event semantics *à la* Champollion (2015), where a verb's event variable is existentially bound at the verb level so that it takes the lowest possible scope. Additionally, if we further assumed that *until*-phrases must attach as low as possible where the result does not generate a logical contradiction and that they can only be extraposed in case of strengthening their meaning, then the atelic vs. telic distinction of *until* simply followed from semantic scopal economy

considerations, reminiscent of Fox (1995). As a consequence, this scopal account of universal ‘until’ predicts that in English *until* behaves on a par with other low universal temporal adverbials, like *for*-adverbials, which since Carlson (1977a, b) have also been known to take low scope with respect to other scope bearing elements in the clause. Such a prediction was indeed borne out. Yet, beyond scope, one crucial differentiation was at stake: their ability or inability to give rise to non-defeasible factive inferences. I demonstrated that it is also possible to capture this contrast in a unified fashion. Taking into account the scalarity of time, it followed that temporal phrases showed active temporal scalar alternatives. However, there is parameterization in whether they do so obligatorily or optionally. English *until* does so obligatorily and its factivity, together with other scalar inferences that it triggers, simply emerges in the form of an obligatory scalar implicature. *For* only optionally triggers scalar inferences, explaining the cancelability of the factive inference. Overall, I showed that it is possible to rescue Mittwoch’s (1977) scopal account of English *until*-phrases by updating it to a quantificational event semantics with the help of an exhaustification-based approach to scalar inferences, e.g. along the lines specified in Chierchia (2013).

On the other hand, Spanish *hasta* can be translated as an existential adverbial of temporal framing in line with an account in the spirit of Krifka (1998). I have put forth an analysis in which the durative component of *hasta* is linked with plurality of events and emerges as a plural implicature, following recent accounts of DP plurality such as Spector (2007). This proposal of existential ‘until’ predicted that *hasta*-phrases in positive contexts are only able to bind plural events in time, i.e.

when the relevant eventuality described by the predicate can be decomposed into subevents of the same kind (e.g. primarily following Kratzer 2008). Additionally, the way we defined plurality opened the possibility for an existential-type adverbial to acquire a cumulative interpretation. This more complicated route eventually paid off when the plural requirement vanished under negation, since negation could be treated logically with no need to resort to a fusion-based treatment. Ultimately, when factoring into their meaning their temporal scalar alternatives, in a way familiar from English *until*, non-cancellable factivity is only a direct prediction for punctual predicates under negation, as supported by the data in Spanish. The existential version of ‘until’ is thus quite distinct from other universal measure phrases. This gives rise to additional atelic interpretations and predicts the possibility of finding languages in which their punctual ‘until’ counterpart has lexicalized differently under negation, considering the rarity of NPIs with ‘universal’ semantics (e.g. Krifka 1995, Chierchia 2004). Thus, this is what, for example, I suggest has happened in the case of Greek.

The cross-linguistic picture of ‘until’-like words in the temporal domain is schematized in the table below. Note that the proposed lexical semantic contrast between an existential and a universal ‘until’ word is attested across languages and not within one language.

	Existential	Universal
Single lexical entry	Spanish <i>hasta</i>	English <i>until</i> & <i>for</i> -adverbials
Double lexical entry	Greek <i>mehri</i> vs. <i>para mono</i>	N/A

Table 6.1: The cross-linguistic parametric picture of temporal ‘until’-like particles I

A further generalization that seems to emerge from Table 6.1 is that we might expect to find an existential variant of *for*-adverbials in certain languages, in the same way as there is a universal and existential version of *until*. I would like to end this existential vs. universal typological pattern by leaving the following hypothesis for future work. English *in weeks* (*in*-XPs), as in *John hasn't met Mary in weeks* (vs. *#John met/has met Mary in weeks*) could potentially be the NPI-counterpart of an existential version of *for*-adverbials. If such a version were to be overt, we could begin by looking into *during*-type adverbials. At a first glance, these do seem to be more permissive than *for*-adverbials in terms of durative interpretations that they receive since, for example, they seem to allow for scopeless cumulative interpretations, as in *Many/thirty people arrived during a period of two hours*. Needless to say, this is an appealing path worth pursuing as it would fit right into the typological picture, but requires further investigation.

Last, we also predict that there could be another parameter at play in the cross-linguistic picture of words that describe durations of events: obligatory vs. optional exhaustification of their temporal alternatives. Above I had suggested that only 'until'-phrases and not 'for'-adverbials obligatorily exhaustify. However, this was left largely as a lexical fact, and it is at least possible in principle for this property to vary independently, predicting further cross-linguistic variation.¹ In principle, we might expect there to be a language whose existential or universal *for*-counterpart obligatorily has active temporal alternatives that need to be brought into its meaning and exhaustified. For instance, if that were the case, we would ex-

¹I would like to thank Hans Kamp for discussion on the parametric picture that we are predicting.

pect to find a language whose *for* counterpart can generate non-defeasible factive inferences in negative contexts when modifying telic predicates. Table 6.1 can be finally augmented to include this additional parameter:

	Existential	Universal
Single lexical entry	Spanish <i>hasta</i>	English <i>until</i> & <i>for</i> -adverbials
Double lexical entry	Greek <i>mehri</i> vs. <i>para mono</i>	N/A
	'Until' Counterpart	'For' counterpart
Obligatory exh	Spanish <i>hasta</i> , Greek <i>para mono</i> , English <i>until</i>	?
Optional exh	Greek <i>mehri</i>	<i>for</i> -adverbials

Table 6.2: The cross-linguistic parametric picture of temporal 'until'-like particles II

'Until' counterpart in Table 6.2 refers to durative adverbials that express the right-boundary of the duration of the interval, whereas 'for' counterpart stands for measure-phrases that express the total duration of the interval, i.e. when the noun phrase governed by 'for' is a genuine measure phrase. I would thus like to take a more cross-linguistic approach in future work to discover which factors are indeed universal and which are subject to parametric variation and how constrained this variation is.

6.2 Looking ahead: extending the system to other domains

Recall from Chapter 1 that Spanish *hasta* has other functions beyond the temporal domain, illustrated again in (1). In space, it can mark the limit of a path in a motion construction (Beavers 2008a, Beavers *et al.* 2010, Bassa-Vanrell 2013), as in (1a), which I refer to as spatial *hasta*. In more abstract domains, it can function as a focus-

sensitive scalar additive particle that signals the least likely member of a scale, roughly equivalent to English *even* (Rooth 1985, 1992), as in (1b), which I refer to as additive *hasta*.

- (1) a. *Juan vino hasta la fiesta con nosotros.*
Juan came until the party with us
'Juan came **up to** the party with us.'
- b. *Juan vino hasta [a la fiesta]_F con nosotros.*
Juan came until at the party with us
'Juan **even** came [to the party]_F with us.'

Beavers (2008a) generalized over temporal and spatial domains for *made* 'until' in Japanese by leaving open the nature of the object of 'until' words that is theta-related to the event *e*, which could be a temporal or a spatial path, hence accounting for uses like (1a) and also temporal uses. However, in the analysis he proposes it is not clear how this would scale up to also cover more abstract uses like (1b) wherein the scale in question does not form an entity theta-related to the event. By contrast, in prior work, e.g. Bassa-Vanrell (2014), I suggested that the theoretical stances and general notions of scalar reasoning of 'until'-like particles via activation of scalar alternatives introduced in this dissertation can be extended to all of these other domains. I hence argue that it is possible to give a uniform semantic and pragmatic core to quite seemingly distinct functions of an aspectual marker like Spanish *hasta*. This could explain why we find such a multi-functionality of 'until'-like words across languages. Overall, I claim that what all these functions have in common is a strong family resemblance of scalarity, which manifests differently depending on what types of scalar alternatives the 'until'-XP computes, which could be based on

time, paths, or likelihood, all of which are independently scalar in their own way. In what follows, I will briefly sketch the unifying core of the dominant theoretical stances across domains.

I posit that there are four identifiable main properties cutting across all uses of *hasta*: (i) scalarity, (ii) complexity, (iii) maximality, and (iv) (un)likelihood. For example, in Bassa-Vanrell (2014), following the analysis of English *even* in Rooth (1985) for scalar additive *hasta*, I claim that spatial *hasta* also situates its syntactic complement at the most unlikely point along a scale of (un)likelihood with respect to contextually relevant scalar alternatives of the same semantic type, and furthermore such a scale cannot be non-gradable. In a programmatic way, I illustrate next how these properties apply in each of these two new cases of *hasta*, while drawing their family resemblance with temporal *hasta*.

To start, the first prominent property at play is scalarity. In the same way as temporal *hasta* activates a temporal scale, additive *hasta* and spatial *hasta* also involve a scale. Such scales are obtained in the same manner: i.e. by replacing *hasta*-XP in the prejacent for contextually relevant alternatives of the same form. What differs is what orders such scales and their domains. In the case of additive *hasta* the scale follows from contextually relevant perceptions of likelihood, which widens the physical domain to more abstract domains. The potential alternatives under consideration are all the propositions obtained by replacing the focused expression with expressions of the same semantic type. On the other hand, in the case of spatial *hasta*, the path would define the scale at issue (e.g. following Krifka 1998, Beavers 2012). In (2) and (3), I exemplify the domain of the alternatives for

the examples given above in (1).

- (2) a. *Juan vino hasta [a la fiesta]_F con nosotros*
 Juan came until at the party with us
 ‘Juan even came [to the party]_F with us.’
- b. **Domain:** potential alternatives of the form *Juan vino [a X] con nosotros*
 ‘Juan came [to X] with us.’ The locations *X* can be along different paths
 or divergent paths.

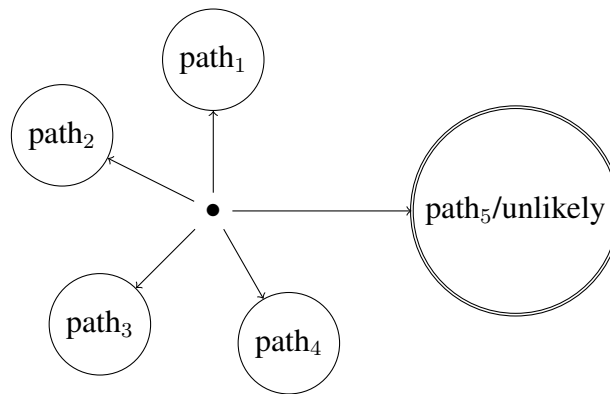


Fig. 6.1: Representation of a domain of alternatives for additive *hasta*

- (3) a. *Juan vino hasta [la fiesta] con nosotros*
 Juan came until the party with us
 ‘Juan came up to [the party] with us.’
- b. **Domain:** Narrowly fixed to be events of Juan reaching all of the various
 points on the path of motion from Juan’s initial point to the party, i.e.
 alternatives of the form *Juan vino a [X] con nosotros* ‘Juan came to [X]
 with us’ for all *X* along a single path.

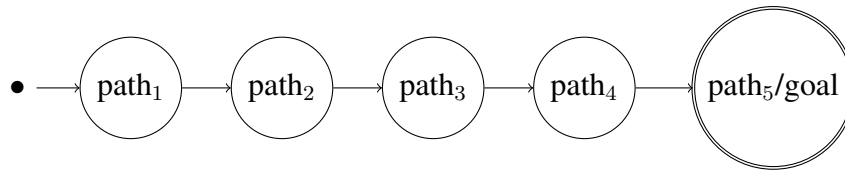


Fig. 6.2: Representation of a domain of alternatives for spatial *hasta*

The crucial difference between the two is that in (2) the alternatives do not need to be narrowly fixed events from Juan’s initial point to his final point. For example, in a context in which Juan came to class with us in the morning, and then left us to go to his place to get lunch, and finally came back to the university in the afternoon to come to a party with us in the evening, the event of *Juan’s coming to class with us in the morning* could still be considered as a potential alternative in the domain of additive *hasta*, but not in the domain of spatial *hasta*.

The second shared property is complexity. In the same way that the set of alternatives activated by temporal *hasta* could not be a singleton set, the scale of alternatives activated by additive *hasta* and spatial *hasta* cannot be non-gradable either. In other words, there must be at least one other relevant alternative to the prejacent besides the prejacent itself. In the case of additive *hasta*, such a property directly follows from the widely assumed additive component of scalar additive particles (Rooth 1985, 1992). For instance, suppose a context in which the only place where Juan is expected to come with us is the party, then the use of *hasta* in (2) above is infelicitous. Likewise, the complexity constraint directly follows from the characteristic that spatial *hasta* cannot modify a two-point path. For instance, suppose a context in which Juan and everyone else are standing right outside the

gate to the party. In that scenario, the use of *hasta* in (3) is also deviant, since there is no relevant subpath (alternative) other than *nothing happened*.

Third, maximality comes into play. In the same way that temporal *hasta* in positive environments gives rise to an interruption inference, thus suggesting that it picks out the endpoint value of the maximal event being modified, additive *hasta* and spatial *hasta* also select the largest event compatible with the entire predicate. In (2), we infer that ‘Juan coming to the party with us’ is the maximal element of the scale under consideration. If there were another more contextually salient alternative, the use of *hasta* would result in deviance. Likewise, in (3), ‘Juan coming to the party with us’ represents the maximal event under consideration. In a context in which Juan even came to a club with us after the party, the use of *hasta* is correctly predicted to be infelicitous.

Last, all alternatives are ranked according to a certain degree of likelihood. Remember that for temporal *hasta*, I suggested that the entailment relation between the alternatives activated a salient probability measure which could explain, for instance, the emergence of readings such as the ‘later-than-expected’ interpretation, or the fact that the longer an eventuality holds the more salient it becomes. In the case of additive *hasta*, this follows from the general assumption about English *even* in Rooth’s framework wherein the alternatives are ranked along a scale of likelihood. As a consequence, *hasta* in (2) signals the least likely element of the scale in question. If ‘Juan coming to the pub with us’ were a more unlikely alternative to the prejacent, the use of *hasta* in (2) would be deviant. In a similar way to temporal *hasta*, the sense of likelihood of the use of spatial *hasta* simply derives from the

properties of the physical world, i.e. the inherent spatial ordering of a path, which may be interrupted at any moment.

Yet, what is even more interesting about exploring the use of spatial *hasta* within this framework is that beliefs of validity on the part of the speaker can also influence *hasta*'s acceptability. This analysis has interesting ramifications within the cross-linguistic Talmyan (1985, 2000) debate as it predicts the acceptability of 'until'-like markers to introduce a goal in a motion construction in more contexts than one would otherwise expect. For example, the use of *hasta* can be acceptable even when the physical scale that *hasta* introduces seems to be, on the surface, a two-point path, as illustrated in (4b) in opposition to (4a).

(4) a. **[Juan is standing right next to the chair]**

Juan fue hasta la silla (caminando).
Juan went until the chair walking
'Juan walked up to the chair.'

b. **[Juan is 1 km away] or [Juan, totally drunk, is standing right next to the chair]**

Juan fue hasta la silla (caminando).
Juan went until the chair walking
'Juan walked up to the chair' or 'Juan *managed* to walk up to the chair.'

Under the conditions in (4b) where the path is superficially short, one theoretically expects the use of *hasta* to be deviant (e.g. Beavers 2008a). The system we have built for aspectual markers based on scalar reasoning and exhaustification of alternatives is able to predict that the use of *hasta* is allowed and furthermore acquires

a ‘manage’-type reading thanks to our own perception of likelihood that causes us to view the path to the goal as longer than we otherwise would, hence incrementing the gradability of the scale in question. Previous theories have noticed such a peculiar behavior of spatial ‘until’-like particles² but could not appropriately account for all the cases in a unifying manner. Instead, a theory that factors into the meaning of ‘until’-like particles the relevant scalar alternatives ranked in terms of a salient measure provides us the proper tools to uniformly explain their behavior, not only in the spatial domain but also in the temporal and more abstract domains.³ Fully exploring these connections and formalizing this work to the same level of detail as for the temporal uses of ‘until’ is left for future work.

²See Beavers (2008a) for an account on *-made* ‘until’ in Japanese, which shows a very similar pattern to Spanish *hasta*.

³Other uses which I have not discussed but that also seem to share this unified core of familiarity is the use of *hasta* as a numeral modifier and as a degree modifier, represented below in (ia) and (ib), respectively. Thanks to Daniel Margulis for pointing out the latter use to me.

- i. a. *En este ascensor caben hasta cuatro personas.*
in this elevator fit until four people
‘This elevator fits up to four people.’
- b. *Juan es tan alto hasta toca el techo.*
Juan is so tall until touches the ceiling
‘John is so tall that he (even) touches the ceiling.’

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Vita

Maria del Mar Bassa Vanrell's main research interests are in semantics, pragmatics, and syntax-semantics interfaces. During her Ph.D. years, she had the opportunity to be a Ph.D. visiting student at the MIT Department of Linguistics and Philosophy in 2014-2015, and at the Department of Linguistics at the University of São Paulo in 2015-2016. Prior to that, she completed her M.A. in Linguistics from the University of Texas at Austin, with a major in syntax and semantics and a minor in Romance linguistics. She had previously obtained her B.A. in English Literature and Linguistics from the University of the Balearic Islands in Spain. As an undergraduate, she also studied at the Linguistics and English Literature Departments at UT Austin in 2006-2007, as well as at the Departments of Linguistics and English Literature at Queen Mary University of London in 2008-2009. Bassa Vanrell has always complemented her research with teaching. During her studies, she taught linguistic and language courses at College of the Holy Cross, University of Texas at Austin, and Boston University.

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