Chapter 4

Imperfectives and Plurality

4.1 Introduction

Imperfectivity, understood as a semantic notion, can be informally described as expressing the idea that an event, state, or habit is ongoing. For instance, the English progressive sentence in (1) says that, at the time when I saw Mary, there was an ongoing event of her crossing Vassar Street, and the 'simple present' sentence in (2) says that Mary is currently in the habit of smoking:

(1) Mary was crossing Vassar Street (when I saw her).

(2) Mary smokes.

In an event-based framework, the intuitions mentioned above can be formalized by using the relation of temporal inclusion. According to this view, someone who uttered (1) would assert that the time at which I saw Mary is included in the time of an event of Mary crossing Vassar Street. Similarly, someone who uttered (2) would assert that the utterance time is included in an interval corresponding to the duration of a habit of Mary smoking. But what does it mean for a time interval to be the time of an event of Mary crossing the street? And what exactly constitutes a habit of Mary smoking? Suppose we answer the first question by saying that the interval of

an event of Mary crossing the street is an interval corresponding to a complete event of Mary crossing the street, beginning when she is on one side of the street and starts crossing, and finishing only when she gets to the other side. Then, we would face the problem of explaining why a sentence like (3) below is judged true, when uttered at a time right after Mary started crossing the street, despite the fact that she never got to the other side:

(3)   Mary was crossing Vassar Street, when a bus hit her.

A way out of this puzzle is to introduce a modal component as part of the meaning of progressive sentences with the effect that the utterer does not commit himself to the existence in the actual world of a complete event of the sort described by the sentence. A proponent of this view is then left with the task of spelling out what kind of modality is involved in these sentences.[1]

What about habituals? In chapter 3, habitual sentences with adverbs such as *always* or *usually* were analyzed as involving quantification over events. The adverbs were treated as quantificational determiners and their (covert) restrictors as variables ranging over event predicates. Habitual sentences with no adverbs of quantification - bare habituals - were analyzed as being structurally similar, but with the (silent) event determiner identified as a plural definite determiner. In both cases, identifying the restrictors of the determiners required the help of linguistic and/or extra-linguistic context. Adverbial clauses, such as the initial *when*-clause in (4a) below, and pre-suppositions triggered by lexical items such as *beat* in (4b) are among the linguistic material that helps determining these restrictors. The influence of extra-linguistic context, such as the salience of a discourse topic, is usually accompanied with intonational cues, as in (4c), where the verb receives a special pitch accent:

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[1] Dowty (1977), Landman (1992), and Portner (1998) are among the works that have undertaken this task. See also Bonomi (1997b) for an event-based analysis that share some of the ideas developed by those authors. For a different view on the matter, cf. Vlach (1981), Bach (1986) and Parsons (1990)

(4)   a.   When John showers, he (always) shaves.

           Every event/The events of John showering ...

       b.   Mary usually beats John at ping-pong.

           Most events of John and Mary playing ping-pong ...

       c.   Mary [writes]$_F$ to her mother.

           The events of Mary communicating with her mother ... [in a discussion about how daughters and mothers living apart communicate.]

There are, however, certain habitual sentences, which I will call 'simple habituals', that seem to behave differently. These sentences can be uttered out of the blue and still sound natural and informative, despite the absence of adverbial clauses, presupposition triggers, or any special focus marking. Some examples are provided in (5):

(5)   a.   John smokes.

       b.   Mary dyes her hair.

       c.   Sally jogs.

Take (5a) for instance, and imagine it uttered out of the blue. It is not clear at all what could play the role of the covert restrictor of an event determiner in this case. For instance, there are so many different circumstances under which a certain person can smoke, that it seems impossible to identify a set of events without being too vague ('every appropriate time to smoke, Mary smokes') or just trivial ('every time Mary smokes, she smokes'). One can smoke just because he or she feels like it from time to time, or every day at noon, or maybe because someone is forcing him or her to do so. It does not matter. A sentence like 'Mary smokes' can be uttered without the intention to link events of Mary smoking to any other kind of event, and a hearer does not feel compelled or invited to accommodate any set of events either. What seems to be at issue here is the existence of events of Mary smoking.

Suppose then that we say that a habit of Mary smoking is a sequence of events of her smoking. A problem arises here that is similar to the one we discussed in connection to the progressive sentence in (3). Imagine Mary died a couple of minutes after someone had uttered (2), and that in fact she used to smoke before she died. One would not conclude from the facts that the speaker was wrong when he uttered (2), despite the fact that the time of that utterance followed the final time interval at which Mary smoked, and therefore was not included within an ongoing sequence of events of Mary smoking. Once again, a way out of this problem would be to include a modal component in habitual sentences, so that someone who utters (2) can avoid committing himself to the existence in the actual world of future events of Mary smoking.

In this chapter, I subscribe to the view that habitual and continuous readings connected with imperfectivity have both a temporal and a modal component. However, I will go further and defend a stronger position, namely, that continuous and habitual readings share the same temporal and the same modal ingredients. The only difference between them is that the former asserts the existence of a singular event of the kind described by the verb phrase, whereas the latter asserts the existence of a plural event of the kind described by the verb phrase.

The rest of the chapter is organized as follows: in section 2, I present the relevant details of how temporal relations such as inclusion and precedence are to be understood when they hold of intervals of plural events. In section 3, I suggest that verb phrases combine with number morphemes forming constituents denoting sets of singular or plural events, and I discuss the temporal component of imperfectivity. In section 4, I analyze some crosslinguistic data involving imperfective constructions and argue that the aspectual operators involved in them display a sensibility to 'number' (singular/plural) that is very similar to what is observed with determiners in the nominal domain. In section 4, I discuss habitual sentences with singular and plu-

ral indefinites and propose a revision in the meaning of the imperfective operator to account for the absence of cumulative readings in simple habituals with plural indefinites. In section 5, I present Portner's work on the modal semantics of progressive sentences in English, and argue that it can be extended to habitual sentences. The upshot is that the logical forms underlying continuous and habitual readings become identical, modulo the number specification of the time intervals involved. Finally, section 6 discuss sentences with two layers of imperfectivity, with quantifiers intervening between two imperfective operators. Section 7 is a brief summary.

4.2   Events and Their Times

Since the occurrence of events in time will be at the center of our discussion, some preliminary technical remarks about how events and times relate are in order.

In addition to the mereology of events that we have been talking about throughout this dissertation, I also assume that there is a mereology of time intervals. The definition of a time interval can be built upon the notion of time point. The set of time points together with the relation $<$ (precedence) form what is called a dense linear order. A time interval i can be defined as a convex set of time points, that is, a set such that for any time points p_x, p_y, p_z, if p_x and p_y belong to i, and $p_x < p_z < p_y$, then p_z also belongs to i. Intuitively, convex intervals correspond to continuous portions in a time line. I call them singular intervals. In addition to singular intervals, I will assume that D_i, the domain of all time intervals, also contain plural intervals, understood as mereological sums have singular intervals as their minimal parts. I take the set D_i to correspond to the set formed by closing off the set of singular intervals (I_{sg}) under sum formation.

Once we acknowledge the existence of plural intervals, we have to redefine relations such as precedence and inclusion, extending them to cases involving sums as well. The

relevant definitions are given below.

(6) *Right Boundary/Left Boundary*

A time point p is the right/left boundary of an interval i *iff* p belongs to a minimal part of i, and for every time point p', if p' belongs to a minimal part of i, then p'$\leq$ p/p $\leq$ p'.

(7) *i-precedence*

An interval i i-precedes an interval i' *iff* the right boundary of i precedes the left boundary of i'.

(8) *i-inclusion*[2]

An interval i is i-included ($\subseteq_i$) in an interval i' *iff* the left boundary of i' precedes the left boundary of i, and the right boundary of i precedes the right boundary of i'.

As far as minimal, atomic intervals are concerned, the definitions above are quite intuitive, so the interval corresponding to March/2001 precedes the interval corresponding to August/2001, and is i-included in the interval corresponding to the first semester of 2001. Now, consider what happens when sums of intervals enter the picture. Let i_1 correspond to March/2001, i_2 to August/2001, and i_3 to the plurality January/2001$\oplus$May/2001. According to (8), i_1 is i-included in i_3, since i_3's left boundary precedes i_1's left boundary, and i_1's right boundary precedes i_3's right boundary. Notice that the fact that the time points belonging to i_1 do not belong to any part of i_3 is irrelevant. Less surprisingly, according to (7), i_3 i-precedes i_2, since i_3's right boundary precedes i_2's left boundary. These definitions will become relevant when we discuss the semantics of aspectual operators.

Finally, I assume that there is an homomorphism τ between the structured domain of events and the structured domain of intervals, so that for any events *e, e'*, $\tau(e \oplus e') =$

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[2] I use the name *i-inclusion* and the notation $\subseteq_i$ to avoid confusion with the notion of sub-interval, standardly defined upon the set-theoretic relation of inclusion $\subseteq$.

$\tau(e) \oplus \tau(e')$. I refer to $\tau(e)$ as the time of the event e.

4.3   The Imperfective Operator

As a starting point, I assume that aspectual operators denote functions that take sets of events as their input and return sets of intervals as their output. As far as temporal semantics is concerned, the main job of an aspectual operator is the introduction of a relation between time intervals in the logical representation of a sentence (cf. Klein 1994). In sentences with a single layer of aspectuality, these relations hold between the interval corresponding to the temporal specification of the clause (past/present/future), and an interval belonging to the denotation of the verb phrase. A typical clause skeleton will then look like (9):[3]

(9)   [$_{TP}$ T   [$_{AspP}$ Asp [$_{VP}$ ... V...]]]

I will treat verb phrases (VPs) in the same way I treated common nouns (NPs) in chapter 2. VP-denotations may contain atomic as well as non-atomic events. Number morphemes combine with a bare VP selecting its relevant members (atomic/non-atomic).

(10)   VP$_{sg}$ = [sg   VP]   VP$_{pl}$ = [pl   VP]

(11) $[\![sg]\!]$ = λ**P**. λ**e**. **P(e)** & **e is atomic**

$[\![pl]\!]$ = λ**P**. λ**e**. **P(e)** & **e is non-atomic**

$[\![VP_{sg/pl}]\!]$ = λ**e**. $[\![\mathbf{VP}]\!]$**(e)** & **e is atomic/non-atomic**

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[3] I will follow the tradition inaugurated with Partee (1973), according to which tenses are treated as pronouns. Thus, when not bound by an operator, T nodes refer to context salient time intervals. Distinctions among tenses, e.g. past vs. present can be encoded as presuppositions in their lexical entries. Following the notational conventions in Heim and Kratzer (1998), lexical entries of tenses would look like the following:
(i) $[\![past_1]\!]^g$ = g(1) if g(1) precedes the utterance time; and undefined otherwise.
(ii) $[\![pres_1]\!]^g$ = g(1) if g(1) is the utterance time; and undefined otherwise.
For our purposes, g can be viewed as a function provided by the context of utterance, mapping indices to contextually salient entities.

I will start by encoding the semantics of imperfectivity in a morpheme, which I will call *Imp*. This morpheme introduces the inclusion relation between intervals, as shown in the lexical entry in (12):

(12) $\llbracket \text{Imp} \rrbracket = \lambda \mathbf{P}_{\langle vt \rangle}. \ \lambda \mathbf{t}. \ \exists \mathbf{e} : \ \tau(\mathbf{e}) \supseteq \mathbf{t} \ \& \ \mathbf{P}(\mathbf{e})$

Before looking at a concrete instance of an English sentence containing this morpheme, consider the logical forms in (13) and (14):

(13) [$_{\text{TP}}$ Past$_1$ [$_{\text{AspP}}$ Imp [$_{\text{VP-sg}}$ sg   [$_{\text{VP}}$ John paint the house]]]]

(14) [$_{\text{TP}}$ Past$_1$ [$_{\text{AspP}}$ Imp [$_{\text{VP-pl}}$ pl   [$_{\text{VP}}$ John paint the house]]]]

Now, imagine the following scenario: Last year, John painted his house once every month. He always started on the 15th and finished on the 17th of each month. Let the events of him painting the house be e_1, e_2,..., e_{12}. Assuming these were the only occasions in which John painted the house, the extension of the bare VP in (13) and (14) is (15):

(15) $\llbracket \text{VP} \rrbracket = \{\mathbf{e_1}, \ \mathbf{e_2}, \ \mathbf{e_1} \oplus \mathbf{e_2}, \ \mathbf{e_3}, \ \mathbf{e_1} \oplus \mathbf{e_2} \oplus \mathbf{e_3}, \ ..., \ \mathbf{e_1} \oplus \mathbf{e_2} \oplus \mathbf{e_3}...\oplus \mathbf{e_{12}}\}$

Given the semantics of *Imp* above, the truth-conditions for (13) and (14) should be as in (16) and (17), respectively:

(16) $\llbracket \text{TP} \rrbracket^g = 1$ *iff* $\exists \mathbf{e} : \ \tau(\mathbf{e}) \supseteq \mathbf{g(1)} \ \& \ \mathbf{e}$ **is atomic** $\&$ **paint(e, j, h)**

(17) $\llbracket \text{TP} \rrbracket^g = 1$ *iff* $\exists \mathbf{e} : \ \tau(\mathbf{e}) \supseteq \mathbf{g(1)} \ \& \ \mathbf{e}$ **is non-atomic** $\&$ **paint(e, j, h)**

Now, assume that Past$_1$ refers to June 16th. Then (13) should be true, since e_6, for instance, verifies the formula embedded under the existential quantifier in (16). What if Past$_1$ refers to June 20th? Now (13) should be false, since there is no event in the denotation of VP$_{sg}$ whose time includes June 20th. The situation changes with (14). If Past$_1$ refers to June 20th, (14) is true, since $e_5 \oplus e_7$, for instance, verifies the

formula embedded under the existential quantifier in (17). We need to invoke a plural event this time, but that is fine, since the denotation of VP_{pl} has plural events as its members. Finally, if $Past_1$ refers to June 16th, (14) is still true, but not because this interval is included in the time of e_6, but because it is included in the time of some plural events, such as $e_5 \oplus e_7$. The conclusion is that logical forms containing *Imp* can express not only the existence of an on-going event at a certain time, but also the existence of on-going sequences of (two or more) events of John painting the house. The choice will depend on whether *Imp* combines with singular or plural VPs.

One can imagine more specialized versions of *Imp*, in which this operator selects for either sets of singularities (P_{sg}) or sets of pluralities (P_{pl}) as its first argument.[4] As a consequence, only singular or plural events are quantified over in the logical representations of sentences containing these operators:

(18) $[\![Imp_{sg}]\!] = \lambda \mathbf{P}_{sg}. \ \lambda \mathbf{t}. \ \exists \mathbf{e} : \tau(\mathbf{e}) \supseteq \mathbf{t} \ \& \ \mathbf{P}(\mathbf{e}) = \mathbf{1}$

(19) $[\![Imp_{pl}]\!] = \lambda \mathbf{P}_{pl}. \ \lambda \mathbf{t}. \ \exists \mathbf{e} : \tau(\mathbf{e}) \supseteq \mathbf{t} \ \& \ \mathbf{P}(\mathbf{e}) = \mathbf{1}$

Now, logical forms containing Imp_{sg} can only express that an event, but not a sequence of events, is ongoing. On the other hand, logical forms with Imp_{pl} can only express that sequences of events are ongoing. My suggestion is that the so-called progressive or continuous readings of imperfective sentences are derived from logical forms like (13), and that habitual readings are derived from logical forms like (14). Thus, as far temporal semantics is concerned, continuous and habitual sentences are nearly synonymous, their logical forms differing minimally, and only with respect to the number specification of the VPs that combine with *Imp*. At this point, I beg the reader to disregard issues concerning modality. I will discuss those issues in detail in section 4.7, where I will supplement the meaning of *Imp* with quantification over possible worlds. As will become clear, I will try to argue that both continuous and

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[4] A parallel with the nominal domain will be discussed in the next section.

habitual readings involve the same kind of modality. In this way, what I presented above can be seen as a first step towards a unified semantics for the continuous and habitual readings associated with imperfectivity. However, before we enter the modal domain, I want to present some data illustrating the view I am advocating here.

4.4 Cross-linguistic Variation

According to what we saw in the previous section, sensitivity to number leads us to expect the existence of three different imperfective operators: Imp, Imp_{sg} and Imp_{pl}. Imp combines with both singular and plural VPs; Imp_{sg} combines only with singular VPs and Imp_{pl} combines only with plural VPs. The sensitivity to number that I am proposing for these aspectual operators is similar to what happens in the nominal domain, where we find determiners like *some*, which combines with both singular and plural noun phrases ('some boy/some boys'), *every*, which combines only with singular noun phrases ('every boy/*every boys'), and *many*, which only combine with plural noun phrases ('*many boy/many boys'). In this section, I argue that all three imperfective operators are attested in natural languages. Simple present sentences with accomplishments and activities in English and Portuguese, as illustrated in (20) below, give rise to habitual readings only, suggesting that Imp_{pl}, in this case a phonetically null operator, is part of their logical forms.

(20)   a. Mary dyes her hair.

        b. A   Maria tinge o   cabelo.
            The Maria dyes the hair.
            'Mary dyes her hair.'

Simple present sentences in Italian, French and Spanish are ambiguous between continuous and habitual readings, suggesting that Imp is available for these languages. The same is true of another well-known construction in Romance, namely, the past

imperfect, as illustrated in (21).[5]

(21) A   Maria tingia   o   cabelo.
      The Maria dye-IMP the hair.

      'Mary was dying/used to dye her hair.'

The progressive in English and Portuguese also gives rise to continuous and habitual readings, although the use of progressive sentences to express habituality is limited to recently acquired habits in both languages.[6,7]

(22) a. [Mary used to stay at home the whole day, but now] she is exercising.

      b. A   Maria está se   exercitando.
         The Maria is   self exercising.

         'Mary is exercising.'

Ambiguity between continuous and habitual readings is attested in several other languages as well (Dahl 1985, 1995), and, according to what I suggested above, it reduces to the possibility of Imp combining with both singular and plural VPs. Finally, earlier stages of Turkish provide an example of a morpheme instantiating Imp_{sg}:

(23) mektup yazyor

      'he is writing letters'

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[5] As its name suggests, the past imperfect is an aspectual operator used only in combination with the past tense. I will encode this restriction in its lexical entry, by means of a logical presupposition (the notation is from Heim and Kratzer (1998)).

(i) $[\![\text{Past Imp}]\!]^g = \lambda P_{<vt>}.\lambda t : t < g(0).\exists e : \tau(e) \supseteq t \& P(e) = 1$

In (i), 0 is a designated index, which the assignment g always maps to the utterance time. After $[\![\text{Past Imp}]\!]$ combines with its first argument, the result is a function from intervals to truth values. The formula after the colon indicates that this function is a partial function, only defined for past intervals. The Past Imperfect behaves in this respect as the expression 'used to' in English, which only combines with the past tense: John used to smoke/*John uses to smoke.

[6] As for other Romance languages, one finds a lot of dialectal variation related to geographical and social factors. For data and discussion, see Squartini (1998) and the references cited there.

[7] Habitual readings of progressive forms are more salient when the progressive is embedded under the Perfect in English:
(i) Mary has been exercising lately.
In Portuguese, the present perfect alone expresses habitual readings, also conveying the idea that the habit is recent (see Schmitt 2001):
(i) A Maria tem se exercitado.
The Mary has self exercised
'Mary has been exercising'.

According to Dahl (1985:418), "relatively recently, the -yor forms seem to have had progressive meaning only."

In conclusion, the analysis proposed here provides a simple account of cross-linguistic variation within the domain of imperfectivity, reducing the differences to a single parameter related to the 'number' requirements of an aspectual operator.[8]

4.5 Habituals and Indefinites

By invoking pluralities in the analysis of habitual readings associated with the simple present, we are able to explain why singular indefinites are not fine in sentences like (24) below:

(24)   John smokes a cigarette.

The logical representation of (24) is given in (25):

(25) $\exists \mathbf{e} : \tau(\mathbf{e}) \supseteq \mathbf{Pres} \ \& \ \mathbf{e} \ \mathbf{is} \ \mathbf{non\text{-}atomic} \ \& \ \exists \mathbf{y} : \mathbf{cigarette}(\mathbf{y}) \ \& \ \mathbf{smoke}(\mathbf{e}, \mathbf{j}, \mathbf{y})$

Since the variable e in the formula $smoke'(e, j, y)$ corresponds to a plurality, and the variable y to an atomic individual, (24) could only be true if John smoked the same cigarette over and over again. The oddness is then due to the fact that an event of smoking a cigarette consumes the whole cigarette, preventing the possibility of other

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[8] However, as Sabine Iatridou pointed out to me, the continuous/habitual opposition is not the only relevant one in understanding the use of imperfective morphology across languages. It is quite common for languages to require imperfective morphemes (Imp) as an ingredient of counterfactual morphology, and, when they do, the following cross-linguistic pattern is observed: "Imp can appear in progressive, generic, or CF sentences. However, if genericity and the progressive take different forms, then counterfactuality will always pattern with the former, never with the latter". She then adds: "I would like to emphasize that if the sameness of form of the verb in ongoing events and generics suffices to tempt us in the direction of reductionist accounts, then the sameness of form of the verb in generics and CFs should compel us much more. The reason is very simple: the languages in which ongoing events and generics share the same form are a subset of the languages in which generics and CFs share the same form.[...] I have not encountered a language where CFs and ongoing events have one form, and generics a different one". Iatridou (2000:258-259) I agree with her that these facts call for a more ambitious research agenda, but I will have to leave this for another occasion. See Iatridou (2000) for a detailed discussion.

events where the same cigarette is smoked again. Different verbal predicates do not conflict with iterativity, and are just fine in the simple present:

(26)   John babysits a one-year-old boy.

Notice, however, that for (26) to be true there must be a certain boy that John takes care of regularly. It would not be true if, say, every night he takes care of a different boy. That is what we expect if the logical form of (26) is as in (27) below:

(27) $\exists \mathbf{e} : \tau(\mathbf{e}) \supseteq \mathbf{Pres} \ \& \ \mathbf{e} \text{ is non-atomic} \ \& \ \exists \mathbf{y} : \mathbf{boy}(\mathbf{y}) \ \& \ \mathbf{babysit}(\mathbf{e}, \mathbf{j}, \mathbf{y})$

Sentence (24) becomes fine if a distributive quantifier intervenes between the imperfective operator and the singular indefinite, as shown in (31):

(28)   John smokes a cigarette every morning.

[$_{\text{TP}}$ Pres [$_{\text{AspP}}$ Imp$_{pl}$ [$_{\text{VP}'''}$ every morning [$_{\text{VP}''}$ 1 [$_{\text{VP}'}$ VP [$_{\text{AdvP}}$ (on) t$_1$]]]]]]

Here, it is not the VP 'John smokes a cigarette', but rather the higher VP''' 'John smokes a cigarette every morning' that is the argument of the imperfective operator. Therefore, there is no requirement that VP be a plural predicate. What we have to worry about is whether the predicate denoted by VP''' has pluralities in it or not. As the derivation below shows, it does.[9]

(29) $[\![\text{VP}']\!]^g = \lambda \mathbf{e}. \exists \mathbf{y} : \mathbf{cigarette}(\mathbf{y}) \ \& \ \mathbf{smokes}(\mathbf{e}, \mathbf{j}, \mathbf{y}) \ \& \ \mathbf{on}(\mathbf{e}, \mathbf{g(1)})$

$[\![\text{VP}'']\!] = \lambda \mathbf{t}. \lambda \mathbf{e}. \ \exists \mathbf{y} : \mathbf{cigarette}(\mathbf{y}) \ \& \ \mathbf{smokes}(\mathbf{e}, \mathbf{j}, \mathbf{y}) \ \& \ \mathbf{on}(\mathbf{e}, \mathbf{t})$

$[\![\text{every morning}]\!] = \lambda \mathbf{P}_{\langle i, vt \rangle}. \lambda \mathbf{e}^*. \ \forall \mathbf{t} : \mathbf{morning}(\mathbf{t}) \ \& \ \mathbf{t} \subseteq \tau(\mathbf{e}^*) \rightarrow \exists \mathbf{e}' \le \mathbf{e}^* :$ $\mathbf{P}(\mathbf{t})(\mathbf{e}') = \mathbf{1} \ \& \ \forall \mathbf{e}' : \mathbf{e}' \le \mathbf{e}^* \rightarrow \exists \mathbf{t} : \mathbf{morning}(\mathbf{t}) \ \& \ \mathbf{P}(\mathbf{t})(\mathbf{e}') = \mathbf{1}$

$[\![\text{VP}''']\!] = \lambda \mathbf{e}^*. \ \forall \mathbf{t} : \mathbf{morning}(\mathbf{t}) \ \& \ \mathbf{t} \subseteq \tau(\mathbf{e}^*) \rightarrow \exists \mathbf{e}' \le \mathbf{e}^* : \exists \mathbf{y} : \mathbf{cigarette}(\mathbf{y}) \ \&$ $\mathbf{smokes}(\mathbf{e}', \mathbf{j}, \mathbf{y}) \ \& \ \mathbf{on}(\mathbf{e}', \mathbf{t}) \ \& \ \forall \mathbf{e}' : \mathbf{e}' \le \mathbf{e}^* \rightarrow \exists \mathbf{t} : \mathbf{morning}(\mathbf{t}) \ \& \ \mathbf{t} \subseteq \tau(\mathbf{e}) \ \&$ $\mathbf{smokes}(\mathbf{e}', \mathbf{j}, \mathbf{y}) \ \& \ \mathbf{on}(\mathbf{e}', \mathbf{t})$

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[9] For simplicity, I treat the noun 'morning' as denoting a set of time intervals.

Variable e^* ranges over events having parts that are events of John smoking a cigarette. But there is no requirement that the same cigarette is consumed in each one of these parts. Since VP″ denotes a set of pluralities, the imperfective operator Imp_{pl} can take it as its argument, and the sentence will have truth conditions requiring that the utterance time be included in the time of a plural event e^*, and that (i) there is an event of John smoking a cigarette on every morning within the time of e^*, and (ii) each part of e^* is an event of John smoking a cigarette in a morning.

The same explanation can be used to account for why habitual sentences with adverbs of quantification, or bare habituals with the silent definite determiner that we postulated in chapter 3 are also fine:

(30)   a. [When he gets angry,] John always smokes a cigarette.

        b. [When he gets angry,] John smokes a cigarette.

The logical forms of these sentences are similar to the logical form of (31), with the adverb of quantification or the silent definite determiner replacing the QP 'every morning':

(31)   When he gets angry ,

      John always smokes a cigarette.

      [$_{TP}$ Pres [$_{AspP}$ Imp_{pl} [$_{VP‴}$ [always C] [$_{VP″}$ 1 [$_{VP′}$ VP [$_{AdvP}$ M t$_1$]]]]]]

      $[\![$always C$]\!]$ = $\lambda \mathbf{P}.\lambda \mathbf{e}^*. \forall \mathbf{e} : \mathbf{C(e)} \rightarrow \exists \mathbf{e}' \leq \mathbf{e}^*$:

      $\mathbf{P(e)(e')} = \mathbf{1}$ & $\forall \mathbf{e}' : \mathbf{e}' \leq \mathbf{e}^* \rightarrow \exists \mathbf{e} : \mathbf{C(e)}$ & $\mathbf{P(e)(e')} = \mathbf{1}$

(32)   When he gets angry ,

      John smokes a cigarette.

      [$_{TP}$ Pres [$_{AspP}$ Imp_{pl} [$_{VP‴}$ [THE$_E$ C] [$_{VP″}$ 1* [$_{VP′}$ VP [$_{AdvP}$ M t$_1$]]]]]]

$$\llbracket \text{THE}_E \ \mathbf{C} \rrbracket = \mathbf{max}\{\mathbf{x}^* : \mathbf{C}(\mathbf{x}^*) \ \& \ \neg \mathbf{AT}(\mathbf{x}^*)\}$$

$$\llbracket 1^* \alpha_{\langle vt \rangle} \rrbracket^{\,g} = \lambda \mathbf{X}. \ \lambda \mathbf{E}. \ \forall \mathbf{x} : \mathbf{x} \leq \mathbf{X} \rightarrow \exists \mathbf{e} \leq \mathbf{E} : \ \llbracket \alpha \rrbracket^{g^{x/1}}(\mathbf{e})$$
$$\& \ \forall \mathbf{e} \leq \mathbf{E} : \exists \mathbf{x} \leq \mathbf{X} : \llbracket \alpha \rrbracket^{g^{x/1}}(\mathbf{e})$$

4.5.1 Plural Indefinites

If the oddness of (24) is due only to the fact the indefinite is singular, one expects that replacing it by any plural indefinite should produce a contrast in acceptability. However, as (33) below shows this is not the case. Uttered out of the blue, (33) sounds as weird as (24):

(33)   # John smokes five cigarettes.

The only way for (33) to be true is if there are five different cigarettes and John smoke each one of them over and over again. But that is not what our current theory predicts, as shown by the logical representation it assigns to (33):

(34) $\exists \mathbf{e} : \ \tau(\mathbf{e}) \supseteq \text{Pres} \ \& \ \mathbf{e} \ \mathbf{is} \ \mathbf{non\text{-}atomic} \ \& \ \exists \mathbf{X} : |\mathbf{X}| = \mathbf{5} \ \& \ \mathbf{cigarettes}(\mathbf{X}) \ \&$
  $\mathbf{smoke}(\mathbf{e},\mathbf{j},\mathbf{X})$

The fact that 'five cigarettes' introduce quantification over pluralities leads us to expect that contrary to what we saw in the case of (24), cumulation should not force the existence of multiple events where the same cigarette is smoked. We can avoid this problem by assuming that the imperfective operator requires the VP-predicate to hold not only of the plural event whose existence is being asserted, but of its proper parts as well:

(35) $\llbracket \text{Imp} \rrbracket = \lambda \mathbf{P}_{\langle vt \rangle}. \ \lambda \mathbf{t}. \ \exists \mathbf{e} : \ \tau(\mathbf{e}) \supseteq \mathbf{t} \ \& \ \mathbf{P}(\mathbf{e}) \ \& \ \forall \mathbf{e}' \leq \mathbf{e} : \mathbf{P}(\mathbf{e}')$

The logical representation of (33) is now the following:

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(36) $\exists e : \tau(e) \supseteq \text{Pres} \ \& \ \textbf{e is non-atomic} \ \& \ \exists X : |X| = 5 \ \& \ \textbf{cigarettes}(X) \ \&$

$\textbf{smoke}(e, j, X) \ \& \ \forall e' \leq e : \exists X : |X| = 5 \ \& \ \textbf{cigarettes}(X) \ \& \ \textbf{smoke}(e', j, X)$

The oddness of (33) results from the fact that the proper parts of a plural event of John smoking five cigarettes are events of him smoking one, two, three or four cigarettes, but not five.

Let us now replace the singular indefinite in (26) with a cardinal plural indefinite:

(37) John babysits three boys.

The sentence is fine but for it to be true there must be three boys such that for each one of them, there are multiple events of John taking care of him. How can we get this result? The fact that the imperfective morpheme requires the existence of a VP-event with proper parts that are also VP-events is welcome since the only way for this to be possible in the case of (37) is if there is more than one event of John babysitting the same boy. We want more, however: we want that every child be babysit more than once. But the requirement that EVERY proper part of such an event be an event of John babysitting three children is too strong a requirement. We need to relax the universal quantification over parts introduced by the imperfective morpheme. It should be enough if a VP-event can be partitioned into proper parts that are also VP-events. For example, if there are three boys, and John has babysit each one of them twice, then the sum of all six events can be partitioned into two proper parts which are also events of John babysitting three boys. The same if there is a third round of babysitting, and a fourth, and a fifth, and so on. If, however, John babysit each boy only once, there will be a plural VP-event, but with no proper part that is also a VP-event. The following revised lexical entry for the imperfective operator gives us what we need:[10]

(38) $[\![\text{Imp}]\!] = \lambda P_{\langle vt \rangle}. \ \lambda t. \ \exists e : \tau(e) \supseteq t \ \& \ P(e) \ \& \ \exists e', e'' < e : e' \otimes e'' \ \& P(e') \ \& \ P(e'')$

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[10] The formula $e \otimes e'$ says that events e and e' do not overlap, that is, they do not have any part in common.

By inspecting (38), one expects that a plural indefinite under the scope of IMP_{pl} should always be fine if it imposes no cardinality requirement on the variable being existentially bound. That is presumably the case with bare plurals in a sentence such as (39):[11]

(39)   John smokes cigarettes.

(40) $\exists \mathbf{e} : \ \tau(\mathbf{e}) \supseteq \text{Pres} \ \& \ \mathbf{e} \text{ is non-atomic} \ \& \ \exists \mathbf{Y} : \mathbf{cigarettes}(\mathbf{Y}) \ \& \ \mathbf{smoke}(\mathbf{e}, \mathbf{j}, \mathbf{Y})$
    $\& \ \exists \mathbf{e}', \mathbf{e}'' < \mathbf{e} : \mathbf{e}' \otimes \mathbf{e}'' \ \& \exists \mathbf{Y} : \mathbf{cigarettes}(\mathbf{Y}) \ \& \ \mathbf{smoke}(\mathbf{e}', \mathbf{j}, \mathbf{Y}) \ \&$
    $\exists \mathbf{Y} : \mathbf{cigarettes}(\mathbf{Y}) \ \& \ \mathbf{smoke}(\mathbf{e}'', \mathbf{j}, \mathbf{Y})$

4.6   On Statives

As we have discussed above, sentences like those in (41) do not require that at the utterance time there be an event of the kind described by the verb phrase:

(41)   a. John smokes.

        b. Mary dyes her hair.

Thus, John does not have to be smoking when (41a) is uttered for the sentence to be true. Similarly, Mary does not have to be dying her hair while (41b) is being uttered.

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[11] One might wonder about cardinal modifiers such as *at least* or *at most*, and why (i)-(ii) are not fine:

(i) # John smokes at least five cigarettes.

(ii)# John smokes at most five cigarettes.

After all, a plural event of John smoking at least/at most five cigarettes can have proper parts which are also events of him smoking at least/at most five cigarettes. One possibility is that the internal structure of NPs with cardinal modifiers have two components, an existential determiner and a maximality degree operator (Hackl 2000), with the maximality operator always scoping above Imp. Sentences like (i-ii) would be roughly paraphrased as follows: the maximal n such that **John smokes n cigarettes** is equal or smaller/greater than 5. What is interpreted below the imperfective operator is then not different from VP-denotations with plain cardinals such as *five cigarettes*. Notice that this treatment has to be extended to the determiner 'some', given the oddness of 'John smokes some cigarettes. Here too the oddness would be attributed to the meaning assigned to the sentence: the maximal n such that **John smokes n cigarettes** is greater than 1. The open question here is how to enforce scope splitting across the imperfective operator.

This is due to our assumption that the imperfective morpheme in English simple present sentences selects for plural predicates of events and that the time of a plural event can include an interval without any of its parts overlapping with that interval. In this respect, the presence of certain distributive quantifiers under the scope of the imperfective morpheme does not change the picture. Both (42a) and (42b) below can be uttered on a Thursday evening and still be true:

(42)   a. John smokes every morning.

        b. John dyes her hair every Monday.

There is a class of predicates, however, that behaves differently. These are the so called stative predicates, as exemplified in (43):

(43)   a. John is in Boston.

        b. John lives in New York.

For (43a) to be true, it is necessary that John be in Boston at the utterance time, and for (43b) to be true, it is necessary that John lives in New York at the utterance time. For instance, even if John visits Boston regularly, if when (43a) is uttered he is in New York, the sentence is simply false. Similarly, knowing that John has just moved from New York to Los Angeles is enough to conclude that (43b) is false, even if he plans to move back to New York in a few years. Judgments change, however, if quantifier phrases like *every morning/every year* are inserted:

(44)   a. John is in Boston every morning.

        b. ?John lives in Boston every year.

Frequent travels to Boston, for instance, can make (44a) true, no matter where John happens to be at the utterance time.[12]

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[12] For reasons that I do not understand, (44b) is not perfect (maybe not even acceptable). This might be due to some stability properties attributed to the subject argument by the predicate *live*. In general, statives formed with the verb *to be* are fine in this context, but 'lexical' statives such as *live, love, know, own* are not. I do not have anything interesting to say about this contrast.

To account for the behavior of stative predicates, I suggest that these predicates have a property that I will call *interval density*. That means the following: if two events e, e' whose times do not overlap are in the extension of a stative predicate S, then their sum $e \oplus e'$ is included in S if, and only if, for every time interval t included in $\tau(e \oplus e')$, there is e'' such that $\tau(e'') = t$ that is also in S. For example, imagine that John was in Boston twice last week, first on Monday and then on Friday again, and stayed there the whole day each time. Then, there will be an event/state of John being in Boston whose time correspond to the whole Monday morning, and another one whose time corresponds to the whole evening of that day. The sum of these events will be in the denotation of the predicate JOHN-BE-IN-BOSTON, since he stayed in Boston the whole afternoon, and therefore there is an event in the extension of this predicate whose time corresponds to the afternoon. Now, although the event of John being in Boston the whole Monday and the event of him being there the whole Friday are both members of the extension of JOHN-BE-IN-BOSTON, their sum is not, since there is no event of him being there on Wednesday for instance.[13]

Returning to the examples in (43), we can now explain why these sentences entail that John is in Boston/lives in Boston at the utterance time. The imperfective operator requires the existence of a plural event of John being/living in Boston whose time includes the utterance time. That, *per se*, does not require that he is/lives in Boston at the utterance time. *Interval density*, however, does, and that is why the sentences can only be true if John currently is/lives in Boston.

The situation with the examples in (44) is different due to the intervention of a distributive quantifier between the verb phrase and the imperfective morpheme. There, the plural event whose existence is being asserted is formed by parts that belong to the stative predicate, but the plural event itself does not have to be in the

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[13] Notice that this represents a departure from Kratzer's (2004) hypothesis that all lexical predicates are cumulative, unless, of course, one finds evidence that stative predicates are complex entities formed by smaller units, which are themselves cumulative.

extension of that predicate.

(45)   John is in Boston every morning.

[$_{TP}$ Pres [$_{AspP}$ Imp$_{pl}$ [$_{VP'''}$ every morning [$_{VP''}$ 1 [$_{VP'}$ VP [$_{AdvP}$ (on) t$_1$]]]]]]

As we discussed in the previous section when example (31) was analyzed, VP''' is the argument of the imperfective operator, and in this case, VP''' denotes a set of plural events whose minimal parts are events of John being in Boston in the morning. This set of plural events results from the presence of the distributive quantifier 'every morning' and does not correspond to the denotation of the stative VP 'John-be-in-Boston'. Only the minimal parts of the plural events belonging to VP''' have to belong to the stative VP.

4.7   Imperfectivity and Modality

In the previous sections, by focusing the discussion on issues concerning temporal semantics, I neglected an important component in the meaning of imperfective sentences. It is now time to revise it. Let us start by looking at continuous readings, exemplified here by the English progressive. I will call the aspectual operator present in these sentences Prog. Since, for the moment, we will only be dealing with continuous readings, the meaning of Prog will be the meaning we assigned to Imp$_{sg}$ before. According to the lexical entry of this aspectual operator, a sentence of the form [T Prog VP] entails the existence of a singular time interval at which an event of the type described by the VP takes place. However, as has been acknowledged in the literature since the seventies, this seems to be too strong, as attested by examples like (46) below:

(46)   John was building a house (when he died).

(46) can be true even if John has never finished building a house. It seems that it is enough that he was in the process of building one for the sentence to be true. This

intuition is corroborated by examples like the following:

(47)   John was crossing the street (when a bus hit him).

Again, for (47) to be true, all we have to check is whether or not John had started walking toward the other side of the street, when the bus hit him. What is interesting about this case is that the sentence can be true even if, when John started crossing the street, the likelihood that he was going to finish it was very low, for instance, if the traffic was heavy, cars were running fast, and the pedestrian light was red. Thus, it appears that external obstacles, no matter how likely they are to interfere in the ongoing event, are not taken into account when we assess the truth of (47). By external obstacles, I mean people or objects other than John and the street he was crossing. What happens when an event is interrupted not by an external obstacle, but by the limitations of one of the participants of the event? Consider a variation of (47) (due to Fred Landman):

(48)   John was crossing the Atlantic.

Imagine (48) being uttered five minutes after John started swimming on the West Coast of Africa towards the Brazilian Coast on the other side of the Atlantic. This sentence is very likely to be judged false, and, apparently, the reason for that is the fact the Atlantic is a huge portion of water, and the John that we have in mind is probably a normal human being. Since any human being would give up or die before being even close to Brazilian waters, the fact that our John had started swimming before the reference time (five minutes after he started in the scenario above) is not enough to make the sentence true. Contrary to the buses and cars in the case of (47), the relevant obstacle here has to do with John's physical conditions and, also, the size of the Atlantic. On the other hand, if John is known to have supernatural powers, judgments change, and the sentence is considered appropriate to describe the situation. These facts tell us that progressive sentences with accomplishment VPs

can be false, even when the process constituting the event being described by the sentence is already going on. When animate participants are involved, not only their physical conditions, but also their mental state seem to matter. Consider (47) again, but this time uttered under different circumstances. Imagine John is standing on one side of the street when he sees a one hundred dollar bill right in the middle of the street. He then starts walking there to pick up the bill, when a bus comes and hit him. (47) is judged false in this case, and this can only be due to the fact he did not intend to cross the street, since apart from that, the scenario is identical to the other one we discussed above in connection to the very same sentence. What is needed then is a supplement to our current lexical entry for Prog that takes into account the facts discussed above. In this section, I will present Paul Portner's modal analysis of the progressive (Portner 1998), which has its roots in the influential work by David Dowty back in the seventies (Dowty 1977). After showing how his analysis of Prog can handle the relevant facts, I will argue that habitual readings can be analyzed along the same lines, once we maintain the unified temporal treatment of habituals and progressives proposed in the previous section. The final result will be a complete unification (temporal and modal) between these two notions.

4.7.1 Portner (1998): The Progressive in Modal Semantics

Portner's background is Angelika Kratzer's semantics for modality (Kratzer 1981), which has three crucial ingredients: a quantifier over possible worlds, a modal base, and an ordering source. Given a world w (the world of evaluation), the modal base (M) provides a set of propositions M(w), which constrain the set of worlds that are being quantified over. Only worlds in which every proposition in the set provided by the modal base is true ($\cap$M(w)) are relevant for the interpretation of the sentence. The ordering source (O) also provides a set of propositions (O(w)), a set understood as an ideal according to which worlds can be ranked. A world w' is at least as close

to the ideal as world w" (w'$\leq_o$ w") if, and only if, every proposition that is true in w' is also true in w". The core feature of the proposal is that, when evaluated with respect to a world w, quantification is restricted to the worlds belonging to ($\cap$M(w)) that are ranked best according to O(w) (Best M,O,w). Crucially, choices of modal bases and ordering sources vary from context to context, being usually determined by both linguistic and extralinguistic material. Portner's proposal is to analyze the meaning of progressive sentences as involving universal modal quantification, along the lines summarized above. The question then is what kinds of modal base and ordering sources are involved in these sentences. His suggestion is that the modal base is a variety of circumstantial one, and that the ordering source is based on the ideal that the event described by the sentence (under VP) is not interrupted by any 'outside' factor. Let us consider the example he used to illustrate what he has in mind:

(49)   Mary was climbing Mount Toby.

Circumstantial modal bases take into consideration what the relevant facts are in a certain context The modal base for (49) would deliver a set of propositions, expressing the relevant facts about Mary's current physical and mental conditions (her strength, her age, her dispositions, etc), Mount Toby's physical state (its height, its soil, its shape, etc ..), and also what Mary is doing (Has she started climbing MT? Is she heading the right way? Is she lost?). This set might look like (50) below:

(50)   M(w) = {'Mary is in good physical condition', 'Mary does not give up easily', 'It was raining lightly on Mount Toby at 7', 'Mary was headed the right way on the trail at 7', }

Given the circumstances above, (49) is intuitively true. However, notice that among the worlds in which every proposition in (50) is true, there are worlds in which Mary will never manage to climb MT. Think about worlds in which she gets

eaten by a bear, or in which she slips and gets seriously injured. Things like that are not necessarily uncommon when people climb mountains, especially if they are not professionals. However, the possibility that these events happen seems to be irrelevant when computing the truth-conditions for (49). That is when the ordering source enters the scene in Portner's analyses. In the case of (49), it would look something like (51):

(51)   O(w) = {'Mary does not get eaten by a bear', 'Mary does not slip and hurt her ankle', 'A surprise summer blizzard does not start on MT', 'Mary does not get lost', }

Together, the propositions in (51) express an ideal set of worlds in which Mary encounters no obstacle in her way towards the top of MT. In a sense, in these worlds (the worlds in ∩O(w)), whether or not Mary manages to climb MT depends exclusively on how they look like at the relevant time. According to (50) and (35), Best (M, O, w) contains all the worlds in which Mary and Mount Toby are similar to what they are in the actual world at the relevant time, and no outside factors like bears, rocks, blizzards interrupt the climbing. The idea is that (49) will be true just in case all such worlds are ones in which Mary climbs Mount Toby. Under the circumstances in (50), (49) is predicted to be true. On the other hand, if it is snowing heavily on MT, the proposition 'It was raining lightly on MT' would be replaced by 'It is snowing heavily on Mt' in M(w). Now, Mary could never make it to the top, even if she tries hard. In this case, Best (M,O,w) would contain worlds in which Mary does not climb MT, and the sentence is predicted to be false. Both predictions are borne out. At this point, it should be clear how Portner's theory could handle the puzzling contrast between (47) and (48), discussed in the beginning of this section. It is clear from what we saw above that both the modal base and the ordering source depend on the description of the event under VP. Thus, in the case of (47), M(w) includes all the relevant facts about John and the street he is crossing, whereas in

the case of (48), it includes all the relevant facts about John and the Atlantic Ocean, including the fact that it is a huge portion of water. In this case, even if we restrict attention to worlds in which all potential obstacles for the completion of an event of John crossing the Atlantic were removed (no sharks, no unexpected storms, etc), given John's limited physical conditions, and the size of the ocean, most, if not all, worlds in this set would be worlds in which he fails to cross the Atlantic. Accordingly, the sentence is judged false. In the case of (47), if the street is an average street, e.g. if it is 30 feet large, then this information is part of M(w). Since John will manage to cross the street in all of then, as soon as we remove the external obstacles (oncoming buses, cars running fast, etc), the sentence is predicted to be true, the correct result. The new lexical entry for Prog that emerges from this discussion is given below:

(52) $[\![\text{Prog}]\!]^w = \lambda \wp_{\langle s, vt \rangle}.\ \lambda t.$ for every world w' in BEST(M, O, w, t), there is an event e, such that $t \subseteq \tau(e)$, and $\wp(w')(e) = 1$.

(53) BEST(M, O, w, t) = the set of worlds w' in $\cap$M(w, t), such that there is no world w" in $\cap$M(w, t) where w" $<_{o(w,t)}$ w'.

Notice that the first argument of Prog in (52) is the intension of a VP denotation, a function from worlds to sets of events. I also added an extra argument for BEST, which captures the fact that the set of propositions delivered by the modal base and the ordering source is sensitive not only to the world of evaluation, but also to what is usually called the reference time. Modal bases and ordering sources change as time goes by. For instance, for a sentence like 'At three o'clock, Mary was climbing Mount Toby', what counts as relevant is not Mary's physical conditions when she was a young child, or how tall Mount Toby was during the Paleolithic. On the contrary, it is their conditions at three o'clock that matters.

4.7.2 Integrating Habituality into the Picture

According to what I said in previous sections, habitual and continuous readings of imperfective sentences share the same temporal semantics. I argued there that the difference between those readings come from a difference concerning the plurality of the time intervals being quantified over, singular intervals in the case of continuous readings, plural intervals in the case of habituals. We have just seen that progressive sentences expressing continuous readings have also a modal component. I will now argue that habitual readings share the same modal component, thus maintaining the view that continuous and habitual readings have the same source (modulo number specification), namely, Imp morphemes: Imp, Imp_{sg} and Imp_{pl}. Consider the following scenario: John, who loves soccer, does not live far from college, where the only soccer field in the neighborhood is located. He goes there regularly to play with his friends. Sentence (54) below is true under these circumstances:

 (54)   John plays soccer.

(54) tells us something about John's current dispositions. Unless some external factor interferes, he will walk to the campus and play soccer again in the future, as he has been doing for a while. The proviso 'unless some external factor interferes' is crucial since a speaker who utters (54) does not commit himself to the existence of future events of John playing soccer regardless of what might happen to John. Thus, if John suddenly dies before tomorrow morning, of course, he will never walk to the campus again, let alone play soccer. Also, if tomorrow John gets a message saying that the campus has closed, and that all departments and facilities, including the soccer field, are being transferred to another location, which happens to be 10 miles away from John's house, he will stop playing soccer. But these possibilities do not interfere in the truth of (54). In assessing the truth of (54), we seem to ignore all possible interruptions of a current sequence of events of John playing soccer. In fact,

sentences like (55) can perfectly be true:

(55)   John used to play soccer, when he died.

Notice the striking similarity between what we saw before in the case of continuous readings of progressive sentences, and what we have just seen above with respect to habitual readings. In particular, compare our discussions of (47), 'John was crossing the street', and (54). In the former, we discarded all potential external obstacles to the completion of a singular event, whereas in the latter we discarded all potential obstacles to the continuation of a sequence of events, which, according to our previous discussions, is nothing but a plural event. Since the singular/plural distinction was factored out from the meaning of Imp, it is natural to conclude that the modal component integrated into the meaning of Imp/Prog discussed in relation to continuous readings carries over to the cases involving habitual readings as well. In other words, the logical forms associated with continuous and habitual readings of imperfective sentences are identical, except for the number specification of the aspectual operator Imp. Before I go through the details of these logical forms, and discuss some important consequences, let me present another fact that strengthens the parallel between continuous and habitual readings. Recall Landman's discovery that in the case of sentences like (48), 'John was crossing the Atlantic', which are judged false if John is not a superhero, what is crucial is the fact that John's physical conditions, and the Atlantic's huge dimensions make it impossible for him to cross the ocean, even if we grant that external obstacles are going to be removed. Thus, in this case it is not enough that John believes he can cross the Atlantic, and intends to do so. The conclusion was that the actual physical features of the participants in the events described under VP are also taken into account by the circumstantial modal base. Are there similar situations involving habituality? I believe there are. Consider the following cartoonlike scenario: One of the hobbies of a certain superhero is to cross the Atlantic to keep his shape. However, yesterday night, while he was sleeping, he

lost his superpowers forever, and became a normal human being. He does not know that, so tomorrow morning he will wake up and prepare for his exercise, just like he does every day. Now, sentence (56) below is not judged true, despite the fact that the superhero's dispositions have not changed.

(56) The superhero crosses the Atlantic.

As in the previous case, the relevant circumstances here take into consideration physical facts about the superhero and the ocean, and that is why the sentence is judged false. Thus, we seem to be dealing with the same kind of circumstantial modal base that Portner proposed for the continuous readings of progressive sentences. I will assume that is the case, and propose the (simplified) logical form in (57) for the habitual reading of sentence (54):

(57) [$_{TP}$ Pres$_i$ [$_{AspP}$ Imp-pl [$_{VP-pl}$ pl [$_{VP}$ John play soccer]]]]

The truth-conditions are given below:

(58) $[\![TP]\!]_w = 1$ *iff* for every world w' in BEST(M, O, w, t), there is a plural event e that occurs in w', such that Pres $\supseteq \tau(e)$ & *play_soccer*(e,j).

First, imagine (54) uttered at a time before the campus was closed. The set of worlds yielded by the circumstantial modal base M at that time would look like (59) below:

(59) M(w, t) = {John played soccer with his friends several times recently, John is in good physical conditions, John intends to play soccer again, there is a soccer stadium close to John's house, }

59 contains relevant information about John's physical and mental states at the utterance time, about the existence of a stadium in the neighborhood, and also about past occurrences of John playing soccer. I assume these are the minimal relevant circumstances taken into consideration by the modal base in simple habitual sentences.

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What about the ordering source? The propositions in the set delivered by the ordering source O encode the conditions for a sequence of events of the type described under VP not to be interrupted. In our case we have something along the lines of (60):

(60) $O(w,t) = \{$John does not die tomorrow, John does not get arrested, the stadium does not close, $\}$

The set BEST (M, O, w, t) will then consist of the worlds in $\cap M(w,t)$ which rank best according to $O(w,t)$. (58) requires that there be a plural time interval at which John plays soccer in all these worlds. This plural interval should include the time of utterance. As a result, if John does not happen to be playing soccer right at the utterance time, (58) requires the existence of both past and future singular intervals at which John plays soccer. In our case, since $M(w,t)$ and $O(w,t)$ are consistent, BEST will contain worlds in which John keeps playing soccer. Therefore, the existence of future playing events in these worlds is guaranteed. Imagine, for instance, that John cannot control the movements of his legs anymore due to a tragic car accident, and that (54) was uttered after these facts became known. This crucial aspect of the new scenario has a direct impact on $M(w,t)$:

(61) $M(w, t) = \{$John played soccer with his friends several times recently, John cannot move his legs, there is a stadium close to John's house, $\}$

Given (61), the worlds in BEST are not worlds in which there are future events of John playing soccer. As a consequence, they are not worlds in which there is a plural interval that includes the utterance time at which John plays soccer. (54) is correctly predicted to be false in this case.

As for past events, in the case of (54), it is quite likely that a person uttering that sentence intends to talk about John's routine, and if so it is natural to assume that the modal base contains information about whether or not there were previous playing

events in the world of evaluation. Thus, in the scenario we had sketched above, the worlds in BEST are worlds in which there were events of John playing soccer before the utterance time, and (54) is correctly predicted to be true under those circumstances. Notice that the sentence would be false if John had never played soccer before the utterance time. Since M(w,t) would contain this information, there would never be a plural interval that included the utterance time in the worlds in BEST, at which John played soccer. I believe this is correct. If John had never played soccer before the utterance time, then (54) is unlikely to be judged true.

There are cases, however, that behave differently. In (62), for instance, what is likely to be at stake is not the actual behavior of the machine, but its design features and capabilities.

(62)   This machine crushes oranges.

What (62) means is that the machine, if used appropriately (most likely as specified in the owner's manual or something equivalent), is capable of crushing oranges. My suggestion is that (62) should be treated on a pair with the sentence 'this machine can crush oranges', with the overt modal *can* replaced by a silent modal with the same meaning. Thus, (62), under its most salient reading, does not involve Imp-pl, and is therefore structurally different from the other simple present sentences that we have been discussing in this chapter. Evidence for this claim is that the presence of a singular indefinite does not make the sentence convey the idea of a sequence of events involving the same individual. For instance, if you come to me very proud of your new food processor, and tell me how easily it can peel an orange or an apple, I can reply pointing to my own machine and say:

(63)   Well, this machine peels a pineapple.

This contrasts with the behavior of singular indefinites in cases where a habit is really what is at issue. That was the case with our previous example 'John smokes

cigarettes/# a cigarette', which, as was discussed above, sounds weird when the singular indefinite is used, the reason being that for such a sentence to be true, according to the theory I proposed, the same cigarette has to be smoked again and again.

Notice that if the progressive is used, the ability reading does not seem an option.

(64)   This machine is/has been crushing oranges.

We predict then that in its habitual (that is, non-continuous) reading, the sentence can only be true if a sequence of events of the type described by the sentence is already going on, which means that there must have been past events of the machine crushing oranges. That seems correct, and indeed, that is what we expect, if the logical form of (64) involves Imp-pl. Sentence (64) cannot be used to talk about a brand new machine that has never being put to use. We also predict that the use of a singular indefinite should make the sentence sound weird, conveying that the same orange is crushed multiple times. This prediction is borne out. Sentence (65) below cannot mean what (64) does:

(65)   This machine is/has been crushing an orange.

Finally, and this is a purely speculative remark, simple present sentences used to describe profession-like activities, as in (66) below, also do not require any event of the relevant type to be true:

(66)   John sells vacuum-cleaners.

Under the intended reading, (66) does not differ in meaning from (67), with the derived noun 'seller' being formed by the nominalizer suffix -*er* attaching to the stem *sell-*.

(67)   John is a vacuum-cleaner seller.

Both (66) and (67) are true if John's job contract specifies that he is in charge of selling vacuum-cleaners, even if he has never sold any. It might be the case that English has a zero-affix, which is a verbal counterpart of the nominalizer *-er*, taking eventive predicates as its argument and returning stative, though still verbal, predicates. Of course, to substantiate the proposal, we would have to be precise about the meaning of these stativizer affix, and, ideally, find cross-linguistic evidence that there are overt counterparts of this morpheme. I will not undertake these tasks here.

Summarizing the discussion in this section, habitual readings of imperfective sentences can be analyzed as involving the same kind of modality observed in connection to continuous readings. Since their temporal components are also the same, we arrive at a unified semantics for the aspectual operators involved in imperfective sentences. The origin of the distinction lies elsewhere, in the number of the VP-predicate with which the imperfective operator combines: singular in the case of continuous readings, plural in the case of habitual readings. We discussed English sentences in the progressive and the simple present, but the same is true of the other instances of imperfectives that we mentioned before, such as the past imperfect in Romance.[14]

4.8 Quantification over ongoing events and Double Modality

We have been assuming so far that the imperfective operator takes a set of events as its argument and returns a set of time intervals. We have also assumed that adverbs of quantification such as *always* and *usually* are event determiners that together with their implicit restrictors form generalized quantifiers that quantify over event variables. The same is true of QPs of the form *every time S*, where *S* is a sentential

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[14] With the possible exception of Italian, whose Imperfect has been claimed to lack a modal component. Cf. Giorgi and Pianesi (1998).

constituent. However, there seem to be cases where these event quantifiers scope above the imperfective operator, suggesting that the result of applying this operator to a set of events is, in fact, another set of events, not a set of intervals. The clearest examples involve continuous readings with the progressive, as in the examples below:

(68) a. When I visit Mary, she is always eating an apple.

  b. Every time I visit Mary, she is eating an apple.

In these cases, for every event of me visiting Mary, there must be an ongoing event of her eating an apple. Sets of ongoing events can also restrict the event quantifiers:

(69) a. When Mary is drinking a beer, she is always smoking a cigarette too.

  b. Every time Mary is drinking a beer, she is smoking a cigarette too.

Quantification over intervals is not enough to handle these cases as the following exemple shows:

(70) When Mary is drinking a glass of wine, she holds it with her left hand.

Here, we need quantification over events. A scenario in which Mary is drinking two glasses of wine at the same time, holding one glass with her right hand and the other with her left hand would count as a counter-example to the truth of (70). Moreover, the most natural interpretation for the pronoun in the matrix clause is the definite description 'the glass of wine she (Mary) is drinking, something problematic if the restrictor is a set of intervals, some of them being intervals at which there is more than one glass of wine that Mary drinks.

Are there cases of habituals under the scope of an event quantifier? The sentences in (71) suggest that there are:

(71) a. When John plays golf, he always plays soccer too.

  b. Every time John plays golf, he plays soccer too.

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These sentences are actually ambiguous. First, they can mean that for every event of John playing golf, there is an event of him playing soccer. These are like the sentences discussed in Rothstein (1995), as we saw in chapter 2, in which every event described in the adverbial clause is matched by an event of the type described in the matrix clause. But these sentences can also mean that whenever John is in the habit of playing golf, he is also in the habit of playing soccer. Here, it does not matter if John plays golf daily, but play soccer once a week, for example. [15]

To allow for event quantifiers to scope above the imperfective operator, we need to revise the denotation of Imp, so that after combining with a set of events, it returns another set of events:

(72) $[\![\text{Imp}]\!]^w = \lambda\wp_{\langle s,vt\rangle}. \lambda e.$ for every world w' in BEST(M, O, w, $\tau(e)$), there is an event e', such that $e \leq e'$, and $\wp(w')(e') = 1$.

The adverb of quantification in (69a), for instance, will then quantify over events that in the BEST-worlds ('the inertia worlds') are parts of (complete) events of Mary drinking a beer.[16]

Finally, since neither the imperfective morpheme nor the the event quantifiers discussed above have a time interval argument anymore, we need an operator that 'converts' sets of events into sets of intervals, otherwise the tense morpheme could not 'connect' to the rest of the sentence. To express the fact that the generalizations

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[15] This ambiguity is not the same ambiguity discussed in Bonomi (1997a), who discusses the Italian counterpart of 'When Leo played golf, he won a lot of money', with both verbs in the past imperfect form. As noticed by the author, besides having a reading paraphrasible as 'there was a time t in the past, such that for every every event of John playing golf within t, there is a related event of him winning money', the sentence has also another reading in which the *when*-clause acts as a time frame, and not a restrictor of the adverb of quantification. Thus, if John used to play golf in 1980, the sentence would mean that in 1980, John used to win a lot of money, with no necessary correspondence between particular events of him playing golf and particular events of him wining money. The second reading I detected for (71a) and (71) is different from both readings discussed by Bonomi, and, as far as I can tell, was not addressed by him in his paper.

[16] Since the VP is singular in this case, the part-of relation should be understood here in a way that is parallel to the relation of material part of Link (1983). Thus, the event of Mary drinking the first half of a can of beer is a part of the event of her drinking the whole can of beer.

in (69) and (71) are described as ongoing at the utterance time, I assume that the inclusion relation between intervals is part of the meaning of this operator:

(73) $[\![\supseteq_i]\!] = \lambda \mathbf{P}_{\langle vt \rangle}.\lambda \mathbf{t}.\ \exists \mathbf{e} : \tau(\mathbf{e}) \supseteq \mathbf{t}\ \&\ \mathbf{P}(\mathbf{e}) = \mathbf{1}$

The logical form of the sentences in (69) and (71) will then display the following scopal ordering: $\supseteq_i \succ always/every\ time \succ Imp$

Notice that the events quantified over by the universal quantifiers need not be actual events, as attested by the fact that a sentence like (69a), for example, support counterfactuals as in the following passage: Mary is not drinking beer right now, but if she were, she would be smoking too. I conclude from that that the $\supseteq_i$ is also a modal operator restricted by a circumstantial modal base and a 'normality-based' ordering source. In other words, it is just like IMP, but relating the intension of a set of events and a time interval (the reference time) instead of an event. What (69a) says then is that in every world w in which Mary is just like she is in the actual world and nothing extraordinary happens, there is an event whose time t includes the utterance time, and for every event included in t that becomes an event of Mary drinking a beer in all the worlds in which Mary is just like she is in w and nothing extraordinary happens, there is an event in w that becomes an event of Mary smoking a cigarette in all worlds in which she is just like she is in w.

4.9   Conclusion and Open Issues

This chapter provided a unified semantics for continuous and habitual readings of imperfective sentences. Based on the assumption that there are both atomic and non-atomic events, I argued that the only difference between continuous and habitual readings concerns the number (singular or plural) of the events that are quantified over in the logical form of the sentences. I proposed that the source of imperfectivity is an aspectual operator, which introduces existential quantification over events

and universal quantification over possible worlds. We went through several cases suggesting that both readings involve the same kind of modality, one that involves a circumstantial modal base and an ordering source based on an ideal in which an ongoing event of the kind described by the sentence is not interrupted by external factors, as proposed by Portner (1998) for the English progressive. I argued that the difference between continuous and habitual readings is related to the fact that in the former it is singular events that are not interrupted, whereas in the latter it is plural ones that are not. I looked at different imperfective operators in Romance and English, and concluded we can reduce the difference between them to the number specification restricting the kinds of events they can quantify over, in a way that is very similar to what happens with determiners in the nominal domain.

Before finishing, I will add some remarks about two constructions whose meanings share certain features with the meaning of imperfective sentences, which suggest that there might be a common core underlying them. How to adequately represent these commonalities is a question that I will leave open.

4.9.1 Imperfectivity and *before*-clauses

We have seen how examples such as (74a) and (74b) were used to motivate a modal analysis of the progressive (Dowty 1977; Landman 1992; Portner 1998 among others), one that does not enforce the existence of an event of the type described by the sentences in the actual world, but only in the worlds that share with it the relevant circumstances at the reference time (the time of the when-clauses in (74)), and in which no external obstacle intervenes.

(74)   a. John was crossing the street, when Mary saw him.

b. John was crossing the street, when a bus hit him.

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In the case of (74a), for instance, after the sentence is uttered, we come to know that the circumstances were such at that time when Mary saw John, that, if no external obstacle intervened, John would cross the street. Whether John actually crossed the street or not remains open. (74b) is similar, except that, due to our knowledge that people hit by buses get seriously injured, we are likely to conclude that John did not cross the street. The statement then gets a counterfactual flavor: if the bus had not hit John, he would have crossed the street.

Consider now (75):

(75)   a. John left the party before there was any trouble.

         b. The police defused the bomb before it exploded.

After (75a), we conclude that the circumstances were such at the time when John left the party that, if nothing extraordinary happened, there would be trouble. Whether there was trouble or not remains open. (75b) is similar, except that world knowledge leads to the inference that if the bomb was defused, it did not explode. The statement then gets a counterfactual flavor: if the bomb had not been defused by the police, it would have exploded.

Examples like (75a) and (75b) have been recently used by Beaver and Condoravdi (2003) to motivate a modal analysis of *before*. In fact, their analysis shares several aspects of modal analyses of the progressive, although they did not establish any connection between *Prog* and *before*. Is the parallel between (74a)-(74b) and (75a)-(75b) accidental? It is interesting that both the progressive and *before* are used to locate some event in the **future** of another event: in the case of the progressive, it is the culmination of the event described by the sentence that is put in the future of the 'reference time', and in the case of *before* it is the event in the subordinate clause that is put in the future with respect to the time of the event of the matrix clause. I suspect that we are facing a semantic universal here: every lexical item whose meaning involves futurity, in the sense described above, is a modal operator.

4.9.2 Habituals and *for*-adverbials

The standard characterization of the distribution of *for*-adverbials is that they combine with atelic, but not with telic predicates.

(76) a.   John was sick for two days.

    b.   John slept for two hours.

    c.   * John ate the cake for 40 minutes.

    d.   * John reached the top for 10 minutes.

However, telic predicates are fine under the so-called iterative reading(Dowty 1977; Zucchi and White 2001; van Geehoven 2004):

(77) a. John dialed the number for ten minutes.

    b. John kicked the ball for twenty minutes.

When it comes to their interaction with indefinites, the iterative reading of *for*-adverbials and the habitual readings that we discussed in connection with the simple present behave strikingly similar. When a singular indefinite is used, for instance, a sentence with a *for*-adverbial can only be true if there are multiple events involving the same individual:

(78)   John dialed a local number for ten minutes. (it has to be the same number)

The situation changes when bare plurals are used:

(79)   John dialed local numbers for ten minutes.(he dialed more than one number)

With other plural indefinites the same (plural) individual is involved:

(80) a. John dialed two numbers for ten minutes.   (the same two numbers)

    b. John hit some golf balls for 30 minutes.   (the same balls)

If a universal quantifier intervenes between the indefinite and the adverbial, the requirement that the same individuals be involved disappears, as can be observe in the example below:

(81)   John hit fewer than four balls every 20 minutes for 2 hours.

All this replicates what we saw in this chapter with respect to habitual readings of imperfective sentences.

(82)   a. Mary babysits a boy.   (the same boy multiple times)

       b. Mary babysits three boys.   (the same three boys multiple times)

       c. Mary babysits a boy every night.   (possibly different boys)

Should we conclude that *for*-adverbials in the sentences above and the operator *Imp* that we postulated for English simple present sentences introduce the same kind of quantification over events? Although it is tempting to answer this question positively, things become more complicated once we realize that despite all the similarities shown above, there are crucial differences as well. For instance, an activity predicate in a simple present sentence gives rise to a habitual reading only, and a sentence like (83) is never about a (singular) ongoing event of John jogging, but rather about multiple events of him jogging (plus modality effects, which I am disregarding here).

(83)   John jogs.

But a *for*-adverbial can combine with an activity predicate and measures a singular event. In other words, what is being measured in (84) below is the duration of a singular event of John jogging. There is no requirement of there be multiple jogging events, contrary to what happened in (83):

(84)   John jogged for two hours.

Of course, iterative readings are also possible with this kind of predicate, but the relevant point here is that they are not forced by the presence of the adverbial, as it

is in the presence of the morpheme Imp, which we assumed is part of the logical form of a sentence like (83).

Another point that is worth mentioning is the fact that singular indefinites within stative predicates under the scope of a *for*-adverb do not necessarily convey that the same individual is being referred to throughout the interval measured by the adverbial phrase:

(85) John owned a car for five years.

This sentence would be true if John changed his car every year, but never being without one during the whole five-year period. The same can be said of plural indefinites. Thus, for (86) to be true, John does not have to have owned the same three cars for five years.

(86) John owned three cars for five years.

Examples (85) and (86) contrast then with the examples in (80) and also (82a) and (82b). Why this is so remains an open issue, whose investigation will certainly require a better understanding of how telicity, event plurality and quantification interact.[17]

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[17] For discussions of telicity in event-based frameworks, see Krifka 1998; Rothstein 2004; Schein 2002.