ANDREA BONOMI

ASPECT, QUANTIFICATION AND WHEN-CLAUSES IN ITALIAN[1]

> When you hear music, after it's over, it's gone in the air.
> You can never capture it again. (E. Dolphy)

0. INTRODUCTION

In languages such as Italian, whose aspectual system is fairly rich, aspect has a variety of functions. One of these, which has been addressed from different points of view, is to determine suitable temporal relations between the eventualities[2] described by a sentence or a sequence of sentences. But little attention has been paid, in formal semantics, to another important function of aspect, that is its role in determining the appropriate type of quantification over eventualities. In the tradition of tense logic and event-based semantics a very common assumption is that, in the absence of explicit adverbs of quantification, the logical form of a sentence is characterised by an existential quantification. For example, a sentence such as *Fred buttered the toast at midnight* is associated with a paraphrase which is approximately of the form *There is an event e such that e is an event of Fred's buttering the toast and e occurred at midnight.*

Since classical theories of events, as Davidson's, are not concerned with aspect, one of the main purposes of this paper is to show its role in determining different types of quantification over events. I will dwell, in particular, upon the distinction between perfective and imperfective in Italian and its relevance not only to the "quality" of the events described by a sentence or a sequence of sentences, insofar as this qualitative characterisation is expressed in terms of temporal properties and relations, but also to their "quantity". With respect to previous treatments, the analysis

2 I use this term (or the term *circumstance*) in the sense of Bach (1981), to denote a general category that includes states and events (stricto sensu). As we shall see, time intervals are just a subclass of this class of entities.

I propose presents two major novelties: (i) different aspectual forms are explicitly connected with different types of quantification over circumstances; (ii) these quantificational properties of aspectual forms can also help to explain the nature of temporal relations between circumstances. Therefore, an essential feature of this approach is a *unified* account of two features of aspect which are often considered separately. In particular, the type of quantificational structure associated with the imperfective provides a simple explanation for an important phenomenon which has no principled justification in other theoretical frameworks, i.e. the exis tence of two possible interpretations of this aspectual form: the habitual reading and the progressive reading.

The paper is organised as follows. In the next section I discuss some crucial examples in which all the possible combinations of the perfective and imperfective forms in a when-structure are considered. More exactly, we shall see how the imperfective form is associated with its two possible interpretations. In Section 2 the habitual reading is analysed in terms of a universal (or "generic") quantifier introduced as a default operator by the imperfective. Section 3 contains the outline of a formal treatment which allows for a compositional account of this reading. In Section 4 the restrictive use of when-clauses is contrasted with their use as "background" clauses that specify a temporal frame. On the basis of this distinction it is possible to explain an interesting phenomenon of ambiguity associated with when-constructions. In Section 5 I propose a *unifying principle* which traces back both readings of the imperfective, i.e. the habitual interpretation and the progressive one, to the same logical form. Another interesting case of ambiguity, predicted by this principle, is considered. In Section 6 I present an analysis of the effects determined by a change in the order of main clause and when-clause, whilst in the last two sections of the paper I take into consideration the constraints that different kinds of eventualities impose on quantificational structures.

1. TYPES OF WHEN-STRUCTURES

The expressive capacity of aspect in Italian is witnessed by the different meanings characterising the possible combinations of the perfective and imperfective aspects in a when-construction:

(1)   Quando alloggiò al Grand Hotel di Cabourg Proust aveva al proprio servizio una segretaria privata.
When Proust lodge (past, perf.) at the Grand Hotel of Cabourg, he have (past, imp.) a private secretary assisting him.

(2)   Quando alloggiava al Grand Hotel di Cabourg Proust ebbe al
        proprio servizio una segretaria privata.
        When Proust lodge (past, imp.) at the Grand Hotel of Cabourg,
        he have (past, perf.) a private secretary assisting him.

(3)   Quando alloggiò al Grand Hotel di Cabourg Proust ebbe al
        proprio servizio una segretaria privata.
        When Proust lodge (past, perf.) at the Grand Hotel of Cabourg,
        he have (past, perf.) a private secretary assisting him.

(4)   Quando alloggiava al Grand Hotel di Cabourg Proust aveva al
        proprio servizio una segretaria privata.
        When(ever) Proust lodge (past, imp.) at the Grand Hotel of
        Cabourg, he have (past, imp.) a private secretary assisting him.

All these sentences are in the past tense, and what changes, from one
example to another, is only the distribution of the aspectual values. But
this variation has important consequences at the level of truth-conditions.
First of all, there is each time a different characterisation of the temporal
relations between the event described by the when-clause and the one
referred to by the main clause. (1) says that there is a (past) event of
Proust's lodging at the Grand Hotel which is temporally *included* in a
(past) event of Proust's having a private secretary assisting him. In (2) the
same events are said to be in the reverse relation, whilst (3) states that
they are temporally "coinciding", in a very broad sense. When passing to
the last example, where the subordinate clause and the main clause are
both in the imperfective, one comes to the second issue mentioned above,
because, unlike the other sentences, (4) has a reading[3] which *cannot* be
paraphrased in terms of an existential quantification over events and/or
times. What it means is that, *every* time Proust lodged at the Grand Hotel,
he was assisted by a private secretary. So, using the symbol '$\subseteq$' to express
the temporal inclusion between events, '$\supseteq$' for the reverse relation and
'$><$' for temporal coincidence[4] and assuming that E_1 and E_2 are the

---

[3] This sentence allows for another reading according to which the when-clause is not the
restrictor of an adverb of quantification but is simply a "background" time adverbial. See
Section 4 for a proper treatment of such cases.

[4] I have already specified that this notion is to be taken in a very broad sense (as, for
instance, in Ritchie (1979)). According to Sandström (1993), more appropriate relations
(like, in particular, the PART-OF relation and the consequentiality relation) are required
to account for the exact meaning of when-clauses in different situations, according to the
context of discourse, the actional properties of the verbs, and so on. I will not address this
problem in the present paper, because my main purpose is to analyse the role of the
perfective/imperfective distinction in determining different logical forms. This grammatical
distinction is responsible for the relation of temporal inclusion in (A) and (B) of schema (5)

events denoted by the when-clause and the main clause respectively, the above examples are a good illustration of the following general paradigm:

(5)	When-clause	Main clause	Temp. relat. between E_1 and E_2
(A)	Perf.	Imp.	$\subseteq$ (once)
(B)	Imp.	Perf.	$\supseteq$ (once)
(C)	Perf.	Perf.	$><$ (once)
(D)	Imp.	Imp.	$><$ (whenever . . .)

As I said at the outset, part of the above reconstruction is accounted for in formal treatments of tense and aspect in Romance languages. In particular, in their analysis in the framework of the Discourse Representation Theory (DRT), Kamp and Rohrer (1983) focus on the perfective/imperfective distinction as illustrated by the opposition, in French, between Passé simple and Imparfait, and show its relevance to the determination of the temporal relationship[5] between the events at issue. The Imparfait is considered only in its "progressive" reading. As for when-clauses, they discuss the following example (which is slightly simplified here):

(6)   Quand Alain vit sa femme
        When Alain see (past, perf.) his wife
   a.   elle lui souriait.
        she smile (past, imp.) at him.
   b.   elle lui sourit.
        she smile (past, perf.) at him.

They remark that, if the when-clause is followed by (a), the event it describes is temporally included in the event denoted by the main clause, whilst this is not true of (b): "when an Imp [Imparfait] sentence follows a sentence in the Passé Simple the new state is typically interpreted as *surrounding* the last mentioned event, whereas when the second sentence is in the PS [Passé Simple], the new event is interpreted as following the old event, or alternatively as included within it" (p. 62).

To account for these phenomena, Kamp and Rohrer resort to the aspectual feature PROG, which "serves to mark the contrast between punctual and durative; for it will be this feature that decides whether the sentence is to be interpreted as introducing an event or state" (p. 67).

(where the aspectual values of the two clauses do not coincide), whilst the exact type of temporal relation required by (C) and (D) depends on extragrammatical factors that I cannot discuss here.

[5] For a general discussion on this topic in the framework of DRT see Hinrichs (1986), Smith (1991) and Kamp and Reyle (1993).

The PS is characterised by the value −PROG, the Imp by +PROG and these two different aspectual values trigger the application of distinct tense rules in the construction of the DR-structure. If +PROG is present, the eventuality introduced by the sentence which is being processed is a state (i.e. a durative eventuality), whilst in the case of −PROG what is introduced is an event (i.e. a punctual eventuality). According to Kamp and Rohrer, such a characterisation of these types of eventualities explains the nature of the temporal relations mentioned above: a state must temporally include an event.

But there is an important point in (5) which is not accounted for in Kamp and Rohrer's treatment of the perfective/imperfective contrast and other related treatments. In the case illustrated in (D), sentence (4) has a reading (the so-called habitual interpretation of the imperfective) which cannot be justified by the attribution to the Italian Imperfetto (or to the French Imparfait, for that matter) of the aspectual value +PROG. On this interpretation, (4) means that, *every* time that Proust lodged at the Grand Hotel, he had a private secretary assisting him. It is obvious that the imperfective does not have a progressive meaning here, but is used to express a regular connection between two types of events. To explain this habitual reading of (4), one might add another aspectual feature, say HAB, so that, besides the form of Imperfetto that we have discussed so far, there would be another characterised by the aspectual value +HAB. But this solution would be totally ad hoc, because the reason why an imperfective form (and in particular the Imperfetto tense) can have *both* the progressive reading and the habitual one would sound mysterious. This double role of the imperfective in Italian is no accident, for the same phenomenon can be observed in languages with different aspectual systems (as documented in Comrie (1976), p. 26). So, there must be some deep connection between the two readings at issue, and an adequate theory of the imperfective must account for it.

Our strategy will be the following. First of all we shall address the problem raised by the habitual interpretation of the imperfective in when-constructions such as (4). The next step will be to extend the analysis suggested for these constructions to the sentences in which the imperfective has a progressive reading.

2. Aspect and Quantification

Let us call *bare when-constructions* sentences like those illustrated in (3) and (4), where no explicit adverb of quantification (as *sempre* [*always*], *a volte* [*sometimes*], and so on) relates the subordinate clause and the main

clause, and both clauses have the same aspectual value. The contrast
between the two types of sentences which can be individuated within this
class of constructions is even more dramatic, with respect to the original
examples, if we consider sentences with other actional characteristics. In
particular, we shall refer to these paradigmatic examples:

(7)   Quando mi vedeva, il custode apriva la porta.
        Whenever the janitor saw me, he opened the door.

(8)   Quando mi vide, il custode aprì la porta.
        (*In a particular circumstance*) *when the janitor saw me, he op-
        ened the door.*

The Italian sentences (7) and (8) differ only in their aspectual value (which
is the imperfective in the former case and the perfective in the latter).
However, their meanings are completely distinct, for (7) can be para-
phrased in terms of universal quantification and (8) in terms of existential
quantification.

The same also applies to French, where there is a sharp opposition
between the "universal" interpretation of an imperfective when-construc-
tion, illustrated by the following example:

(9)   Quand le moment de son passage me semblait proche, je re-
        montais d'un air distrait.
        *Whenever the moment of her appearance seemed near, I went
        up with an air of indifference* (Proust, *Guermantes*).

and the "existential" meaning of a perfective when-construction:

(10)   Quand il tourna la tête, je vis que je m'étais trompé.
        (*In a particular circumstance*) *when he turned his head, I real-
        ized my mistake* (Proust, *Guermantes*).

To account for a similar (although implicit) distinction in English without
assuming an implausible lexical ambiguity of the connective *when*,[6] Partee
(1984) suggests that the main clause, in a sentence of the type instantiated

---

[6] This alleged ambiguity could not explain the cases in which the contrast between universal
and existential interpretation is quite evident although no temporal connective is present.
Compare:

> Leo parcheggiava la sua auto dove Lia parcheggiava la sua bici
> Leo park (past, imp.) his car where Lia park (past, imp.) her bike = Univ.
> reading
> Leo parcheggiò la sua auto dove Lia parcheggiò la sua bici
> Leo park (past, perf.) his car where Lia park (past, perf.) her bike = Exist.
> reading.

here by (7), contains an implicit "modalization" (p. 269). One of the reasons why Partee assumes the existence of this modalization in the English counterpart of (7) is that 'a main clause alone can have a similarly generic or habitual reading' (p. 269). Yet, if we consider the main clause of (7), that is

(11)   ?Il custode apriva la porta,
        The janitor open (past, imp.) the door,

we must admit that it does not suggest, by itself, such a reading. On the contrary, it sounds very strange if uttered "out of the blue", i.e. in isolation. The "modalization" suggested by Partee requires a more precise reference to aspect. In English, where the perfective/imperfective distinction is neutralised in the simple past, the modalization can appear to be "implicit". But in Italian (where this distinction has an overt grammatical counterpart) the role of *aspect* is quite evident: it is in this direction that the origin of the "universal" interpretation is to be searched for. Thus, instead of basing this interpretation, in the case of (7), on the habitual reading of the main clause, I will go the other way around. The habitual reading will be accounted for in terms of a universally quantified logical form associated with the imperfective form of the when-constructions. Subsequently, this kind of analysis will be extended to the progressive reading.

Let us see how the contrast, in meaning, between (7) and (8), is based on a systematic connection between aspectual[7] categories and quantificational structures. The idea is that, in a sentence such as (7) the universal interpretation is determined by the presence of a phonetically empty quantifier whose syntactic manifestation is the imperfective morphology in the main verb of the matrix and in the main verb (if any) of the subordinate clause. The uniformity of aspectual morphology in the two clauses is the syntactic mark that these clauses are the semantic arguments of an invisible operator. This is tantamount to saying that the imperfective morpheme does not have an independent meaning, but is imposed by an *agreement condition*. In fact, a subordinate clause which has no verbs (and, as a consequence, no aspectual morphology), can have the same role that an imperfective when-clause has in a given context, i.e. to restrict the quantifier at issue. For example:

---

[7] And actional categories as well. Tense, aspect and actionality (Aktionsart) are deeply connected in Italian, as shown in Castelnovo (1992). See Bertinetto (1986) for a presentation of the aspect/actionality system in Italian. Notice that the perfective *aspect* must be carefully distinguished from the perfect *tenses*. See Comrie (1976: 12) about the "unfortunate" tendency to use the term *perfective* for what should be termed *perfect*.

(12)   Alle sette il custode apriva la porta.
        At seven o'clock the janitor open (past, imp.) the door.

expresses the same habitual meaning expressed by:

(13)   Quando erano le sette il custode apriva la porta.
        When it be (past, imp.) seven o'clock, the janitor open (past,
        imp.) the door.

even though no imperfective morpheme is present in the subordinate
clause in (12). This fact suggests that in (13) such a morpheme is not
semantically autonomous, but satisfies an agreement condition imposed
by an invisible operator. And an important consequence of this approach
is that if the subordinate clause and the main clause do not have a uniform
imperfective morphology, they *cannot* be, respectively, the restrictor and
the matrix of the phonetically empty operator we are considering. This
prediction is confirmed by sentences such as:

(14)   Quando entrai in aula, Leo fumava.
        When I go (past, perf.) into the room, Leo smoke (past, imp.).

which cannot mean that every time I went into the room, Leo smoked.
Example (14) has only a progressive meaning which will be analysed in
Section 5 and which is based on the idea that the when-clause is not in
the scope of the default operator associated with the imperfective.

To sum up, my claim is that a bare when-construction has a tripartite
logical form with a (possibly null) restrictive when-clause that must agree
in aspectual value with the main clause. In the next section we will see
how this proposal can be framed in a suitable formalism.

3. A Theoretical Model

One of the most fruitful ideas we have inherited from Frege's logic and
philosophy of language concerns quantification phenomena. In his theory,
quantification can be reconstructed, in general, as a second order relation:
i.e. a relation between "concepts" or, in extensional terms, between sets.
For example, two sentences as:

(15)   Every computer is off.
(16)   Some computer is off.

are associated with the same type of logical form, respectively:

(15') REL_{EVERY} ([x is a computer]$_R$, [x is off]$_M$).
(16') REL_{SOME} ([x is a computer]$_R$, [x is off]$_M$).

What changes is only the intended relation. The general form is the following:

(17) $REL_{QUANT}([\quad]_R, [\quad]_M)$.

In this schema, 'REL_{QUANT}' stands for the relation at issue; '$[\quad]_R$' (the *restrictive* clause) specifies the property that identifies a set of objects; finally, '$[\quad]_M$' (the *main* clause or matrix) specifies the property that is attributed to these objects.

A natural extension of this view takes into account contextual reference, which restricts the import of quantification to a subpart of the given universe. In the case of (15) it is obvious that the statement is not about all the computers in the world; more reasonably, it may refer to the computers installed in our office. Sometimes this contextual *background* is explicit, as, for example, in:

(18)   In the office, every computer is off.

In any case, though implicit, the reference to the intended background (which can be suggested by the context) plays an essential role in the dynamics of quantification. If this role is accounted for in a logical form such as (17), the resulting structure is something like this:

(19) $[\quad]_B: REL_{QUANT}([\quad]_R, [\quad]_M)$.

In this new structure, '$[\quad]_B$' (the background-clause) introduces a reference to the relevant segment of the universe, in which the other two concepts or sets must be individuated. (To go back to our example, the effect is that the discourse is restricted to the individuals in the office. In the formalism, this effect can be rendered in various ways.[8]) To sum up, the three major elements of a quantification structure coincide, respectively, with the background-clause, the restrictive clause and the main clause.

Within such a theoretical framework, the idea that the quantificational relation between the restrictor and the matrix can be expressed by temporal adverbs such as *always*, *sometimes*, etc., is suggested by Russell (1905), where sentences like *All men are mortal* are said to mean '*If x is human, x is mortal*' is always true. More recently, when-clauses have been explicitly treated as restrictive clauses within the scope of these adverbs of quantification by Lewis (1975), whilst the logical properties of the connective

---

[8] The context which restricts the domain of quantification is a subset of the universe in Westerståhl (1985) and a submodel (in a particular sense of the word) in Bonomi (1992).

when have been studied in connection with its temporal and "atemporal"[9] uses. To my knowledge, little attention[10] has been paid in this framework to the role of aspect in selecting the intended quantificational structures, even though, as we have just seen, such a role is quite evident in a number of natural languages. In the rest of the paper, I will concentrate on the aspectual opposition between perfective and imperfective.

As I have already emphasised with respect to our two paradigmatic examples, repeated here:

(7)   Quando mi vedeva, il custode apriva la porta.
        Whenever the janitor saw me, he opened the door.
(8)   Quando mi vide, il custode aprì la porta.
        (*In a particular circumstance*) *when the janitor saw me, he opened the door.*

Two points are noteworthy: (i) the *only* difference between (7) and (8) has to do with aspect; (ii) nonetheless their meanings are completely distinct. To account for this twofold observation it can be said that *both* sentences have the same type of logical form, that is (17). What changes is only the quantificational relation, which is represented, respectively, by REL$_{EVERY}$ and REL$_{SOME}$. In our examples the subordinate clause and the main clause agree in aspectual value, which is the imperfective in (7) and the perfective in (8), and this fact can be seen as the syntactic manifestation of a default operator which relates the two clauses.

The reference to a structure such as (17) allows us to say that the temporal connective *quando* splits a sentence into a restrictive clause and a main clause. More exactly, we would like to associate with (7) and (8) logical forms[11] of this kind:

(7') $\forall e([\text{Cont}(e) \wedge \text{the-janitor-see-me}(e)]_R \rightarrow$
        $[\exists e'(\text{the-janitor-open-the-door}(e') \wedge ><(e, e'))]_M)$.
(8') $\exists e([\text{Cont}(e) \wedge \text{the-janitor-see-me}(e)]_R \wedge$
        $[\exists e'(\text{the-janitor-open-the door}(e') \wedge ><(e, e'))]_M)$.

---

[9] Different analyses of the "atemporal" use of when-clauses are proposed by Carlson (1979), Farkas and Sugioka (1983) and Declerck (1988). I will not address this issue here. Both uses are discussed in Bennett and Partee (1978), Stump (1985), Rooth (1985) and de Swart (1991).

[10] de Swart (1991) is an exception, because she discusses many examples in which the perfective form and the imperfective one show quite distinct behaviours with respect to adverbs of quantification in French. Yet, the difference in quantificational properties between "bare" imperfective when-constructions such as (7) and "bare" perfective when-constructions such as (8), which is the main topic of the present paper, is not taken into consideration in her dissertation.

[11] Ignoring for the moment the *past* tense.

Here 'the-janitor-see-me(e)' is an abbreviation for 'see(e) $\wedge$ Agent$(e,$ the janitor$)$ $\wedge$ Patient(e, I)'[12] and 'Cont(e)' denotes the property of contextual relevance. So, (7') means that every contextually relevant event of the janitor's seeing me temporally coincides with an event of the janitor's opening the door.

An alternative solution would be to adopt Carlson's "generic" dyadic operator GEN[13] instead of the universal quantifier. The advantage would be that, since a sentence such as (7) can be true even if there are (exceptional) cases in which the janitor does not open the door when he sees me, the generic quantifier, which allows for exceptions, does not require the restriction to the "relevant" circumstances in order to neutralise the possible counterexamples. Yet, the semantics of GEN is still an open problem and is often associated with properties which make the use of this quantifier problematic in the case of the habitual reading of the imperfective in Italian. For example, GEN is considered appropriate to express "principled" generalisations over entities of a class, not mere "accidental" facts about them.[14] But this requirement would not be satisfied by many imperfective when-constructions of Italian, which simply refer to contingent or even fortuitous series of events. Furthermore, it has often been noticed[15] that the generic operator cannot be contextually restricted. But this property would clash, once more, with imperfective sentences of Italian (as, for instance, (7)), where a restriction to an intended interval of time is not only possible but also necessary. The most natural interpretation of (7) is not that whenever, in the past, the janitor saw me, he opened the door, but that there is a past period of time, possibly made *salient* by the context, in which whenever the janitor saw me, he opened the door.

On the other hand, in natural languages universal quantification as such can allow for exceptions, as witnessed by sentences such as *Every day Kant went out for a walk* or *Leo always smoked*, that can be true although there surely were situations in which Kant did not go out for a walk or Leo did not smoke. In other words, universal quantification is compatible with an implicit restriction to the relevant situations, or even presupposes it. For these reasons, to build up the logical forms of sentences like (7) I shall adopt the more familiar solution, based on universal quantification (restricted to relevant circumstances), although the analysis I propose is

---

[12] That is, e is an event of seeing whose agent is the janitor and the patient is the speaker. See Link (1987), Krifka (1989), Bonomi and Casalegno (1993) for these notions of event semantics.

[13] See Krifka et al. (1995) for a general discussion on this topic.

[14] Ibid., p. 44.

[15] Ibid., p. 45.

independent of this choice and is consistent with most interpretations of the generic operator. (To leave this option open, I will often speak of universal or generic quantification.)

Let us see how logical forms such as (7')–(8') can be obtained in a compositional way. In what follows I shall try to keep the formalism as simple as possible. Since the semantics of time adverbials in general is not the topic of the paper, I shall ignore some well-known problems (as for instance the possibility of having several time adverbials in the same sentence) whose treatment would entail a more elaborate framework. The domain of entities is made up of individuals, eventualities (or circumstances) and intervals. The set I of intervals is a subset of the set E of eventualities, in the sense that intervals are "empty" eventualities: i.e. they can be seen as segments on the time axis characterised only by some extension. I will use $e, e', e'', \ldots$ as variables ranging over the whole set E of eventualities, whilst $i, i', i'', \ldots$ range over the set I of intervals. The predicates A, B, C, $\ldots$ will stand for sets of eventualities in general. As we have just seen, the way (untensed) atomic propositions are translated into the language of event semantics is the usual one. For example, 'Leo run' is translated into '$\lambda e[\text{Run}(e) \wedge \text{Agent}(e, \text{Leo})]$' or (in a shortened form) '$\lambda e[\text{Leo-run}(e)]$'. In general, let us call expressions such as $\lambda e\phi$ (where ϕ is a formula) *E-abstracts*. Among them we have the abstract '$\lambda e[\text{Cont}(e)]$' which denotes the (phonetically empty) predicate of being contextually relevant. To shorten our formulae, this predicate will be left implicit, unless the discussion concerns its specific role in determining the appropriate truth-conditions. A particular subclass of E-abstracts is represented by *I-abstracts* (or temporal abstracts), i.e. expressions such as $\lambda i\phi$, which are equivalent to $\lambda e[\text{I}(e) \wedge \phi]$. As specified above, the symbol '$\subseteq$' expresses the temporal inclusion between events, '$\supseteq$' the reverse relation and '$><$' temporal coincidence (in the broad sense discussed in footnote 4). In the case of two intervals i and i', '$><(i, i')$' is equivalent to '$=(i, i')$'.[16]

As we have already seen, our starting point is the idea that, in the case of bare when-constructions, when-clauses (like if-clauses in Heim (1982)) have an invariable semantic role, i.e. the role of restricting an "invisible" quantifier. In languages such as Italian the nature of this quantifier is syntactically marked by a particular aspectual feature: perfectivity is associated with existential quantification (as a default value), imperfectivity

---

[16] As specified in fn. 4, this stipulation does not do justice to the variety of temporal relations associated with when-constructions. The only reason why it is adopted here is that it allows for a considerable simplification of logical forms.

with universal (or generic) quantification. This association of aspectual features with invisible *dyadic* operators having a restrictor and a matrix as semantic arguments has a morphological realisation in the fact that the main verbs of both clauses share the same aspectual morpheme.[17]

Unfortunately, temporal connectives as *when, after, before,* etc. are not so easy to deal with in a strictly compositional framework. In contrast with connectives like *if,* they convey *temporal information,*[18] and since they combine with the subordinate clause, a natural move would be to include in the semantic counterpart of this clause, i.e. in the restrictor, the relevant temporal information. This strategy is adopted, for instance, in Stump (1985), where a sentence such as:

(20)   When he finished his work, Leo always lighted a cigar.

has a logical form which can be roughly paraphrased as follows:

(20′)   Every (past) time interval that coincides with an interval at which Leo finishes his work is an interval at which Leo lights a cigar.

But if there is no problem with the connective *when* (interpreted as expressing temporal coincidence), this strategy does not work with other connectives, e.g. *after.* In fact, the intended meaning of:

(21)   After finishing his work, Leo always lighted a cigar.

is not captured by a logical form whose paraphrase is:

(21′)   Every (past) time interval that follows an interval at which Leo finishes his work is an interval at which Leo lights a cigar.

i.e. a paraphrase which describes Leo as a perpetual smoker. The meaning of a sentence like (21) is better rendered by the following paraphrase:

(21″)   Every (past) time interval at which Leo finishes his work is an interval which is followed by an interval at which Leo lights a cigar.

where the temporal information provided by the connective is incorporated into the matrix (not into the restrictor), exactly as in our paradigmatic logical form (7′).

---

[17] See Chierchia (1995) for a characterisation of the habitual morpheme as carrying an agreement feature [+Q] that induces the presence of the generic quantifier in its checking domain.

[18] See de Swart (1991) for an extensive discussion of this problem.

So, our problem is to find a compositional strategy to obtain, in correspondence with sentences such as (7) and (8), logical forms like those illustrated respectively in (7') and (8'), where the temporal information is shifted from the restrictive to the matrix.

A first possibility is to conceive of an adverb of quantification in a sentence like (21) as a *triadic* operator, where the extra argument contains the temporal information provided by the temporal connective. For example, if we identify the meaning of *when* with temporal coincidence (expressed by the symbol '$><$'), we might have rules of the following type:

(22)   ALWAYS(WHEN, A, B) $= \forall e[A(e) \rightarrow \exists e'(B(e') \wedge ><(e, e')]$.

Bare when-constructions might be treated along these lines, by supposing (as we do) that the imperfective morpheme is the syntactic mark of the presence of an invisible operator assimilable to *always*.

In what follows I will adopt an alternative formal framework, which seems to be more satisfactory from the point of view of compositionality. With respect to other treatments of adverbs of quantification, this choice entails some complications which are justified by the peculiarity of temporal connectives.

The first step will be to explain how *quando* combines with the two clauses in its domain to produce a particular relational structure. In the second place, we will concentrate on the aspectual operator, seen as function which maps this relational structure into the quantificational structure we aim at. The semantic counterpart of *quando* is here the function **when**, whose arguments are two sets of circumstances A and B and whose value is a relation that associates any circumstance e in A with the set C of circumstances in B that temporally coincide with e.[19] That is:

(23)   **when**(A, B) $= \lambda e \lambda C[A(e) \wedge \forall e'[C(e') \leftrightarrow B(e') \wedge ><(e, e')]]$.

The same can be done in the case of *dopo* (*after*), *prima* (*before*), and so on, by changing the intended temporal relationship. To go back to our example, we have:

(24)   **when**(λe[the-janitor-see-me(e)], λe[the-janitor-open-the-door(e)]) $= \lambda e \lambda C$[the-janitor-see-me(e) $\wedge \forall e'[C(e') \leftrightarrow$ the-janitor-open-the-door(e') $\wedge ><(e, e')]]$.

Let us call *when-abstracts* this kind of formulae (in particular, the term

---

[19] This idea was suggested by P. Casalegno.

temporal when-abstract will denote a subclass of such formulae, where the variable bound by the lambda operator ranges over intervals).

We have seen that in bare when-constructions the presence of the same imperfective (or perfective) morphology *both* in the main clause and in the subordinate clause (if any) marks the existence of phonetically unrealised operators. Let PF and IPF be these operators, whose role is to map the above when-abstracts into temporal abstracts describing an interval in which *some* (or *every*) event e of a certain type is in a particular temporal relation with an event e' of another type. This result is achieved by means of the following rules:

(25) $PF(\lambda e \lambda C \phi) = \lambda i \exists e[\subseteq(e, i) \wedge \exists C[\phi(e, C) \wedge C \neq \emptyset]].$

(26) $IPF(\lambda e \lambda C \phi) = \lambda i \forall e[\subseteq(e, i) \wedge Cont(e) \wedge \exists C[\phi(e, C)] \rightarrow \exists C[\phi(e, C) \wedge C \neq \emptyset]].$

In our example:

$PF(\lambda e \lambda C[\text{the-janitor-see-me}(e) \wedge \forall e'[C(e') \leftrightarrow \text{the-janitor-open-the-door}(e') \wedge ><(e, e')]]) - \lambda i \exists e[\subseteq(e, i) \wedge \exists C[\text{the-janitor-see-me}(e) \wedge \forall e'[C(e') \leftrightarrow \text{the-janitor-open-the-door}(e') \wedge ><(e, e')] \wedge C \neq \emptyset]].$

the last formula is equivalent to:

$\lambda i \exists e[\subseteq(e, i) \wedge \text{the-janitor-see-me}(e) \wedge \exists e'[\text{the-janitor-open-the-door}(e') \wedge ><(e, e')]].$

In the case of the imperfective we have:

$IPF(\lambda e \lambda C[\text{the-janitor-see-me}(e) \wedge \forall e'[C(e') \leftrightarrow \text{the-janitor-open-the-door}(e') \wedge ><(e, e')]]) = \lambda i \forall e[\subseteq(e, i) \wedge Cont(e) \wedge \exists C[\text{the-janitor-see-me}(e) \wedge \forall e'[C(e') \leftrightarrow \text{the-janitor-open-the-door}(e') \wedge ><(e, e')]] \rightarrow \exists C[\text{the-janitor-see-me}(e) \wedge \forall e'[C(e') \leftrightarrow \text{the-janitor-open-the-door}(e') \wedge ><(e, e')] \wedge C \neq \emptyset]].$

but this formula is equivalent[20] to the following one:

---

[20] This is so because for every circumstance e there always exists a set of circumstances of type B which are temporally coinciding with e (in the worst case, it is the empty set). So the formulae $A(e)$ and $\exists C[A(e) \wedge \forall e'[C(e') \leftrightarrow B(e') \wedge ><(e, e')]]$ are equivalent. Notice that the introduction of set C is a necessary step, from a compositional point of view, to obtain *two* different logical forms (for the perfective and the imperfective, respectively) from a *single* when-abstract

From now on, the result of the application of the operators IPF and PF will be directly identified with the reduced formulae.

$\lambda i \forall e[\subseteq(e, i) \wedge \text{Cont}(e) \wedge \text{the-janitor-see-me}(e) \rightarrow \exists e'[\text{the-janitor-open-the-door}(e') \wedge ><(e, e')]]$.

From this formula it is possible to obtain the logical form we aim at (i.e. (7′), with the addition of the appropriate temporal information) by applying a tense rule which is responsible for the existential closure of the formula and the temporal location of the circumstances in the past, present or future. The resulting formula would be the following:

$\exists i[<(i, \text{now}) \wedge \forall e[\subseteq(e, i) \wedge \text{Cont}(e) \wedge \text{the-janitor-see-me}(e) \rightarrow \exists e'[\text{the-janitor-open-the-door}(e') \wedge ><(e, e')]]]$.

The syntactic analysis presupposed by the whole derivation can be summarised as follows:
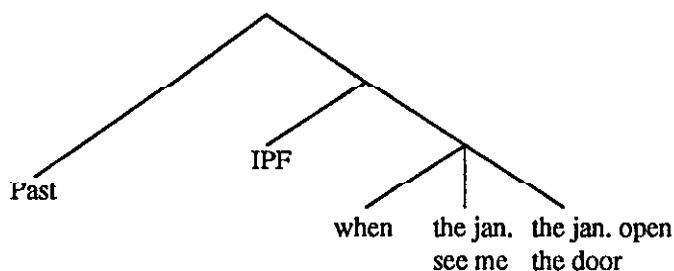
4. RESTRICTIVE AND BACKGROUND CLAUSES

Actually, because of the issues raised by the temporal location of eventualities, the tense rules we need are a little different from the one we have just suggested. From this point of view, a qualification about the role of the connective *when* is in order.

In the formal framework adopted here *when* is treated as a binary operator which introduces a temporal relationship between two sets of eventualities or time intervals. But in many cases this kind of temporal information is only implicit and *when* must be assumed as a default connective. Take for instance the sentence:

(27)   Al Country Club, Leo giocava a golf.
        At the Country Club, Leo used to play golf.

At the surface level, no temporal connective is present, but it is quite

clear that the full meaning of (27) is expressed by a logical form in which the events of being at the Country Club are temporally related with the events of playing golf, i.e. by a logical form corresponding to a sentence such as:

(28)   Quando si trovava al Country Club, Leo giocava a golf.
        When he was at the Country Club, Leo used to play golf.

where the temporal information at issue is explicitly expressed. So, in the case of (27) we must assume the existence of an *implicit* when-operator which specifies the temporal relationship between the circumstances described by the restrictor and those described by the matrix.

Notice that the entire when-clause is often left implicit. This is the case of "bare" habituals such as

(28)a.   Leo giocava a golf.
          Leo used to play golf.

which can have the meaning expressed by sentence (28) in some particular situations (if, for instance, it is clear from the discourse that we are speaking of the Country Club), or a more generic meaning, if the role of the implicit restrictor is only to circumscribe the set of relevant circumstances or intervals. I shall propose a formal treatment of these sentences when discussing example (32) below.

In other cases, an implicit when-operator is necessary to account for the temporal information provided not by the restrictor of a quantifier, but by a "frame" adverbial, as witnessed by the following sentence:

(29)   A Roma, Leo studiava teologia.
        In Rome, Leo studied theology.

whose natural interpretation is not that whenever Leo lived in Rome he studied theology, but is expressed by a logical form corresponding to a sentence such as:

(30)   Quando viveva a Roma, Leo studiava teologia.
        When he lived in Rome, Leo studied theology = In the period in which he lived . . .

These considerations draw attention to the existence of implicit temporal relations which must be accounted for in our semantic representations. In the framework under discussion, a natural way of achieving this result is to use the semantic operator 'when' as a (possibly null) operator that makes these relations explicit. This is why it will occur at different levels of logical forms. The idea is that it can combine with the subordinate clause

not only to produce the restrictor of an explicit or implicit quantifier, but also to give rise to a "frame" adverbial occupying a higher position in the logical form. This second role of when-clauses can be accounted for by a rule in which the tense operator applies to a temporal when-abstract. For example, in the case of the past tense we have:[21]

(31) $\text{PAST}(\lambda i \lambda C \phi) = \exists i [<(i, \text{now}) \wedge \exists C [\phi(i, C) \wedge C \neq \emptyset]]$.

To see a significant application of this rule let us address an interesting problem. Consider the following sentence:

(32)   Quando giocava a golf, Leo guadagnava molto
         When Leo play (past, imp.) golf, he make (past, imp.) a lot of money.

This sentence has a reading expressed by the following logical form:

(33) $\exists i [<(i, \text{now}) \wedge \forall e [\subseteq (e, i) \wedge \text{Leo-play-golf}(e) \rightarrow \exists e' [\text{Leo-}$
         make-a-lot-of money$(e') \wedge ><(e, e')]]]$.

In the last section we saw how such logical forms can be obtained in the present framework. On this reading, (32) means that, in a given period of time, every (relevant) event of Leo's playing golf was associated with a corresponding event of Leo's making a lot of money. This is a natural interpretation if, for instance, Leo is a former golf champion who was paid a lot of money for *each* appearance. But (32) has another possible interpretation. Suppose that, in the intended period of time, Leo used to get fabulous fees for his services as a lawyer, so that, in this period, he could afford expensive sports like golf and polo. In such a context, sentence (32) is still perfectly appropriate, even though the intended interpretation cannot be expressed by a logical form such as (33). The point is that, this time, there is no correspondence between the events of Leo's playing golf and the events of Leo's making money, but only, more generically, an overlap between two intervals of time: the period in which Leo used to make money (as a lawyer) and the one in which he used to

---

[21] A complete treatment of tense and temporal adverbials in general is not in the scope of the present paper. This is why the tense rules sketched here are based on an overt simplification, which allows us to concentrate on the specific issues raised by aspect as such.

We have endorsed the "Surface Tense Constraint" stated in Ritchie (1979): if two clauses are joined by a temporal connective, they must have the same tense. As a consequence, the tense rules we are considering can be introduced at the end of the recursive procedure. But it should be borne in mind that the theory of aspect under discussion is independent of such a choice. What is essential here is that in the cases in which the when-clause is a restrictor the aspectual operator IPF (or PF) has scope over *when*, whilst in the cases in which the when-clause is a frame adverbial it is *when* that has wide scope.

play golf. Formally speaking, the main difference is that in the former case the informational content about Leo's playing golf is part of the restrictive clause. But in the latter case this possibility is ruled out, and the only effect it produces is to specify the intended interval of time. Generally this is the role of what I called a background clause, which is not introduced as a restrictor with respect to an adverb of quantification, but characterises, at a higher level in the sentence, a temporal framework (if any).

Since this reading of (32) is determined by the presence of two bare habituals, we must show how sentences of this kind can be accounted for in the theoretical framework under discussion. We have just remarked that a sentence such as (28a), which is one of the two bare habituals at issue, can be seen as an imperfective when-construction where the restrictor is a phonologically null element whose semantic content is empty, apart from the reference to the set of relevant circumstances or intervals. To obtain the intended logical form of (28a) we might proceed as follows:[22]

> **when**$(\lambda i[=(i, i)], \lambda e[\text{Leo-play-golf}(e)]) = \lambda i \lambda C \forall e[C(e) \leftrightarrow$
> $\text{Leo-play-golf}(e) \wedge ><(i, e)]$.

> IPF$(\lambda i \lambda C \forall e[C(e) \leftrightarrow \text{Leo-play-golf}(e) \leftrightarrow ><(i, e)]) =$
> $\lambda i \forall i'[\subseteq(i', i) \wedge \text{Cont}(i') \to \exists e[\text{Leo-play-golf}(e) \wedge ><(i', e)]]$.

By applying the appropriate tense rule, what we obtain is exactly the formula we aim at. But notice that, formally speaking, the role of the empty when-clause is only to map an E-abstract such as $\lambda e[\text{Leo-play-golf}(e)]$ into a when-structure which represents the argument of the operator IPF. So, to avoid the proliferation of hidden when-clauses, an alternative (but equivalent) solution is to make this mapping possible by adopting a suitable type-shifting rule. That is, if A is an E-abstract:

> $\uparrow(A) = \lambda i \lambda C \forall e[C(e) \leftrightarrow A(e) \wedge ><(i, e)]$.

This is the solution we shall adopt here, so that the logical form corresponding to the second reading of sentence (32) is obtained in the following way. First of all let us translate the bare habituals occurring, respectively, in the subordinate clause and in the main clause:

> $\uparrow(\lambda e[\text{Leo-play-golf}(e)]) = \lambda i \lambda C \forall e \leftrightarrow [C(e) \leftrightarrow \text{Leo-}$
> $\text{play-golf}(e) \wedge ><(i, e)]$.

---

[22] Some reductions, based on equivalent formulae, have been omitted.

IPF($\lambda i \lambda C \forall e[C(e) \leftrightarrow$ Leo-play-golf$(e) \wedge ><(i, e)]) =$
$\lambda i \forall i'[\subseteq(i', i) \wedge$ Cont$(i') \rightarrow \exists e[$Leo-play-golf$(e) \wedge ><(i',e)]]$.

$\uparrow$ ($\lambda e[$Leo-make-money$(e)]) = \lambda i \lambda C \forall e[C(e) \leftrightarrow$
Leo-make-money$(e) \wedge ><(i, e)]$.
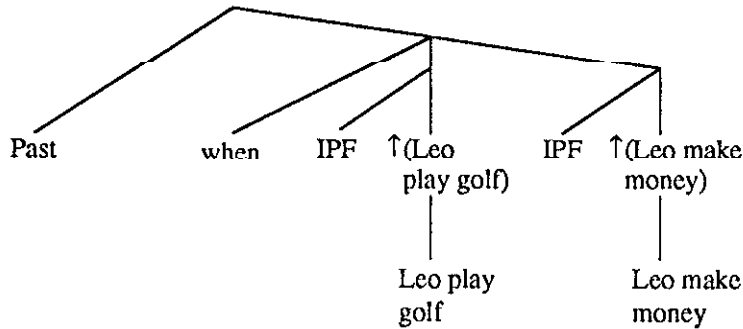
IPF($\lambda i \lambda C \forall e[C(e) \leftrightarrow$ Leo-make-money$(e) \wedge ><(i, e)]) =$
$\lambda i \forall i'[\subseteq(i', i) \wedge$ Cont$(i') \rightarrow$
$\exists e[$Leo-make-money$(e) \wedge ><(i', e)]]$.

At this point, we can derive the appropriate temporal when-abstract and
then apply the tense rule:

when($\lambda i \forall i'[\subseteq(i',i) \wedge$ Cont$(i') \rightarrow \exists e[$Leo-play-golf$(e) \wedge$
$><(i', e)]]$, $\lambda i \forall i'[\subseteq(i', i) \wedge$ Cont$(i') \rightarrow \exists e[$Leo-make-
money$(e) \wedge ><(i', e)]]) = \lambda i \lambda C[\forall i'[\subseteq(i', i) \wedge$ Cont$(i') \rightarrow$
$\exists e[$Leo-play-golf$(e)] \wedge ><(i', e)] \wedge \forall i'[C(i') \leftrightarrow \forall i''[\subseteq(i'', i')$
$\wedge$ Cont$(i') \rightarrow \exists e[$Leo-make-money$(e) \wedge$
$><(i'', e)]] \wedge ><(i, i')]]$.

PAST($\lambda i \lambda C[\forall i'[\subseteq(i', i) \wedge$ Cont$(i') \rightarrow \exists e[$Leo-play-golf$(e)] \wedge$
$><(i', e)] \wedge \forall i'[C(i') \leftrightarrow \forall i''[\subseteq(i'', i') \wedge$ Cont$(i') \rightarrow \exists e[$Leo-
make-money$(e) \wedge ><(i'', e)]] \wedge ><(i, i')]]) = \exists i[<(i,$ now$)$
$\wedge \forall i'[\subseteq(i', i) \wedge$ Cont$(i') \rightarrow \exists e[$Leo-play-golf$(e) \wedge$
$><(i', e)]] \wedge \forall i'[\subseteq(i', i) \wedge$ Cont$(i') \rightarrow \exists e[$Leo-make-
money$(e) \wedge ><(i', e)]]]$.

It should be noticed that, in contrast with the syntactic structure of (7)
discussed at the end of the last section, this time *when* has scope over the
aspectual operator IPF:

The logical form we have obtained, i.e.

$$\exists i[<(i, \text{now}) \land \forall i'[\subseteq(i', i) \land \text{Cont}(i') \rightarrow \exists e[\text{Leo-play-golf}(e)$$
$$\land ><(i', e)]] \land \forall i'[\subseteq(i', i) \land \text{Cont}(i') \rightarrow \exists e[\text{Leo-make-}$$
$$\text{money}(e) \land ><(i', e)]]].$$

means that there is a time interval at which Leo has both the habit of playing golf and the habit of making money, i.e. that these two habits temporally *overlap*. It might be objected that this reconstruction is too weak, because what (32) means (on the reading at issue) is that the former habit is temporally *included* in the latter. A similar problem is raised by Ritchie (1979). Relative to some analogous examples from English (with stative verb phrases instead of habituals), he maintains that the interval described by the when-clause is included in the interval described by the main clause. He sets up his view against Heinämäki (1978), whose treatment of these sentences is based on temporal overlap rather than inclusion. But consider a continuation of (32) such as *And he did not give up playing even after falling into poverty*. In this case Ritchie's treatment is not correct, because it predicts that this new sentence is inconsistent with (32), whilst it is perfectly acceptable. The point is that in some contexts the intended relationship can be inclusion, but in others it can be its converse. (Similar examples can be found in the case of statives as well.) Since overlap is compatible with both situations, my suggestion is that it can be chosen as the default relation, letting the context (and the actional characteristics of the verbs) specify a more definite relation (if any). I leave the problem open to discussion.

5. A Unifying Principle

To consider another crucial case in which the when-clause is not used as the restrictor of an (implicit) adverb of quantification. let us go back to the chart presented at the outset of the paper. So far, I have disregarded two possible combinations of the perfective and imperfective aspects: the case (5.A), in which the subordinate clause is perfective whilst the main clause is imperfective, and its converse, the case (5.B). Typically, in both situations the imperfective can have the progressive interpretation, and the reader may wonder how the theoretical framework presented here can account for this characteristic of the imperfective. Should we succeed in this task, we would at last have a complete reconstruction of the possible combinations of aspectual values in a when-structure.

First of all, some explanations about the progressive reading of the

imperfective are in order. Take, for instance, an activity verb such as *fumare* (*smoke*) and consider its occurrence in the following sentence:

(34) Quando battè (past, perf.) il primato di apnea, Leo fumava (past, imp.).
      When Leo broke the apnea record, he used to smoke.

Here, only the habitual reading of the imperfective is possible, and what is peculiar to this reading from an intuitive point of view is the idea that the event *e* of Leo's breaking the apnea record is temporally included in a frame interval *i* characterised by the occurrence of several events of Leo's smoking. Since these events are temporally separate, they do not cover the entire interval *i* and *e* may take place at a moment at which no event of Leo's smoking is in progress.

But consider this other occurrence of the imperfective form of the verb *fumare*:

(35) Quando entrai (past, perf.) in aula, Leo fumava (past, imp.).

The natural interpretation of this sentence is that the event *e* of the speaker's entering the room occurs at a moment at which an event of Leo's smoking is in progress, because this moment is included in a frame *i* interval which is entirely occupied by a single, continuous event of Leo's smoking. This use of the imperfective form is equivalent to the *Perifrasi Progressiva*, i.e. the specialised grammatical form for the progressive meaning in Italian. In other terms, (35) expresses the same meaning expressed by the sentence:

(35)a. Quando entrai in aula, Leo stava fumando.
        When I entered the room, Leo was smoking.

On the other hand, the semantics of the imperfective (on this interpretation) cannot be identified with the semantics of the Perifrasi Progressiva, because the equivalence we have just detected between (35) and (35a) becomes problematic if the activity VP *fumare*, in (35), is replaced by an accomplishment VP as, for instance, *completare la dimostrazione* (*complete the proof*). The resulting sentence is hardly acceptable for many speakers, whilst the corresponding sentence with the Perifrasi Progressiva raises no problem. So, the semantics of the progressive reading of the imperfective requires an independent treatment, which is the main topic of this section. For the sake of simplicity, in what follows I shall concentrate on the uncontroversial cases, i.e. activity VPs, by postponing to the last section a brief discussion of the more problematic data.

The question we have to address is the following. The double reading

of the imperfective is a very important characteristic of the aspectual system of Italian: as a consequence, an ideal analysis must provide a principled explanation for this phenomenon. We have already seen how it is possible to reconstruct the habitual interpretation in terms of universal quantification. So, our problem can be reformulated in the following terms: is this type of quantificational structure also appropriate to account for the two cases we have not yet dealt with, i.e. the cases (5.A) and (5.B), in which the imperfective has the progressive reading? In other words, what I propose to test is the following conjecture:

(36)   IPF Unifying Principle:
   (i)   The progressive reading of the imperfective and the habitual reading originate from the *same* logical form, based on universal quantification over circumstances.
   (ii) The context can have a crucial role in determining which, of these two readings, is admissible.

The intuitive idea is the following. Exactly as the habitual reading of the imperfective in a sentence such as (34) means that an extended period of time is characterised by the occurrence of a series of events of Leo's smoking (in our translation: in every (relevant) circumstance, Leo smoked), in a sentence such as (35) the progressive reading of the imperfective means, this time, that a local interval is characterised by a series of events of Leo's smoking. What is crucial here is the context (including the actional characteristics of the verbs), which suggests the habitual reading as the more natural one in the former situation, and the progressive reading in the latter. The conjecture stated in (36) predicts that, if the context is not specific enough, and if the Aktionsarten of the verbs do not act as a filter, both readings are fully admissible. In fact, this prediction is confirmed by the existence of sentences such as:

(37)   Quando fu notato da Miles Davis, Ahmad Jamal suonava in un trio.
       When Ahmad Jamal be noticed (past, perf.) by Miles Davis, he play (past, imp.) in a trio.

which can mean either that Miles Davis realised that Ahmad Jamal is a great pianist whilst Ahmad Jamal was playing in a trio (in a particular circumstance, e.g. during a concert at the Pershing Club), or that this intuition took place, more generally, in a period of time in which Ahmad Jamal used to play in a trio (although, at the moment of Miles Davis's intuition, Ahmad Jamal was reading a book on the beach). If the context provides no further information, these two alternative readings are equally

admissible, and an advantage of the theoretical framework adopted here
is that, by applying the semantic rules associated with the when-construc-
tions and the imperfective, we obtain a *single* logical form which accounts
for both interpretations, letting the context select the one preferred. In
fact, the logical form generated by the compositional rules illustrated
above is the following (the derivation is omitted):

(38) $\exists i[<(i, \text{now}) \wedge \exists e[\subseteq(e, i) \wedge \text{M.D.-notice-A.J.}(e)] \wedge$
        $\forall i'[\subseteq(i', i) \wedge \text{Cont}(i') \rightarrow \exists e[\text{A.J.-play-in-a-}$
        $\text{trio}(e) \wedge ><(i', e)]]]$.

Once more, in the syntactic analysis presupposed by such a reconstruction
when has scope over the aspectual operators:
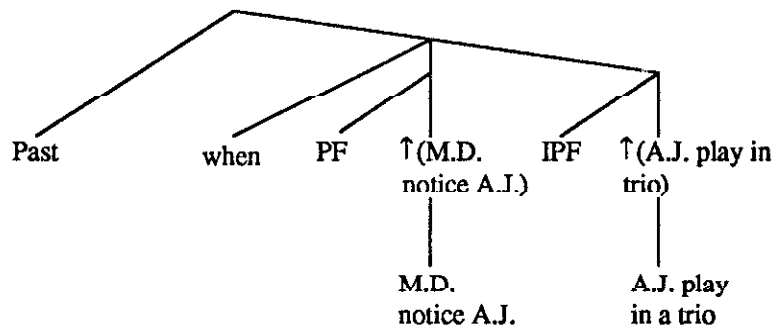
What (38) means is that there is a past interval i which temporally includes
an event of Miles Davis's noticing Ahmad Jamal, and that all the relevant
subintervals in i are characterised by the occurrence of an event of Ahmad
Jamal's playing in a trio. As I have already suggested, such a reconstruc-
tion of the imperfective in (37) makes it compatible with both interpreta-
tions of the sentence. In particular, no extra hypothesis is required to
account for the relation of temporal inclusion between the event described
by the perfective clause and the event described by the imperfective clause,
because this kind of information is correctly expressed by (38), i.e. a
logical form generated by rules already present in the general treatment
of when-structures, tense and aspect discussed so far. In other words, the
progressive reading of the imperfective in when-constructions such as (37)
is none other than a further illustration of the contrast between the situ-
ations in which a when-clause represents the restrictor in a universal (or
generic) quantificational structure and the situations in which it does not
play this role and behaves like any other time adverbial to contribute a

reference time (in the broad sense of the term).[23] In general, the progress-
ive reading of when-structures like (37) is characterised by the non-
correspondence of the aspectual values in the two clauses, and this is the
proof that the subordinate clause is *not* introduced to restrict the (implicit)
universal quantifier associated with the imperfective, because such a non-
correspondence would be a violation of the agreement requirement
imposed by the hidden quantifier. But this is also true of the "habitual"
reading of (37), so that the same logical form can account for both situ-
ations, by allowing a unified treatment of both readings.

At this point, an explanation about the truth-conditions of a sentence
such as (37) is necessary. On the one hand, the explanatory power of the
theory under discussion is considerably strengthened if the two possible
readings of (37) are traced back to the *same* logical form (i.e. (38)); on
the other hand, it is also evident, from our analysis, that these two readings
can be associated with different truth-conditions. (37) is true, on the
habitual reading, if Miles Davis's intuition is temporally included in an
interval in which several events of Ahmad Jamal's playing in a trio take
place. Since these events are temporally separate, Miles Davis's intuition
may occur at a moment at which no event of Ahmad Jamal playing in a
trio is in progress. On the contrary, this possibility must be ruled out for
(37) to be true on the progressive reading: which means that the two
interpretations of the imperfective we are analysing have *distinct* truth
conditions. So, we have to address an interesting problem: how can a
single logical form account for this difference in truth-conditions?

We have already hinted at the essential role of the context from this
point of view. For example, if the context of discourse or the background
assumptions suggest that the frame interval i, in (38), is an "extended"
period of time (with respect to the type of activity at issue), then only the
habitual reading is acceptable. On the contrary, the progressive interpreta-
tion sounds quite natural if there is an implicit reference to a "local",
smaller segment of time. These different assumptions about the frame
interval i have important consequences in terms of truth-conditions, be-
cause we have just seen that a necessary condition for the truth of the
progressive reading of (37) is that the extension of i is completely occupied

---

[23] This distinction parallels the distinction, in Stump (1985), between the use of when-clauses
as restrictors associated with an (implicit or explicit) adverb of quantification and their use
as "main tense adverbials". Beyond the difficulty concerning the location of the temporal
information provided by the connective, another problem, with Stump's approach, is
represented by those situations in which a when-clause, used as a "main tense adverbial",
contains a "habitual" sentence, as in the second reading of our example (32). It is unclear
how this reading can be accounted for in Stump's theory.

by a *single* event of Ahmad Jamal's playing in a trio. A possible way of
accounting for this requirement concerning the frame interval is based, in
the present framework, on the clause 'Cont(i')' occurring in the restrictor
of the universal quantifier[24] in (38). The role of this clause is to restrict
the domain of eventualities or intervals to the set CONT of *relevant*
eventualities or intervals. This kind of restriction can play a crucial role
in distinguishing the two readings at issue in terms of truth-conditions. In
fact, suppose that only the progressive reading is associated with the
condition that i itself belongs to the set CONT: in this case, a consequence
of (38) is that i must temporally coincide with a single event of Ahmad
Jamal's playing in a trio. But, as desired in the case of the progressive
reading, such a requirement can be satisfied only if the frame interval i is
short enough not to exceed the presumable duration of a single event of
playing in a trio: otherwise, several distinct events of playing in a trio
must be temporally included in i, i itself does not temporally coincide with
a *single* event of this type, and it is perfectly possible that no event of
Ahmad Jamal's playing in a trio is in progress at the moment at which
Miles Davis's realises that he is a great pianist. In general, the assumptions
concerning the frame interval i can change according to the context, and
the role of these different assumptions in selecting the progressive reading
or the habitual reading can be captured, at the level of the logical form,
by specifying whether i must be an element of CONT or not: this is why
the same logical form can be associated with different truth-conditions
and can account for both readings of the imperfective.

6. CLAUSE ORDER

The treatment of the perfective/imperfective contrast outlined in the pre-
vious sections can help to explain an interesting phenomenon. Take these
pairs of sentences:

(39)a.   Quando la stanza si riempiva di fumo, Leo apriva la porta
          *When the room fill (past, imp.) with smoke, Leo open (past,
          imp.) the door.*

   b.   Leo apriva la porta quando la stanza si riempiva di fumo
          *Leo open (past, imp.) the door when the room fill (past, imp.)
          with smoke.*

(40)a.   Quando la stanza si riempì di fumo, Leo aprì la porta.

---

[24] I am indebted to S. Zucchi for pointing out this kind of strategy.

When the room fill (past, perf.) with smoke, Leo open (past, perf.) the door.

b. Leo aprì la porta quando la stanza si riempì di fumo.
Leo open (past, perf.) the door when the room fill (past, perf.) with smoke.

The only surface difference, between (39a) and (39b), concerns the position of the main clause with respect to the when-clause. However, this shifting has important effects. If the intonation is not marked, (39b) has a possible or even preferred meaning (given by (39b′)) that (39a) *cannot* have (assuming, once again, that the intonation is not marked). The interaction between the aspectual value and the articulation $[\ldots]_R[\ldots]_M$ is crucial in this case: if the order of the constituents is reversed, the restrictive clause and the when-clause can exchange roles. In our (simplified) translation we obtain the following structures:

(39)a′. $\forall e([\text{the-room-fill-with-smoke}(e)]_R \rightarrow$
$[\exists e'(><(e, e') \wedge \text{Leo-open-the-door}(e'))]_M)$.

b′. $\forall e([\text{Leo-open-the-door}(e)]_R \rightarrow [\exists e'(><(e, e') \wedge \text{the-room-fill-with smoke}(e'))]_M)$.

(39a′) means that any event of the room's filling with smoke entails a (subsequent) event of Leo's opening the door, whilst (39b′) expresses the converse statement (any event of Leo's opening the door entails a (preceding) event of the room's filling with smoke). Thus, the difference in meaning between (39a) and (39b) is properly reconstructed in terms of an interchange between restrictive clause and matrix (ignoring an interesting problem of temporal order that I will address in a moment).

However, a related phenomenon calls for an explanation. Why does the change in truth-conditions that occurs when passing from (39a) to (39b) not take place when passing from (40a) to (40b)? After all, there is the same kind of shift in both circumstances. Once more, the framework under discussion provides a very natural explanation. Although the same kind of interchange takes place, it has no effect, *because the perfective is associated with an existential quantification*. Thus, this time the resulting first order logical forms are logically equivalent, as can easily be seen:

(40)a′. $\exists e([\text{the-room-fill-with-smoke}(e)]_R \wedge [\exists e'(e >< e' \wedge \text{Leo-open-the-door}(e'))]_M)$.

b′. $\exists e([\text{Leo-open-the-door}(e)]_R \wedge [\exists e'(e >< e' \wedge \text{the-room-fill-with-smoke}(e')]_M)$.

The equivalence of these two formulas explains the invariance of truth-conditions when passing from (40a) to (40b).[25]

One might object that, on the reading discussed above, (39b) is assigned the logical form (39b'), which coincides with the one attributed, in the present framework, to the following sentence:

(39)c.   Quando Leo apriva la porta, la stanza si riempiva di fumo
          When Leo open (past, imp.) the door, the room fill (past, imp.)
          with smoke.

But this identity of logical form contrasts with the evident difference in meaning between (39b) and (39c)! (A similar remark can be made with respect to the perfective case.)

A plausible response to this kind of objection is that a when-structure has, among other things, two distinct roles: (a) on the semantic level, it selects what enters the restrictive clause and what enters the main clause; (b) on the pragmatic level, it contributes to establishing a particular temporal relationship between the eventualities at issue, so that our generic reference to the temporal relationship of "coincidence" (in a very broad sense) denoted by ">$<$" is no longer adequate.[26] For instance, one of the factors that makes the temporal relationship between eventualities more definite is the following implicature associated with when-structures: if there is no aspectual contrast and the when-clause and the main clause are both in the (im)perfective, the event described by the former *precedes* (possibly as a cause) the event described by the latter. That this is only a pragmatic implicature is proved by the fact that, in the presence of suitable verb phrases and related world knowledge, it can easily be cancelled, as shown by a number of counterexamples discussed in Hinrichs (1986: 75). As for French, such data are analysed by Kamp and Rohrer (1983), who use the term *rhetorical relations* to cover this area of phenomena. In this connection, (39b) is not equivalent with (39c), because the relevant implicatures are not preserved when changing the sentence which *quando* applies to. Thus, if we want to concentrate on the logical properties of the sentences at issue, we have to consider examples where such implicatures are cancelled, in the sense that the temporal order of the events is independently fixed by the lexical meanings of the verbs and/or by world

---

[25] This invariance does not mean that the two sentences are also interchangeable "salva congruitate" in any context of use, for example as answers to particular questions or in the presence of a particular topic/comment structure.

[26] See footnote 4 above, which refers to Sandström (1993) for a discussion of this problem.

knowledge. In this case, as expected, the patterns illustrated above can be equivalent,[27] as shown by the following examples:

(41)   Leo dava una festa in giardino quando invitava molta gente.
        Leo give (past, imp.) a party in the garden when he invite (past, imp.) many people.

(42)   Quando dava una festa in giardino, Leo invitava molta gente.
        When Leo give (past, imp.) a party in the garden, he invite (past, imp.) many people.

This time the order of the events is not influenced by the implicature associated with the connective *quando*, because this implicature is cancelled by the lexical meanings of the verbs, according to which the event of inviting many people can only precede the event of giving a party. As a result, (41) does have a reading which coincides with the (only) reading of (42). The same kind of reasoning can be applied to the corresponding sentences in the perfective form: once we have neutralised the pragmatic implicatures of the interchange between when clause and main clause, the equivalence at issue is not problematic any longer.

But a further qualification is needed at this point. I have just said that (41) *can* be equivalent with (42), in the sense that there is a reading of (41) which coincides with the (only) reading of (42). This is the interpretation on which inviting many people is a necessary condition for giving a party in the garden. The existence of this reading is confirmed by the following continuation of (41):

(41')   ... Di conseguenza, in tutte le situazioni in cui aveva invitato solo poche persone, la festa si teneva altrove.
        ...As a consequence, in all the situations in which Leo had invited only few people, the party took place elsewhere.

But (41) has also a reading which coincides with the (only) reading of:

(43)   Quando invitava molta gente, Leo dava una festa in giardino
        When Leo invite (past, imp.) many people, he give (past, imp.) a party in the garden.

On this interpretation of (41), giving a party in the garden is a necessary condition for inviting many people, and a proper continuation of (41) is this time:

---

[27] Once more it must be kept in mind that equivalence does mean interchangeability "salva congruitate". (See fn. 25.)

(41″)   ... Di conseguenza, in tutte le situazioni in cui la festa si teneva
           in casa, solo poche persone erano state invitate
           *...As a consequence, in all the situations in which the party
           took place indoors, only few people had been invited.*

This ambiguity of sentences such as (41) can be explained by the following
principle:

> **(R/M)**
> In a restrictive/matrix structure, A is the restrictor and B the
> matrix if:

(i)   A precedes B, or
(ii)   A is the expression associated with the connective *quando*.

It is easy to see that the predictions made by this principle are correct. In
fact, (42) and (43) cannot be ambiguous, because the conditions (i) and
(ii) coincide: the connective *quando* is applied to the expression which
comes first, so that only this expression can be the restrictor. On the
contrary, in sentences like (41), which have the structure *A quando B*,
the selection of the restrictive clause can be determined by (i) or by (ii),
which in this case are alternative conditions. This is why a sentence of
this type can be ambiguous, provided that one of the two possible readings
is not ruled out by the pragmatic implicatures mentioned above. Finally,
(R/M) also predicts that in sentences such as (44a), which we are about
to discuss, this ambiguity does not appear, since, in the absence of the
temporal connective, the choice of the restrictor can only be determined
by the order of the constituent phrases. This interference of aspect with
quantificational structures is quite general and systematic, involving not
only when-clauses and similar constructions, but other kinds of expressions
as well. For example, the same behaviour characterises other temporal
adverbials or even adverbials of a quite different kind. Within the follow-
ing pairs of sentences (if uttered with normal intonation) each one has
truth-conditions which diverge from the other's:

(44)a.   Alle cinque Lia prendeva il tè
          At five o'clock Lia have (past, imp.) tea
     b.   Lia prendeva il tè alle cinque
          Lia have (past, imp.) tea at five o'clock

(45)a.   In ufficio Leo giocava a carte
          In the office Leo play (past, imp.) cards
     b.   Leo giocava a carte in ufficio
          Leo play (past, imp.) cards in the office.

On the contrary, truth-conditions do not change within the following pairs (where, as before, the "rhetorical relations" are not relevant):

(46) a. Alle cinque Lia prese il tè.
         At five o'clock Lia have (past, perf.) tea.
     b. Lia prese il tè alle cinque.
         Lia have (past, perf.) tea at five o'clock.

(47) a. In ufficio Leo giocò a carte.
         In the office Leo play (past, perf.) cards.
     b. Leo giocò a carte in ufficio.
         Leo play (past, perf.) cards in the office.

The point is that, in these cases too, the kind of logical form under discussion accounts for these different behaviours. For example, (45a) and (45b) would be (roughly) translated into:

(45) a'. $\forall e([\text{Leo-be-in-the-office}(e)]_R \rightarrow$
          $[\exists e'(\text{Leo play cards}(e') \land ><(e, e'))]_M)$.
     b'. $\forall e([\text{Leo-play-cards}(e)]_R \rightarrow$
          $[\exists e'(\text{Leo-be-in-the-office}(e') \land ><(e, e'))]_M)$.

Whilst the translations of (47a) and (47b) would be:

(47) a'. $\exists e([\text{Leo-be-in-the-office}(e)]_R \land$
          $[\exists e'(\text{Leo-play-cards}(e') \land ><(e, e'))]_M)$.
     b'. $\exists e([\text{Leo-play-cards}(e)]_R \land$
          $[\exists e'(\text{Leo-be-in-the-office}(e') \land ><(e, e'))]_M)$.

As before, the crucial difference is a matter of aspect, which determines non-equivalent logical forms. This means that the solution suggested for the when-constructions must be generalised and that aspect plays a systematic role in the determination of the relevant quantificational structures.

7. KINDS OF EVENTUALITIES

Another problem raised by when-constructions is discussed in Kratzer (1995). She remarks that whilst (the English counterpart of) a sentence such as:

(48) Quando parla portoghese, Lia lo parla bene.
      When Lia speaks Portuguese, she speaks it well.

is perfectly acceptable, (49) is not:

(49)   ?Quando sa il portoghese, Lia lo sa bene.
        When Lia knows Portuguese, she knows it well.

According to Kratzer, this phenomenon is due to a structural difference
between predicates referring to events and predicates referring to (perma-
nent) states: in the former case, but not in the latter, a variable for space-
temporal locations is involved. In (48) this variable can be bound by an
implicit quantifier, as the logical form suggested by Kratzer shows:

(48') Always_t ([Speak-Port.(Lia, t)]$_R$, [Speak-Port.-well (Lia, t)]$_M$).

But this does not hold for (49), because, as we have just said, no variable
for space-temporal locations is associated with a stative predicate. Thus,
the corresponding logical form:

(49') Always_t ([Know-Port.(Lia)]$_R$, [Know-Port.-well(Lia)]$_M$).

turns out to be a case of empty quantification. This is why (49) sounds
odd. On the other hand, Kratzer emphasises that (the English counterpart
of) a sentence such as:

(50)   Quando un italiano sa il portoghese, lo sa bene.
        When an Italian knows Portuguese, he knows it well.

is perfectly acceptable. To account for this difference between (49) and
(50) Kratzer endorses a theory of indefinite descriptions à la Heim-Kamp.
As a consequence the resulting logical form is the following:

(50') Always_x ([Italian(x) $\wedge$ Know-Port.(x)]$_R$, [Know-it-well(x)]$_M$).

Once again, there is a free variable that the implicit quantifier can bind.
Quantification is not empty, and the sentence is in order.

A first problem, with this reconstruction, is that if a verb referring to a
state is to be seen as an n-place predicate, a verb referring to an event is
to be seen as an $n + 1$-place predicate, where the extra argument is
represented by the space-temporal location. However, this difference is
often questionable. Take, for instance, the following sentence, which is
quite acceptable:

(51)   Quando sapeva il portoghese e lo parlava a scuola, Lia leggeva
        molti giornali brasiliani.
        When Lia know (past, imp.) Portuguese and speak (past, imp.)
        it at school, she read (past, imp.) many Brazilian newspapers.

Here the two predicates *know Portuguese* and *speak Portuguese* are on

the same level, and it is not so easy to make this fact consistent with the idea that they are structurally different.

Moreover, it turns out that, depending on the aspectual and actional values, the *same* verb can belong to either class of predicates. Actually, (51) itself is an illustration of this point, because it is in virtue of the aspect that the predicate *speak Portuguese*, associated with the habitual reading of the imperfective, can be considered on a par with the stative predicate *know Portuguese*. As for actionality, whilst *know* should be classified as a stative two-place predicate in a sentence like *Lia knows Portuguese*, it should be classified as a three-place predicate in a sentence like *Lia knows how to dress her hair*. A sentence such as:

(52)   When Lia knows how to dress her hair, she is happy.

is perfectly in order and should be assimilated to (48), for knowing how to dress one's hair is not a permanent property. Yet, it is not clear how to avoid the implausible conclusion that the number of arguments a predicate applies to is not definite (or that a predicate is lexically ambiguous).

On the other hand, what we have just said about verbs (and their objects) holds for adjectives too. For instance, the sentence:

(53)   Quando era depresso, Leo era aggressivo.
        When Leo was depressed, he was aggressive.

is *ambiguous*, for it can have both the "universal" meaning (whenever . . .) and the "background" one (in the period in which . . .). In the latter interpretation, Leo's depression (and aggressiveness) is naturally seen as a stable state of individuals (at least in some contexts), whilst in the former it is an episodic state, involving "stages" of individuals. However, it is the *same* predicate that expresses both the permanent and the temporary property, so that it is hard to see how the number of its arguments can change.

Another interesting point is that the oddity we have observed in the case of (49) can affect sentences where *no* permanent states or properties are involved. For example:

(54)   ?Quando (= ogni volta che) si fa amputare la gamba sinistra,
        Leo se la fa amputare bene.
        *When (= whenever) Leo has his left leg amputated, he has it
        amputated well.*

Of course, the oddity of this sentence is due to the fact that there is just one "eventuality" of Leo's having his left leg amputated, whereas the

"universal" reading presupposes[28] the existence of several eventualities of
this kind. As will be seen in a moment, a similar remark will have a crucial
role in our solution to the problem raised by (49).

The last issue I would like to discuss is the following. As we have just
observed, (49) is unacceptable. But the situation changes if a different
tense is used. For example, this new sentence is not problematic:

(55)   Quando sapeva il portoghese, Lia lo sapeva bene.
        *When Lia know (past, imp.) Portuguese, she know (past, imp)
        it well* = *When Lia knew Portuguese, she knew it well.*

Thus, not only do we have to explain (as Kratzer intends to do) why (49)
is not acceptable, but we must also account for the acceptability of (55),
which has no apparent justification in Kratzer's framework. Exactly as in
(49), we have here a *stative* predicate: the same predicate indeed. Since
there is no discrepancy, prima facie, about the variables that must be
bound by a quantifier, how is it possible to account for the fact that (49),
but not (55), is problematic? The only manifest difference, between these
two sentences, concerns tense. It is to this element that we will turn now.

Before looking for an explanation for the different behaviours of (49)
and (55), it should be noticed that the latter turns out to be acceptable
only if the when-clause has the role of a "frame" adverbial (= in the
period in which . . .), not of the restrictor of a universal or generic quanti-
fication (= whenever . . .). On the other hand, this second possibility is of
course available in the case of:

(56)   Quando parlava portoghese, Lia lo parlava bene.
        *When Lia speak (past, imp.) Portuguese, she speak (past, imp.)
        it well.*

In the present framework the reason for this phenomenon is quite simple.
As for (56), the universal reading is approximately represented by the
following logical form:

(56') $\forall e([\text{Lia-speak-Port.}(e)]_R \rightarrow$
        $\exists e'[\text{Lia-speak-Port.-well}(e') \wedge ><(e, e')]_M).$

This formula states that for *every eventuality* of the type described in the

---

[28] It is not universal quantification as such that presupposes a plurality to quantify over,
because it is not difficult to find counterexamples to such a claim. On the other hand,
this kind of presupposition must be attributed to the universal reading of *temporal* when-
constructions in Italian: for instance, if the janitor has never seen me, or if he saw me just
once, there is no plausible way of assigning a truth-value to our paradigmatic example (7).
(I am indebted to G. Carlson for drawing attention to this point.)

restrictive clause there is a corresponding eventuality of the type described in the main clause. For such a statement to be felicitous, there must be *numerous* distinct eventualities that meet the description specified by the restrictive clause: that is, in the present case, numerous circumstances in which Lia speaks Portuguese. If *just one* eventuality of this kind should be available, universal quantification would be infelicitous. (56) satisfies this presupposition, because there can be, in the past, numerous circumstances of the specified type. But this is not true of (55), because knowing Portuguese is assumed to be a *single*, uninterrupted state.[29] A question such as *How many times did you know Portuguese?* is senseless, at least in ordinary situations. In the same vein, the "universal" reading of (55) is infelicitous, for there is at most a single state satisfying the restrictive clause. In fact, if in (56') the predicate *speak Portuguese* is replaced by the predicate *know Portuguese* (to obtain the logical form corresponding to the universal reading of (55)), the result is quite odd: it is tantamount to accepting as meaningful the senseless question mentioned above.

On the other hand, the reason why the "background" reading of (55) is in order is clear. For (55) to be felicitous on this reading, it is only necessary to refer to a single interval in which Lia knows Portuguese.

Note that if a non-permanent stative is chosen, the universal reading is again allowed (or even favoured), as witnessed by sentence (53), repeated here as (57):

(57)   Quando era depresso, Leo era aggressivo.
         When Leo be (past, imp.) depressed, he be (past, imp.) aggressive.

A logical form like (56') would be appropriate in this case, for there can be, in the past, numerous distinct circumstances in which Leo is depressed. Therefore, unlike (55), (57) can have not only the background reading (= in the period in which Leo was depressed, he was aggressive), but the universal interpretation as well (= whenever Leo was depressed, he was aggressive). To conclude this part, it should be noted that the kind of argument I have just used applies to sentence (50) as well. Thus, we get a reasonable explanation of the reasons why this sentence, unlike (49), is

---

[29] In other words, we are assuming that, with respect to a single person, there are not numerous states of knowing Portuguese, but just one (if any). If one thinks that this assumption is not completely correct because it is possible to imagine that a person can forget a language and learn it again several times, a different predicate (as for instance *being a child*) should replace the predicate *knowing Portuguese* in all the above examples. (I owe this remark to an anonymous referee.) Yet, to avoid complications in the discussion about Kratzer's analysis, I did not modify the original examples.

acceptable (on the universal reading). Since there can be many Italians knowing Portuguese, there can be many distinct eventualities (= states) described by *be Italian and know Portuguese* (as many eventualities, indeed, as Italians knowing Portuguese). Thus, speaking of *all* these eventualities is perfectly appropriate.

8. WHEN-CLAUSES AND TIME SPECIFICATIONS

We have so far analysed the reasons why the universal reading (i.e. a logical form like (56')) can be associated with (56), but *not* with (55). The conclusion is that (55) is unacceptable on this reading, and since the same can be said of (49), which also presupposes the existence of various eventualities of Lia's knowing Portuguese, this is a first explanation for the phenomenon pointed out by Kratzer. But to fully account for the oddity of (49), one must also explain why it is not possible to give this sentence the background reading (which is allowed in the case of (55)). This is a problem which is not addressed in Kratzer's paper.

This time (49) and (55) manifest different behaviours. As I have just recalled, on the background reading (55) is perfectly in order: it simply means that there is a past period in which Lia knows Portuguese and in this period she knows it well. But (49) is not acceptable on this reading either: it cannot mean that there is a present period in which Lia knows Portuguese and in this period she knows it well. Before discussing this point, I will consider a related issue.

Take the following sentence:

(58)   ?Quando arriva Leo, Teo prepara la cena.
        When Leo arrives, Teo gets dinner ready.

The question mark signals that this sentence cannot mean: there is a moment, at present, at which Leo arrives, and at this very moment Teo is getting dinner ready. In other terms, (58) is not acceptable on the genuinely "present" reading. It is acceptable, instead, on the "future" interpretation (= when Leo arrives, Teo will get dinner ready) or on the universal one (= whenever Leo arrives, Teo gets dinner ready). The explanation, I suspect, is the following.

On the improper reading, the eventuality described by the main clause would be assigned two time specifications: (i) the temporal reference provided by the when-clause; (ii) the deictic reference to the utterance time, which is already guaranteed by the present tense. But this is pragmatically acceptable only if one of these specifications serves to narrow down the other. Since (58) does not meet such a requirement, it cannot

have the existential reading (if the present tense means simultaneity with respect to the utterance time, not posteriority). On the contrary, in the case of this other sentence:

(59)   Quando arrivò Leo, Teo preparò la cena.
        When (in a particular circumstance) Leo arrived, Teo got dinner ready.

the existential reading is allowed. The point is that in the main clause of (58) the deictic reference expressed by the (genuine) *present* tense is already sufficient to specify the *exact* temporal location of the eventuality of Teo's getting dinner ready: it is the utterance time (= now). This specification conflicts with the specification provided by the when-clause. On the other hand, in (59) the deictic feature, i.e. the past tense, has a less specific meaning; it only entails that the eventuality of Teo's getting dinner ready must be located somewhere in the past: there is room, then, for a more definite location of this eventuality, and the when-clause provides this specification. Should a further specification be added, the resulting sentence would be unacceptable:

(60)   ?Quando arrivò Leo, Teo preparò la cena quando suonò la campana.
        When Leo arrived, Teo got dinner ready when the bell rang.

The same problem that the when-clause raises in (58) affects other temporal descriptions as well, e.g. adverbials. For example:

(61)   ?Lia corre alle cinque.
        Lia is running at five o'clock.

cannot mean: at the present moment it is five o'clock, and at this very moment Lia is running. But, as before, this sentence is not problematic on the "future" reading or the universal one; and if the present tense is replaced by the past tense, the result is, once more, perfectly acceptable (for the same reasons as before):

(62)   Lia corse alle cinque.
        Lia ran at five o'clock.

These phenomena can be unified under the following "hierarchical" principle:

(HP)a. two time indications (provided by when-clauses, adverbials, deictic reference) cannot apply to the same eventuality unless one of them narrows the other;

b. with normal intonation, the expression referring to the larger segment of time must precede the other.

The second requirement can explain the oddity[30] of the following sentence:

(63)   ?Quando trovò i soldi, quando era giovane Leo si recò in Brasile.
        When Leo found enough money, when he was young he went to Brazil.

In this case, if the ordering of the when-clauses is reversed and the temporal expression denoting the larger segment of time comes first, the resulting sentence is perfectly acceptable, as predicted by (b).

To go back to our issue, we have just seen why on the "present" reading (58) and (61) violate the first requirement of the principle. The time specification provided by the when-clause (or by the adverbial *at five o'clock*) conflicts with the time specification provided by the deictic reference in the main clause, without introducing any further delimitation. As for (49), it is characterised by an analogous violation of principle (HP). In fact, as this principle states, the use of a when-clause is felicitous only if it introduces a temporal specification which is not provided by other temporal indicators. In the case of (55), this specification is ensured by the past tense ('when Lia knew Portuguese' has as an implicature that Lia does not know Portuguese *any more*: thus the period at issue is delimited by its final point). This is why (55) is not problematic. Symmetrically, the same effect is ensured by the future tense (where the implicature is that Lia does not know Portuguese *yet*, so that the intended period is delimited by an initial point). This remark is confirmed not only by the complete acceptability of:

(64)   Quando Lia saprà il Portoghese lo saprà bene.
        When Lia know (fut.) Portuguese, she know (fut.) it well.

but also by the increased acceptability of (49) *itself* if the present tense means *posteriority*:

(65)   Vedrai, quando Lia sa il portoghese, lo sa bene.
        You will see, when Lia knows Portuguese, she knows it well.

---

[30] The acceptability of such expressions improves if a marked intonation is used (or a comma is added), because of the parenthetical effect we obtain in this way.

or by the fact that if the temporal connective specifies an explicit end point of the relevant interval, the result is not problematic:

(66)   Da quando Lia sa il portoghese, lo sa bene.
       [*which literally means: Since when Lia know* (*pres.*) *Portuguese, she know* (*pres.*) *it well*].

In the case of (49) things are different. This sentence diverges from (55) and (64), for the tense of the when-clause (if assumed as a genuine present) does not entail any implicit temporal delimitation. But it diverges from (66), too, because the temporal connective specifies no end point of the interval at issue. For all these reasons, the temporal reference introduced by the when-clause does not contribute to a better specification of the temporal reference, which is already fixed by a deixis in the main clause. And this violation of principle (HP) explains the oddity of sentence (49) even on the "background" reading of the when-clause, which was the last issue we had to consider in connection with Kratzer's example.

9. Conclusions and Open Problems

In connection with the opposition between perfective and imperfective morphology, two possible situations can characterise when-structures in Italian:

(i)   the main clause and the subordinate clause have the same aspectual value;
(ii)   they have different values.

Starting from (i), my aim was to show that the imperfective (or perfective) morphology of the main verbs in *both* clauses is the syntactic mark of an invisible universal (or existential) quantification over circumstances which has these clauses as its arguments. So, a first result of the present approach is a systematic account of the deep connection between the aspectual characteristics of bare when-constructions and their quantificational properties. Such properties explain the episodic (or "semelfactive") interpretation of perfective bare when-constructions and the habitual interpretation of the imperfective ones.

This last remark raises a major problem, for the imperfective has another possible interpretation in Italian, the progressive reading, which is typical of the situations mentioned in (ii) above. Current treatments of aspect provide no principled explanation for this double role of the

imperfective, which is not an eccentricity of Italian but is an essential feature of other aspectual systems. To fill this gap, I have first shown that, even in the case of a uniform aspectual value in the when-construction, the subordinate clause may not be the restrictor of an implicit (or explicit) quantifier, if it is used to specify a reference time (in the broad sense of the term). This is necessarily so when the non-coincidence of the aspectual values in the main clause and in the subordinate clause shows that these clauses are not the arguments of a default quantifier. Not surprisingly, such a situation is described in (ii), where the imperfective has the "framing" effect of the progressive pointed out in Jespersen (1931): more exactly, the imperfective clause provides the temporal frame for the event denoted by the perfective clause. What is crucial, from this point of view, is the remark that the possibility of determining such a framing effect is *also* characteristic of habitual clauses, as witnessed by the existence of when-structures in which the progressive interpretation of the imperfective and its habitual reading are equally admissible. This remark justifies the attribution to the imperfective of a *single* type of logical form, based on universal (or generic) quantification. Therefore, in the present theoretical framework it is possible to present a unified treatment of both readings of the imperfective, without any extra hypothesis. And this is the other main result of the theory under discussion.

An open problem, with this reconstruction, concerns the connection between aspectual forms and *explicit* adverbs of quantification. In fact, in this paper I have discussed only when-constructions in which the perfective is associated with a default existential quantifier and the imperfective with a default universal quantifier. In this case the difference in truth-conditions between these two types of sentences is quite clear and intuitive. But both aspectual forms are compatible with (most) explicit adverbs of quantification. For example, the following pairs of sentences are perfectly in order:

(67)a.   Sempre, quando mi vedeva, il custode apriva la porta.
          Always, when the janitor see (past, imp.) me, he open (past, imp.) the door.

    b.   Sempre, quando mi vide, il custode aprì la porta.
          Always, when the janitor see (past, perf.) me, he open (past, perf.) the door.

(68)a.   A volte, quando mi vedeva, il custode apriva la porta.
          Sometimes, when the janitor see (past, imp.) me, he open (past, imp.) the door.

b.   A volte, quando mi vide, il custode aprì la porta.
     *Sometimes, when the janitor see (past, perf.) me, he open (past,
     perf.) the door.*

A first problem, with these examples, is represented by sentences (67b) and (68a), because the explicit adverbs of quantification they contain do not coincide with the invisible quantifier associated with the corresponding bare when-constructions. It is not clear what kind of syntactic and semantic devices neutralise the default quantifier when an explicit adverb of quantification is present. This is a general problem which concerns all the formal analyses based on the presence of an invisible operator.[31]

When we consider each pair of sentences separately, we have to face a more specific issue. In fact, we may wonder whether there is any *semantic* difference when passing from (67a) (or 68a) to (67b) (or (68b)). Intuitions are not clear on this point, although there seems to be no difference in terms of *truth-conditions*. For example, the situations that would make (67a) true would also make (67b) true, and viceversa. One might say that an Italian speaker is naturally inclined to associate the perfective with a *delimited* interval of time (with both end points made "visible") and, as a consequence, with a *determinate* quantity of eventualities located in that interval. This would not be true of the sentences in the imperfective, where the intended interval is felt as an indefinite period of time, because its end points are unspecified. Interestingly enough, such a characterisation of the perfective/imperfective contrast is not far from the intuitive import attributed by Bennett (1977) to the distinction between closed and open intervals, which he resorts to in his reconstruction of a particular form of imperfective, i.e. the progressive. So, Bennett's distinction might be incorporated into our analysis by discriminating the types of time intervals generated in the when-abstracts by the operators IPF and PF.

Reasoning in terms of open and closed intervals might contribute to explaining why the perfective, but not the imperfective, is acceptable when the duration of the course of events at issue is exactly specified:[32]

(69)   Per quindici giorni, quando mi vide, il custode aprì (sempre)
       la porta.
       *For fifteen days, when the janitor see (past, perf.) me, he
       (always) open (past, perf.) the door.*

---

[31] Starting from Heim (1982), for there are if-constructions with explicit adverbs of quantification which do not coincide with the invisible "necessity" operator required by bare if-clauses, i.e. by sentences with no explicit adverb of quantification.
[32] The same phenomenon is detected in French by Ducrot (1979: 20).

(70)   ?Per quindici giorni, quando mi vedeva, il custode apriva (sem-
        pre) la porta.
        *For fifteen days, when the janitor see (past, imp.) me, he
        (always) open (past, imp.) the door.*

Moreover, the association of the perfective with a closed interval suggests
the idea that only a definite number of events can be located in that
interval. So, if this number is exactly specified, the perfective is appro-
priate, as shown by this sentence:

(71)   Per nove volte, quando mi vide, il custode aprì (sempre) la
        porta.
        *For nine times, when the janitor see (past, perf.) me, he (always)
        open (past, perf.) the door.*

whilst the imperfective is not acceptable:

(72)   ?Per nove volte, quando mi vedeva, il custode apriva (sempre)
        la porta
        *For nine times, when the janitor see (past, imp.) me, he (always)
        open (past, imp.) the door.*

Unfortunately, it is also evident that in many contexts some of these
intuitions can easily be cancelled, as witnessed by the following discourse:

(73)   L'anno scorso, da giugno a luglio, andai al mare esattamente
        quindici volte. Ebbi fortuna, perché ricordo che, quando arri-
        vavo, trovavo bel tempo.
        *Last year, from June to July, I went to the seaside exactly fifteen
        times. I was lucky, because I remember that, when I arrive
        (past, imp.), I find (past, imp.) fine weather.*

Here, the intended time interval and the number of relevant circumstances
are exactly delimited, but the use of the imperfective in the when-construc-
tion is perfectly acceptable. If this is true, what we have just stated about
the use of the imperfective (or the perfective) must be considered very
cautiously. In general, if the intuitions associated with the (im)perfective
morphology are not semantic entailments determined by logical forms but
pragmatic "implicatures", an open problem is to know how strong they
are and what kind of formal representation fits them.

Another issue that deserves further investigation is the following. As I
have repeated at the outset of this section, one of the advantages of the
analysis under discussion is the possibility of a unified account of the two
main readings of the imperfective. As for the progressive reading, in

Section 5 I specified that its compatibility with accomplishment VPs turns out to be problematic. Although the intuitive data are somewhat controversial, many speakers find the following sentence odd:

(74)   ?Quando morì, Proust completava la *Recherche*.
       When Proust died, he complete (past, imp.) the Recherche.

This anomaly does not concern only when-clauses, but also temporal adverbials in general. The acceptability of the following example is even more problematic:

(75)   ?Alle cinque Leo dimostrava il teorema.
       At five o'clock Leo prove (past, imp.) the theorem.

It should be noticed that, in both cases, if the Imperfetto is replaced by the Perifrasi Progressiva we obtain sentences whose acceptability raises no problem at all, as witnessed by:

(74)a. Quando morì, Proust stava completando la *Recherche*.
        When Proust died, he was completing the Recherche.

(75)a. Alle cinque Leo stava dimostrando il teorema.
        At five o'clock Leo was proving the theorem.

In general, the more a verb phrase is characterizable as an *accomplishment* (in the sense of Vendler (1967)), whose inherent culmination point is strictly specified, the less it is compatible with the progressive reading of the imperfective (whilst it is perfectly compatible with the Perifrasi Progressiva).[33] The idea is that if an accomplishment VP can have an activity reading, then the progressive interpretation sounds fairly natural, otherwise it sounds odd. And, if this remark is correct, we can wonder how the theory under discussion can account for this difference in behaviour between activities (or states) and accomplishments with respect to the progressive reading of the imperfective.

To answer this question, take an activity verb such as *correre* (*run*) and its use in the Imperfetto:

(75)   Quando lo vidi, Leo correva nel parco.
       When I saw him, Leo run (past, imp.) in the park.

and consider the logical form that our analysis assigns to it:

(75') $\exists i[\prec(i, \text{now}) \land \exists e[\subseteq(e, i) \land \text{I-see-Leo}(e)] \land \forall i'[\subseteq(i', i) \rightarrow$
$\exists e'[\text{Leo-run-in-the-park}(e') \land \succ\prec(e', i')]]]$.

This formula says that there is an interval i such that all its (relevant) subintervals temporally coincide with an eventuality of a given type (in our case, the type of Leo's running in the park). Clearly, this condition is satisfied by eventualities that have the "subinterval property" (Bennett and Partee, 1978), i.e. eventualities of a type A such that, if e is of type A and the interval i coincides with the duration of e, then all the (relevant) subintervals of i coincide with the duration of an eventuality of the same type.[34] States and activities, which have this property, are compatible with the progressive reading of the imperfective, expressed by logical forms such as (75'): in our example, the event of Leo's running which temporally coincides with the interval i can be seen as the sum of smaller events of Leo's running which temporally coincide with the subintervals of i. Unlike activities and states, accomplishments do not have the subinterval property. If an event of Proust's completing the *Recherche* temporally coincides with the interval i, then no subinterval of i can correspond to a smaller event of Proust's completing the *Recherche*, and a logical form of the type illustrated in (75') turns out to be inappropriate, because it presupposes that the event at issue can be segmented into subevents of the same type. Therefore, the kind of logical form that the theory under discussion assigns to the progressive reading of the imperfective provides a simple explanation for the oddity of this reading in the case of accomplishment VPs.

REFERENCES

Bach, E.: 1981, 'On Time, Tense and Aspect: an Essay in English Metaphysics', in P. Cole (ed.), *Radical Pragmatics*, Academic Press, New York, pp. 63–81.

Bennett, E.: 1977, 'A Guide to the Logic of Tense and Aspect in English', *Logique et Analyse* **20**, 571–517.

Bennett, M. and Partee, B.: 1978, *Toward the Logic of Tense and Aspect in English*, Indiana University Linguistic Club, Bloomington.

Bertinetto, P.: 1986, *Tempo, Aspetto e Azione nel verbo italiano*, Accademia della Crusca, Firenze.

Bonomi, A.: 1992, 'Persistent Truths', *Intellectica* 1/2, 79–103.

Bonomi, A. and Casalegno, P.: 1993, 'Only: Association with Focus in Event Semantics', *Natural Language Semantics* **2**, 1–56.

Carlson, G. N.: 1979, 'Generics and Atemporal When', *Linguistics and Philosophy* **3**, 57–98.

---

[34] See Dowty (1986) and Moltmann (1991) for a more accurate version of this principle, which includes the necessary restrictions.

Carlson, G. N. and Pelletier, F. J. (eds.): 1995, *The Generic Book*, University of Chicago Press, Chicago and London.

Castelnovo, W.: 1992, *Progressive and Aktionsarten in Italian*, Dip. di Filosofia, Università di Milano.

Chierchia, G.: 1995: 'Individual Level Predicates as Inherent Generics', in Carlson and Pelletier (1995).

Comrie, B.: 1976, *Aspect*, Cambridge University Press, Cambridge.

Declerck, R.: 1988, 'Restrictive When-Clauses', *Linguistics and Philosophy* **11**, 131–168.

Dowty, D.: 1986, 'The Effects of Aspectual Classes on the Temporal Structure of Discourse: Semantics or Pragmatics?', *Linguistics and Philosophy* **9**, 37–61.

Ducrot, O.: 1979, 'L'imparfait en français', *Linguistische Berichte* **60**, 1–23.

Farkas, D., and Sugioka, Y.: 1983, 'Restrictive If/When Clauses', *Linguistics and Philosophy* **6**, 225–258.

Heinämäki, O.: 1978, *Semantics of English Temporal Connectives*, Indiana University Linguistics Club, Bloomington.

Hinrichs, E.: 1986, 'Temporal Anaphora in Discourse of English', *Linguistics and Philosophy* **9**, 63–82.

Jespersen, O.: 1931, *A Modern English Grammar on Historical Principles*, IV, Allen and Unwin, London.

Kamp, H. and Reyle, U.: 1993, *From Discourse to Logic*, Kluwer, Dordrecht.

Kamp, H. and Rohrer, Ch.: 1983, 'Tense in Text', in R. Bäuerle, Ch. Schwarze and A. von Stechow (eds.), *Meaning, Use and Interpretation of Language*, Springer, Berlin/New York, pp. 250–269.

Kratzer, A.: 1995, 'Stage-Level and Individual-Level Predicates', in Carlson and Pelletier (1995).

Krifka, M.: 1989, 'Nominal Reference, Temporal Constitution and Quantification in Event Semantics', in R. Bartsch, J. van Benthem and P. van Emde Boas (eds.), *Semantics and Contextual Expressions*, Foris, Dordrecht, pp. 75–116.

Krifka, M. et al.: 1995, 'Genericity: An Introduction', in Carlson and Pelletier (1995).

Lewis, D.: 1975, 'Adverbs of Quantification', in E. Keenan (ed.), *Formal Semantics of Natural Language*, Cambridge, Cambridge, pp. 3–15.

Link, G.: 1987, 'Algebraic Semantics of Event Structures', in J. Groenendijk, M. Stokhof and F. Veltman (eds.), *Proceedings of the 6th Amsterdam Colloquium*, ITLI, Amsterdam, pp. 243–262.

Moens, M.: 1987, *Tense, Aspect and Temporal Reference*, University of Edinburgh, Edinburgh.

Moltmann, F.: 1991, 'Measure Adverbials', *Linguistics and Philosophy* **14**, 629–660.

Parsons, C.: 1990, *Events in the Semantics of English*, The MIT Press, Cambridge (Mass.) and London.

Partee, B.: 1984, 'Nominal and Temporal Anaphora', *Linguistics and Philosophy* **7**, 243–286.

Ritchie, G. D.: 1979, 'Temporal Clauses in English', *Theoretical Linguistics* **6**, 87–115.

Rooth, M.: 1985, *Association with Focus*, University of Massachusetts, Amherst.

Russell, B.: 1905, 'On Denoting', *Mind* **14**, 589–567.

Sandström, G.: 1993, *When-Clauses and the Temporal Interpretation of Narrative Discourse*, Department of General Linguistics, University of Umeå.

Smith, C.: 1991, *The Parameter of Aspect*, Kluwer, Dordrecht.

Stump, G.: 1985, *The Semantic Variability of Absolute Constructions*, Reidel, Dordrecht.

de Swart, H.: 1991, *Adverbs of Quantification: A Generalized Quantifier Approach*, Rijksuniversiteit, Groningen.

Van Eynde, F.: 1992, 'Towards a Dynamic and Compositional Treatment of Temporal Expressions', in P. Dekker and M. Stokhof (eds.), *Proceedings of the 8th Amsterdam Colloquium*, ITLI, Amsterdam, pp. 153–172.

Vendler, Z.: 1967, *Linguistics in Philosophy*, Cornell University Press, Ithaca, New York.
Westerståhl, D.: 1985, 'Determiners and Context Sets', in J. van Benthem and A. ter Meulen
(eds.), *Generalized Quantifiers in Natural Language*, Foris, Dordrecht, pp. 56–67.

Dipartimento di Filosofia
Università degli Studi di Milano
via Festa del Perdono, 7
20122 Milano (Italy)
e-mail: bonomi@imiucca.csi.unimi.it