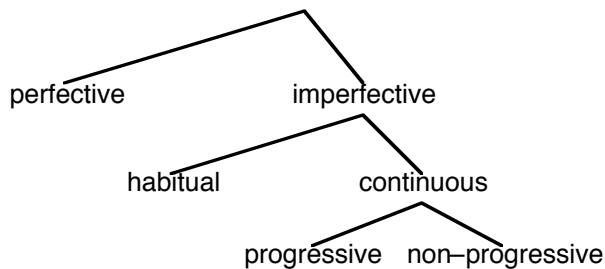


# 1. THE IMPERFECTIVE PAST

A diagram of the main distinctions in the domain of aspect:



from Comrie

Topic: The semantics of the distinction between perfective and imperfective marking.

Focus: Languages with a choice between past imperfective and past perfective.

French: Passé simple/Passé composé vs. Imparfait

Italian: Preterito vs. Imperfetto

Spanish: Pretérito vs. Imperfecto

Widespread intuitions about the contribution of the imperfective:

*Passé Simple/Composé*

*Imparfait*

Table from Binnick

punctual

as if event occurs in an instant

durative

event takes place over time

closed

event is a completed whole

open

event is partial and incomplete

narrative movement

the story line is advanced

no narrative movement

the event is not part of the main story line

exterior

the event is viewed from outside

interior

the event is viewed from within

While some of this sounds intolerably mystical, in a formal semantic framework the intuition behind it can be implemented quite straightforwardly.

With respect to the evaluation interval the situation described by the sentence is claimed to be ongoing.

Reichenbach:  
R in E ?

There are two major uses of the imperfective: “progressive” and “habitual”.

- (1) Gianni dipingeva la parete  
*Gianni painted-IMP the wall*
- (2) a. Gianni was painting the wall (when I came in).  
b. (In those days) Gianni painted the wall (regularly).

Can this ambiguity be reduced somehow?

## 2. BACKGROUND ON WHEN-CLAUSES AND TEMPORAL RELATIONS

“Rhetorical Relations” in non-habitual uses:

- (3) a. When I came in, Mary  $\left\{ \begin{array}{l} \text{was on the couch} \\ \text{was sleeping} \\ \text{was eating an orange} \\ \text{--} \\ \text{slept} \\ \text{ate an orange} \end{array} \right\}$ .
- b.  $\left\{ \begin{array}{l} ?\text{When} \\ \text{While} \end{array} \right\}$  I  $\left\{ \begin{array}{l} \text{was on the couch} \\ \text{was sleeping} \\ \text{was eating an orange} \\ \text{--} \\ \text{slept} \\ \text{ate an orange} \end{array} \right\}$ , Mary came in.

Early discussion in  
Heinämäki's Dissertation

Classic references:

Kamp 1979  
Hinrichs 1981, 1986  
Partee 1984  
Dowty 1986

### First Attempt

- (4) *When pPAST, qPAST* uniformly means  
 $\square \left( \text{PAST}(i) \ \& \ p(i) \ \& \ q(i) \right)$
- (5)  $\square \left( \text{PAST}(i) \ \& \ I \text{ come in}(i) \ \& \ \text{Mary be on the couch}(i) \right)$

Fine. We get temporal inclusion of the coming-in event in the being-on-the-couch state.  
What about processes?

- (6)  $\square \left( \text{PAST}(i) \ \& \ I \text{ come in}(i) \ \& \ \text{Mary slept}(i) \right)$

This would require inclusion of the coming-in event in the sleeping process. Is this really what the sentence means? Consider Dowty's

- (7) When John entered the president's office, the clock on the wall ticked loudly.

Dowty observes that process predicates allow an inceptive/inchoative reading. It may be that such a reading is preferred, since there is the competing possibility of a progressive.

- (8) When John entered the president's office, the clock on the wall was ticking loudly.

Anyway, we definitely have the wrong prediction for clear event predicates:

- (9)  $\square \left( \text{PAST}(i) \ \& \ I \text{ come in}(i) \ \& \ \text{Mary ate an orange}(i) \right)$

Here, simultaneity of two events would be required. Instead, the sentence seems to express a succession of two events.

### Second Attempt

- (10) When  $p_{PAST}$ ,  $q_{PAST}$  uniformly means  
 $\Box \left( PAST(i) \ \& \ p(i) \ \& \ \Box i' \left( i' \text{ just after } i \ \& \ q(i') \right) \right)$ .

This would give us the succession reading of two events. It would (almost) give us the inclusion reading of an event and a state. Dowty argues that what we get is enough. Pragmatics will usually supply inclusion. But not always: *When I finally came in, Mary was happy*.

Quantified Cases

- (11) a. Whenever Mary telephoned, Sam was asleep.  
 When Mary telephoned, Sam was always asleep.  
 b. Whenever I come home late, Emma complains miserably.  
 When I come home late, Emma always complains miserably.

Observe same internal temporal relations.

- (12) *always when*  $p_{PAST}$ ,  $q_{PAST}$  uniformly means  
 $\Box i \left( PAST(i) \ \& \ p(i) \ \Box \Box i' \left( i' \text{ just after } i \ \& \ q(i') \right) \right)$ .

- (13) Whenever Mary wrote a letter, Sam answered it  $\left\{ \begin{matrix} \text{immediately} \\ \text{two days later} \end{matrix} \right\}$ .  
 When Mary wrote a letter, Sam always answered it  $\left\{ \begin{matrix} \text{immediately} \\ \text{two days later} \end{matrix} \right\}$ .

Do these modifiers replace “just after” in (12)? Or is there more structure?

“Partee’s Problem”

so-called by de Swart in her dissertation, also discussed by Johnston

- (14) Before John makes a phone call, he always lights up a cigarette.

does not mean:

$$\Box i \left( \Box i' \left( i \text{ before } i' \ \& \ \text{John makes a phone call}(i') \right) \ \Box \Box i' \left( i' \text{ just after } i \ \& \ q(i') \right) \right)$$

nor

$$\Box i \left( \Box i' \left( i \text{ before } i' \ \& \ \text{John makes a phone call}(i') \right) \ \Box q(i) \right)$$

These would require that John is lighting up a cigarette at all times preceding each phone call.

The same problem arises with *after*:

(15) After John made a phone call, he always lit up a cigarette.

This cannot be verified by a situation in which John has only ever smoked once but where that happened after all his phone calls.

==> Rothstein

Partee's suggestion: insure that the before-condition ends up in the nuclear scope:

(16) When John makes a phone call, he always lights up a cigarette beforehand.

adopted by de Swart,  
Bonomi

But this still doesn't get the meaning right. We need to exclude the possibility that one cigarette was smoked once but it was before all of his phone calls.

Other possibility: interpret *before* as *just before*, etc. Once this move is made, it doesn't matter so much whether the condition is in the restriction or in the scope.

Johnston

### Another Possible Configuration to Keep in Mind

A normal habitual structure:

(17) Whenever John was depressed, he smoked.

A doubly habitual structure:

(18) Whenever John ran for exercise, he slept soundly.

can mean:

During any period during which John regularly ran for exercise (rather than swimming or not doing anything) he usually slept soundly.

After these preliminaries, turn to the imperfective past.

### 3. KAMP & ROHRER (1983)

- (19) Quand Alain vit sa femme,  
*When Alain saw-PERF his wife*
- a. elle lui souriait  
*she him smile-IMP*
- b. elle lui sourit  
*she him smile-PERF*

“when an 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 passé simple, the new event is interpreted as following the old event, or alternatively as included within it.”

Just treat imparfait as a progressive?

Bonomi’s complaint: but why also habitual reading?

### 4. BONOMI’S MAIN PROPOSAL

[At this point, I will not use the exact machinery proposed by Bonomi. The spirit of his proposal survives nevertheless. I discuss his machinery in an appendix.]

The imperfective and perfective do not by themselves effect a semantic operation. They signal the presence of a universal quantifier over times and an existential quantifier over times respectively. When a *when*-clause and the main clause have the same aspectual marking, it is possible to posit just one such quantifier. In that case, the *when*-clause is read as the restrictor of that quantifier.

cf. Newton on Greek

“Our starting point is the idea that, in the case of bare *when*-constructions, *when*-clauses 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 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 realization in the fact that the main verbs of both clauses share the same aspectual morpheme.”

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

- (20) Quando mi vedeva, il custode apriva la porta.  
*When me saw-IMP, the janitor opened-IMP the door*

“Whenever he saw me, the janitor opened the door”

$$\lambda i \left( \text{PAST}(i) \ \& \ \text{the janitor see me}(i) \ \lambda i' \left( \text{just after } i \ \& \ \text{he open the door}(i') \right) \right)$$

But that’s actually not what Bonomi uses. He has:

$$\lambda i \left( \text{PAST}(i) \ \& \ \lambda i' \left( i' \ \& \ \text{the janitor see me}(i') \ \lambda i'' \left( i'' \ \& \ \text{he open the door}(i'') \right) \right) \right)$$

$\lambda$  stands for “temporal coincidence”

The tense applies all the way outside. The universal quantifier quantifies over all subintervals of the interval introduced by tense. Of course we don’t necessarily need a restrictive *when*-clause:

- (21) Alle sette il custode apriva la porta.  
*At-the seven the janitor opened-IMP the door*

Quando erano le sette il custode apriva la porta.  
*When was-IMP the seven the janitor opened-IMP the door*

Al Country Club, Leo giocava a golf  
*At-the Country Club Leo play-IMP golf*

Quando si trovava al Country Club, Leo giocava a golf  
*When si found at-the Country Club Leo play-IMP golf*

Leo giocava a golf  
*Leo play-IMP golf*  
 “Leo used to play golf”

- (22) Quando giocava a golf, Leo guadagnava molto  
*When play-IMP golf Leo made-IMP a lot (of money)*

This has a habitual reading: 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. (Leo is a pro that gets paid a lot of money for each appearance. Or, Leo is good and wins a lot of bets).

But it also has a doubly habitual reading: during the period during which he used to play golf, he was a big-money maker.

Idea: here we have two bare habituals linked by a *when*-clause. Perhaps, this is a case where *when* restricts the tense? That's sort of what Bonomi does, except that he has a more complicated version of it.

$$(23) \quad \exists \left( \text{PAST}(i) \ \& \ \exists i' \left( i' \ \& \ \text{Leo play golf}(i') \right) \ \& \ \exists i'' \left( i'' \ \& \ \text{Leo make a lot}(i'') \right) \right)$$

When both clauses are perfective, or when there is just one perfective main clause, an existential quantifier is triggered:

(24) Quando mi vide, il custode aprì la porta  
*When me saw-PERF, the janitor opened-PERF the door*

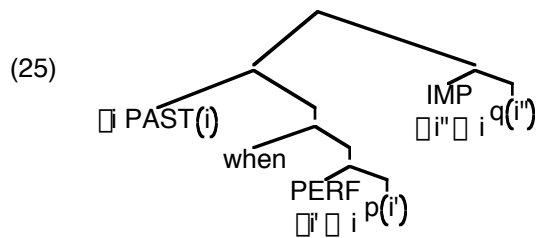
(On some particular occasion) "When the janitor saw me, he opened the door"

$$\exists \left( \text{PAST}(i) \ \& \ \exists i' \left( i' \ \& \ \text{the janitor see me}(i') \ \& \ \exists i'' \left( i'' \ \& \ \text{he open the door}(i'') \right) \right) \right)$$

How to Get a Progressive Reading out of a Habitual Sentence

"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".

Consider cases where the *when* -clause contains a perfective past and the main clause contains an imperfective past. Here, the *when*-clause cannot be restricting the universal quantifier triggered by the imperfective. It must be restricting the tense. We have something like the following structure:



Bonomi's idea is that this logical form is general enough to cover both habitual and progressive readings of the imperfective.

- (26) a. Quando entrai in aula, Leo fumava.  
*When came-PERF in room, Leo smoked-IMP*  
 “When I came into the room, Leo was smoking”
- b. Quando entrai in aula, Leo stava fumando.  
*When came-PERF in room, Leo was smoking-PROG*

The example in (26a) pretty much only has a progressive reading. But the following is actually ambiguous:

- (27) Quando fu notato da Miles Davis, Ahmad Jamal suonava in un trio.  
*When was-PERF noticed by Miles Davis, Ahmad Jamal play-IMP in a trio*

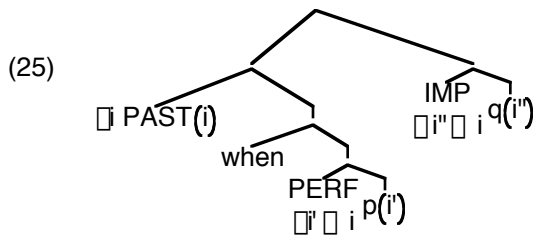
This can either mean: (i) habitual When Miles Davis discovered him, Ahmad Jamal was part of a trio, or (ii) progressive When Miles Davis discovered him, Ahmad Jamal was playing in a trio.

Bonomi suggests that all that differs is whether the interval during which Miles Davis is asserted to have discovered him is large or small. If it is large then a habitual reading is more likely, if it is small a progressive reading is more likely.

We can modulate the force of the universal quantification over subintervals of the evaluation interval by assuming certain conditions on what is a relevant subinterval. As pointed out to Bonomi by Sandro Zucchi, if it is assumed that the evaluation interval is itself a relevant subinterval, only the progressive reading will be generated.

### The Progressive Reading of the Imperfective Past is not like the English Progressive

Consider again Bonomi’s structure for the progressive reading of the imperfective:



While this does claim that the evaluation interval is full of q-events, it doesn’t actually say that there is an ongoing q-event. In fact, (25) will only work if q is an atelic predicate of intervals. In a way, Bonomi’s universal quantifier is the opposite of a progressive operator. His quantifier requires that every subinterval of the evaluation interval is a q-interval. The progressive operator of English would require that the evaluation interval be part of a q-interval.

One consequence of Bonomi's system is that there should not be a progressive reading when the predicate is telic. He predicts a contrast between the following examples:

- (28) a. ?Quando morì, Proust completava la *Recherche*.  
*When died-PERF Proust complete-IMP the Recherche*
- a'. Quando morì, Proust stava completando la *Recherche*.  
*When died-PERF Proust was completing-PROG the Recherche*
- b. ?Alle cinque Leo dimostrava il teorema.  
*At-the five Leo proved-IMP the theorem.*
- b'. Alle cinque Leo stava dimostrando il teorema.  
*At-the five Leo was proving-PROG the theorem.*

Bonomi says that "although the intuitive data are somewhat controversial, many speakers [find the imperfective sentences in (28)] odd".

Let's tease the issue apart.

Giorgi & Pianesi seem to suggest that the imperfective is in fact OK with telic predicates, but that it doesn't quite mean the same as the progressive. In particular, the modal dimension of the progressive is said to be absent in the case of the imperfective. So,

- (29) Quando venne interrotto da Lucifero, Dio stava creando un unicorno.

is of course fine (and no unicorn needs to exist). But the following differ

- (30) a. Quando Artù entrò, Merlino creava un unicorno.  
b. Quando Artù entrò, Merlino stava creando un unicorno.

G & P don't say that (30a) is odd, but that it does imply that the unicorn was in fact created. (30b) on the other hand is supposed to allow the possibility that in the end the unicorn wasn't created.

This alone would explain why (28a) is odd. It would require a modal progressive reading, and if that is unavailable, (28a) would be out. (28b) on the other hand should be OK according to G&P but "odd" according to Bonomi.

What about other languages with imperfective pasts? Do they have progressive-like readings of telic predicates in the imperfective?

Let's do some minimal fieldwork.

Consider the following English discourse:

*When Bob came into the room, Sam was building a house of cards. But the draft from the open door collapsed the structure, and so Sam never got to complete it.*

In the languages I had time to test, this discourse is fine with an explicit progressive construction in the main clause of the first sentence:

- (31) a. Quando Bob entrò nella stanza, Sam stava costruendo un castello di carte. Ma lo spiffero proveniente dalla porta aperta fece crollare la struttura cosicché Sam non la completò mai.
- b. Lorsque Jean est entré dans la piece, Pierre était en train de construire un chateau de cartes. Mais le courant d'air provenant de la porte que l'on venait d'ouvrir a fait s'ecrouler la construction, si bien que Pierre n'a jamais pu finir son chateau.
- c. Cuando Bob entro en el cuarto, Sam estaba construyendo una casa de cartas. [Continuation OK].

With an imperfective, things are different:

- (32) a. ?Quando Bob entrò nella stanza, Sam costruiva un castello di carte.  
# Ma lo spiffero proveniente dalla porta aperta fece crollare la struttura cosicché Sam non la completò mai.
- b. ?Lorsque Jean est entré dans la piece, Pierre construisait un chateau de cartes. Mais le courant d'air provenant de la porte que l'on venait d'ouvrir a fait s'ecrouler la construction, si bien que Pierre n'a jamais pu finir son chateau.
- c. Cuando Bob entro en el cuarto, Sam construia una casa de cartas. [Continuation a little weird].
- d. Otan o Bob bike sto domatio, o Sam extize ena xartospito. Ala to revma gremise tin kataskevi, ke etsi o Sam dhen to apoteliose.

In Italian (according to Caterina, in accordance with Bonomi), the imperfective is slightly odd with such a telic predicate. If it is possible at all, it cannot have the modal reading (in accordance with Giorgi & Pianesi).

In French (according to Philippe), the imperfective seems not perfectly natural with a telic predicate. (It becomes better with a passé simple in the *when*-clause; this may be because the high-brow register that has the passé simple also allows the progressive reading of the imperfective more readily. Less of a competition from the explicit progressive?). But, in distinction to Italian, the modal reading is available with the imperfective: (032b) is a coherent discourse.

In Spanish (according to Calixto), the explicit progressive is preferred, but the imperfective is available. The continuation is a little weird with the imperfective.

In Greek (according to Sabine), there is no explicit progressive competing with the imperfective, and the continuation forcing the modal reading is fine.

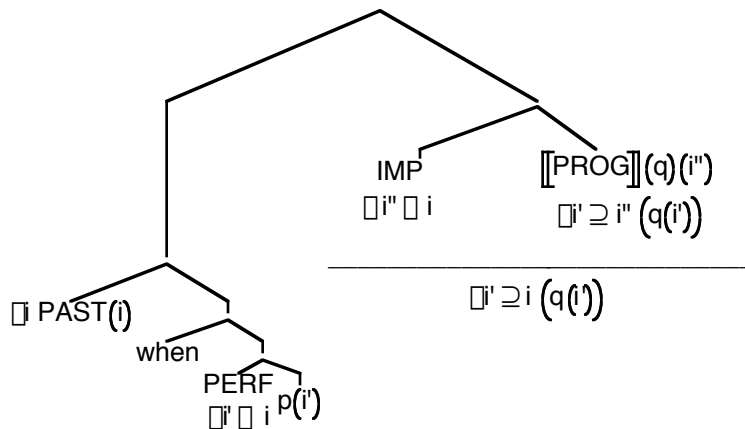
## Repairing Bonomi

What we could do is add a covert PROG-operator under the universal quantifier triggered by the imperfective. If Giorgi & Pianesi are right that the progressive imperfective does not have the modal meaning of an explicit progressive, we can give the covert PROG operator the following simple meaning:

$$(33) \quad \llbracket \text{PROG} \rrbracket (p)(i) \text{ iff } \Box' \supseteq i (p(i'))$$

If we inserted such an operator in (25), we'd get:

(34)



In effect, the covert progressive operator cancels out the force of the universal quantifier.

A covert PROG operator may be needed for these languages anyway. Recall that they allow simple present tense reportive sentences involving non-stative predicates:

(35) Gianni mangia una mela.  
*Gianni eats an apple*

Gianni corre.  
*Gianni runs*

But now some of the appeal of Bonomi's analysis is gone. The progressive and habitual readings do not always come from the same source.

Conclusion: Perhaps, we should re-evaluate the situation and consider alternatives to Bonomi's meaning for the imperfective.

## 5. OVERT ADVERBIAL QUANTIFIERS AND ASPECT CHOICE

Another problem with Bonomi's analysis (acknowledged in his paper) is that the imperfective is compatible with overt adverbs of quantification, which means that it cannot be straightforwardly the reflex of a covert universal operator:

- (36) a. A volte, quando mi videva, il custode apriva la porta.  
b. A volte, quando mi vide, il custode aprì la porta.

What is the distinction signalled by aspect choice here (assuming there is a distinction at all)?

“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.”

- (37) Per quindici giorni  
*For fifteen days*
- a. ?quando mi videva, il custode (sempre) apriva la porta.  
b. quando mi vide, il custode (sempre) aprì la porta.

- (38) Per nove volte  
*For nine times*
- a. ?quando mi videva, il custode (sempre) apriva la porta.  
b. quando mi vide, il custode (sempre) aprì la porta.

- (39) L'anno scorso, da giugno a luglio, andai al mare esattamente quindici volte. Ebbi fortuna, perché ricordo che,  
  
quando arrivavo, trovavo bel tempo.

“Here, the intended time interval and the number of relevant circumstances are exactly delimited, but the use of the imperfective in the *when*-construction is perfectly acceptable.”

- (40) a. Last year, I went to the beach quite a lot.  
Luckyly,  $\left\{ \begin{array}{l} \text{any} \\ \text{every} \end{array} \right\}$  time I went the weather was great.
- b. Last year, I went to the beach exactly fifteen times.  
Luckyly,  $\left\{ \begin{array}{l} \text{?any} \\ \text{every} \end{array} \right\}$  time I went the weather was great.

This relates to the availability of what I call “specific generics”, lawlike statements about a clearly delimited situation.

cf. *At the party last night John talked to any woman that came up to him.*

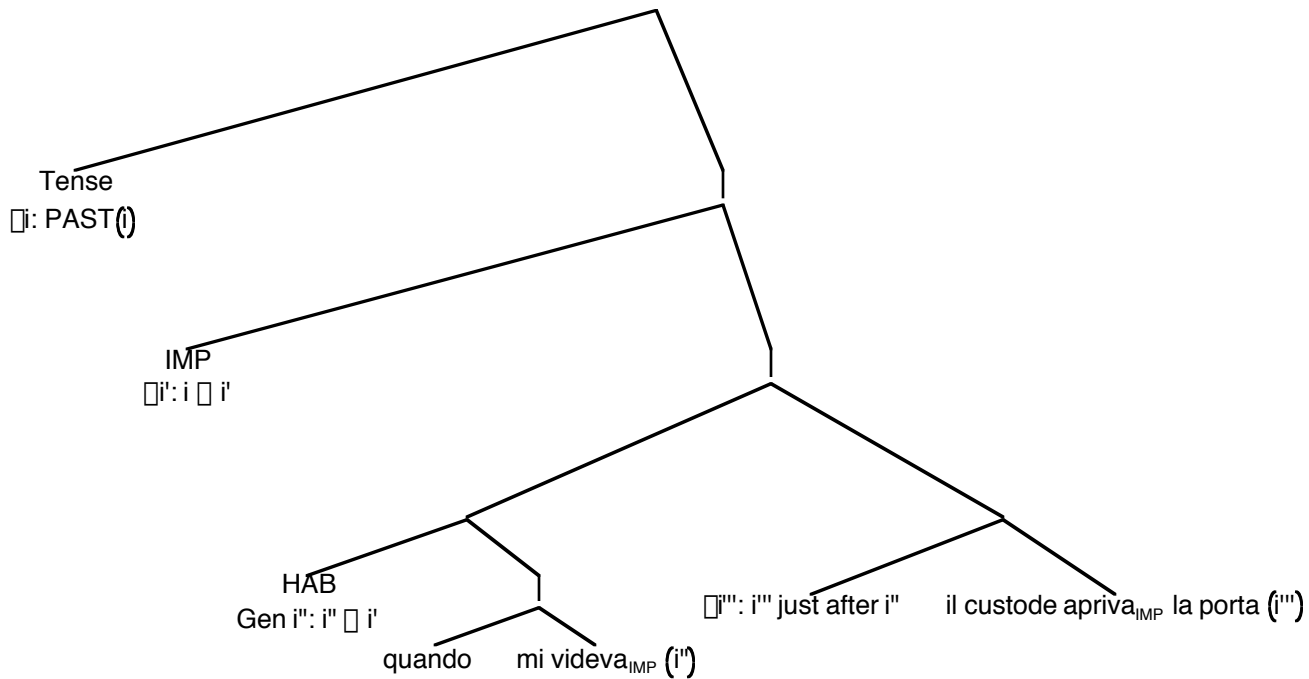
## 6. IMPERFECTIVE TRIGGERS INCLUSION OPERATOR ON INTERVALS

### The Simple Idea:

- The Imperfective Aspect triggers an inclusion operator on intervals.
- It presupposes that its complement predicate is stative.
- Stativity can hold lexically (stative and process predicates).
- Stativity can be derived by silent progressive or habitual operators.
- Imperfective marking is a reflex of the inclusion operator (to allow for “aspect agreement”).

### Sample Structures

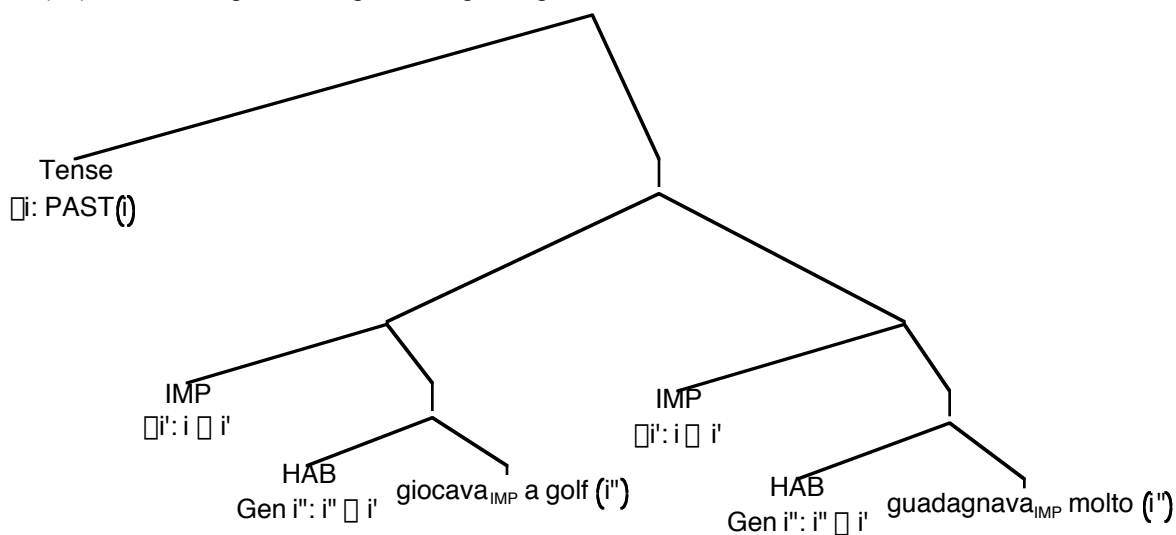
(41) Quando mi vedeva, il custode apriva la porta.



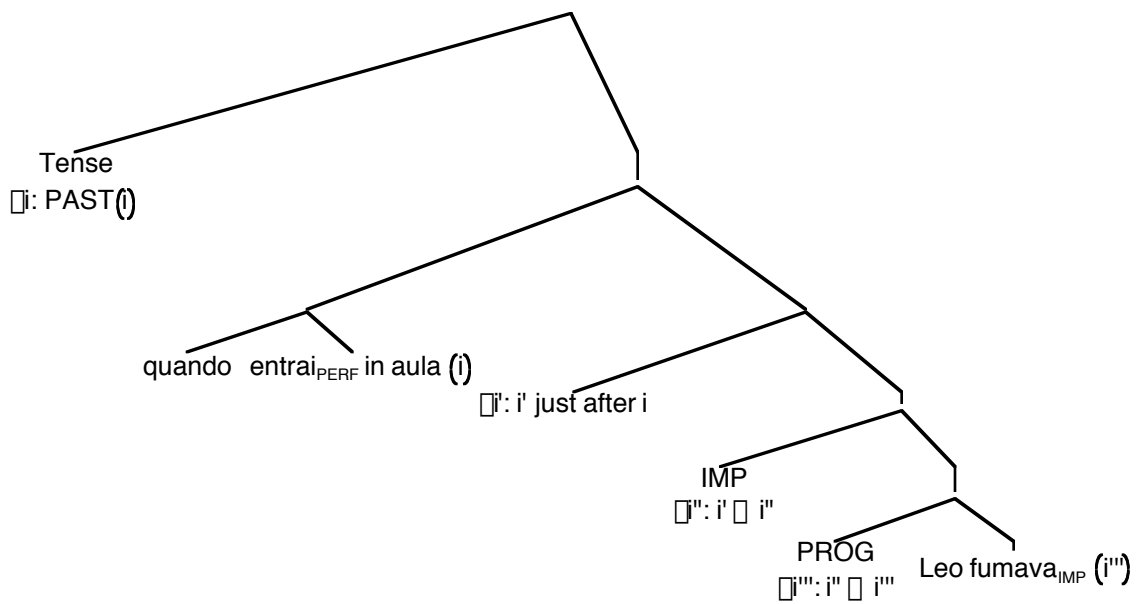
Relate “inclusion” idea to stories that connect the imperfective to “locative” locutions: evaluation interval is inside an ongoing event/state.

cf. *Last year, John was in the habit of smoking after dinner.*

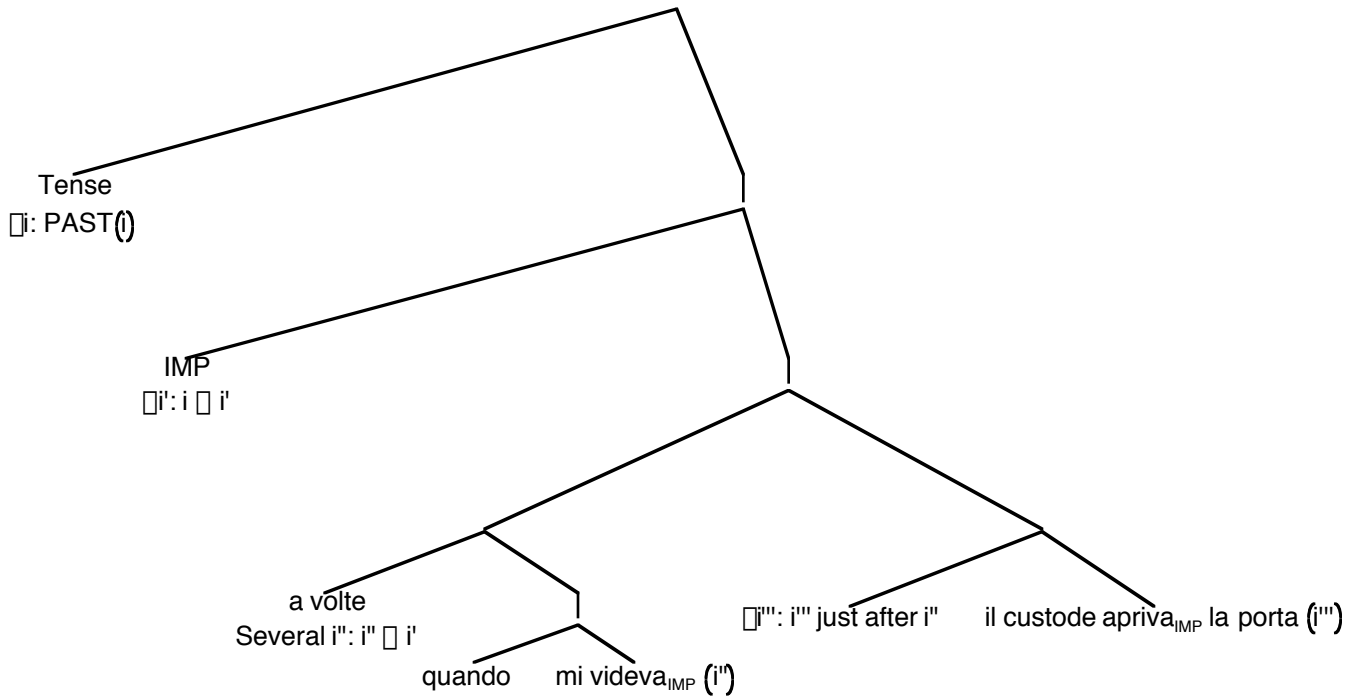
(42) Quando giocava a golf, Leo guadagnava molto



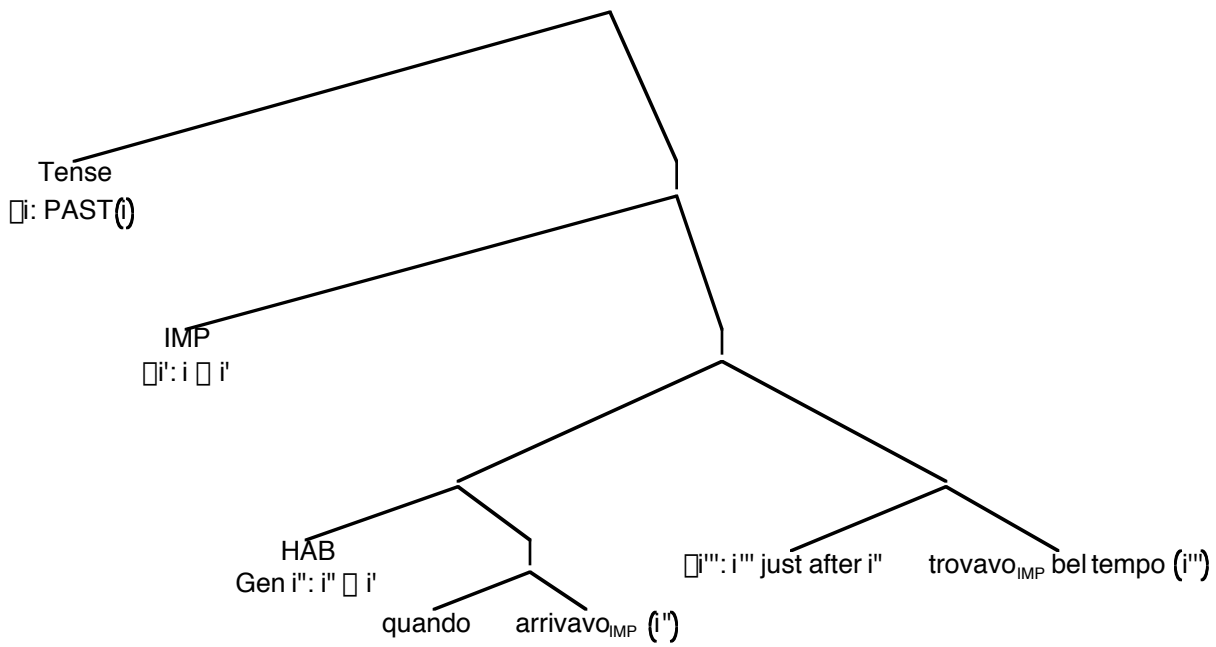
(43) Quando entrai in aula, Leo fumava.



(44) A volte, quando mi videva, il custode apriva la porta.



(45) L'anno scorso, da giugno a luglio, andai al mare esattamente quindici volte. Ebbi fortuna, perché ricordo che, quando arrivavo, trovavo bel tempo.



## 7. THE PRESUPPOSITIONAL NATURE OF THE IMPERFECTIVE

- (46) Gianni dipingeva la parete  
*Gianni painted-IMP the wall*

“ungrammatical if there is no ‘presupposed’ familiar time at which the event of painting the wall is assumed to take place” (Delfitto & Bertinetto 1995).

- (47) Il custode apriva la porta.  
*The janitor open-IMP the door*

“sounds very strange if uttered ‘out of the blue’, i.e. in isolation” (Bonomi)

- (48) a. Ho mangiato una mela  
*Have eaten an apple*

“I ate an apple”

- b. Mangiava una mela.  
*Ate-IMP an apple*

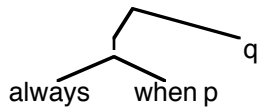
(48a) is “perfectly interpretable, even in the absence of any context”. (48b), however, “is odd if uttered ‘out-of-the-blue’. It is appropriate as an answer to questions such as ‘What were you doing yesterday?’ or ‘What were you doing when John arrived?’, which explicitly provide a temporal location from which the imperfect can take its temporal reference.” (Giorgi & Pianesi).

cf. *John was painting the wall. The janitor was opening the door.* These are similarly strange out of the blue.

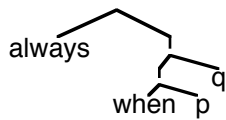
## APPENDIX: BONOMI'S TRICKS

Bonomi does not want to assume that at LF the quantificational operator, the restrictive material, and the scope material find themselves in the appropriate positions. Instead, he intends to recover the necessary information from a structure where the *when*-clause and the main clause together form one constituent that becomes the single argument of a quantificational operator. How can that work?

(49) Instead of



we need to interpret



Following a suggestion by Casalegno, Bonomi proposes the following meaning for  $\llbracket \text{when} \rrbracket p, q$ , a denotation that he calls a *when*-abstract:

$$(50) \quad \llbracket \text{when} \rrbracket (p)(q) = \lambda i \lambda C \left[ p(i) \ \& \ \exists i' \left( C(i') \ \& \ q(i') \ \& \ i \sqsubseteq i' \right) \right]$$

This is a relation between an interval  $i$  and a set of intervals  $C$  iff  $i$  is a  $p$ -interval and  $C$  is a set of  $q$ -intervals coinciding with  $i$ .

From this we can retrieve the set of  $p$ -intervals, which can then be fed into the first logical argument of the quantifier over intervals. This is done by just existentially closing the  $C$ -set. For any  $p$ -interval, there will be a set of  $q$ -intervals coinciding with it, because there will at least be the empty set of such intervals. Thus, we have the following equivalences:

(51) Recovery of the Restriction from a *When*-Abstract

$$\begin{aligned}
 & \lambda i. \lambda C \left( \llbracket \text{when} \rrbracket (p)(q) (i)(C) \right) \\
 &= \lambda i. \lambda C \left( \lambda i' \lambda C \left[ p(i) \ \& \ \exists i' \left( C(i') \ \& \ q(i') \ \& \ i \sqsubseteq i' \right) \right] (i)(C) \right) \\
 &= \lambda i. \lambda C \left( p(i) \ \& \ \exists i' \left( C(i') \ \& \ q(i') \ \& \ i \sqsubseteq i' \right) \right) \\
 &= \lambda i. p(i) \\
 &= p
 \end{aligned}$$

For the second logical argument of the quantifier, we can basically use the whole *when*-construct with one further condition that the C-set be non-empty. The repetition of p in the nuclear scope will not be harmful as long as we are dealing with quantifiers that are assumed to be conservative anyway. Here's what we get:

(52) Recovery of the Nuclear Scope from a *When*-Abstract

$$\begin{aligned}
 & \exists i. \exists C \left( \left( \llbracket \text{when} \rrbracket (p)(q) \right) (i)(C) \right) \& C \neq \emptyset \\
 &= \exists i. \exists C \left( \left( \exists i' \exists C' \left[ p(i) \& \exists i' \left( C(i') \supseteq q(i') \& i \sqsubseteq i' \right) \right] \right) (i)(C) \right) \& C \neq \emptyset \\
 &= \exists i. \exists C \left( p(i) \& \exists i' \left( C(i') \supseteq q(i') \& i \sqsubseteq i' \right) \right) \& C \neq \emptyset \\
 &= \exists i. p(i) \& \exists i' \left( q(i') \& i \sqsubseteq i' \right)
 \end{aligned}$$

That is, we get the set of p-intervals for which there is a coinciding q-interval.

So, the entries for the covertly tripartite quantifiers will look like this. The existential quantifier is of course not essentially dyadic, so we can give it a fairly simple entry.

(53) Existential Quantification over Intervals

The existential quantifier over intervals takes as its arguments a *when*-abstract (a relation between intervals and sets of intervals) and an evaluation interval.

$$\begin{aligned}
 & \llbracket \exists \rrbracket (\llbracket \text{when} \rrbracket (p)(q))(i) = 1 \\
 & \text{iff } \exists i' \left( i' \sqsubseteq i \& \text{RELEVANT}(i') \& \exists C \left( \llbracket \text{when} \rrbracket (p)(q) \right) (i')(C) \right) \& \left( \exists C \left( \llbracket \text{when} \rrbracket (p)(q) \right) (i)(C) \& C \neq \emptyset \right) \\
 & \text{iff } \exists i' \left( i' \sqsubseteq i \& \text{RELEVANT}(i') \& \exists C \left( \llbracket \text{when} \rrbracket (p)(q) \right) (i')(C) \& C \neq \emptyset \right)
 \end{aligned}$$

When this is applied to a *when*-abstract, we get the following calculation:

(54) Assembly of Existential Quantification from a *When*-Abstract

$$\begin{aligned}
 & \llbracket \exists \rrbracket \left( \llbracket \text{when} \rrbracket (p)(q) \right) (i) = 1 \\
 & \text{iff } \exists i' \left( i' \sqsubseteq i \& \text{RELEVANT}(i') \& \exists C \left( \llbracket \text{when} \rrbracket (p)(q) \right) (i')(C) \& C \neq \emptyset \right) \\
 & \text{iff } \exists i' \left( i' \sqsubseteq i \& \text{RELEVANT}(i') \& p(i') \& \exists i'' \left( q(i'') \& i'' \sqsubseteq i' \right) \right)
 \end{aligned}$$

And for the universal quantifier, we need:

(55) Universal Quantification over Intervals

$$\begin{aligned} \llbracket \forall \rrbracket (p)(i) &= 1 \\ \text{iff } \forall i' \left( i' \sqsubseteq i \ \& \ \text{RELEVANT}(i') \ \& \ \forall C \left( \llbracket p \rrbracket (i')(C) \right) \right) \sqsubseteq \left( \forall C \left( \llbracket p \rrbracket (i)(C) \ \& \ C \neq \emptyset \right) \right) \end{aligned}$$

When this is applied to a *when*-abstract, we get:

(56) Assembly of Universal Quantification from a *When*-Abstract

$$\begin{aligned} \llbracket \forall \rrbracket \left( \llbracket \text{when} \rrbracket (p)(q) \right) (i) &= 1 \\ \text{iff } \forall i' \left( i' \sqsubseteq i \ \& \ \text{RELEVANT}(i') \ \& \ \forall C \left( \llbracket \text{when} \rrbracket (p)(q)(i')(C) \right) \right) \sqsubseteq \left( \forall C \left( \llbracket \text{when} \rrbracket (p)(q)(i)(C) \ \& \ C \neq \emptyset \right) \right) \\ \text{iff } \forall i' \left( i' \sqsubseteq i \ \& \ \text{RELEVANT}(i') \ \& \ p(i') \right) \sqsubseteq \forall i'' \left( q(i'') \ \& \ i'' \sqsubseteq i \right) \end{aligned}$$

When we have a universal quantifier that is not given a *when*-abstract, we need to do some more fancy footwork. One possibility is to posit an empty *when* and an empty trivial restrictive clause. Another possibility, adopted by Bonomi, is to type-shift the main clause argument of a syntactically unrestricted quantifier into the same kind of object as a *when*-abstract.

(57) Type-Shift of a Predicate of Intervals into a *When*-Abstract

$$\uparrow (p) = \lambda i. \lambda C. \forall i' \left( C(i') \sqsubseteq q(i') \ \& \ i' \sqsubseteq i \right)$$

This can be fed to one of the quantifiers to give the right kind of meaning.