

TELOCITY AND PERFECTIVITY: TWO INDEPENDENT SYSTEMS

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We argue that a distinction is needed between semantic aspect, on the one hand, and morpho-syntactic tense and aspect, on the other. The two phenomena are governed by independent systems. Semantic aspect, which is exemplified by the categories telic and atelic, is determined by the type of interval at which the event holds in the framework of interval semantics. Morpho-syntactic tense and viewpoint aspect, which reflects the perfective/imperfective distinction, are determined by the Reference time system based on the relations established between Reference time, Speech time, and Event time. Contrary to popular view, perfectivity is fully independent of semantic aspect and is only determined by the relations of Reference time and Speech time.

1. Introducing the problem

The term *aspect* is used in linguistic theory to cover (at least) two distinct phenomena. The first one regards semantic aspect or telicity distinctions, the second one regards the morpho-syntactic coding of tense and aspect. In this paper, we will address the question of how the two interact.

The basic distinction in the area of semantic aspect is that between telic and atelic predicates¹. This is a truth-conditional distinction that gives rise to many telicity

¹ As common, we use the term *telic predicates* for both accomplishments and achievements (ii). Atelic predicates include both states and activities (i). This corresponds to the event-state distinction in DRT.

(i) Atelic (state) predicates:

- (a) love music, know French, be tired (*states*)
- (b) grow, run, wander, drive a car, push a stroller, eat popcorn (*activities*)

(ii) Telic (event) predicates:

- (a) break, build a house, write a novel, take a deep breath, dress up, run to the park (*accomplishments*)
- (b) reach the peak, recognize someone, understand the problem, loose a pen (*achievements*)

dependent entailments, e.g., the progressive entailment, which is commonly used as a test for telicity (Dowty 1986, Hinrichs 1985, de Swart 1998):

- (1) a. Mary was driving the car → Mary drove the car
 b. Mary was running a mile -/→ Mary ran a mile

(1) shows that the two types of predicates license different logical inferences: a sentence with an atelic predicate in the progressive entails the truth of the sentence with a verb in the simple past form (1a), whereas a sentence with a telic predicate does not, (1b).

Our major example for morpho-syntactic tense and aspect in this paper will be the system of tense and morphological aspect in Russian. The tense system of modern Russian is aspectually constrained: the verbs in perfective aspect appear in two tense forms, whereas imperfective aspect allows for the derivation of three tense forms. The full system of Russian tenses is given in Table 1:

Table 1: Temporal/aspectual system in Russian

	IMPERFECTIVE	PERFECTIVE
past	čita- <i>l</i> read-sg.masc	pro-čita- <i>l</i> PF-read-sg.masc
non-past	čita- <i>et</i> read-3sg bud- <i>et</i> čitat' be-3sg read-INF	pro-čita- <i>et</i> PF-read-3sg

The table illustrates that the forms in the past row and the forms in the non-past row(s) have identical inflection respectively. This allows us to say that there exists one main opposition in the domain of tense in Russian: past vs. non-past.

The asymmetry of the tense system manifests itself in the derivation of non-past forms: in the imperfective aspect, two non-past tense forms can be derived, a simple (*čitaet*) and periphrastic (*budet čitat'*) form, whereas perfective aspect allows for the derivation of only one simple non-past form (*pro-čitat'*).

The interpretation of sentences with non-past perfective forms crucially differs from the interpretation that sentences with simple non-past imperfective forms receive:

- (2) Čto ty sejčas delaeš'? – Čitaju /*Pročitaju knigu
 what you now do-IMP-pres.3sg? – Read-IMP-pres.1sg/*PF-read-pres.1sg book
 'What are you doing now? – I am reading a book'

Example (2) shows that only the imperfective aspectual form can be used in an answer to the question 'What are you doing now?' perfective aspect is ungrammatical in this context. Perfective non-past simple forms almost uniformly trigger future interpretation, whereas imperfective forms can also refer to the present. We will refer to the property of the perfective non-past forms that prevents their use in the typical

progressive contexts such as (2) as *the absence of the actual present interpretation*. Our specific question, then, is what are the relations between perfectivity and telicity, or semantic aspect.

The semantic impact of the perfective-imperfective distinction is often described in terms of perspective, or viewpoint (Comrie 1976). A sentence in the imperfective form describes a situation "from inside", namely the speaker gets the internal perspective of the situation, which is viewed from the point of the speech time. Thus, in a sense, the situation is still relevant at the time of speech. The perfective aspect, by contrast, enforces a view "from outside". This appears to be a different semantic distinction than the one of telicity. However, other approaches either conflate the two distinctions, assuming that the perspective distinction is just a specific instantiation of the telicity distinction (Smith 1997), or argue that the crucial distinction for the semantic impact of perfectivity is, in fact, only telicity. Most recent studies of Slavic languages take the later view, assuming there is an intimate connection between perfectivity and telicity, and at least the following entailment holds (Filip 1993):

(3) Perfectivity → Telicity

We will investigate this interaction in more detail in section 3, where we show that the alleged relation between perfectivity and telicity aspect cannot be established. More generally, we argue that semantic aspect and viewpoint or morphological aspect are two independent systems that should not be conflated. In section 4, we propose an analysis for perfectivity, based on the relations between Reference time and Speech time, which explains also the viewpoint impacts of perfectivity.

2. Semantic aspect: the definition of telicity

To address the question of the relation of the two systems, we first need to provide a definition of the *telic-atelic* distinction. Let us start the pursuit with another instance of telicity dependent entailments, which has attracted less attention in the literature².

(4) *Telic propositions*:

- a. Max built this house last year → Max is not building this house now.
- b. The vase broke → The vase is no longer (in the process of) breaking

(5) *Atelic propositions*:

- a. Max wandered in India last year $\not\rightarrow$ Max is not wandering in India now
- b. The tree grew $\not\rightarrow$ the tree is no longer growing.

² Although the intuitions regarding (4) and (5) seem pretty robust, we are not aware of discussions of this entailment pattern in the literature. We focus on this basic entailment, first, because unlike the progressive entailment it is independent of the analysis of tense, and it can be checked also in languages that have no progressive. Next, we chose it because it has been the hardest to capture within interval semantics approaches to aspect, which we follow here.

A telic proposition in the past tense entails that the event it reports on no longer holds. This is the case both when the predicate is transitive, as in (4a), and intransitive, as in (4b). When the proposition is composed of an atelic predicate, this entailment does not hold (5a, 5b). These results indicate that the telicity distinction is, indeed, truth conditional, and the definition of telicity should enable capturing them.

There are two families of approaches to the question what telicity is. The boundedness approaches originated in Verkuyl (1972) and developed in Smith (1983) and Tenny (1994) can be viewed as the most popular today. These approaches offer various accounts of how telic predicates (or the eventualities they denote) are temporally bounded, delimited, measured, etc., while atelic predicates are not. There are various approaches offering varying definitions, which we will not survey here. However, at first glance, it appears that this line of reasoning could easily explain the entailment pattern in (4)-(5). Suppose telicity is a property of events. Then the telic events in (4) are bounded, and, given that they are reported in the past tense, they must have ended. For the non-bounded events all that is entailed is that they started before the speech time. However, the question of what makes telic events temporally bounded remains. Obviously, the fact that a given event has an endpoint in the actual world does not provide sufficient ground for defining it as telic. There are many events in the actual world that ended. For instance, the event denoted by the sentence *John Kennedy lived in the White house* definitely ended when Kennedy was murdered. This does not make the reported event, or the proposition, telic. In fact, the reasoning goes the other way around: if a given proposition has the property of defining the event being described as telic, then when the past tense is used, we infer that the event has terminated (or reached an end point), without any particular knowledge of the actual world. Boundedness needs to be defined independently of the temporal duration of events in the actual world.

The other family comprises the interval semantic approaches and attempts a definition in terms of the type of intervals denoted by the telic and atelic propositions (Bennett and Partee (1972), Taylor (1977), Dowty (1986), Reinhart (1986)). Stated roughly, the intervals at which telic propositions are true have no subintervals (or subsets). The intervals at which atelic propositions are true do have subintervals. Dowty's (1986) definition of telicity along these lines is given in (6):

- (6) "A sentence ϕ is an accomplishment/achievement (...) iff it follows from the truth of ϕ at an interval I that ϕ is false at all subintervals of I ." (Dowty, 1986:13).

This line can be viewed as a specific formalization of Vendler's (1967) *homogeneity* distinction, which is broadly assumed. By this criterion, atelic predicates, like mass nouns, denote homogeneous objects, which have subparts. Thus, if one wandered in the park for three hours, there must also be units smaller than three hours that are described as wading in the park, just like a piece of gold can be broken to smaller pieces of gold. But telic predicates, just like count nouns, are non homogeneous.³

³ See Hinrichs (1985) for a comprehensive survey of the homogeneity distinction and its relations to the count-mass distinction. Homogeneity can be illustrated with the different entailments in (i) and (ii):

A strong motivation for the boundedness approach comes from delimited atelic predicates. It was observed by Kamp & Roher (1983), among others, that such predicates behave like telic in some respects. This observation plays a crucial role in the system of Kamp & Reyle (1993) and de Swart (1998). The telicity symptoms of delimited atelic predicates are found in two contexts: with sequence interpretation of conjoined past tense sentences, and, closer to our topic, with the use of the perfective aspect. Delimited atelic predicates can occur only in the perfective form, as illustrated in (7a) for French (Hataav 1997) and in (7b) for Russian:

- (7) a. Jean dansa /* dansait trois fois.
 Jean danced-Perf / *danced-Imp three times
 Jean danced three times
- b. Ivan *(po)-igral dva časa i ušel
 John *(Pf)-play.Pst.sg.masc. two hours and Pf-leave.Pst.sg.masc.
 John played for two hours and left.

Under the prevailing assumption that the perfective aspect correlates with telicity, the facts in (7) would follow if telicity is defined in terms of boundedness, since delimiters can be viewed as bounding the time of the event. However, Borik (2002: III.2) shows that in all other respects, delimited atelic predicates behave as atelic. For instance, contrary to de Swart (1998), the progressive entailment holds for the delimited atelic predicate in (8a), in contrast to the delimited telic in (8b):

- (8) a. The computer was working between 4 and 7 p.m. →
 The computer worked between 4 and 7 p.m.
- b. The computer was solving two problems between 4 and 7 p.m. -/→
 The computer solved two problems between 4 and 7 p.m.

As mentioned earlier, we will argue that perfectivity is independent of telicity. Hence the definition of telicity cannot be based on any observations regarding perfective aspect. As for the context of sequence entailment, Borik (2002) argues that the analysis of this phenomenon, just as that of perfectivity, falls under the Reference-time system, which governs morphological aspect, and is independent of telicity. Delimiters have an effect in this system, but not in the telicity system.

The intuition underlying the interval semantics approach seems to be on the right track, as it captures the basic property of (non-)homogeneity that seems crucial for the definition of telicity. On this view, telicity is a type of relation between intervals and something else. The question, however, is what constitutes "something else". As

(i) Max wrote two novels from 1928 till 1931 -/→ Max wrote two novels from 1928 till 1930

(ii) Max drove his car from 8 to 12 → Max drove his car from 8 to 11

(i) is a telic, non-homogenous proposition (an accomplishment). By Dowty's definition, it follows that if *Max wrote two novels* is true at the interval of three years from 1928 to 1931, it cannot be true at any of its subintervals. The defining property of atelic, homogenous, propositions, like (ii), is that if they are true at some interval *I*, there must be some subinterval of *I* at which they are also true.

formulated in (6), it is a relation between intervals and truth of propositions. But, as pointed out in a different context by Kamp and Reyle (1993), telicity cannot, in fact, be stated in terms of truth (of propositions) at intervals. Let us illustrate this with an example. Suppose the state of affairs in the world is such that Max built his house in September 2002. Then the sentence in (9a) must be true:

- (9) a. Max built his house in 2002.
 b. Max built his house in September 2002.

However, the sentence in (9b) must also be true, given our state of affairs. So *Max built his house* is true at the interval of 2002, but it is also true at its subinterval of September 2002. This contradicts the definition of telicity in (6), hence the sentence in (9a) could not be defined as telic by the given definition. This is just a specific instance of a broader problem with constructing temporal analyses based on the relation of truth at an interval. See Kamp and Reyle (1993, section 5.1.3) for the full-fledged argument.

Nevertheless, we believe this is only a matter of implementation, and the intuition underlying interval semantics is correct. In our modification, telicity is defined on the relation between intervals and events. The variables needed are both an event variable and an interval variable, as in (10):

- (10) e = event variable, corresponds to *eventuality*, whether telic, or atelic;
 I = temporal variable, corresponds to *interval*.

Both variables are needed, as has been argued by Krifka (1989, 1992).⁴ Thus, let us assume standard event semantic representations, incorporating the interval variable. Abstracting away from tense, (11a) is then represented as (11b):

- (11) a. Max kissed Lucie
 b. $\exists(e) \exists(I) (\text{kiss}(e) \ \& \ \text{agent}(e, \text{Max}) \ \& \ \text{patient}(e, \text{Lucie}) \ \& \ AT(e, I))$
 (where I is an interval at which e holds)

The crucial relation for our purpose is $At(e, I)$, which means that an event e holds at an interval I . It is this relation that telicity is defined on. We assume, like in DRT, that the telicity distinction applies to eventualities, namely that it is a property of eventualities. However, unlike in the DRT tradition, we do not postulate it as a primitive distinction, namely, our analysis does not require more than one event variable. The telicity distinction is then defined in (12):

- (12) For any e, I :
 a. e is *telic* iff $AT(e, I) \rightarrow \neg \exists I' (I' \neq I) \ \& \ AT(e, I')$
 b. e is *atelic* iff $AT(e, I) \rightarrow \exists I' (I' \neq I) \ \& \ AT(e, I')$

⁴ His framework (and hence the implementation of the variables) is significantly different from ours.

By (12), for a telic event, if it holds at a given interval I , there can be no other interval distinct from I at which it also holds. For atelic events, it is the other way around. If an atelic event holds at a given interval I there is always some other interval at which they hold (whether a sub-interval or a super interval of I). Thus, (12) captures the intuition underlying the interval semantics approach. In the case of telic events, the proposition describing the event may be true at many intervals, (as was shown for (9)), but the interval at which the event took place is unique, with no sub- or superintervals.

Let us now check how this definition captures the termination entailment that we illustrated in (4) and (5). We observed there that a proposition reporting on a telic event in the past tense entails that the event no longer holds, as in (13a), but this entailment does not hold for atelic events, as in (13b). For the sake of simplicity, we abstract away from the temporal adverbials in (4).

- (13) a. Max built his house \rightarrow Max is not building his house now.
b. Max wandered in India \nrightarrow Max is not wandering in India now.

So far we have not incorporated tense into our representations. We postpone the discussion of the tense system till section 4, but in the meanwhile, let us capture the fact that our sentences have a past interpretation with the statement that the interval at which the event holds precedes the speech time: $I < S$. The temporal representation of (14a) is then given in (14b):

- (14) a. Max built his house
b. Tense representation (S = Speech time):
 $\exists I \exists e (\text{build}(e) \ \& \ \text{agent}(e, \text{Max}) \ \& \ \text{patient}(e, \text{his house}) \ \& \ \text{At}(e, I) \ \& \ I < S)$
c. Incorporating telicity:
 $\exists I \exists e (\text{build}(e) \ \& \ \text{agent}(e, \text{Max}) \ \& \ \text{patient}(e, \text{his house}) \ \& \ \text{At}(e, I) \ \& \ I < S \ \& \ \neg \exists I' (I' \neq I) \ \& \ \text{AT}(e, I'))$

Build his house is a telic predicate, so e in (14b) is telic. Hence, by the definition in (12a), (14b) entails that there is no interval other than I at which e holds. Let us incorporate this into the representation, as in (14c). It is now part of the representation that there is no other interval at which the given building event holds. The only interval at which this event holds precedes the speech time S . Hence this building event must hold before S (or be 'completed' before S).

The temporal representation of (15a) is identical to that of (14a). But in this case, the predicate, hence the event, is atelic. If we incorporate the definition of atelicity (12b) into the representation, we obtain (15b):

- (15) a. Max wandered in India
b. Tense representation (telicity incorporated):
 $\exists I \exists e (\text{wander}(e) \ \& \ \text{agent}(e, \text{Max}) \ \& \ \text{location}(e, \text{India}) \ \& \ \text{At}(e, I) \ \& \ I < S \ \& \ \exists I' (I' \neq I) \ \& \ \text{AT}(e, I'))$

It is now given that there must be at least one interval other than I , at which the event of

wandering holds. The other intervals could be anywhere. They could be subsets of the given I (i.e. all other intervals of wandering also precede S , in which case Max no longer wanders in India), but they could also coincide with S , in which case the wandering still goes on. Hence (15a) does not entail that the event is finished.

The progressive entailment we mentioned in section 1 also follows from the telicity definitions in (12) straightforwardly. However, showing this requires more explicit tense representations than we have been assuming so far. So we will return to this in section 5.

3. Telicity and perfectivity

Let us turn now to the question whether perfectivity is determined by telicity. To keep the question independent of the specific definition of telicity that we just gave, we would use some well established telicity tests. There exist numerous tests (cf. Hinrichs 1985) which show that telic and atelic predicates exhibit different linguistic properties and different behaviour in a number of contexts. In addition to the progressive entailment illustrated above, we also use the following two tests:

- Adverbial modification (Dowty 1986, Verkuyl 1972): telic predicates, as opposed to atelic ones, allow for modification by so-called ‘frame’ adverbials, e.g., *in an hour* in (16b), whereas atelic predicates, like the one in (16a), take duration adverbials of the *for an hour*-type:

- (16) a. Mary drove the car for an hour/*in an hour
 b. Mary ran a mile *for an hour/ in an hour

- Conjunction (Verkuyl 1972): the conjunction test also involves temporal modification. Compare (17a) and (17b):

- (17) a. Mary drove her car on Monday and on Tuesday (ambiguous)
 b. Mary ran a mile on Monday and on Tuesday (non-ambiguous)

Two conditions concerning temporal modification have to be fulfilled here. First, full temporal prepositional phrases should be conjoined (i.e. the second ‘on’ cannot be omitted) and, secondly, the temporal units denoted by these PPs should be subsequent. For instance, the expression ‘on Monday and on Tuesday’ provides good grounds for testing, while ‘on Monday and Wednesday’ does not.

There is a clear difference in the interpretation of the two sentences in (17). (17a) with an atelic predicate is ambiguous: it can report one ongoing eventuality of driving throughout two days or it can refer to two different ‘driving’ eventualities that occur independently during two temporal intervals denoted by PPs. The first reading is not available for (17b), which is not ambiguous: it has to be two different eventualities, two ‘mile-runnings’, as it were.

In the next two subsections, we apply these tests to the Russian data and see whether there is, indeed, a dependency between the (im)perfectivity value of a given predicate and its telicity properties. The strongest hypothesis about their relationship is that perfectivity can be fully defined in terms of telicity: telicity \leftrightarrow perfectivity.

The hypothesis is given as an iff-condition, which implies that two generalizations are supposed to hold: all telic predicate should be perfective and perfective predicates should come out telic. Let us examine these alleged generalizations in turn.

3.1. Telicity \rightarrow Perfectivity?

In order to show that telicity does not entail perfectivity, it suffices to show that there are sentences with imperfective telic predicates. The examples below illustrate that there are, indeed, telic imperfective sentences ((18a)-(20a)). To make a stronger claim, we also show that imperfective sentences can be atelic, so there is, indeed, no correspondence between imperfectivity and (a)telicity.

First consider the results of the adverbial modification test:⁵

- (18) a. Petja uže peresekal étot kanal *(za) polčasa
 Peter already cross-IMP-pst.sg.masc. this channel *(in) half-hour
 'Peter (has) already crossed this channel in/*for half an hour'
- b. Petja uže putešestvoval po Indii (*za)dva goda
 Peter already travel-IMP-pst.sg.masc. in India (*in)two years
 'Peter has already traveled/was already travelling in India *in/for two years'

As the examples in (18) illustrate, imperfective forms can be compatible with both *in-* and *for an hour* type of adverbials. Crucially, though, *za polčasa* 'in half an hour' is grammatical in (18a), which shows that the imperfective predicate in (18a) patterns with telic predicates. As for (18b), there is no possible interpretation of this sentence that could allow the use of the frame adverbial, i.e., *za dva goda* 'in two years'. Hence, (18b) is an example with the imperfective atelic predicate. Thus, the results of the adverbial modification test are interpreted as follows: imperfective predicates in Russian can be both telic and atelic.

The conjunction test gives similar results:

- (19) a. Petja uže peresekal étot kanal v četverg i
 Peter already cross-IMP-pst.sg.masc. this channel in Thursday and
 v pjatnicu
 in Friday
 'Peter already crossed this channel on Monday and on Tuesday'
- b. Petja uže putešestvoval po Indii v maje i v ijune
 Peter already travel-IMP-pst.sg.masc. in India in may and in June

⁵ In all the examples in this section, we abstract away from a progressive interpretation of the sentences, which allows us, among other things, to classify the use of *za* (in) in (18a,b) as grammatical or ungrammatical.

'Peter was already traveling/traveled in India in May and in June'

Example (19a) can only be interpreted as describing two separate eventualities of crossing the channel, one of which took place on Monday, another one on Tuesday. This means that the predicate in this sentence behaves like telic. As for (19b), it can easily be interpreted as describing an ongoing activity of Peter's traveling in India for two months. The results we obtain here are the same results that the adverbial modification test provided: the first imperfective predicate behaves like telic, the second one like atelic. The conclusion is again that imperfective predicates can be both telic and atelic.

Now let us look at the results of the progressive entailment for the same predicates:

- (20) a. Petja peresekal etot kanal kogda načalsja
 Peter cross-IMP-pst.sg.masc. this channel when PF-begin-pst.sg.masc.
 štorm \neg → Petja uže peresekal etot kanal
 storm \neg → Peter already cross-IMP-pst.sg.masc. this channel
 'Peter was crossing this channel when the storm began
 \neg → Peter already crossed this channel'
- b. Petja putešestvoval po Indii kogda načalas'
 Peter travel-IMP-pst.sg.masc. in India when PF-begin-pst.sg.fem.
 vojna → Petja uže putešestvoval po Indii
 war → Peter already travel-IMP-pst.sg.masc. in India
 'Peter was travelling in India when the war began →
 Peter already travelled in India'

The sentence in (20a) behaves like a sentence with a typical telic predicate, because it blocks the entailment from past progressive to simple past. This result is fully consistent with the results of the other telicity tests for the imperfective predicate *peresekat' kanal* 'cross a/the channel'. As for (20b), it shows all the signs of being atelic: it licenses the entailment to imperfective past in Russian. Hence, this predicate should be classified as atelic.

To sum up the results, we have just shown that, according to the telicity tests, imperfective predicates in Russian can be both telic and atelic. This means that telicity does not entail perfectivity, because there are imperfective telic sentences. Therefore, the first part of the hypothesis being tested here has just been refuted:

(21) Telicity \neg → Perfectivity

Let us now examine the second part of the hypothesis, namely, whether perfectivity does indeed entail telicity.

3.2. Perfectivity → Telicity?

In the previous section, we established that telicity is not a sufficient condition for perfectivity. Now we will investigate the other part of our hypothesis, namely, whether

telicity is a necessary condition for perfectivity. We will employ the same telicity tests as above.

The examples below show that different perfective verbs can be combined with different types of temporal adverbials. In (22a), the perfective predicate is modified by 'in an hour' adverbial, patterning with telic predicates, whereas the one in (22b) patterns with atelic predicates in allowing only for a 'for an hour' type of adverb.

- (22) a. Petja pro-čital knigu *(za) čas
 Peter PF-read-pst.sg.masc. book-ACC *(in) hour
 'Petja read a book in an hour/*for an hour'
 b. Petja pro-sidel v tjur'me (*za) pjat' let
 Peter PF-sit-pst.sg.masc. in prison (*in) five years
 'Peter was in prison for five years'

Similarly, the conjunction test in (23) illustrates that the sentences with the perfective predicates tested in (22) above, behave differently with respect to telicity. In particular, the interpretation of (23a) is unambiguous: it describes two different reading eventualities. This result is found only with telic predicates. The sentence in (23b), however, can also be interpreted as reporting on one ongoing eventuality, which is the reading available only for atelic predicates.

- (23) a. Petja pročitai knigu v ponedel'nik i vo vtornik
 Peter PF-read-pst.sg.masc. book-ACC in Monday and in Tuesday
 'Peter read a book on Monday and on Tuesday'
 b. Petja pro-sidel v tjur'me v maje i v ijune.
 Peter PF-sit-pst.sg.masc. in prison in May and in June
 'Peter was in prison in May and in June'

Finally, the progressive entailment test in (24) shows that one of the examined sentences with the perfective predicates blocks the entailment (24a), exactly like the telic predicates in English, but in example (24b) the entailment is licensed, which confirms the atelicity of the predicate in this sentence.

- (24) a. Kogda pozvonila mama, Petja čital knigu -/→ Petja pro-čital (etu) knigu
 When PF-call-pst.sg.fem mom, Peter read-IMP-pst.sg.masc. book -/→
 Peter PF-read-pst.sg.masc. (this) book
 'When mom called, Peter was reading a book -/→ Peter read a book'
 b. Kogda priexala mama, Petja sidel v tjur'me
 When PF-arrive-pst.sg.fem mom, Peter sit-IMP-pst.sg.masc. in prison
 pjat' let → Petja pro-sidel v tjur'me pjat' let
 five years → Peter PF-sit-pst.sg.masc. in prison five years
 'When mom arrived, Peter was in prison for five years → Peter was in prison for five years'

Thus, all the telicity tests yield one and the same result: one of the tested perfective predicates comes out telic (examples (22a)-(24a)), whereas the other one exhibits typically atelic behaviour (examples (22b)-(24b)). These examples just showed that perfective marking on a verb does not guarantee the telicity of a given predicate:

(25) Perfectivity $\not\rightarrow$ Telicity

Based on the results of the tests in Russian, we draw the following conclusion: telicity is neither a necessary, nor a sufficient condition for perfectivity. This means that there is no connection between perfectivity and telicity, hence, these two aspectual phenomena should be carefully kept apart.

We will argue that the semantic impact of perfectivity is indeed in the realm of point of view, or perspective, as mentioned in section 1. This realm is governed by the relations of Reference time and Speech time. To show this, we need, first, to establish the general system that underlies the morpho-syntactic tense and aspect.

4. Reference time theory

In this section, we will develop a theory of tense and temporal relations, based on the notion of Reference time (Reichenbach 1947), which would allow us to account for morpho-syntactic tense and aspect. We will see that morphological aspect marks perspective, or viewpoint, which is completely independent of telicity.

4.1. The set-up of the Reference time theory

The theory that we develop employs familiar notions of Reichenbach (1947) tense system and defines a set of relations that can be established between them. Reichenbach argues that to capture the tense system of natural language we need the following three temporal variables in (26):

(26) E = event time
S = speech time
R = Reference time

Reichenbach's E corresponds to the interval I we have assumed before. In order to maintain the familiar Reichenbachian terminology in the formulation of tenses, let us then assume the notation in (27):

(27) For any e, I such that $AT(e, I)$, I is called *E(vent) time (of e)*.

Among the reasons Reichenbach cites for why we also need the Reference time interval is the distinction between past and present perfect in English. In terms of the relations between E and S, the two sentences in (28) are equivalent:

- (28) a. I ate (E<S)
 b. I have eaten (E<S)

In both cases the event of eating took place before speech time. However, the sentences differ in contextual factors, like, for instance, the degree of relevance of the event to the ongoing discourse, namely to the speech time. In other words, (28a) is more appropriate as an answer to a question *What did you do this morning?* than (28b). (28b), however, is a more appropriate answer to a question like *Are you hungry?* Reichenbach captures the difference with the tense representations in (29), where "_" marks the *precede* relation:

- (29) a. Simple past: E,R_S
 b. Present perfect: E_R,S

In the early DRT implementation, e.g. Hinrichs (1981) and Partee (1984), E and R are set variables, and the simple past would be represented as in (30):

- (30) Simple past: $E \subseteq R \ \& \ R < S$

For Partee and subsequent work in the DRT framework, the simple past representation in (30) holds only when the eventuality that takes place at time E is telic, or an event in the DRT notation. When the eventuality is atelic (a state), the relation of E and R is reversed, and R is a subset of E. Thus, for each tense there would be two representations, depending on the type of the eventuality. This reasoning also eventually led to the assumption of two primitive variables for states and events in, for instance, Kamp&Reyle (1993). We believe this distinction is not necessary. For the full argumentation, see Borik (2002).

Rather, we assume that the relation between E and R is always fixed, i.e. E is a subset of R. The definition of this relation is given in (31):

- (31) $E \subseteq R: \exists R, E, e$ such that $AT(e, E) \ \& \ E \subseteq R$

(31) is based on the framework outlined in Reinhart (1999, 2000). The crucial change in the definition of the $E \subseteq R$ relation in (31), compared to previous analyses, is that it does not stipulate that *all* intervals at which *e* holds are necessarily included in the Reference time, but only that there exists at least one such interval. This is what guarantees the telicity entailments. If the event holding at *E* is telic, the telicity definition in (12) entails that there is only one interval at which it holds, hence, if there is an interval *E* included in *R*, at which *e* holds, all intervals at which *e* holds are included in *R*. But in the case of atelic events (states), if an interval *E* at which *e* holds is included in *R*, there is no inference regarding other possible intervals at which *e* holds. Thus, the difference between telic and atelic events follows independently from the definition of telicity and need not be built into the relation of E and R. On our

analysis telicity is determined by the relations of E and e (the relation $At(e, E)$), independently of R .⁶

Let us examine further the intuition behind (31) with the example of sentences in the past tense in (32):

- (32) a. Mary bought a new dress last week
b. Mary was sick last week

Based on (31), the simple past tense in our model is represented as follows:

- (33) Simple past: $\exists E, R, S, e (At(e, E) \ \& \ E \subseteq R \ \& \ R < S)$

Let us assume, in accordance with the idea of Reichenbach, that temporal expressions like '*last week*' specify the Reference time interval. However, unlike Reichenbach, we do not assume that the denotation of, for instance, '*last week*' is the R itself. The interpretation of this type of temporal adverbials that we adopt here is the following: '*last week*' and similar temporal expressions denote a set of all subintervals of the interval indicated by '*last week*'. Then example (32a) is interpreted as reporting on an event e which holds at some temporal interval E which is included in R , which is, in turn, is a subset of the set of intervals specified by *last week*. Independently of the issues of tense, e in (32a) is telic. Hence, all the intervals at which the event took place are included in that R included in *last week*. In the case of the atelic (32b), we cannot infer from the sentence whether the period of sickness was fully included in the intervals of last week. What the sentence asserts, though, is that there is at least one interval E , such that the eventuality of Mary being sick holds at this interval and it has to be included in R , which is a subset of intervals specified by '*last week*'.

Thus, according to (31), in all tense representations E is a subset of R . The only exception is the progressive. As in DRT, we assume that the progressive operation reverses this relation:

- (34) Progressive: $E \subseteq R \rightarrow R \subseteq E$

Another temporal variable that the theory employs is *S(peech) time*. The relative position of interval E with respect to interval S on the temporal axis determines temporal interpretation: if E and S overlap, the sentence has a present temporal interpretation, if E precedes S , the sentence is interpreted as past and, finally, if E follows S , the interpretation of a sentence is future.

The relation between S and R is taken to determine morphological tense and perspective in English. This is exactly the relation that distinguishes between the English simple past and present perfect. Consider (35):

⁶ Assuming (31), we also do not have to postulate more than one primitive for *eventuality*. We consider it an important conceptual advantage of our model over the model of, for instance, Kamp&Reyle (1993), with both *states* (s) and *events* (e) as primitives, or the one of de Swart (1998), with *states* (s), *processes* (p) and *events* (e) as semantic primitives.

- (35) a. Peter has (already) bought the car
b. Peter bought the car

The temporal interpretation of these two sentences is the same: they both report a buying eventuality that happened in the past. Hence, the relation determining temporal interpretation should be the same for both sentences: E precedes S (cf. Reichenbach's representations in (29)). Neither of the two sentences are in the progressive, which means that E is included in R, according to (31). Then, the representations for (35a) and (35b) can possibly differ only in the relation between the S- and R-intervals:

- (36) a. simple past: $\exists E, R, S, e (At(e, E) \& E \subseteq R \& R < S)$
b. present perfect $\exists E, R, S, e (At(e, E) \& E \subseteq R \& S \cap R \& E < S)$

The representation for the present perfect tense requires the intervals of S and R to overlap. This insures two things: present tense morphology of the finite verb and a special effect of *relevance* of the described situation for the present moment. The *relevance* interpretation which present perfect in English gives rise to can be intuitively attributed to the position of S, which is associated with the present, relative to R, which includes the E-time. If both S - and E-time intervals 'share' the same R-time interval, the situation is perceived "from the perspective, or view point of the present", hence viewed as relevant for the present. Thus, in our model the linguistic notion of R-time provides the means to capture the intuitive concept of relevance or *perspective*.

Some other tenses in English are given the following semantic representations:

- (37) a. simple future: $\exists E, R, S, e (At(e, E) \& E \subseteq R \& S < R)$
b. simple present: $\exists E, R, S, e (At(e, E) \& E \subseteq R \& S \cap R \& E \cap S)$

To sum up, the system of relations between three basic temporal variables that our system makes use of is the following: the default R-E relation is always the same, i.e. $E \subseteq R$; the S-E relation determines temporal interpretation; perspective and tense morphology in English are determined by S-R.

4.2. Perfectivity in Russian

In this section we will apply the theory of R-time to the Russian data and show that the aspectual differences in Russian can be accounted for in terms of the S-R relation.

Suppose we just have a basic model of the E-R-S relations outlined in the previous section. Assume further that there are no additional operations and no specific data to analyse. What we can do now is to compute all possible relations that can be established between S, R and E in this model.

Since we are working with temporal intervals, there are two basic relations that can be established: overlap and precedence. If two intervals overlap, no strict precedence relation can be established between them. Thus, the first thing to look at in each case is

the intersection between a pair of intervals, and, if it is empty, to determine the precedence relation between these intervals.

We assume that the default configuration $E \subseteq R$ always obtains (except for the progressive). The relation between R and E being fixed, we can now look at the possibilities that arise when the S-interval comes into the picture. At this point, the relation that we should look at is the one between R and S. There are two options: either these intervals overlap or not:

$$(38) \quad \text{a. } S \cap R = \emptyset \quad \text{or} \quad \text{b. } S \cap R \neq \emptyset$$

In the first case, we can establish a precedence relation between S and R immediately. Since E is included in R, the relevant order of E and S follows automatically from the order of R and S:

$$(39) \quad \text{a. } E \subseteq R \ \& \ S < R \quad \text{or} \quad \text{b. } E \subseteq R \ \& \ R < S$$

If the intersection between S and R is not empty, as in (38b), we can look at the relation between E and S. There are, again, two logical possibilities: either S and E overlap or not. If the latter is the case, a precedence relation can be established between them:

$$(40) \quad \text{a. } E \subseteq R \ \& \ S \cap R \neq \emptyset \ \& \ S < E \quad \text{or} \quad \text{b. } E \subseteq R \ \& \ S \cap R \neq \emptyset \ \& \ E < S$$

If the E and S intervals overlap, we obtain the following configuration:

$$(41) \quad E \subseteq R \ \& \ S \cap R \neq \emptyset \ \& \ S \cap E \neq \emptyset$$

What we have just derived in (39)-(41) are the five basic logically possible configurations that our system of E-R-S relations allows for. However, E, R and S stand for the meaningful notions of a specific theory of temporal relations, so our next step is to determine the empirical value of the derived configurations.

If we now compare the set of possible configurations derived above with the tense system of Russian (Table 1 in Section 1), we will see immediately that the number of representations coincides with the number of tense forms in the table. Now let us assign each form from Table 1 a configuration from the list in (39)-(41), establishing thereby an isomorphic relation between the set of representations and the set of the Russian tense-aspect forms.

Since the actual present interpretation can only arise with imperfective aspect, this means that the following configuration (present tense morphology and present temporal interpretation) has to be ascribed to simple imperfective non-past forms:⁸

$$(42) \quad E \subseteq R \ \& \ S \cap R \neq \emptyset \ \& \ S \cap E \neq \emptyset$$

⁸ The progressive is not taken into account for the moment, it is integrated later.

Past tense forms can be both imperfective and perfective. Note, that the sentences with the verb in the past tense form always have a past temporal interpretation, which indicates that the relation determining temporal interpretation and morphological tense in Russian should be the same, unlike in English. The representation of past imperfective should have a common part with (42), a part that would determine morphological aspect. The temporal interpretation (i.e. the relation between S and E) should be past, which yields the following configuration:

$$(43) \quad E \subseteq R \ \& \ S \cap R \neq \emptyset \ \& \ E < S$$

Note, that this is, indeed, the only possible configuration that can be ascribed to the past imperfective forms in Russian that allows us to keep the interpretational difference between imperfective present and imperfective past. Hence, we conclude that the E-S relation in Russian does, indeed, determine both temporal interpretation and morphological tense.

The non-past periphrastic imperfective forms with the future temporal interpretation will then be represented as follows:

$$(44) \quad E \subseteq R \ \& \ S \cap R \neq \emptyset \ \& \ S < E$$

As for the perfective forms, they can only get either future, or past temporal interpretation. The corresponding representations for perfective forms are the following:

$$(45) \quad \begin{array}{l} \text{a. } E \subseteq R \ \& \ S \cap R = \emptyset \ \& \ S < E \\ \text{b. } E \subseteq R \ \& \ S \cap R = \emptyset \ \& \ E < S \end{array}$$

The sets of configurations corresponding to the forms of perfective and imperfective aspect differ in one part: the relation between S and R. In perfective configurations, the S and R intervals do not overlap, their intersection is empty. Imperfective aspect results when these intervals overlap. This allows us to formulate the condition for perfectivity:

$$(46) \quad \begin{array}{l} \text{Perfective aspect corresponds to the configuration } S \cap R = \emptyset \\ \text{Imperfective aspect is the absence of the perfective configuration, i.e.: } S \cap R \neq \emptyset \end{array}$$

Note that the condition in (46) fully excludes the possibility for perfective aspect to have a present temporal interpretation. In order to obtain this interpretation, the intersection of E and S should not be empty. On the condition that the default relation between E and R holds, this only becomes possible if R and S overlap, which contradicts the perfectivity condition in (46).

Now let us briefly address the question of progressive. It is well known that the following generalization holds for Russian:

$$(47) \quad \begin{array}{l} \text{The progressive in English always corresponds to the Imperfective in Russian,} \\ \text{but the opposite is not true.} \end{array}$$

Since perfective aspect excludes progressive interpretation, the perfectivity conditions also require the default relation between E and R to hold, i.e. E has to be a subset of R. The conjunction of these two conditions (S does not overlap with R and E is included in R) defines perfective aspect:

$$(48) \quad \text{Perfective aspect: } E \subseteq R \ \& \ S \cap R = \emptyset$$

Imperfective aspect results when at least one of these conditions is not met, i.e. it is the absence of perfective:

$$(49) \quad \text{Imperfective aspect: } \neg E \subseteq R \vee S \cap R \neq \emptyset$$

This representation correctly captures the generalization in (47). Imperfective aspect can get the meaning of progressive when the first perfectivity condition fails to hold, i.e. configuration $\neg E \subseteq R$ arises. Imperfective aspect, however, can also result when another perfectivity condition ($S \cap R = \emptyset$) does not hold. Thus, imperfective is predicted to have two general meanings, one of which is a progressive meaning.

These definitions of (im)perfectivity also explain the interaction between tense and viewpoint aspect, since perfectivity is now defined in such a way that the actual present interpretation is incompatible with perfective aspect.

Finally, this model does not presuppose any relation between perfectivity, defined in temporal terms, and telicity, defined solely in terms of the relations between *e* and *E*. Moreover, the relation which determines *perspective* in our model is the one that determines aspect in Russian, which reflects the intuition that perfectivity determines a special way of looking at a situation, the speaker's viewpoint (cf. Comrie 1976). In particular, in our model the properties of R-time reflect the speaker's view on an eventuality: a speaker can acquire an internal view on an eventuality only if there is a certain domain which includes *both* a relevant eventuality (represented as E) *and* the speaker's position, i.e. S-time. A perspective from *within* the R-time domain provides an internal viewpoint. Thus, *internal* here means 'within the same domain' and corresponds to imperfective aspect. When there is no 'common' domain to establish the *internal perspective*, i.e. the speaker is positioned *outside* the R-time, the perspective is *external*. This corresponds to the perfective aspect.

5. The Progressive entailment

Let us now go back to the interaction between telicity and morho-syntactic tense, which manifests itself in the progressive entailment exemplified in (1) in Section 1. The question can now be formulated as follows: what are the conditions, under which the past progressive configuration in (50) entails the past configuration in (51)?

$$(50) \quad \exists E, R, S, e \ (At(e, E) \ \& \ R \subseteq E \ \& \ R < S)$$

$$(51) \quad \exists E, R, S, e (At(e, E) \ \& \ E \subseteq R \ \& \ R < S)$$

Let's start with the atelic sentence in (1a). Incorporating the definition of telicity into the tense representation we obtain the following (relevant part of the) configuration for this sentence:

$$(52) \quad \exists E, R, S, e (At(e, E) \ \& \ \mathbf{R} \subseteq \mathbf{E} \ \& \ R < S \ \& \ \exists E' [(E' \neq E) \ \& \ AT(e, E')])$$

If we take E' to be equivalent to R , then, due to the definition of telicity, the relevant e also holds at R . Since the eventuality is atelic, there will always be another interval E'' , which, for instance, can be a subinterval of R , at which the same eventuality also holds. Thus, (50) entails (51) for an atelic predicate.

Let us now look at a telic predicate. The representation for (1b) is given in (53):

$$(53) \quad \exists E, R, S, e (At(e, E) \ \& \ \mathbf{R} \subseteq \mathbf{E} \ \& \ R < S \ \& \ \neg \exists E' [(E' \neq E) \ \& \ AT(e, E')])$$

If we take that E' in (53) to be equivalent to R , then we might or might not get the entailment. The eventuality e can only hold at R if it is the same as E and E' , due to the definition of telicity. However, we do not know whether it is the case, because R is not required to be a *proper* subinterval of E . Consequently, we don't know whether a given eventuality holds at R or not. It amounts to saying that the inference from past progressive to simple past for telic predicates is not properly licensed.

Thus, the results of the progressive entailment are now accounted for. Note that the tense representations for telic and atelic eventualities are kept uniform, and the entailment results really depend only on the telicity properties.

6. Conclusions

We have argued that in the analysis of temporal relations and aspect, two independent systems must be assumed. Semantic aspect (telicity) is determined by the relations of E and e , namely, the interpretation of the relation $At(e, E)$ (an event e holds at an interval E). For telic events there is only one interval at which they hold (a singleton set of intervals), for atelic events there are at least two intervals at which they hold. Morpho-syntactic tense and viewpoint aspect is determined only by the Reference time system, namely the relations of E , R and S , which are not affected by whether the predicate is telic or atelic. The instance of morphological aspect we discussed in detail is the perfective/imperfective distinction in Russian. We argued that this distinction is determined mainly by the S-R relations. In the perfective aspect the S and R intervals do not overlap, i.e. $S \cap R = \emptyset$. This means that this type of aspect codes relations of viewpoint or perspective, rather than telicity.

The theory that we have presented allows us to:

- account for the relevant interactions between the system of tense, viewpoint aspect and telicity aspect;

- formalize the intuitive notion of viewpoint/perspective/relevance, which underlies the opposition between perfectivity and imperfectivity in Russian and simple past and present perfect in English;
- provide a uniform account of tense, define perfectivity and provide means to sufficiently differentiate between telicity and perfectivity, accounting thereby for the absence of a strict correlation between the two.

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