

The Interaction between Phase Particles and Aspectual Relations

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Abstract. The aim of this paper is to introduce a two-dimensional formal framework explaining the combinatorial behavior of the phase particles ‘already/still/not yet/no longer’ with respect to (in)homogenous VPs in German and to the (im)perfective aspect in Czech, Upper Sorbian and Russian. We will explain the distribution of the phase particles by examining the different temporal structures built up from semantic aspectual relations and the phase structure of ‘already/still/not yet/no longer’. It will be shown that ungrammatical combinations yield an incorrect formal representation.

Keywords: phase particles, aspect, event semantics

1. Introduction

This paper is dealing with the interplay between aspect and the four phase particles ‘already/still/not yet/no longer’, sometimes called aspectual particles. We compare the situation in German which has no morphological category of aspect to the situation in Russian, Czech and Upper Sorbian.¹ Though altogether being provided with morphological aspect these Slavic languages show considerable differences in the admissible combinations of the phase particles with morphological aspect in several morphological tenses. The basic meaning of the phase particles is illustrated by the examples in (1).

- (1) a. *Pětr uže spít.* (Ru)
Peter already sleep_{imp}
Peter is already asleep.
- b. *Pětr chodží hišće do šule.* (USo)
Peter goes_{imp} still to school
Peter is still at school.

¹ Throughout this paper, we use English phase particles in inverted commas like ‘already’ to refer to the German and Slavic counterparts of them, e.g. to *schon/uže/už/hižo* altogether. We use italics like *schon* or *hižo* to refer to the concrete phase particles in the respective language. The semantic formalizations of the phase particles are referred to by capital letters STILL and NO-LONGER.

- c. *Das Licht ist nicht mehr an.* (Ger)
 the light is no longer on
 The light is not on anymore.
- d. *Ptáci ještě nezpívají.* (Cz)
 birds still not – sing_{imp}
 The birds are not singing yet.

According to Löbner (1989, p. 173; 1990, pp. 107-113), the basic meaning is confined to sentences in which the phase particle:

- (i) refers to a temporal scale,
- (ii) has wide scope over the whole sentence and
- (iii) is applied to an ‘imperfective’, ‘atelic’ sentence.

The phase particles in (2), for instance, do not fit in this basic meaning. In (2a) and (2b) condition (i) is violated since the phase particles refer to a scale of volume or weight and to a local scale respectively. In (2c) the phase particle ‘already’ (*hižo*) has narrow focus on the temporal frame adverbial ‘tomorrow’ (*jutře*), thereby violating condition (ii). Finally, in (2d) and (2e) condition (iii) is not fulfilled because the argument sentence is perfective or telic. This use of ‘still’ (*noch/eště/ještě/hišće*) and ‘no longer’ (*nicht mehr/bol’she ne/už ne/nic wjac*) is called the perfective use by Löbner (1989, pp. 199ff). The difference between the perfective and the basic meaning shows up e.g. in that in the basic meaning ‘still’ (*hišće*) and ‘no longer’ (*nicht mehr*) require the argument sentence to be true at a certain time preceding the reference time (see 1b and 1c). The perfective ‘still’ (*hišće*) and ‘no longer’ (*nicht mehr*) in (2d) and (2e), by contrast, lack this presupposition. Throughout this paper, we are concerned with the basic meaning of the phase particles only, unless stated otherwise.

- (2) a. *Eto eště pismo, a eto už posylka.* (Ru)
 this still letter, but this already parcel
 This is still a letter, but this is already a parcel.
- b. *Zgorzelec je ještě v Polsku, Görlitz už ne.* (Cz)
 Zgorzelec is still in Poland, Görlitz already not
 Zgorzelec is still within Poland, Görlitz not anymore.
- c. *Pětr hižo jutře přijedže, nic wutoru.* (USo)
 Peter already tomorrow arrive_{perf}, not tuesday
 Peter is arriving already tomorrow, not on tuesday.
- d. *Peter erreicht den Zug nicht mehr.* (Ger)
 Peter catch the train no longer
 Peter will not catch the train anymore.

- e. *Pětr hišće přindže.* (USo)
 Peter still come_{perf}
 Peter will come yet/eventually.

In section 2 we shall formalize the basic meaning of the phase particles. Condition (i) and (ii) will turn out to be essential for our formalization. In section 3 we will examine the crucial German and Slavic data thoroughly thereby showing that condition (iii) does not hold without restrictions. Therefore - unlike Löbner (1989, p. 173; 1990, p. 113) - we do not take it as a defining feature of the basic meaning of the phase particles. Instead, we will show that a suitable refinement of condition (iii) does hold. A further important empirical finding of section 3 is the disambiguating function the phase particles exhibit with respect to several readings of morphological past tenses. Section 4 is devoted to specifying our assumptions about aspect and tense in the semantic composition of sentences. This will allow us to reformulate the empirical findings in formal semantic terms thereby unifying and simplifying the rather complicated description of the data of section 3. Finally, in section 5 we will be in a position to explain the data of section 3 formally by deducing the restricted version of condition (iii) from the formalization based on conditions (i) and (ii).

For expository reasons, we are restricting ourselves to German in the following section. The discussions and results of section 2 carry over to the considered Slavic languages in a straightforward manner.

2. Formalizing the Basic Meaning of the Phase Particles

It is widely known that the basic meaning of the phase particles is made up of an assertion and a presupposition. A sentence like (1a) asserts that Peter is asleep at the speech time, and presupposes that he was not asleep at some time in the recent past. More generally, the assertion of ‘already’ states that the argument sentence P holds at the time of assertion, i.e. at the reference time t_r of the sentence. The presupposition states that P did not hold at some time before t_r and gives rise to a temporal structure - the phase structure - consisting of a negative and a following positive phase of P . During the negative phase P is false, during the positive one P is true and the reference time t_r is part of the positive phase of P . ‘Not yet’, on the other hand, presupposes (the expectation of) a change from a negative phase of P to a positive one as well, but asserts that the reference time t_r belongs to the negative phase.

By analogy, ‘still’ asserts that the argument sentence is true at the reference time, but presupposes (the expectation) that a negative phase

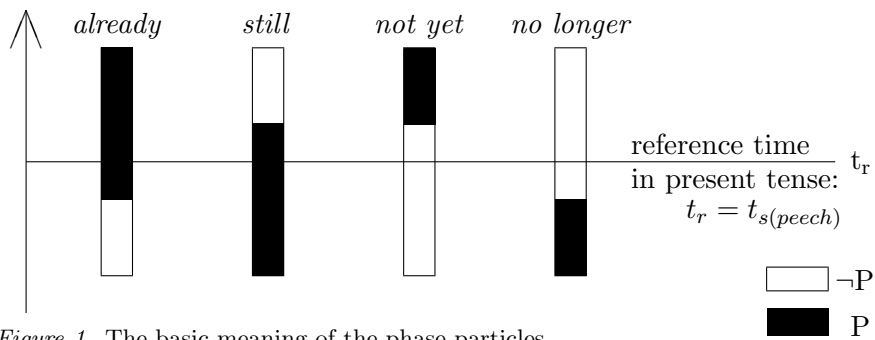


Figure 1. The basic meaning of the phase particles

of P will follow after the reference time, i.e. a change from positive to negative polarity. Again, ‘no longer’ shares this presupposition, but requires that the reference time already belongs to the negative phase. Figure 1 on p. 4 illustrates the phase structures triggered by the four phase particles.²

In the literature there is a controversial discussion about the status of the phase structure after the reference time t_r .³ Löbner (1989, 1990) does not take into account the interval after t_r in formalizing the phase particles.⁴ He argues it is irrelevant for their truth conditions. Otherwise we were required to have certain knowledge about the future development for deciding whether sentences with $t_r = t_s(\text{peech})$ containing phase particles are true - which clearly is not the case.⁵ However, Löbner (1999, p. 60) admits that *noch* (‘still’) and *noch nicht* (‘not yet’) trigger a conversational implicature that the polarity of the argument sentence will eventually change after t_r .⁶ Doherty, on the other hand, concludes from the incorrectness of *noch* (‘still’) in sentences with irreversible predicates like ‘old’ or ‘dead’ (see 3) that “[...] it is necessary to assume that *noch* presupposes a succeeding phase of not-S.” (Doherty 1973, p. 155)

- (3) **Die Maus ist noch tot.*
The mouse is still dead.

² Although figure 1 is meant to be a general illustration of the basic meaning of the phase particles for all tenses, one can locate the reference time t_r at the speech time t_s for the present tense sentences in examples 1, 3 and 4.

³ For a more detailed survey of the discussions about this topic see Max and Malink 2001, pp. 95-101.

⁴ König (1977, pp. 182f) does not take into account the interval after t_r in the representation of ‘still’ either, but unlike Löbner he makes use of it in the representation of ‘already’.

⁵ See Löbner 1989, p. 176; 1990, p. 118.

⁶ König (1977, pp. 192f) too regards the negative phase after t_r of ‘still’ as a conversational implicature rather than presupposition.

It is true, while ‘already’ and ‘no longer’ presuppose a factual change of polarity before the reference time, ‘still’ and ‘not yet’ in some cases may be uttered felicitously without any factual change after t_r . For instance, (4) can be uttered without the light ever going off after the speech time t_s .

- (4) *Das Licht ist noch an.*
The light is still on.

But this asymmetry between the changes of polarity after and before t_r is due only to insufficient knowledge about the development after t_r . Especially if t_r is the speech time the epistemic access to the time after t_r is unstable and it may be impossible to know whether the change of polarity will be actually realized. Nevertheless, the speaker or his environment still expects the change in (4). To capture this asymmetry the presuppositions after t_r can be embedded into an modal or epistemic⁷ operator expressing the speakers expectations or the assumptions of some community (e.g. Smessaert and ter Meulen 2004⁸). The situation is similar if t_r is before the speech time t_s like in (5).

- (5) *Als ich in das Zimmer kam, war das Licht noch an.*
When I entered the room, the light was still on.

If there is no factual change to the negative phase between t_r and t_s , i.e. if the light has not been turned off, the only way of uttering (5) is by expecting such a change. The speaker might expect at t_s that the light went out between t_r and t_s if he has no sufficient information about the development in the room between t_r and t_s . If he does, i.e. if he knows that the light has been on during the whole interval between t_r and t_s - in a vivid narration - he still can express the expectations he had at t_r when entering the room.⁹

⁷ Compare the modal or epistemic weakening of the presupposition after the reference time triggered by ‘still’ e.g. in Doherty (1973, p. 160), van der Auwera (1998, p. 40), Lasersohn (1999)

⁸ Nevertheless, Smessaert and ter Meulen do not regard the presupposition after the reference time as belonging to the “non factual, speaker dependent, subjective” meaning components of the phase particles, but to the “actual ones, although the future, as continuations of the current state, is already considered modal.” (Smessaert and ter Meulen 2004, p. 237)

⁹ The speaker could have expected the phase structure of *noch* at t_r , i.e. that the light is turning off shortly after t_r . Alternatively, he could have expected the phase structure of *nicht mehr* at t_r , i.e. he expected that the light had turned off before t_r , e.g. if there had been an event which was likely to turn off the light before t_r , but did not do so (see van der Auwera (1998, pp. 39f) for such counterfactual meaning components of ‘still’). In any case, a phase structure with a change from a positive phase to a negative one is expected.

There are complex interactions between epistemic accessibility and tense with regard to the presuppositions after the reference time. Moreover there may be further pragmatic meaning components of the phase particles like evaluation of the development as early/late or fast/slow, discussed e.g. in van der Auwera (1993) and Smessaert and ter Meulen (2004). Whereas Smessaert and ter Meulen are focussing on the role phase particles are playing in dynamic temporal reasoning within discourse and use a DRT framework, we are interested primarily in the function and logical properties of phase particles within the semantic composition of single sentences. Therefore, we do not want to address epistemic or pragmatic issues, and shall omit epistemic and other modal operators in the formalization for the sake of simplicity. Instead, we are giving a logical account for the fullblown phase structures displayed in figure 1.¹⁰

We use a many-sorted first order language containing variables $t, t_1, t_x \dots$ of type $\langle i \rangle$ (time) and variables $e, e_1, e_x \dots$ of type $\langle ev(\text{entuality}) \rangle$. The time variables range over an atomic semi-lattice of time points and intervals, ordered by the mereological relation \subseteq ('improper part of') (see Krifka 1989). Thus, there is no differentiation between time points and time intervals and we quantify over both of them at the same time by the variables of type $\langle i \rangle$. The precedence relation $<$ is a sharp partial order within semi-lattice of time points and intervals. τ is an unary function of type $\langle ev, i \rangle$ assigning to every event its event time and \oplus is a binary function of type $\langle \langle i, i \rangle, i \rangle$, the sum operation for times. Some of the axioms governing these relations and operations are listed below on p. 27 in a set Π of postulates (π_{1-9}).

Now, the phase structure of 'already' can be described by stating the existence of a last time t_x of the negative phase, such that for all times t , the argument sentence P holds at t if t is after t_x and P does not hold at t if t is not after t_x , i.e. formula (6).¹¹

$$(6) \quad \exists t_x \forall t (t_x < t \leftrightarrow P(t))$$

Of course, the phase structure imposed by the phase particles does hold only for a contextually relevant time (Löbners 'Betrachtintervall'). This contextually relevant interval may cover a couple of years like in

¹⁰ The formal results of section 5, i.e. the (in)consistencies which are to explain the natural language data, carry over to phase particles containing epistemic operators except that absolute (in)consistency becomes (in)consistency of beliefs and expectations. Setting aside the discussion to which extent the phase structure after the reference time is presupposed or conventionally implicated or expected, we shall say in the following that the phase particles presuppose these fullblown phase structures for terminological convenience.

¹¹ See Krifka (1995, p. 242) for a similar analysis of the presupposition of 'already'.

(7a) or only some seconds like in (7b), where the phase particle focuses on a single change of the traffic lights and neglects all preceding and following ones.

- (7) a. Peter is still a child.
b. The traffic lights are already green.

The contextually relevant time of the phase particles can be captured simply by restricting the quantifiers in (6) to a time interval I .¹² Then, to avoid trivial phase structures, we have to demand that the last time t_x of the negative phase is neither an initial nor a final part of I which is done in definition (1).

$$\text{DEF 1.} \quad t_1 \in t \quad =_{df} \quad t_1 \subseteq t \wedge \exists t_2^{\subseteq t} t_3^{\subseteq t} (t_2 < \hat{t} < t_3) \\ [t_1 \text{ is part of } t, \text{ but is not a final or initial part of } t]$$

Thus, the phase structure of ‘already’ is (8).

$$(8) \quad \exists t_x^{\in I} \forall t^{\subseteq I} (t_x < t \leftrightarrow P(t))$$

‘Not yet’ is similar to ‘already’ in that it presupposes a phase structure with a change from negative to positive polarity and differs from it in that the reference time t_r belongs to the negative phase. Therefore, both particles share the same presupposition (8) and differ from each other only in asserting $\neg P(t_r)$ or $P(t_r)$ respectively, i.e. in whether the reference time t_r is part of the negative or positive phase.

‘Still’ and ‘no longer’, on the other hand, presuppose phase structures with one change from positive to negative polarity. A first attempt to formalize this phase structure would be (9). But since we are quantifying over both time intervals and time points this formalization leads to the following difficulty. For, neither $I < t_x$ nor $t_x < I$ does hold for any $t_x \in I$, but due to $I \subseteq I$ (9) states $t_x < I \leftrightarrow \neg P(I)$ and thereby $P(I)$, i.e. the argument sentence P of the phase particles holds at the whole contextually relevant time I which clearly is not what we want. The argument sentence is needed to be true just at the times before the beginning time t_x of the negative phase but not at times overlapping with the negative phase, let alone at the whole interval I .

$$(9) \quad \exists t_x^{\in I} \forall t^{\subseteq I} (t_x < t \leftrightarrow \neg P(t))$$

¹² The variable I is of type ⟨i⟩ like all other time variables. We are using here I instead of t with an index only for graphical convenience.

This difficulty can be overcome by insuring there is a first time t_x of the succeeding negative phase such that $P(t)$ is true if t is before t_x and false otherwise, i.e. by (10). (10) states $\neg P(I)$ and therefore is incompatible with (9).

$$(10) \quad \exists t_x^{\in I} \forall t^{\subseteq I} (t < t_x \leftrightarrow P(t))$$

In formalizing the basic meaning of the phase particles we are using a two-dimensional framework like suggested e.g. by Karttunen and Peters (1979), Bergmann (1981) or Max (2002). Two-dimensional formulae $\left[\begin{array}{c} \textit{Assertion} \\ \textit{Presupposition} \end{array} \right]$ are tuples of classical first order expressions consisting of an assertion and a presupposition. Now, the phase particles can be defined in Def. 2.¹³

DEF 2. *Let I and t_r be variables of type $\langle i \rangle$ and let P be a variable of type $\langle i, t \rangle$:*

$$\text{ALREADY} \quad =_{df} \quad \lambda P \lambda t_r \lambda I. \left[\begin{array}{c} P(t_r) \\ \exists t_x^{\in I} \forall t^{\subseteq I} (t_x < t \leftrightarrow P(t)) \end{array} \right]$$

$$\text{NOT-YET} \quad =_{df} \quad \lambda P \lambda t_r \lambda I. \left[\begin{array}{c} \neg P(t_r) \\ \exists t_x^{\in I} \forall t^{\subseteq I} (t_x < t \leftrightarrow P(t)) \end{array} \right]$$

$$\text{STILL} \quad =_{df} \quad \lambda P \lambda t_r \lambda I. \left[\begin{array}{c} P(t_r) \\ \exists t_x^{\in I} \forall t^{\subseteq I} (t < t_x \leftrightarrow P(t)) \end{array} \right]$$

$$\text{NO-LONGER} \quad =_{df} \quad \lambda P \lambda t_r \lambda I. \left[\begin{array}{c} \neg P(t_r) \\ \exists t_x^{\in I} \forall t^{\subseteq I} (t < t_x \leftrightarrow P(t)) \end{array} \right]$$

Two-dimensional formulae are evaluated relative to classical models. This allows us to distinguish in a straightforward manner falseness of sentences containing presuppositions from incorrectness without giving up classical two valued models (see Def. 3).

DEF 3. *A two-dimensional expression $\mathcal{H} = \left[\begin{array}{c} A \\ B \end{array} \right]$ is true within a classical interpretation, if A and B are true in it. \mathcal{H} is false, if A is false and B is true. Otherwise \mathcal{H} is incorrect.*

¹³ Due to the incompatibility of (9) and (10) $\text{ALREADY}(P, t_r, I)$ is not equivalent to $\text{NO-LONGER}(\neg P, t_r, I)$, and nor is $\text{STILL}(P, t_r, I)$ to $\text{NOT-YET}(\neg P, t_r, I)$. That means Löbners (1989, p. 172; 1999, pp. 55ff) duality conditions do not hold for the phase particles in Def. 2, but see note 25 on p. 24.

Moreover, a presupposition preserving negation \neg_a is defined in Def. 4.

DEF 4. $\neg_a \begin{bmatrix} A \\ B \end{bmatrix} =_{df} \begin{bmatrix} \neg A \\ B \end{bmatrix}$ (*presupposition preserving negation*)

This negation neatly fits the natural language default negation of the phase particles which is illustrated by (11).

- (11) a. Peter is already asleep. - No, he is not asleep yet.
 b. Peter is not asleep anymore. - No, he is still asleep.

Theorem 1 states that ALREADY and NOT-YET are mapped on each other by \neg_a as well as STILL and NO-LONGER.

Theorem 1. For every P , t_r and I we have:

$$\begin{aligned} \neg_a \text{ALREADY}(P, t_r, I) &= \text{NOT-YET}(P, t_r, I) \\ \neg_a \text{STILL}(P, t_r, I) &= \text{NO-LONGER}(P, t_r, I) \end{aligned}$$

3. The distribution of the phase particles in German and Slavic

In the preceding section we discussed the basic meaning of the four phase particles and its representation. The representation introduced in Def. 2 is based on conditions (i) and (ii) on p. 1. So far we said nothing about condition (iii) stating that phase particles in their basic meaning can be applied only to ‘imperfective’, ‘atelic’ sentences. In this section we will have a closer look at this condition from an empirical point of view. We will start by introducing German data and turn to Slavic data in the second part of this section.

It is well-known that VPs can be divided into two groups depending on whether they denote homogenous situations or inhomogenous ones. Homogeneous descriptions apply to a situation if and only if they apply to every part of that situation.¹⁴ Intuitively, they can be thought of as atelic VPs. The defining property of inhomogeneous or quantized descriptions of situations is that if they apply to a situation then they must not be true of any part of that situation. Roughly, those descriptions correspond to telic VPs.¹⁵ As for the fact that Slavic languages are aspect languages one has to take into account the

¹⁴ See e.g. Bach 1981, p. 70, Krifka 1989, pp. 45f.

¹⁵ In the literature German VPs are often analyzed in terms of the Vendlerian (1957) verbal classes: activities, states, accomplishments and achievements. The former two are atelic, and the latter two telic. For our purposes, the binary distinction between homogenous (atelic) and inhomogenous (telic) descriptions will do.

distinction between morphological perfective and imperfective aspect. Besides other properties, morphologically perfective verbs usually give rise to inhomogeneous VPs whereas morphologically imperfective verbs usually head homogenous ones.

3.1. (IN)HOMOGENEITY AND PHASE PARTICLES IN GERMAN

Assuming condition (iii) (p. 1) one would expect that phase particles can only combine with homogenous VPs in German. Example (12) shows that this combination is unproblematic in all morphological tenses.

- (12) a. *Das Kind schläft schon.* (Ger)
 the child sleeps_{hom/pres} already
 The child is already asleep.
- b. *Maria arbeitete noch.*
 Maria worked_{hom/past} still
 Maria still worked.
- c. *Jane wird noch nicht wach sein.*
 Jane will not yet be awake_{hom/fut}
 Jane will not be awake yet.
- d. *Bob hat nicht mehr gelacht.*
 Bob has not longer smile_{hom/perfect}
 Bob smiled no longer.

The surprising fact - following condition (iii) - is that combinations of the phase particles and inhomogenous VPs are possible depending on the morphological tense. First, we consider the respective data in the present tense and then in the perfect tense.

3.1.1. Morphological present and past tense

Generally speaking, the combination of the phase particles and inhomogenous VPs is not possible in the present/past tense (see 13) unless the context allows for a very specific reinterpretation of the VP.

- (13) a. **Peter gewinnt (gewann) das Spiel noch nicht.* (Ger)
 Peter win_{inhom/pres (past)} the game not yet
- b. **Der Rat verabschiedet (verabschiedete) schon das Gesetz.*
 the council pass_{inhom/pres (past)} already the bill
- c. **Peter isst (aß) die Suppe schon auf.*
 Peter eat_{inhom/pres (past)} the soup already up

If at all there is a possibility to interpret the kind of sentences in (13) we have to find homogeneous reinterpretations of the VPs, e.g. habitual, iterative or capability readings like in (14b).¹⁶

- (14) a. **Das Kind gewinnt das Schachspiel noch nicht.* (Ger)
 the child win_{inhom/pres} the chess game not yet
- b. *Das Kind gewinnt beim Schachspielen noch nicht.*
 the child win_{inhom/pres} at playing chess game not yet
 The child does not win at chess yet.

In the present and past tense, only atelic VPs can be combined with the phase particles which confirms condition (iii) without restrictions.

3.1.2. *The morphological perfect tense*

The situation is completely different in perfect tense sentences in German. The phase particles ‘already’ and ‘not yet’ are compatible with both homogenous and inhomogenous VPs in the perfect tense. The difference between the two kinds of VPs shows up in the interpretation of the morphological perfect since the temporal interactions between the phase structure of the phase particles and the temporal/aspectual structure of the tensed VPs are different for the two cases. It is widely assumed that the German morphological present perfect has two quite different readings, a purely temporal past tense reading with reference time before speech time (15b) and an aspectual reading with reference time at speech time (15a) - the proper perfect reading (see e.g. Klein, 2000).¹⁷ We assume that the proper aspectual perfect reading denotes

¹⁶ There are some inhomogenous VPs which allow a combination with phase particles in the present tense (see (i)-(iii)).

- (i) *Anne haut schon ab.* (Ger)
 Anne push_{inhom/pres} already off
 Anne already pushes off.
- (ii) *Der Student bestellt die Zeitung schon ab.*
 the student cancel_{inhom/pres} the newspaper already
 The student already cancels the newspaper.
- (iii) *Der Film fängt schon an.*
 the film start_{inhom/pres} already
 The film already starts.

It seems that the reason for this special combinatorial behaviour lies in the specific lexical semantics of the involved verbs (for more details see Zybatow & Malink, 2003, p. 343). However, we will not consider examples of that kind here.

¹⁷ There are many competing analyses of the German perfect tense (ambiguity theories vs. underspecification theories). Musan (2002), for instance, assumes an unique meaning of the perfect which always includes a resultant state, but this state can stay uninterpreted due to pragmatic principles. Klein (2000), on the other hand,

an everlasting resultant state of events in the sense of Parsons (1990, p. 231). The combination of ‘already’ and ‘not yet’ with homogenous VPs in the morphological perfect allows for both readings (15a vs. 15b).

(15) *Peter hat noch nicht Klavier gespielt.* (Ger)

Peter has not yet piano play_{inhom/perfect}

a. Peter has not played the piano yet.

Context: Peter’s mum tells Peter’s dad that Peter has not fulfilled his everyday duty in playing the piano yet.

$t_r = t_s$ (perfect reading)

b. Peter did not play the piano yet.

Context: When I entered the pub yesterday, Peter did not play the piano yet.

$t_r < t_s$ (past reading)

However, if inhomogenous VPs are combined with ‘already’ and ‘not yet’ in the perfect tense the resulting sentence exhibits just one reading - the perfect one. With other words, ‘already’ and ‘not yet’ disambiguate the German perfect in these cases. Both phase particles are compatible with the perfect reading of the morphological present perfect with $t_r = t_s$ (see 16a and 17a). But when t_r is bound to lie before t_s by an adverbial like *five minutes ago* the perfect reading of the present perfect is ruled out (see 16b and 17b) and ‘already’ and ‘not yet’ become incorrect (see 16c and 17c) with the present perfect though being still compatible with the perfect reading of the morphological past perfect.

(16) a. *Er hat noch nicht verloren.* (Ger)

he has_{pres} not yet lose_{inhom/perfect}

He has not lost yet. $t_r = t_s$

b. *Vor fünf Minuten hat er verloren.*

five minutes ago has_{pres} he lose_{inhom/perfect}

He lost five minutes ago. $t_r < t_s$

c. *Vor fünf Minuten hatte/*hat er noch nicht verloren.*

five minutes ago has_{past}/*had_{pres} he not yet lose_{inhom/perfect}

Five minutes ago, he had/*has not lost yet. $t_r < t_s$

(17) a. *Sie hat es schon aufgegessen.* (Ger)

she has_{pres}it already eat up_{inhom/perfect}

She has it already eaten up. $t_r = t_s$

assumes an ambiguity between a past reading and a resultant state reading of the perfect tense. In this paper we adopt Klein’s analysis of the German perfect.

- b. *Vor fünf Minuten hat sie es aufgegessen.*
 five minutes ago has_{pres} she it eat up_{inhom/perfect}
 She ate it up five minutes ago. $t_r < t_s$
- c. *Vor fünf Minuten hatte/*hat sie es schon aufgegessen.*
 five minutes ago has_{past}/*had_{pres} she it already eat up_{inhom/perfect}
 Five minutes ago, she had/*has it eaten up. $t_r < t_s$

The other two phase particles ‘still’ and ‘no longer’ are - in their basic meaning - incompatible with inhomogenous VPs in the perfect tense. The only available interpretation for (18a) and (18b) is the so-called perfective reading of ‘still’ and ‘no longer’ in German like in (2d) and (2e).

- (18) a. *Er hat den Kaffee nicht mehr ausgetrunken.* (Ger)
 he has_{pres} the coffee no longer drink up_{inhom/perfect}
 He did not drink up the coffee anymore
 (since it was already too late).
- b. *Er hat den Zug noch erreicht.*
 he has_{pres} the train still catch_{inhom/perfect}
 He caught the train yet/eventually
 (because the train was delayed).

By contrast, the basic meaning of the German ‘still’ and ‘no longer’ can be combined homogenous in the perfect tense. However, the ambiguity of the German perfect between the past reading and the perfect reading disappears in this case. The only interpretation which is possible for (19a) and (19b) is the past reading of the perfect, i.e. t_r is simultaneous with the event time and lies before t_s .

- (19) a. *Peter hat noch Klavier gespielt.* (Ger)
 Peter has_{pres} still piano play_{hom/perfect}
 Peter still played the piano
 (when I came into the pub yesterday). $t_r < t_s$
- b. *Peter hat nicht mehr Klavier gespielt.*
 Peter has_{pres} no longer piano play_{hom/perfect}
 Peter did not play the piano anymore
 (when I came into the pub yesterday). $t_r < t_s$

To sum up the German data, inhomogenous VPs are significantly restricted in their compatibility with the basic meaning of the phase particles (see 13). However, it would be an oversimplification to say

that phase particles can combine only with homogenous VPs. There are two ways that the combination of an inhomogenous VP with a phase particle gets grammatical. One way is to force a habitual, iterative or capability reinterpretation (*schon das Schachspiel gewinnen* interpreted as *schon beim Schachspiel gewinnen*, see (14)). The other way is the availability of a perfect reading of the perfect tense, but this option does work only for ‘already’ and ‘not yet’. The basic meaning of ‘still’ and ‘no longer’ in German is generally incompatible with the perfect reading of the perfect and forces its past reading with homogenous VPs (see 19) or must be interpreted in the so-called perfective reading of the phase particles with inhomogenous VPs (see 18).

In the next section we discuss the situation in Slavic languages and in section 4 we will give a generalization of the German and Slavic data.

3.2. MORPHOLOGICAL ASPECT AND PHASE PARTICLES IN RUSSIAN, CZECH AND UPPER SORBIAN

Along with other Slavic languages Russian, Czech and Upper Sorbian distinguish between imperfective and perfective verbs morphologically. The former describe a situation from the inside which means that potential boundaries of the situation are neglected (see Comrie 1993). Roughly speaking, Slavic imperfective verbs can be grouped together with homogenous VPs in German. Perfective verbs describe bounded (telic) situations from the outside and correspond to inhomogenous VPs in German. In the following, we look at the behavior of perfective and imperfective verbs in different tenses and their (in)compatibility with phase particles. For the sake of clarity we concentrate on the phase particle *uže/už/hižo* (already), but the main results carry over to the other phase particles as well.

3.2.1. Present tense

It does not come as a surprise that the combination of ‘already’ with imperfective verbs causes no problems in the present tense (see 20 and 1).

- (20) a. *Petr už dosahuje kopce.* (Cz)
 Peter already reach_{imp/pres} mountain
 Peter is already reaching the mountain.
- b. *Pětr hižo jabluka ščípa.* (USo)
 Peter already apples pick_{imp/pres}
 Peter is already picking apples.

- c. *Poezd už edet.* (Ru)
 train already go_{imp/pres}
 The train is already going.

With respect to perfective verbs the situation is different in all three Slavic languages. Due to the nature of the perfective aspect the present tense of perfective verbs has a future default reading and cannot describe ongoing situations. In Czech and Upper Sorbian it is impossible to combine perfective verbs in the present tense with ‘already’ because they give rise to inhomogenous VP which cannot serve as arguments for the phase particles. Thus, (20a) and (20b) become ungrammatical when the aspect of the verb is changed from imperfective to perfective (see 21).¹⁸

- (21) a. **Petr už dosáhne kopce.* (Cz)
 Peter already reach_{perf/pres} mountain
 b. **Pětr jabluka hižo zeščípa.* (USo)
 Peter apples already pick_{perf/pres}

Unlike in Czech and Upper Sorbian, Russian perfective verbs in the morphological present tense can express future perfect as well as simple future. It is the future perfect reading which makes the combination of ‘already’ with perfective verbs possible in Russian (see 22b). As a matter of fact, ‘already’ even forces the future perfect interpretation of perfective present tense verbs (see 22b) and excludes simple future interpretations like in (22a). Thus, in Russian ‘already’ shows the same disambiguating behavior like in the German perfect sentences (16) and (17).

- (22) a. *V vosem časov poezd uedet.* (Ru)
 at eight o'clock train go_{perf/pres}
 At 8 o'clock, the train will depart.
 b. *V vosem časov poezd už uedet.* (Ru)
 at 8 o'clock train already go_{perf/pres}
 At 8 o'clock, the train will have already departed.
 * At 8 o'clock, the train will already depart.

¹⁸ In Czech there is an emotive secondary use of *už* (‘already’) in the sense of *už konečně* (finally, after all) in which (21a) can be considered an acceptable sentence, expressing that John is expected to reach the mountain eventually after big troubles soon. However, this use of *už* as a modal particle lies beyond the basic meaning of the phase particles and will be neglected in the following.

The above data show that the combination of perfective verbs in the present tense with ‘already’ in the three Slavic languages is possible only if a future perfect reading is available. Czech and Upper Sorbian present tense perfective verbs lack this possibility and therefore are not allowed with ‘already’. In Russian, the morphological present tense of perfective verbs has a future perfect reading which enables ‘already’ to be combined with them.

3.2.2. Past Tense

As the combination of imperfective verbs and ‘already’ is unproblematic in all tenses we just consider the data with perfective verbs. In Czech and Russian, there is only one past tense which can have a past or a perfect reading. Therefore ‘already’ is compatible with perfective verbs in the Russian and Czech past tense (see 23). Upper Sorbian differentiates between a simple past tense and a perfect tense. Like in German, only the latter allows for the combination of a perfective verb with ‘already’ (24a). The simple past tense of perfective verbs is called ‘aorist’ in Upper Sorbian. When perfective verbs appear in the ‘aorist’ they are incompatible with ‘already’ (24b) as they are in the present tense (21b).

- (23) a. *Petr už dosáhl kopce.* (Cz)
 Peter already reach_{perf/past} mountain
 Peter has already reached the mountain.
- b. *Pětr už vyigral* (Ru)
 Peter already win_{perf/past}
 Peter has already won.
- (24) a. *Pětr je jabluka hižo zeščípat.* (USo)
 Peter is_{pres} apples already pick_{perf/perfect}
 Peter has already picked (all the) apples.
- b. **Woni jabluka hižo zeščípachu.* (USo)
 they apples already pick_{perf/aorist}

Note that all three correct sentences (23a, 23b and 24a) need to have a perfect interpretation ($t_r = t_s$). Simple past interpretations with $t_r < t_s$ are not available in this kind of sentences as is shown by the incorrectness of (25b). The incorrectness of (25b) is caused by the subordinate clause, which excludes the perfect reading by shifting t_r before t_s . (25b) is correct without the phase particle ‘already’ in which case the main clause receives a simple past reading (25a). Moreover, (25b) can be corrected if the past tense in the main clause is replaced

by a possessive participle construction which allows for a past perfect reading (25c). The past perfect must be expressed by paraphrastic means like in (25c) since there is no morphological past perfect and the past tense usually does not allow for a past perfect reading. Upper Sorbian has a morphological past perfect tense and hence the situation is much the same like in the German examples (16) and (17).

- (25) a. *Když přišla do sportovní haly, vyhráhl.* (Cz)
 when come_{past} into gym win_{perf/past}
 When she came into the gym, he won.
- b. **Když přišla do sportovní haly, už vyhráhl.*
 when come_{past} into gym already win_{perf/past}
- c. *Když přišla do sp. haly, už měl vyhráhno.*
 when come_{past} into gym already have_{past} win_{perf/pass. part. 3.neutr.}
 When she came into the gym, he had already won.

Again, the situation is different in Russian. The morphological tense system of Russian is very poor and as was said before there exists just one past tense. But, of course, Russian can express past perfect readings. One way of forcing such a past perfect interpretation is the use of phase particles in combination with perfective verbs in the past tense (26b).

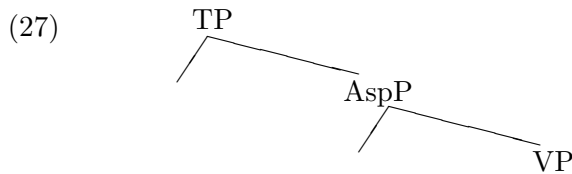
- (26) a. *Kogda ona prišla v sportzal, on vyigral.* (Ru)
 when she come_{past} into gym he win_{perf/past}
 When she came into the gym, he won.
- b. *Kogda ona prišla v sportzal, on už vyigral.* (Ru)
 when she come_{past} into gym he already win_{perf/past}
 When she came into the gym, he had already won.
 * When she came into the gym, he won.

We can conclude that ‘already’ in its basic meaning can combine with imperfective verbs without restrictions. Combinations with perfective verbs are possible only when a (present, future or past) perfect reading is available which is quite similar to the situation in German with respect to inhomogenous VPs.

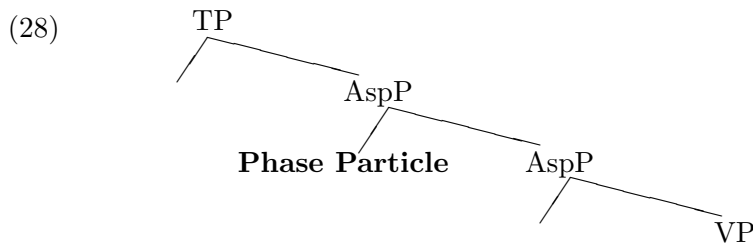
4. Aspectual Relations

In this section we will draw some general conclusions from the data observed in section 3. Our starting point is the differentiation between

semantic aspect and morphological aspect. The task of the semantic aspect is determine the relation between the reference time t_r and the event time $\tau(e)$ (see Klein 1994, Paslawska and von Stechow 2002). Although German does not have a morphological category of aspect it can express the same semantic aspectual relations like Slavic languages. Before introducing these semantic relations we shall make a short remark on the syntax of aspect. It is widely assumed that aspectual information is located in a functional Asp-node. Moreover, we follow e.g. Paslawska and von Stechow (2002) in assuming that AspP is located between the tenseless VP and the tense phrase TP (see 27). The task of the TP is to determine the relation between the reference time t_r and the speech time t_s . For the sake of simplicity, the VP will be represented semantically by an event predication $\lambda e.Q(e)$ which we do not analyze in more detail.



Now, the question is at which position the phase particles should be located in the semantic composition. The above examples have shown that aspectual information is essential for the (un)grammaticality of phase particles. For, the aspectual resultant reading of the morphological perfect tense turns sentences that are ungrammatical in the present tense into grammatical ones (see 13 vs. 16a, 17a and 21 vs. 23a, 24a). On the other hand, purely temporal information - the relation between the event time and the speech time - is not relevant for the (un)grammaticality of the phase particles. If a sentence with a phase particle is grammatical in the present tense it can be shifted along the time axis without changing aspectual information and without loss of grammaticality (see 12). Ungrammatical present tense sentences containing phase particles stay ungrammatical in other morphological tenses as long as aspectual information is not affected by them (see 13, 21b and 24b). This is why we assume that the phase particles are adjoined to the AspP and therefore beneath the TP-node (28). Thus we locate the phase particles in much the same way like adverbs of quantification are adjoined to the AspP e.g. in von Stechow (1991: 103f) and Musan (2002: 18f). We shall not commit ourselves to the exact position of the phase particles in the syntax. The only thing important here is the relative order: first the semantic aspect is applied to the VP and second the phase particles are applied to the resulting expression.



The three most important semantic aspects or relations between the reference time t_r and the event time $\tau(e)$ are defined in (29) (see Klein 1994; Paslawska and von Stechow 2002). Aspectual intuitions are reconstructed by them in terms of purely temporal relations.

- (29) IMPERFECTIVE $=_{df}$ $\lambda t_r. \exists e(Q(e) \wedge t_r \subseteq \tau(e))$ ¹⁹
 PERFECTIVE $=_{df}$ $\lambda t_r. \exists e(Q(e) \wedge \tau(e) \subseteq t_r)$
 PERFECT $=_{df}$ $\lambda t_r. \exists e(Q(e) \wedge \tau(e) < t_r)$

The semantic PERFECTIVE aspect states that the event time $\tau(e)$ is included in t_r . The boundaries of the event lie within t_r which leads to a bounded interpretation of the event. This corresponds to the intuition that in perfective sentences the event is seen from the outside. On the contrary, the semantic IMPERFECTIVE aspect states that t_r is included in $\tau(e)$. The boundaries of the event do not lie within t_r . This corresponds to the intuition that in imperfective sentences the event is seen from the inside as an unbounded event. The semantic PERFECT aspect simply states that $\tau(e)$ is before t_r . That means that if PERFECT is true of a time t then it is also true of all times after t . Thus, the PERFECT aspect neatly fits the intuition that sentences with an aspectual perfect reading denote an everlasting resultant state (Parsons 1990, p. 231, Kratzer 2000).

Now, the examples of section 3 can be reanalyzed in terms of semantic aspect. In German, the morphological present perfect of inhomogeneous VPs licenses semantic PAST²⁰ tense with PERFECTIVE aspect (16b, 17b). The German present perfect of homogeneous VPs licenses PAST IMPERFECTIVE (15b, 19). For both kinds of VPs the PRESENT PERFECT reading is licensed by the German present perfect (15a, 16a, 17a). Upper Sorbian shows the same behavior like German with respect

¹⁹ Usually, there is a further λ -abstraction about the predicate Q in the definition of the semantic aspects (e.g. Kratzer 2000, Paslawska and von Stechow 2002). We omit it for the sake of simplicity and assume that the semantic aspect has already been applied to a VP-denotation $\lambda e.Q(e)$.

²⁰ We use PAST, PRES and FUT to indicate the semantic tense of the sentences. In the following we will say e.g. 'PAST PERFECTIVE' as a shorthand for 'PAST tense in combination with PERFECTIVE aspect'.

to the morphological aspectual distinction instead of homogeneity distinction.²¹ The Czech past tense also licenses PAST PERFECTIVE with perfective verbs (25a), PAST IMPERFECTIVE with imperfective verbs and PRESENT PERFECT with both aspects (23a). In Russian, perfective verbs in the present tense allow for both FUTURE PERFECTIVE (22a) and FUTURE PERFECT (22b). Consequently, Russian perfective verbs in the past tense allow for a PAST PERFECTIVE (26a), PAST PERFECT (26b) and PRESENT PERFECT (23b) reading.

In (30),²² the relations between morphological tense on the one hand and semantic aspect and semantic tense on the other hand are summarized in a somewhat simplified way. In Slavic languages, the morphological aspect is crucial for the selection of semantic aspect in the several morphological tenses. In German, we take it, the (in)homogeneity of the VP is the crucial criterion which determines the choice of semantic aspect.²³

(30)

Ger	present tense	present perfect	past tense
homog. VP	PRES IMP	PAST IMP or PRES PERF	PAST IMP
inhom. VP	FUT PFVE	PAST PFVE or PRES PERF	PAST PFVE
USo	present tense	present perfect	synthetic past
imp. verb	PRES IMP	PAST IMP or PRES PERF	PAST IMP
perf. verb	FUT PFVE	PAST PFVE or PRES PERF	PAST PFVE
Cz	present tense	past tense	
imp. verb	PRES IMP	PAST IMP or PRES PERF	
perf. verb	FUT PFVE	PAST PFVE or PRES PERF	

²¹ In Upper Sorbian the morphological aspectual distinction is not as sharp as in Russian and Czech. However, we neglect exceptions in the aspectual system of Upper Sorbian with respect to the data we are interested in here.

²² We abbreviate: PRES = PRESENT; FUT = FUTUR; IMP = IMPERFECTIVE; PFVE = PERFECTIVE; PERF = PERFECT

²³ In the same way, Smessaert and ter Meulen (2004, p. 215) take (a)telicity to be the crucial criterion for the choice of the semantic aspect.

Ru	present tense	past tense
imp. verb	PRES IMP	PAST IMP or PRES PERF
perf. verb	FUT PFVE or FUT PERF	PAST PFVE or PAST PERF PRES PERF

To sum up, in section 3 we saw that it is quite complicated to describe the (in)correctness of phase particles in terms of morphological aspect or homogeneity of the VP since the compatibility varied from language to language depending on the specific properties of the several morphological tenses. Condition (iii) on p. 1 states that the phase particles can be combined only with ‘imperfective’ sentences. We are now in the position to refine this condition. Phase particles can be combined with inhomogenous VPs in German and perfective verbs in Slavic provided that a PERFECT reading is available. Intuitively one could say, that the PERFECT aspect introduces a resultant state in AspP above the VP-layer, which like all states is homogenous. But note that only ‘already’ and ‘not yet’ can be applied to this state. Thus, condition (iii) can be restated in terms of semantic aspect and should be replaced by the four following rules:

- (A) Phase particles are compatible with sentences which license the semantic IMPERFECTIVE aspect (see 1, 12, 15b, 19, 20), and
- (B) they lead to incorrectness in sentences which license the semantic PERFECTIVE aspect (see 13, 14a, 16c, 17c, 21, 22b, 24b, 25b, 26b).
- (C) *Already* and *not yet* are compatible with sentences which license PERFECT (see 15a, 16a, 17a, 23, 24a, 26b), whereas
- (D) *still* and *no longer* in the basic meaning are incompatible with sentences which license PERFECT (see 18 and 19).

In the next section, we will provide a formal explanation for (A)-(D) within the two-dimensional framework introduced in section 2.

5. The data predicted

In this section, we discuss the results of applying the phase particles defined in Def. 2 (p. 8) to the three semantic aspects in (29). Thus, we relate the formal apparatus of section 2 and 4 to the empirical data of

section 3. The functional application of ALREADY to IMPERFECTIVE is shown in (31). (32) summarizes the results of applying ALREADY and STILL to each of the semantic aspects in (29). The results for NOT-YET and NO-LONGER differ from (32) only in negating the assertion.

$$(31) \text{ ALREADY}(\text{IMPERFECTIVE}) = \\ \lambda P \lambda t_r \lambda I. \left[\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow P(t)) \right] (\lambda t_r. \exists e(Q(e) \wedge t_r \subseteq \tau(e))) = \\ \lambda t_r \lambda I. \left[\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge t \subseteq \tau(e))) \right]$$

$$(32) \text{ a. ALREADY}(\text{IMPERFECTIVE}) = (31)$$

$$\text{b. ALREADY}(\text{PERFECTIVE}) = \\ \lambda t_r \lambda I. \left[\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) \subseteq t_r)) \right]$$

$$\text{c. ALREADY}(\text{PERFECT}) = \\ \lambda t_r \lambda I. \left[\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t_r)) \right]$$

$$\text{d. STILL}(\text{IMPERFECTIVE}) = \\ \lambda t_r \lambda I. \left[\exists t_x \in I \forall t \subseteq I (t < t_x \leftrightarrow \exists e(Q(e) \wedge t \subseteq \tau(e))) \right]$$

$$\text{e. STILL}(\text{PERFECTIVE}) = \\ \lambda t_r \lambda I. \left[\exists t_x \in I \forall t \subseteq I (t < t_x \leftrightarrow \exists e(Q(e) \wedge \tau(e) \subseteq t_r)) \right]$$

$$\text{f. STILL}(\text{PERFECT}) = \\ \lambda t_r \lambda I. \left[\exists t_x \in I \forall t \subseteq I (t < t_x \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t_r)) \right]$$

The presuppositions in (32) differ from each other only in the relation between t and t_x on the left side of the material equivalence and between $\tau(e)$ and t on the right side, but these differences have important consequences. The presuppositions of the application to IMPERFECTIVE in (32a) and (32d) behave like a presupposition should behave. They are Π -satisfiable,²⁴ i.e. consistent with the set Π of postulates on p. 27, and they are not trivial in the sense that they would

²⁴ To see that, for instance, the presupposition of ALREADY(IMPERFECTIVE) in (32a) is Π -satisfiable consider a model with three time atoms t_1, t_2, t_3 . The domain

follow from the assertion. We will see soon that these conditions are not fulfilled for the other presuppositions in (32). There are no technical difficulties with ALREADY and STILL in applying them to IMPERFECTIVE, nor are there any with NOT-YET or NO-LONGER since they yield the same presuppositions. This explains item A of the results on p. 21. However, the situation changes when the phase particles are applied to the PERFECTIVE aspect.

Theorem 2. ALREADY(PERFECTIVE) and NOT-YET(PERFECTIVE) are incorrect in every Π -interpretation, i.e. their presupposition $\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) \subseteq t))$ is not Π -satisfiable.

Proof. If the bivalence $\forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) \subseteq t))$ did hold for a $t_x \in I$ there would be a $t_1 \subseteq I$ and a $t_2 \subseteq I$ such that $t_1 < t_x < t_2$ by Def. 1 (p. 7). By $t_x < t_2$ and $t_2 \subseteq I$ the bivalence gives $\exists e(Q(e) \wedge \tau(e) \subseteq t_2)$. By (π_7) , $\exists e(Q(e) \wedge \tau(e) \subseteq t_2 \oplus t_1)$ does hold as well. By (π_8) we have $t_2 \oplus t_1 \subseteq I$ and thus $t_x < t_2 \oplus t_1$ does hold by the bivalence. By (π_7) and (π_1) we have $t_1 \subseteq t_2 \oplus t_1$. This gives $t_x < t_1$ by (π_5) and $t_x < t_2 \oplus t_1$, contradicting $t_1 < t_x$ and (π_3) .

Theorem 3. STILL(PERFECTIVE) and NO-LONGER(PERFECTIVE) are incorrect in every Π -interpretation, i.e. their presupposition $\exists t_x \in I \forall t \subseteq I (t < t_x \leftrightarrow \exists e(Q(e) \wedge \tau(e) \subseteq t))$ is not Π -satisfiable.

Proof. If the bivalence $\forall t \subseteq I (t < t_x \leftrightarrow \exists e(Q(e) \wedge \tau(e) \subseteq t))$ did hold for a $t_x \in I$ there would be a $t_1 \subseteq I$ and a $t_2 \subseteq I$ such that $t_1 < t_x < t_2$ by Def. 1 (p. 7). By $t_1 < t_x$ and $t_1 \subseteq I$ the bivalence gives $\exists e(Q(e) \wedge \tau(e) \subseteq t_1)$. By (π_7) , $\exists e(Q(e) \wedge \tau(e) \subseteq t_2 \oplus t_1)$ does hold as well. By (π_8) we have $t_2 \oplus t_1 \subseteq I$ and thus $t_2 \oplus t_1 < t_x$ does hold by the bivalence. By (π_7) and (π_1) we have $t_2 \subseteq t_2 \oplus t_1$. This gives $t_2 < t_x$ by (π_6) and $t_2 \oplus t_1 < t_x$, contradicting $t_x < t_2$ and (π_3) .

Theorems 2 and 3 state that the phase particles cannot be applied felicitously to the PERFECTIVE semantic aspect. This explains item

of time (atoms and intervals) is $T = \{t_1, t_2, t_3, t_1 \oplus t_2, t_2 \oplus t_3, t_1 \oplus t_3, t_1 \oplus t_2 \oplus t_3\}$. The precedence relation $<$ is the following set of ordered pairs $\{t_1 t_2, t_2 t_3, t_1 t_3, t_1 t_2 \oplus t_3, t_1 \oplus t_2 t_3\}$ and the ‘part-of’ relation \subseteq is the reflexive and transitive hull of $\{t_3 t_1 \oplus t_3, t_1 t_1 \oplus t_3, t_1 \oplus t_3 t_1 \oplus t_2 \oplus t_3 \dots\}$. Let e be the only element of the event domain and let $Q(e)$ and $\tau(e) = t_3$ hold. All postulates (π_{1-9}) are fulfilled in this model. Now, let I be $t_1 \oplus t_2 \oplus t_3$, such that $t \subseteq I$ holds for all times $t \in T$. $t_2 \in I$ does hold by Def. 1 on p. 7. t_3 is the only time t in T such that $\exists e(Q(e) \wedge t \subseteq \tau(e))$ does hold. Moreover, t_3 is the only time t in T such that $t_2 < t$ does hold. Thus, $\forall t \subseteq I (t_2 < t \leftrightarrow \exists e(Q(e) \wedge t \subseteq \tau(e)))$ does hold as well as $\exists t_2 \in I \forall t \subseteq I (t_2 < t \leftrightarrow \exists e(Q(e) \wedge t \subseteq \tau(e)))$. The consistency of the presupposition of STILL(IMPERFECTIVE) in (32a) can be shown by a similar construction.

B of the results on p. 21. Moreover, the two theorems predict that in sentences allowing for a PERFECTIVE and a PERFECT reading the PERFECTIVE reading is ruled out by ALREADY. This is the reason for the disambiguating effect of ‘already’ and ‘not yet’ we observed in the examples (16a), (17a), (22b), (23), (24), (26b). Besides, theorems 2 and 3 can also account for the well-known fact that in Slavic languages phase verbs (e.g. ‘begin’, ‘stop’) as a rule are incompatible with perfective verbs. For, one can reasonably assume that phase verbs denote similar phase structures like phase particles.

With respect to the IMPERFECTIVE and PERFECTIVE aspect, the four phase particles behave uniformly. They are altogether compatible with IMPERFECTIVE, but incompatible with PERFECTIVE. This uniformity fails when the phase particles are applied to the PERFECT aspect. STILL and NO-LONGER, on the one hand, are incompatible with PERFECT (see theorem 4) which explains item D of the results on p. 21.

Theorem 4. STILL(PERFECT) and NO-LONGER(PERFECT) are incorrect in every Π -interpretation, i.e. their presupposition $\exists t_x \in I \forall t \subseteq I (t < t_x \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t))$ is not Π -satisfiable.

Proof. If the bivalence $\forall t \subseteq I (t < t_x \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t))$ did hold for a $t_x \in I$, there would be a $t_1 \subseteq I$ and a $t_2 \subseteq I$ such that $t_1 < t_x < t_2$ by Def. 1 (p. 7). By $t_1 < t_x$ and $t_1 \subseteq I$ the bivalence gives $\exists e(Q(e) \wedge \tau(e) < t_1)$. By (π_4) we have $t_1 < t_2$ and consequently $\exists e(Q(e) \wedge \tau(e) < t_2)$. Then the bivalence and $t_2 \subseteq I$ give $t_2 < t_x$, contradicting $t_x < t_2$ and (π_3) .

On the other hand, theorem 5 states that the application of ALREADY to PERFECT does not add any new information to the argument. Hence, the presupposition of ALREADY(PERFECT) cannot cause any incorrectness. The same holds for NOT-YET(PERFECT) since both expressions share the same presupposition (see 36) which explains item C of the results on p. 21.²⁵ Note that the proof of theorem 5 heavily draws

²⁵ A remark on duality: we have seen in footnote 13 on p. 8 that duality fails for the phase particles defined in Def. 2 since formulae (9) and (10) are not equivalent. With the results of the present section duality can be regained as follows. We have seen that the only correct presuppositions are the presuppositions of ALREADY(IMPERFECTIVE), STILL(IMPERFECTIVE) and ALREADY(PERFECT). Assuming that imperfective aspect selects for homogeneous event predications, it can be argued that the universal quantifier of these presuppositions can be equivalently restricted to atoms of time, e.g. $\exists t_x \in I \forall t \subseteq I (ATOM(t) \rightarrow (t < t_x \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t))$). Hence, we can assume that the universal quantifier of the presupposition is restricted to atoms of time in all correct uses of the phase particles. It turns out that with this restriction of the universal quantifier formulae (10) and (9) become equivalent which yields duality. However, the technical details of this argumentation would lead us too far away.

on postulate (π_9) on p. 28 which states that for each event predication $Q(e)$ the perfect-resultant state described by $\exists e(Q(e) \wedge \tau(e) < t)$ has an immediate left boundary.²⁶

Theorem 5. The application of ALREADY to PERFECT does not add any new information since in any case there is a time I such that the presupposition $\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t))$ follows from the assertion $\exists e(Q(e) \wedge \tau(e) < t_r)$ with respect to Π .

Proof. By (π_2) there is a time I such that $\forall t_1 (t_1 \subseteq I)$. By (π_9) there is a t_x and a t_2 such that $t_2 < t_x$ and $\forall t (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t))$. Since $\exists e(Q(e) \wedge \tau(e) < t_r)$ does hold the bivalence gives us $t_x < t_r$. By $t_2 < t_x$, $t_x < t_r$ and $t_x \subseteq I$ we get $t_x \in I$ (see Def. 1, p. 7) and consequently there is an I such that $\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t))$.

The redundancy of the application of ALREADY to PERFECT can be confirmed empirically. In the IMPERFECTIVE sentence (33), for instance, ‘already’ triggers the presupposition that the light was not on during a negative phase before the reference time whereas the same sentence without ‘already’ does not carry this presupposition.

- (33) *Das Licht ist schon an.*
The light is still on.

In the PERFECT sentence (34a), by contrast, ‘already’ does not trigger a new phase structure. Both (34a) and the same sentence without ‘already’ (34b) imply that Peter had not reached the mountain (yet) during a negative phase before the reference time.

- (34) a. *Peter hat den Berg schon erreicht.*
Peter has already reached the mountain.
b. *Peter hat den Berg erreicht.*
Peter has reached the mountain.

²⁶ This is a rather strong claim and one might not want it to hold generally for all event predications $Q(e)$ (e.g. not for tautological event predications). However, intuitively it is a valid claim about ‘natural’ event predications usually expressed by VPs. Since it is meant to be applied to those ‘natural’ event predications in this paper we shall accept (π_9) and shall avoid appropriate technical restrictions of (π_9) for the sake of formal simplicity. Moreover, (π_9) would be dispensable if we assume that the event variable e is not bound by the semantic aspect but above the phase particle (see Zybatow and Malink to appear). For, the formula $\exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow (Q(e) \wedge \tau(e) < t))$ follows immediately from $\forall t \subseteq I (\tau(e) < t \leftrightarrow (Q(e) \wedge \tau(e) < t))$ and $Q(e)$.

PERFECT aspect sentences already express a phase structure by themselves since perfect-resultant states per se have a left boundary. The phase structure induced by the perfect is much the same like the phase structure of ALREADY in that there is a change from a negative phase to a positive one and that the reference time belongs to the positive phase (see figure 1 on p. 4). Consequently, ALREADY is redundant when applied to PERFECT whereas STILL and NO-LONGER lead to incorrectness because they require a change from positive to negative polarity.

This is not to say ALREADY has no contribution at all to the meaning of PERFECT sentences. Subjective evaluations of the course of events as ‘early’ or ‘fast’ (see Smessaert and ter Meulen 2004) lie beyond the scope of this paper, but there are two contributions relevant for our semantic analysis.

First, ALREADY is the disambiguator par excellence for sentences licensing both a PERFECT and a PERFECTIVE reading since it is incompatible with the latter (theorem 2) and does not change the meaning of the former reading (theorem 5). Sentences allowing for a (PRESENT) PERFECT and (PAST) IMPERFECTIVE reading, by contrast, stay ambiguous when adding ALREADY and have to be disambiguated by other means since ALREADY is compatible with the IMPERFECTIVE reading as well (see 15).

Second, ALREADY makes the phase structure induced by PERFECT a presuppositional phase structure which becomes relevant for the negation of sentences with morphological perfect tense. In German as well as in the considered Slavic languages, simple negation of the morphological perfect tense²⁷ like in (35a) does not presuppose the existence of an event of Peters ironing the shirt. By contrast, if the presupposition preserving negation²⁸ of ALREADY, i.e. NOT-YET, is used like in (35b), the presupposed change from a negative phase to a positive one is preserved by the negation and the (expectation of the) existence of an event of Peters ironing the shirt is presupposed (see Henning 2002, pp. 64f).

- (35) a. *Peter hat das Hemd nicht gebügelt.*
Peter did not iron the shirt.
- b. *Peter hat das Hemd noch nicht gebügelt.*
Peter has not ironed the shirt yet.

²⁷ I.e. the only past tense in Czech and Russian.

²⁸ See (36) and theorem 1 on p. 9.

Theorem 6 captures this fact by stating that if NOT-YET is applied to the PERFECT aspect of a VP-denotation $\lambda e.Q(e)$ there is an event e with $\lambda e.Q(e)$, but this event is not before the reference time t_r .

$$(36) \text{ NOT-YET(PERFECT)} = \neg_a \text{ALREADY(PERFECT)} = \\ \lambda t_r \lambda I. \left[\begin{array}{c} \neg \exists e(Q(e) \wedge \tau(e) < t_r) \\ \exists t_x \in I \forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t)) \end{array} \right]$$

Theorem 6. If $\text{NOT-YET(PERFECT)}(t_r, I)$ is true (see Def. 3 on p. 8) there is an e such that $Q(e) \wedge \tau(e) \not< t_r$.

Proof. Let there be a $t_x \in I$ such that $\forall t \subseteq I (t_x < t \leftrightarrow \exists e(Q(e) \wedge \tau(e) < t))$. By Def. 1 on p. 7 there is a $t_1 \subseteq I$ such that $t_x < t_1$. By the bivalence we get $\exists e(Q(e) \wedge \tau(e) < t_1)$ and an e such that $Q(e)$. By $\neg \exists e(Q(e) \wedge \tau(e) < t_r)$ we have $Q(e) \wedge \tau(e) \not< t_r$.

6. Conclusion

In the first part of this paper we have introduced a two-dimensional formal representation of the basic meaning of the four phase particles ‘already/still/not yet/no longer’. This representation captures the pre-suppositional nature of the phase particles. Having done that, we have looked at crucial data from German and Slavic which at the first sight showed a rather unsystematic behavior with respect to the grammaticality of the phase particles in the considered sentences. The unsystematic character of the data disappears if the morphological description of section 3 is replaced by a description in terms of semantic aspect. On the basis of the semantic aspect we could refine widespread assumptions about the distribution of the phase particles. Particularly, condition (iii) on p. 2 could be replaced by the generalizations A-D on p. 21. Finally, we were in the position to prove and explain the empirical findings of this paper within our two-dimensional framework.

Appendix: Set II of postulates

$$(\pi_1) \forall t(t \subseteq t)$$

$$(\pi_2) \exists t \forall t_1(t_1 \subseteq t)$$

$$(\pi_3) \forall t \forall t_1(t < t_1 \rightarrow t_1 \not< t)$$

- (π_4) $\forall t \forall t_1 \forall t_2 (t < t_1 \wedge t_1 < t_2 \rightarrow t < t_2)$
- (π_5) $\forall t \forall t_1 (t_1 < t \rightarrow \forall t_2 (t_2 \subseteq t \rightarrow t_1 < t_2))$
- (π_6) $\forall t \forall t_1 (t_1 < t \rightarrow \forall t_2 (t_2 \subseteq t_1 \rightarrow t_2 < t))$
- (π_7) $\forall t \forall t_1 \forall t_2 (t \subseteq t_1 \vee t \subseteq t_2 \rightarrow t \subseteq t_1 \oplus t_2)$
- (π_8) $\forall t \forall t_1 \forall t_2 (t_1 \subseteq t \wedge t_2 \subseteq t \rightarrow t_1 \oplus t_2 \subseteq t)$
- (π_9) $\exists t_1 \exists t_2 (t_2 < t_1 \wedge \forall t_3 (t_1 < t_3 \leftrightarrow \exists e (Q(e) \wedge \tau(e) < t_3)))$

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