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Modelling 'the perfect', a category between tense and aspect

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Abstract

I demonstrate that a consistent interpretation of Reichenbach's (1947) primitives and their configurations enables the construction of an intuitive and elegant semantic space for all logically possible tense meanings, independent of their mode of expression. I argue that the property which defines the perfect in absolute tense systems is the dissociation of the temporal location of the situation from the reference point from which it is viewed (i.e. R ≠ E). The analytical problems posed hitherto by the English Perfect are due to the fact that it neutralises the distinction between E < R and R < E. Although the semantic dimension of the perfect emerges from the system of temporal meanings, alternatively the perfect could be viewed as a category expressing meanings between canonical tense and canonical aspect, overlapping both.

Keywords: perfect tense, tense semantics, tense and aspect, grammatical features

1. The perfect and Reichenbach's tense theory

1.1. Aims of the paper

This paper has two aims.[1] The first aim is to promote a new solution to the so-called 'present perfect puzzle' formulated by Klein (1992: 525):

> In *Chris has left York,* it is clear that the event in question, Chris's leaving York, has occurred in the past, for example yesterday at ten. Why is it impossible, then to make this event time more explicit by such an adverbial, as in **Yesterday at ten, Chris has left York*?

I demonstrate that the puzzle ceases to exist if the perfect is analysed as a semantic category which involves *any* dissociation of the temporal location of the situation from the reference point from which we choose to view the situation. I provide a simple model that is capable of representing this dissociation. In the proposed model, based on Reichenbach's (1947) primitives E, S, and R, the perfect is represented as a dissociation of R and E (R ≠ E). The original idea promoted here is that, in tense systems with the primary deictic centre at the time of speech S, the dissociation of R and E may be grammaticalised as one category (a Perfect tense) regardless of the order of the two primitives along the time axis, thus neutralising the meaning distinction between E < R and R < E.

The second aim of the paper is to show the relationship between the perfect and the semantic tense distinctions that have been identified as logical possibilities for language. In the model proposed here, all logically possible tense meanings are captured with Reichenbach's primitives. I demonstrate that resolving a hitherto

[1] I gratefully acknowledge a British Academy Overseas Conference Grant which enabled me to present this paper at the 18th International Congress of Linguists in Seoul, Korea, 21-26 July 2008, and benefit from the comments of participants in the session on Tense, Aspect and Modality.

unnoticed inconsistency in Reichenbach's original interpretation of his system (see section 3.1) leads to a surprisingly clean and theoretically convincing system of tense meanings, that is, values of the tense feature. In the proposed system, the perfect can be regarded as a non-canonical tense, or alternatively it could be viewed as a semantic category between canonical tense and canonical aspect, overlapping both.

1.2. Reichenbach's 'relative tense theory'

Reichenbach's (1947) framework is still used by many linguists, mostly descriptivists and some semanticists, to model grammaticalised tense values. It has been criticised over the years (recently for example by Vet 2007), and various influential attempts have been offered to improve it (e.g. Hornstein 1990).

Acknowledging the inadequacy of the traditional interpretation of Reichenbach's representations of tenses, I argue that Reichenbach's own interpretation of his system, repeated by most other researchers, was inconsistent (see section 3). Resolving the original errors of interpretation, however, reveals an elegant system, avoids the complications of other proposals, and provides a solution to the 'present perfect puzzle'. I argue, therefore, that Reichenbach's primitives *are* adequate to model tense meanings in natural language and provide a suitable foundation for a formal framework to model tense.

1.3. The perfect: preliminary observations

Although the perfect is often traditionally listed as an aspect, it cannot be viewed as a canonical aspect since it tells us nothing directly about the internal temporal organisation of the situation (Comrie 1976). If we take tense to be the grammaticalisation of location in time (Comrie 1985: vii), the perfect can be viewed as a tense. Specifically, we can first construct the semantic space of logical possibilities of expressing basic (non-perfect) tense meanings, that is all meanings where R = E, and then add the dimension of the perfect, that is all meanings where R ≠ E, as a systematic extension of the basic tense meanings (see section 2.3).

Because it is possible to isolate the whole 'dimension' of the perfect within tense, and because its meaning is not purely deictic but captures a certain way of viewing a situation already located in time, the perfect could alternatively be viewed as a separate category, between tense and aspect. In other words, it could be argued that while the definition of tense has to include deixis, the distinction between R = E and R ≠ E is independent of deixis. However, even in relative tense systems such as the one found in Yup'ik (Mithun 1999), which grammaticalise only the relation between R and E and always assume the deictic centre at R, the interpretation of tensed sentences is possible only when the deictic centre R is hooked either at the point of speech S (which can be regarded as the 'default' interpretation) or away from it (for example in narratives), depending on the context. Thus, relative tense systems arguably indicate that the perfect may be more appropriately analysed as a dimension within tense rather than as a separate category.

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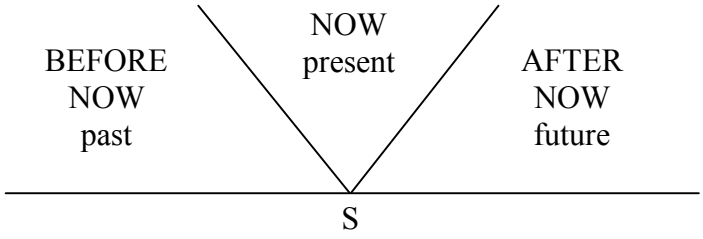
2. Modelling tense meanings

2.1. Time and tense

Following Comrie (1985: 2-3) and many other authors, I assume that time can be represented as a straight line, with the past represented conventionally to the left and the future to the right. The present moment is represented by a point on that line, labelled S (mnemonic for 'speech time'):

(1)



Several things are intentionally left unspecified in diagram (1). One is whether the time line is bounded at either the left or the right (including whether it bends to form a circle; this might correspond to a different culture-specific conceptualisation of time, found on a limited scale in all cultures). Also unspecified is the representation of the flow of time, that is, whether S (or Ego) moves along a stationary time line, or time flows past a stationary reference point S (or Ego). These are important philosophical questions, but they do not seem to play a role in the analysis of tense as a grammatical category, even though they are metaphors that are important sources of time expressions across languages.

One of the extra-linguistic presuppositions for an utterance is constituted by the speaker's consciousness of the relation of the speech situation S to the reported situation/event (E) along the time axis. For temporal distinctions, the speech situation S projected onto the time axis serves as the basic orientation point. The distinction between absolute and relative tenses, however, results from the possibility of locating the deictic centre of the utterance either at the moment of speech (yielding absolute tenses, e.g. most tenses in English), or at any moment on the time line (yielding relative tenses, e.g. tenses in Yup'ik, Mithun 1999). An absolute tense system, with the primary deictic centre at S, can therefore be understood as a special case of a relative tense system.[2]

For temporal as opposed to aspectual distinctions the reported situation E (mnemonic for 'event') can be an event, state, process, or action, and is represented on the time line as a 'point' regardless of its internal temporal contour such as duration or iterativity. Similarly, S and R (see next section) also represent temporal locations relative to the other 'points' on the time line, while being neutral as to whether they are points or intervals of time longer than a point. As is conventional, the hyphen represents the relation 'coincides/overlaps with' (and therefore the order of the two

[2] Note that, although tenses in Yup'ik are all relative, very commonly the deictic centre of the utterance does fall at the moment of speech, which results in an 'absolute' interpretation. Furthermore, non-finite verb forms (which do not realise any absolute tense value) in languages such as English can be seen as realising relative tense (see e.g. Comrie 1985: 56-62).

coinciding points is irrelevant). Diagram (2) illustrates a naive view of a sample set of absolute tenses:

(2)

past		E	**S**	
present			**S**-E	
future			**S**	E
past of the past	E_2	(E_1)	**S**	

On this view, a past situation E can be represented as occurring in the time before and not including the present moment (time 'before' S); a present situation E, whether continuing or repetitive, can be represented as occurring at the present moment (even though it may be encompassing a shorter or longer stretch of time) as long as it overlaps with the time which temporally or psychologically includes S; and a future situation E (a prediction, imposition or an instance of pre-planning) can be represented as occurring in the time after the present moment (time 'after' S).[3] Furthermore, it is possible that a single proposition (expressed in a simple clause) implies the occurrence of a second situation which is usually derivable from the context – as in, for example, the past of the past (or the pluperfect), which is a temporal relation that has been grammaticalised in many languages including English where it is expressed by one of the uses of the Past Perfect.

2.2. The R point

It is now widely accepted that the relative positions of just two points on the time line – the speech time S, and the event time E – are not sufficient to account for all the different tense meanings found in language. Therefore, since Reichenbach, most tense theories have used a third point in time, labelled R (mnemonic for 'reference point') to capture all possible tense distinctions. R indicates a psychological or imaginary temporal location which the speaker chooses to be the temporal reference point for the clause; it may, but does not have to, coincide with the basic orientation point S. The R point does not have to be expressed overtly through any lexical item in the clause, but may remain implied. It alters, in a systematic way, the viewing of the temporal location of a situation whose actual location represented by E remains constant with regard to S.

Diagram (3) represents the set of *absolute tenses* given earlier in (2), this time including the R point which is relevant to all tenses. Therefore, a non-naive representation of the absolute past, present, future, and past of the past all involve R coinciding with E:

(3)

past		E-**R**	**S**	
present			**S**-E-**R**	
future			**S**	E-**R**
past of the past	E_2-$\mathbf{R_2}$	(E_1-$\mathbf{R_1}$)	**S**	

'relative' 'absolute'

[3] It is assumed here that future time reference can, in principle, be subsumed under tense (see e.g. Comrie 1985: 43-48), even though some languages may not have a future tense or tenses and express future time reference with a modal category such as the irrealis.

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Note that within the past of the past, the temporal relation of the reported event, labelled here as E_2, is absolute with regard to the deictic centre S, but relative with regard to the reference point which locates the occurrence of the implied event E_1 (see also Comrie 1985: 65-68). Relative tenses in general are those which disregard the speech time S, but instead have a different temporal point as their deictic centre. The following is a sample set of *relative tenses*, illustrating different possible locations of E with respect to R, omitting the speech time S:

(4)

anterior		E	**R**	
simultaneous			**R**-E	
posterior			**R**	E
anterior of anterior	E_2	(E_1)	**R**	

The tense meaning labelled here as 'simultaneous' is also referred to as 'simple', which is the label used originally by Reichenbach (1947).

Observe that the set of relative tenses in (4) parallels the set which illustrated the naive representation of absolute tenses in (2). However, I have now argued that the meanings of the absolute past, present, future, and past of the past have to include a reference point R which coincides with E, as in (3). In this way, all absolute tenses are correctly represented as a special case of relative tense: they are all a type of simultaneous/simple tense, that is, a tense where R = E.

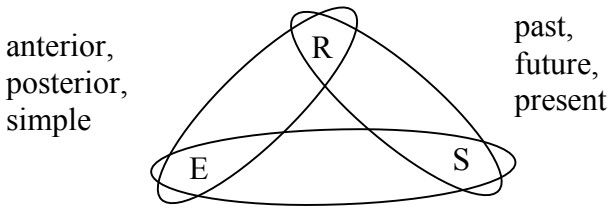
Thus, in a post-Reichenbachian view of tense, it is not the position of E relative to S (the 'naive view'), but the position of R relative to S which makes the speaker view the situation as 'past', 'present', or 'future'. Furthermore, these temporal interpretations are expected to obtain regardless of the position of the reported event E. As was already shown in (4), the position of R with respect to E yields three possible tense meanings that have been labelled as 'posterior', 'simple/simultaneous', and 'anterior':

(5)

R	S		past
	R-S		present
	S	**R**	future
R	E		posterior
	R-E		simple
	E	**R**	anterior

Understanding the meanings coded by the second set of relations is crucial for the interpretation of the perfect (section 2.4): 'posterior' can be understood as looking at E from an earlier point, or looking forward; 'simple' is best understood as 'simultaneous'; and 'anterior' can be understood as looking at E from a later point, or looking backward. Diagram (6), which distills Reichenbach's insights, is a visualisation of the relationships between all three primitives proposed by Reichenbach:

(6)



Note that the relation of E to S does not have a corresponding set of labels.

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2.3. Tense meanings with one deictic centre (S)

Equipped with the three Reichenbachian primitives, we can map out the logical possibilities for tense meanings. I begin by illustrating the range of possibilities of coding the relation 'E before S' as different tenses. If the truth value of the proposition matched against the state of the world at the primary point of reference S yields the representation 'E before S', then the possible tense meanings incorporating the above relationship, that is, all possible ways of viewing the above situation, are:

(7)	**R**	E		S		posterior past
		E-**R**		S		simple past
		E	**R**	S		anterior past
		E		S-**R**		anterior present
		E		S	**R**	anterior future

All possible tense meanings that involve only one deictic centre (S) include three simple tense meanings (where R = E), five anterior tense meanings (where E < R), and five posterior tense meanings (where R < E). The three simple tense meanings, where R = E, are represented and illustrated from English in (8). The text in square brackets indicates the context for the temporal interpretation of the clause in question:

(8)	**R-E**	S		simple past
				I saw him (yesterday)
				she was crying (for an hour)
		S-**R-E**		simple present
				the kettle is boiling
				I live here
		S	**R-E**	simple future
				he will finish it (tomorrow)
				she will still be doing it (tomorrow)
				[*I can see that*] *I am playing tennis (tomorrow at 5)*

It is important to reiterate that in this system tense meanings are conceived of as independent of aspectual meanings, even though there are interesting interactions between tenses and aspects. Hence, the English examples given in (8) illustrate expressions of temporal locations of events regardless of the internal temporal contours of the events and of any additional modal meanings conveyed. Also, as is now obvious, the names of tense meanings ('simple past', simple present', etc.) do not necessarily correspond to particular grammatical tenses in a language (e.g. the English tenses labelled as Simple Past, or Simple Present). Thus, we can distinguish sentences such as *I saw him*, which is expressed with the Simple Past tense and has simple past temporal semantics, and *if I were you,* which is also expressed with the Simple Past tense but is typically understood as having simple present temporal semantics (and an additional modal meaning; see for example Patard 2008 on the modal uses of the English Simple Past).

To complete the account of the system of all possible tense meanings with one deictic centre (S), (9) lists representations of five anterior tense meanings, where E < R:

(9)	**E**	**R**	S				anterior past
	E		S-**R**				anterior present
	E		S		**R**	}	
			S-**E**		**R**	}	anterior future
			S	**E**	**R**	}	

And (10) lists representations of five posterior tense meanings, where R < E:

(10)	**R**	**E**	S			}	
	R		S-**E**			}	posterior past
	R		S		**E**	}	
			S-**R**		**E**		posterior present
			S	**R**	**E**		posterior future

Examples of sentences expressing tense meanings in (9) and (10) are given in the next section.

2.4. The perfect: R ≠ E

All anterior tense meanings (E < R) and posterior tense meanings (R < E) together share the property R ≠ E. I propose that this property defines the semantic category of the 'perfect' (Kibort 1997). In absolute tense systems, the category of the perfect is typically used 'to express events that took place before the temporal reference point but which have an effect on or are in some way still relevant at that point', as well as to express 'persistent situations' (Dahl & Velupillai 2005: 271). This characterisation together covers all uses of the Present Perfect tense in English, both experiential/resultative/recent past, and universal.

I propose that English has grammaticalised precisely the whole category of the perfect as defined by the property R ≠ E. The following are typical expressions in English of the two meanings (E < R and R < E) within this category:

(11)	*I have seen John*	**E**	S-**R**	(anterior present)
(12)	*I have lived here for ten years*	**R**	S-**E**	(posterior past)

It is widely accepted that in (11) a past event (E) is viewed from the perspective of 'now' (S), hence S-R, (see for example Brisard 2008). This use of the English Present Perfect has been referred to as the 'existential/experiential perfect' or the 'indefinite anterior' (e.g. Comrie 1976; McCawley 1971, 1981), and the temporal meaning it represents corresponds also to two other uses of the English Present Perfect, the so-called 'perfect of result' or the 'stative perfect' (as in *John has left*), and the 'perfect of recent past' or the 'hot news perfect' (as in *I've just spoken to John*).

In contrast, the English example in (12) is never associated with the representation (R S-E). This use of the Present Perfect has been referred to as the 'universal perfect', the 'perfect of persistent situation', or the 'perfect of extended now'. Its distinct interpretation, different from (11) yet expressible with the same morphology as (11), has been a source of problems for all tense theorists since Reichenbach, who have tried to provide a unified account of the English Perfect (see next section for an example of Reichenbach's attempt to account for the 'universal perfect'). As for the representation (R S-E), Reichenbach did not find any corresponding grammatical tense for it in

English (1947: 297; see also the Appendix), and most neo-Reichenbachian tense systems either propagate this exclusion or attempt to assign to it a future interpretation (e.g. Vet 2007: 9ff for French).

However, if the relation R < E ('posterior') is understood as looking at the event E from an earlier reference point R, and if the event E still holds at the point of speech (S-E), then the representation (R S-E) is precisely the one which captures the English 'universal perfect' or the 'perfect of extended now'. It is normally accepted that 'now' can be extended to express universal or timeless situations, as in diagram (1), and E can extend with it indefinitely, as in *spiders have eight legs*. By analogy, E can hold over a stretch of time which extends from an earlier reference point R (e.g. 'ten years ago') to the present (S), including 'now' (S-E), as in *I have lived here for ten years.*[4] Note, however, that the reference point R does not need to be expressed overtly through any particular lexical item, either in the perfect tenses or any other tense meanings. Hence, *I have always loved him* is still interpreted as (R S-E), with an 'understood' reference point R which provides the temporal bracket from which to view the situation. Placing the reference point before S-E, rather than together with S-E, means that the situation does not hold universally, but it has been holding for an overtly unexpressed period of time, e.g. *I have always loved him* [*since we first met / since he was born /* etc.].

The examples in (13) and (14) are an illustration from English of all anterior and posterior tense meanings identified earlier in (9) and (10), respectively:

(13)	**E**	**R**	S			*I had met him before* *he will have finished it last week*
	E		S-**R**			*I have met him* *he will have finished it by now*
	E		S		**R**	*he will have finished it by tomorrow,* [*in fact, he has finished it already*] [*if it rains tomorrow,*] *we will have worked in vain yesterday* (Comrie 1985: 73)
			S-**E**		**R**	*he will have finished it by tomorrow,* [*he is finishing it now*]
			S	**E**	**R**	[*he hasn't finished it yet, but*] *he will have finished it by tomorrow*
(14)	**R**	**E**	S			*I had known him for ten years*
	R		S-**E**			*I have known him for ten years*
	R		S		**E**	*next year we will have known each other for ten years*
			S-**R**		**E**	[*it's 1990, so*] *in the year 2000 we will have known each other for ten years*
			S	**R**	**E**	[*if she gets married next year,*] *in the year 2000 she will have been married for ten years*

[4] Since E overlaps with 'now' (S) in this tense meaning, it is unsurprising that the universal perfect is most common with stative verbs when non-progressive; however, when progressive/iterative, it is found with dynamic and other non-stative verbs (e.g. punctual).

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3. Tense meanings versus forms that realise them

3.1. Reichenbach's (mis)interpretation of his system

I am now in a position to point out three critical errors in Reichenbach's original and others' later interpretations of his system.

First, both Reichenbach and many re-interpreters of his system assumed erroneously that any one logical tense meaning, defined as a particular configuration of the points {S, E, R}, must correspond to a particular grammaticalised tense in a language (see the Appendix for Reichenbach's original system of tenses and his suggestion of their corresponding English counterparts). However, languages typically combine two or more tense meanings into clusters which we recognise as grammaticalised tenses, and thus grammaticalise fewer temporal distinctions that are logically possible (note that, despite looking for one-to-one correspondences, Reichenbach did allow the Simple Future tense in English to have two different interpretations). Also, apart from the purely temporal meaning, grammaticalised tenses often include aspectual and modal meanings or other meanings expressing actionality distinctions, and can be employed for various pragmatic functions (e.g. polite questions, etc.). This is a key point, disregard of which leads to confusion of meaning and form and is bound to lead to an unsatisfactory account of tense regardless of which primitives, whether Reichenbachian or other, are used to model temporal meaning.

The second point treats an issue related to the cumulation of different meanings within individual grammatical tenses. Namely, Reichenbach's model is designed for tense, that is, to capture distinctions between different configurations of the 'points' (the primitives of the system) along the time line. Despite this, Reichenbach himself tried to force his system to express some aspectual or actionality distinctions that he encountered in English (specifically, durativity and iterativity). Both in Reichenbach's and in many neo-Reichenbachian systems, aspectual distinctions are added as various symbols (bars, boxes, zigzags, eyes, etc.) to representations expressing simple relative positioning of the three points on the time line. However, since it is assumed in such accounts that these aspectual distinctions belong to the system of tense oppositions, rather than being orthogonal to it, it is impossible to capture all distinctions consistently when they are scrutinised across such a tense/aspect system, and it is virtually meaningless to attempt comparisons of such concepts between languages, especially languages which are not closely related.

Reichenbach's attempt to include durativity in his model of tenses provides an instructive example (1947: 290). The English Simple Past sentence *I saw John* is represented as (R-E S). In order to represent *I was seeing John*, Reichenbach adds a short horizontal bar above the R-E in the Simple Past representation, to indicate that the event 'covers a certain stretch of time' ($\overline{\text{R-E}}$ S). By analogy, while the Present Perfect sentence *I have seen John* is represented as (E S-R), in order to represent *I have known him for ten years* (the 'second usage' of the English Present Perfect) Reichenbach adds a long horizontal bar above the Present Perfect representation, stretching from before E until and including the moment of speech ($\overline{\text{E S-R}}$). This is intended to indicate 'extended tense' or durativity, with the duration of the event reaching up to S. It is not clear, however, how continuing with this procedure would

allow Reichenbach to represent *I have been seeing John* or *I have been living here for a while*, and so on.

Although Reichenbach's key insight, for which he is acclaimed, was to interpret the relationship (E S-R) as expressing one type of the Present Perfect in English (the experiential/resultative perfect, as in *I have seen John*), it is clear that his account of the other type of the English Present Perfect (the universal perfect, as in *I have lived here for ten years*) is unsatisfactory, as it mixes up temporal and aspectual properties and thereby creates irresolvable problems for his tense system. Unfortunately, both Reichenbach and many others have tried to interpret the universal perfect as a variant of the experiential perfect. Having assigned the English Present Perfect tense to the (E S-R) representation, they failed to notice that there was already an appropriate model of the universal perfect in Reichenbach's system waiting to be used (R S-E). This shows that even Reichenbach himself did not apply his interpretation of the primitives and their configurations consistently throughout his system. In particular, he failed to interpret correctly the set of posterior tenses (R < E) and thought that four of them (out of five) could not be expressed through any particular grammatical tense in English. Unfortunately, this inconsistency has so far been repeated by all re-interpreters of his system.

Reichenbach's misinterpretation of the posterior relation (R < E) led him to suggest that one of the five posterior tenses, (S-R E), corresponded to the English Simple Future (note, however, that in Reichenbach's interpretation the English Simple Future also had an alternative representation, (S R-E), which indeed represents the simple future tense meaning). Furthermore, he incorrectly suggested that the representation (R E S), one of the three posterior past meanings, corresponded to *would* in *I did not expect that he would win the race*, *was going to* in *I did not expect that he was going to win the race*, and *was to* in *the king lavished his favour on the man who was to kill him* (1947: 297-298). This is because he failed to differentiate between absolute tense meanings in simple or main clauses, and relative tense meanings in subordinate clauses, as in the bi-clausal examples that he provided.

In the account offered here, the representation (R E S) is a temporal model of a simple clause expressing the 'universal perfect' (R < E) shifted into the past, before and not overlapping with the moment of speech, as in *I had known him for ten years* – see (14). On the other hand, the examples given by Reichenbach are bi-clausal and have to be represented with two pairs of points {E, R}. The pair of points $\{E_1, R_1\}$, representing the main clause, has its deictic centre at the point of speech S, while the pair $\{E_2, R_2\}$, representing the subordinate clause, has its deictic centre at R_1:

(15) {*I did not expect*}$_{E1}$ {*that he would win the race*}$_{\mathbf{E2}}$ $\mathbf{R_1}$-E_1 $\mathbf{R_2}$-$\mathbf{E_2}$ S

In the examples given by Reichenbach, there is no need to invoke the semantic category of the perfect which involves a stretch of time in either direction from event E_2, hence the representation of the relative tense in these examples (R_1 R_2-E_2) is analogous to the representation of a simple future tense meaning (S R-E), except that it is shifted into the past by virtue of locating its deictic centre at R_1 which is before S. Another possible tense combination in which *would* expresses a relative tense meaning, which escaped Reichenbach's attention, is illustrated in (16):

(16) {*I did not expect*}$_{E1}$ {*that he would be living here now*}$_{\mathbf{E2}}$ $\mathbf{R_1}$-E_1 S-$\mathbf{R_2}$-$\mathbf{E_2}$

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Many more tense combinations are logically possible and expressible, involving both simple and perfect meanings. In section 3.3 I briefly mention them again, distinguishing between relative tenses in tense combinations and relative tenses which can function independently in main clauses by implying an event E_2.

3.2. Tenses as grammaticalisations of tense distinctions

I now return to the issue of tense meaning versus tense form. Despite the wide range of logical possibilities (which do not have an obvious limit if degrees of remoteness are additionally considered), not all of the possible tense meanings are found grammaticalised as tenses in any particular language. It is very common to find neutralisations of various temporal distinctions in one grammatical tense in a language. Furthermore, tense meanings are often grammaticalised in combination with other (aspectual, modal) distinctions. This is why grammaticalised tense-aspect-mood categories found in particular languages frequently do not correspond, despite often being labelled similarly.

English, for example, grammaticalises the whole semantic category of the perfect ($R \neq E$) as a distinct tense, the Perfect. However, it neutralises the distinction between $E < R$ and $R < E$. Hence, one Present Perfect tense is used in English for both meanings: *I have seen John* and *I have lived here for ten years*. Similarly, one Past Perfect tense is also used for both: *I had seen John before* and *I had lived there for ten years*. Furthermore, the Past Perfect in English also includes the 'simple past + simple past' tense meaning (see section 3.3). One Future Perfect tense neutralises numerous different temporal distinctions, as was exemplified in (13) and (14).

In the remaining part of this section, I give three more examples of grammaticalisation choices involving perfect meanings ($R \neq E$), as found in three different languages other than English: Brazilian Portuguese, Polish, and Yup'ik.

A Northeastern variety of Brazilian Portuguese has a highly restrictive Present Perfect tense which grammaticalises exclusively the 'universal perfect' (R S-E) meaning (Laca, Cabredo-Hofherr & de Carvalho 2007), as in *Pedro tem dormido na varanda o inverno inteiro* 'Pedro has been sleeping on the balcony all winter'. Therefore, apart from obeying other restrictions regarding the internal structure of the reported event, the Present Perfect tense cannot be used to express typical experiential/resultative meanings. For example, it cannot be used with 'already' or 'still not': *Ela* (**ja*) *tem escrito artigos* 'She (*already) has written articles', **Ela ainda não tem chegado* 'She still not has arrived'; it cannot express resultative or recent anteriority readings: **Acho que João tem matado o segurança* 'I think that João has killed the guard'; and it cannot express certain future perfect meanings: **Quando a Ana regressar de Groningen, tu tens acabado a tese* 'When Ana returns from Groningen, you [will] have finished your thesis'.

Polish does not have a distinct Perfect tense,[5] but grammaticalises the split within the Perfect ($E < R$ versus $R < E$) by using simple Past versus simple Present tense, respectively. For example: *Spotkałem ją tylko raz* 'I [have] met her only once', *Już to czytałem* 'Already I [have] read this', versus *Znam go od dziesięciu lat* 'I know him

[5] Although there appears to be evidence that a new Polish Perfect, with the auxiliary *mieć* 'have', is emerging from the resultative (Björn Hansen, personal communication).

since ten years', *Pisze tę książkę odkąd się poznali* 'S/he writes this book since they met' (see Kibort 1997 for more examples).

Finally, Central Alaskan Yup'ik has a relative tense system (Mithun 1999) and grammaticalises only the relation between R and E. Hence, it has distinct grammatical tenses to express the different relative positions of R and E:

(17) simultaneous: *nalkutaqa* 'I am/was finding it'
anterior: *nalkutellruaqa* 'I found/had found it'
immediate/imminent posterior: *nalkkutqataraqa* 'I am/was about to find it'
distant posterior: *nalkuciiqaqa* 'I will/would find it'

Furthermore, the deictic centre of the utterance is always assumed to be at R. Unlike languages with absolute tense systems, Yup'ik uses the relations E < R and R < E for 'displaced experience' rather than to indicate a stretch of time bounded by R and E. Hence, Yup'ik (E R) and (R E) temporal representations may correspond to (E-R S) and (S E-R), respectively, in absolute systems. Therefore, a stretch of time indicating 'current relevance' or 'extended now', such as the one expressed by perfect meanings in absolute tense systems, is expressed in Yup'ik by allowing the R-E point itself to be interpreted as extended forwards or backwards, as required (Mithun 1999: 31-33), like the 'now' in diagram (1).

3.3. Secondary tenses and tense combinations

Most tense meanings discussed so far locate an event E with respect to the primary deictic centre S. These may be called *primary* tense meanings. However, further (relative) tense meanings may locate an event E_2 with respect to the deictic centre R_1 which is the reference point for an implied event E_1 (whose deictic centre is, in turn, S; see also (3) above). These may be called *secondary* tense meanings. Examples of such tense meanings grammaticalised as tenses are the following uses of the English Past Perfect (see also Squartini 1999 who argues for distinguishing this tense meaning as a grammaticalised tense in Germanic and Romance) and Future in the Past, illustrated in (18) and (19), respectively:

(18) [*By then,*] *they had moved in* R_2-E_2 (R_1-E_1) S
simple past + simple past ('earlier')

(19) [*John left for the front;*] *he would never return* (R_1-E_1) R_2-E_2 S
(Comrie 1985: 75) simple past + simple future ('later')

In both representations above, E_1 is an implied event, perhaps mentioned earlier in the discourse, and E_2 is the dependent event which is expressed overtly.

Many more combinations of {E_1, R_1, S} and {E_2, R_2, S} are logically possible, where the deictic centre of E_2 is R_1. However, if both events have to expressed, the combination may not be grammaticalised as a separate tense.

4. Conclusions

When interpreted consistently throughout the system, Reichenbach's primitives {S, E, R} *are* adequate to model all logically possible *tense meanings* in language. The range of logical possibilities for expressing the location of an event in time can be

argued to constitute the range of possible values of the grammatical feature 'tense'. As with other grammatical features such as gender or number, out of the large range of possibilities languages grammaticalise different sets of values by neutralising some of the possible meaning distinctions. I have given examples of the different grammaticalisation choices by comparing briefly the category of the perfect in English, Brazilian Portuguese, Polish, and Central Alaskan Yup'ik. Therefore, as opposed to tense meanings, *forms of tenses* in languages result from grammaticalisation choices over possible tense values which may involve neutralisations of different temporal distinctions, often in combination with additional distinctions: aspectual, modal, and other.

As the approach outlined in this paper prioritises meaning (content) over mode of expression (form), it is compatible with realisational models of morphosyntax and capable of providing formal semantic input to such models. In an inferential-realisational approach to morphology (e.g. Stump 2001, 2002, 2006) feature values are identified by establishing a 'form-paradigm' correlating inflected stems with morphosyntactic or morphosemantic properties. The cells in a language's form-paradigm are the basis for deducing the morphological realisation of the cells in that language's content-paradigm. It is assumed that every lexeme in a language has an associated 'content-paradigm': a set of cells each of which consists of the pairing of the lexeme with a maximal consistent set of morphosyntactic or morphosemantic properties (for example, the values of the feature tense). The cells in a lexeme's content-paradigm correspond to the different types of nodes into which forms of that lexeme may be inserted in syntactic structure. An inferential-realisational approach is particularly suitable for the study of tense which is frequently realised through periphrasis, portmanteau inflection (that is, cumulative exponence; for example, combination of tense exponence with aspect and mood), and extended exponence. On this view, periphrastic realisation of a tense value corresponds to one cell of a content-paradigm, which is advantageous both theoretically and practically in computational applications.

Feature values which have a morphological realisation are conceived of as units of linguistic description which are abstract enough to capture regularities across different components of grammar (morphology and syntax; morphology and semantics; morphology, syntax, and semantics) regardless of their mode of expression in a particular language or for a particular class of linguistic elements in a language. This means that, although they are proposed because they are initially recognised through morphology, the basis for their classification is content, not form. A content-based inventory of morphologically realised tense values, based on the meaning distinctions identified with Reichenbachian primitives, would be capable of enabling a systematic comparison of the temporal categories already found in different languages, as well as predicting which temporal categories may yet be found. The space of logical possibilities described by such an inventory could, therefore, be considered a 'suitable framework in which different tense (...) systems can be compared' (Dahl 2000: 3), a framework which we are currently still lacking.

As for the semantic category of the perfect in absolute tense systems, I have argued that it can be identified as a tense meaning which has the property $R \neq E$. If, as in English, grammaticalisation neutralises the distinction between $E < R$ and $R < E$, it is possible to have one grammatical category of the Perfect that includes both the experiential/resultative perfect and the universal perfect. Finally, as for the starred

example from the 'present perfect puzzle' quotation in section 1.1 (**yesterday at ten, Chris has left York*), it can be understood straightforwardly as semantically incoherent, because it implies two reference points R located at different positions with respect to S: one is R < S (*yesterday at ten*), and the other is S-R (*Chris has left York*). Hence, the clausal modifier *yesterday at ten* involves a temporal concept which is semantically incompatible with the interpretation of the clause *Chris has left York* expressed in the Present Perfect, much like it would be incompatible with a clause in the Future Simple (*I will go*), even though it is not normally posited that */#yesterday I will go* is a puzzle. Once the distinctive semantics of both the experiential/resultative perfect (E S-R) and the universal perfect (R S-E) in the system of tense meanings are properly recognised, it is possible to predict straightforwardly which temporal concepts will be (in)compatible with these tense meanings.

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Appendix

Reichenbach's system of tenses (1947: 297):

Structure	New Name	Traditional Name
E R S	anterior past	Past Perfect
E-R S	simple past	Simple Past
R E S	posterior past	------
R S-E		
R S E		
E S-R	anterior present	Present Perfect
S-R-E	simple present	Simple Present
S-R E	posterior present	Simple Future
S E R	anterior future	Future Perfect
S-E R		
E S R		
S R-E	simple future	Simple Future
S R E	posterior future	------