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Reference frames of space and time in language

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ABSTRACT

To what extent do conceptual schemas underlying temporal language correspond to those of spatial language? This paper addresses this question by providing an overview of reference frames for space as well as time, building on and systematically extending earlier accounts. A consistent framework using simple spatial models is proposed, which integrates a range of previously underexplored complexities with respect to spatial language used in both static and dynamic settings, as well as aspects peculiar to time. The framework, which is based on English, allows for identifying and accounting for the relationship between spatial and temporal concepts systematically. Furthermore, it highlights the distinction between conceptually similar (spatial and temporal) structures reflected in language on the one hand, and metaphorical transfer of clearly spatially based concepts on the other.

1. Introduction

How are spatial and temporal relationships expressed in language, and how do these expressions relate to each other? These questions have intrigued researchers in pragmatics, psycholinguistics, and various areas in cognitive science for a long time, raising heated debates and controversies across disciplines. The issue relates to two fundamental aspects of basic scientific interest. On the one hand, the reflection of spatiotemporal concepts in language highlights human cognition with respect to the ubiquitous domains of space and time. On the other hand, the very notion of (spatial or temporal) reference frames signals a fundamental discrepancy between the directly observable outside world to be represented in language, and the repertory of linguistic expressions available to represent such a world. This discrepancy is often felt to be stronger for temporal than for spatial notions, which may be one reason why language systematically re-uses established (spatial) concepts in metaphorical ways to express more abstract (temporal) relationships—similar to transfer processes in other conceptual domains (Lakoff and Johnson, 1980).

However, the transfer from spatial to temporal concepts in language is neither simple nor exhaustive. First, temporal concepts and relationships can also be addressed in language in other ways, for example via the grammar system or by pragmatic ordering principles (Reichenbach, 1947; Klein, 1994; Halliday and Matthiessen, 1999), and by lexical items that are used primarily or solely in the temporal rather than the spatial domain. Second, the fact that structural features of spatial and temporal domains differ in important respects such as asymmetry and dimensionality (Traugott, 1978; Galton, this volume) undermines efforts of transferring basic notions of spatial reference frames directly to the domain of time. Finally, typically both spatial and temporal linguistic descriptions are semantically highly underspecified with respect to their precise meaning in context. The contextually based choice of a suitable reference frame is primarily a pragmatic issue; for instance, perspective choices such as "from my point of view" typically remain implicit, and terms such as *left* and *right* can be interpreted on the basis

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of both intrinsic and relative types of reference frames (Levinson, 2003). Although this kind of ambiguity is less prevalent in the temporal domain, examples (discussed in more detail below) such as "move the meeting forward" (McGlone and Harding, 1998) indicate that the application of implicit conceptual reference frames also holds for the temporal domain. Furthermore, deictic reference points or "perspectives" are also prevalent in the temporal domain (Langacker, 1999).

In spite of these complications, there are important systematic overlaps and parallels between the conceptual and linguistic representations of spatial and temporal relationships, which need to be explored and adequately accounted for. Various researchers have put forward substantial contributions to this line of thinking. Empirical psycholinguistic research (Boroditsky, 2000, 2001) as well as cross-linguistic work in cognitive semantics and grammar (e.g., Haspelmath, 1997; Svorou, 1994) and child language acquisition research (Clark, 1973) supports the conceptual closeness of spatial and temporal notions as well as the psychological reality of metaphorical transfer between domains (Gentner, 2001). Various accounts of temporal reference frames have been proposed in heterogeneous ways (Bender et al., in press; Kranjec, 2006; Moore, 2006; Zinken, 2009) in order to reconcile temporal and spatial concepts, but no general agreement appears to have been achieved so far. There are many possible reasons for this unresolved state. One problem lies in the fact that there are two ways in which temporal concepts can be differentiated: on the one hand, they can be expressed in deictic (i.e., contextually anchored) as well as non-deictic ways (McTaggart, 1908; Traugott, 1978); on the other hand, temporal concepts represent two complementary metaphors, MOVING TIME and MOVING EGO (Clark, 1973). These two distinctions are neither identical nor can they be directly mapped; instead, there are distinct ways of expressing temporal relationships with or without a deictic reference point (Moore, 2006; Kranjec, 2006). Another problem concerns the fact that accounts of spatial reference frames have hitherto typically been addressed only with respect to static relationships, rather than dynamic concepts. The latter, however, are particularly decisive for the temporal domain; this fact is directly reflected in the notions of MOVING TIME and MOVING EGO. Further confusions may arise from different conceptions of the notion of metaphor (Tyler and Evans, 2003; Graf, this volume) as well as its relevance for understanding temporal language (Habel and Eschenbach, 1997; Gentner, 2001), although this additional complication does not necessarily affect the systematicity of reference frames.

The main aim of the present paper is to introduce a systematic framework for representing conceptual reference frames underlying English language usage by employing simple spatial models, capturing relationships between entities consistently both in the spatial and in the temporal domain. With respect to the spatial domain, the framework directly builds on and expands earlier work by Levinson (2003), for instance by integrating the systematic difference language makes between topologically *internal* vs. *external* relationships. Crucially, the transfer to the temporal domain presupposes a clearcut integration and representation of *dynamic* concepts in the framework, which has not been spelled out for spatial reference frames so far. The resulting "toolbox" of basic roles and relations is suitable for representing abstract relational concepts conveyed by linguistic descriptions across discourse contexts and languages, and may thus serve as a framework for comparing lexicogrammatical as well as pragmatic structures of language in the ubiquitous domains of space and time.

2. Spatial reference frames

2.1. Basic framework

Perhaps the most widely adopted systematic account of reference frames was proposed by Levinson (1996, 2003). Levinson's account will not be re-told in detail but rather be taken as a given, a starting point for providing a different perspective on the same framework. Levinson proposes to differentiate between three basic spatial reference frames, the **absolute**, the **relative**, and the **intrinsic**. I will in the following discussion account for all three types by using a uniform spatial schema, consisting of a set of spatial **roles** (**locatum**, **perspective**, and **relatum**) (see Fig. 1a) which are represented by **entities** or **places**, and the **relations** between them. The assignment of these roles and relations depends on the underlying conceptual **reference frame**. Assuming abstract roles and relations that are represented by concrete entities or concepts is common, for instance, in ontological modelling approaches (e.g., Bateman et al., 2010); this kind of schematization supports the identification of (and differentiation between) implicit and explicit conceptual participants of a linguistic description. The combination of this type of modelling with earlier accounts of reference frames allows for a concise analysis and representation of various conceptual distinctions. Apart from the basic differentiation between absolute, relative, and intrinsic reference frames just mentioned, language may reflect topological relations. While the standard situation in Levinson's approach is that objects are spatially separate (**external** reference frames, see below), they may also be located *inside* of one another (**internal** reference frames, section 2.2). Further linguistic and conceptual options arise due to various **motion concepts** (section 2.3), which are particularly crucial for the transfer to the temporal domain.

Whenever two spatial entities – such as objects or persons – are spatially related to each other using the so-called **projective terms** (*in front of*, *behind*, *to the right*/*left of*), all three spatial roles (perspective, locatum, and relatum) are involved in one way or another. With other spatial terms this may or may not be the case, as will be shown by a few examples below. In the static case (without the involvement of motion), the role of **locatum** is represented by the entity that is currently being described (which may as a shorthand be referred to as locatum); and the role of **relatum** is represented by another entity that the locatum is being described in relation to. Unlike the cases of relatum and locatum, the **perspective** cannot simply be identified with an entity, as it is ontologically different: it represents a direction rather than an entity. An entity may however be capable of providing the basis for determining the direction, in which case it is called the **origin** (of a coordinate system, in Levinson's terms). Alternatively, the perspective may be culturally or situationally shared. In each case, a vector-like

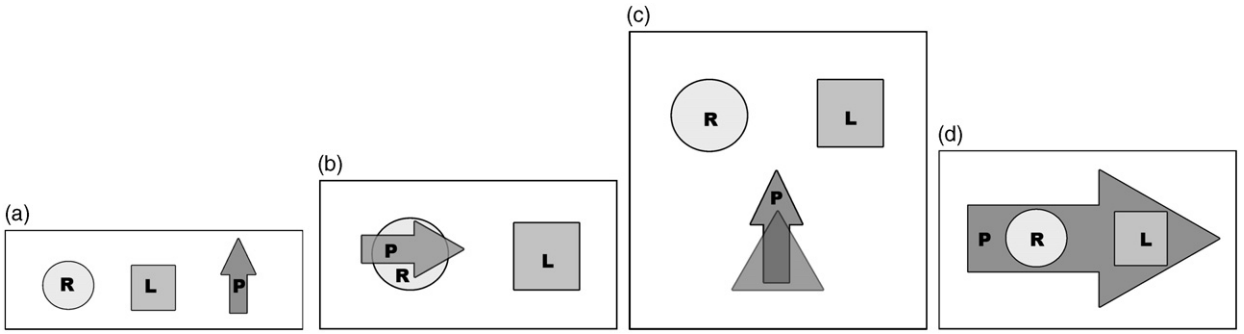


Fig. 1. Spatial schema underlying all reference frames: the circle represents the relatum, the square the locatum, and the arrow the perspective. Where applicable, the circle is represented in the linguistic examples as "ball", and the square as "box". (a) Set of roles; R = **relatum**, L = **locatum**, P = **perspective**. (b) Intrinsic case. (c) Relative case (in which the perspective is provided by another entity called the *origin*, represented by a triangle). (d) Absolute case.

(directional) structure is assumed (without the implication of motion that may be suggested by the term direction), independent of whether the (actual or potential) point of view of a person is involved.

In the (static) **intrinsic** case, the relative position of the locatum with respect to the relatum is described by referring to the relatum's intrinsic properties such as *front* or *back*. Therefore, one can say:

(1) There is a box in front of me.

In this case, the relatum is the speaker and the perspective is supplied by the speaker's front or view direction (i.e., the speaker serves as origin). In Fig. 1b, this idea is represented by the arrow coinciding with the relatum. Any entity with the potential to provide a direction may serve as relatum in an intrinsic reference frame, including objects with functional parts (chairs or cars) and the like (Herrmann, 1990). The exact position of the locatum relative to the relatum (for instance, whether an object is conceived of as being *directly* or rather *diagonally* in front of another, how close it is, and the like) then depends on a variety of factors including the (functional) relationships between objects (e.g., Coventry and Garrod, 2004; Carlson-Radvansky et al., 1999), their size (Talmy, 2000), and the situational context (Bateman et al., 2007). This is true for all types of reference frames. In the following, representations will reflect prototypical or "ideal" spatial relationships (Herskovits, 1986).

Unlike the intrinsic case, the **relative** case is based on a *different* entity (other than the relatum) providing a perspective. In (2) the relatum (the ball) does not possess an intrinsic front. To interpret such an utterance, the underlying perspective needs to be identified, which may be the speaker's or the addressee's point of view, or a different entity (or place) that provides a basis for a view direction (see Fig. 1c). Here the origin is represented by a triangle. Triangles, in the present framework, represent concrete entities that cannot be equated with the roles of locatum or relatum.

(2) There is a box to the right of the ball (from my point of view).

(3) There is a box in front of the ball (from my point of view).

With the front–back axis used in example (3), relative reference frames are somewhat ambiguous. As Hill (1982) demonstrates, two conceptual alternatives are conceivable (see Fig. 2). In English, the relation *in front of* usually expresses that the locatum is closer to the origin than the relatum, but the opposite may also be the case. In other languages such as Hausa, the opposite is the preferred interpretation (Hill, 1982). The following account will assume the more typical interpretations in English as a default, leaving the alternatives implicit.

In the **absolute** case, ubiquitous orientation systems such as compass directions (*north*, *south*, *east*, *west)* or, in other languages, environmental features (*uphill*, *downhill*, *upriver*, *downriver*) provide a culturally shared basis for determining perspective (Levinson, 2003). For example, if the north direction is towards the top of the page, the following is consistent with the depiction in Fig. 1d:

(4) There is a box east of the ball.

Pederson (2003) suggests that a sub-type of the absolute case is to assign directions based on the local environment, as in (5) which is consistent with Fig. 1d, if the *wall* happens to be on this page's right side:

(5) The box is towards the wall from the ball.

Absolute reference frames of both kinds (cardinal and local) use linguistic expressions that are distinct from those used for intrinsic and relative reference frames. In (5), the spatial relationship is expressed by reference to the affordances of the environment (*towards the wall*), while in (4) it employs the compass direction system. This linguistic difference reflects a

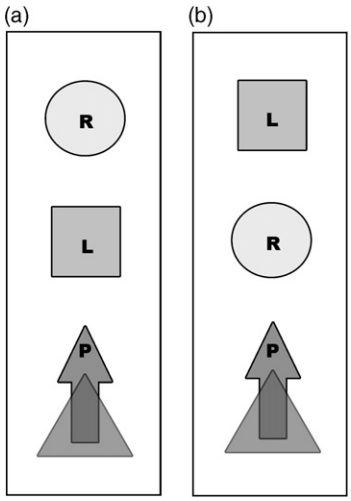


Fig. 2. Two possible interpretations of the front–back axis in a relative reference frame: With *in front of*, the locatum (box) may be (a) closer to or (b) more distant from the origin than the relatum.

fundamental difference concerning the conceptual basis for direction assignment. Projective terms rely on an underlying (view) direction for interpretation of the intended spatial relationship; this direction is determined independently of the actual choice of spatial term and is not expressed by it. In contrast, in absolute reference systems the intended direction is chosen from the (culturally or situationally) available orientation system and directly expressed by the spatial term. In the models, this difference is represented by the arrow which, in the case of projective terms, shows the view direction (i.e., perspective) but not the relational direction expressed by the spatial term, while in the case of absolute reference systems it directly reflects the intended direction as expressed by the spatial term.

2.2. Internal relationships

Levinson's framework is geared towards (and typically applied to) **external** relationships, i.e., relations between objects that are spatially separate, as in the examples given so far. Does it equally account for cases in which the locatum is positioned *inside* of the relatum, yielding an **internal** relationship? Language sometimes distinguishes between these two topological kinds grammatically (Miller and Johnson-Laird, 1976; Talmy, 2000), as seen from the distinction between the external example (6) and the internal relationship expressed in (7):

(6) The box is *in front of* the car.

(7) The box is *in the front of* the car.

In internal relationships, the relatum is conceptually ascribed part regions that are described by projective terms, sometimes explicitly so by referring to *sides* (such as "on the left/right side", Carroll, 1997). As with external relationships, the perspective or direction underlying such a description may come from different sources. In (7), represented by Fig. 3a, the

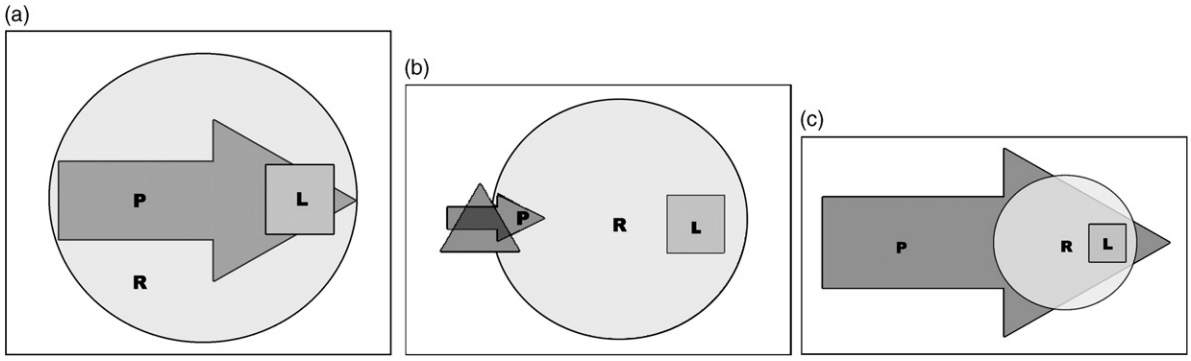


Fig. 3. Internal relationships: the relatum (represented by the big circle) is an entity large enough to spatially contain the smaller locatum (the square). (a) Intrinsic case. (b)Relative case, with the entity providing a perspective positioned either inside or outside the relatum. (c) Absolute case.

direction is based on the relatum's intrinsic parts; this yields a clear **internal intrinsic** case in which the relatum encompasses the locatum.

Internal relative cases are based on an observer's viewpoint. For instance, if the relatum *room* in example (8) has no intrinsic parts of its own (e.g., a room with several doors), a direction may be derived from the speaker looking into the room (as origin). If Fig. 3b is taken to represent example (8), the relatum corresponds to the room and the locatum to the box. The exact position of the origin is not reflected linguistically in internal relative reference frames; it may be located inside or outside the relatum (or at the borderline, standing in the door, for example). Since intrinsic sides are typically ascribed to objects by the way humans interact with them (Herrmann, 1990), internal *relative* reference frames may sometimes not be distinguishable from internal *intrinsic* ones.

(8) The box is in the back of the room.

Furthermore, abstract regions (rather than concrete entities) may also be partitioned into internal (relative) sections by adopting a *global perspective* (Carroll, 1997). The observed region can be a specific assembly of objects that are perceived as belonging together or being relevant for the discourse situation (Gorniak and Roy, 2004), or any other kind of region that is within the limits of perception. For example, in German it is possible to say:

(9) Dort hinten steht eine Kiste. [lit., "There in the back stands a box."]

Here, the visual field is partitioned into regions in relation to the position of the speaker. Then, the area close to the observer is referred to as *vorne* (front), and the area more distant from the speaker within the visual field is referred to as *hinten* (back) (see Tenbrink, 2007, for discussion of syntactical patterns). Paralleling example (8), example (9) also corresponds to the situation in Fig. 3b if the circle (relatum) represents the speaker's visual field, the square represents the box, and the view direction (the arrow) is derived from the speaker.

Finally, the **internal absolute** case is straightforward, as it employs a ubiquitous directional system, both within and outside of any relatum. In example (10), the town is the locatum (represented by the square in Fig. 3c) and the country is the relatum (represented as the big circle).

(10) The town is in the east of the country.

2.3. Movement

So far, the discussion has focused on static relationships between objects, which have been described as conceptually primary (Svorou, 1994:22). When the entities in question are in motion, several distinct effects emerge. Motion can be expressed by a range of spatial terms, some of which are semantically dynamic, while others resemble static expressions (Miller and Johnson-Laird, 1976); for instance, projective terms may be used dynamically just as well as statically (Retz-Schmidt, 1988:102). Motion can provide an independent perspective (Svorou, 1994; Fillmore, 1997), and motion descriptions can reflect the same three types of reference frames as static descriptions (Levinson, 2003:96f.). However, depending on which object (or role in the present framework) is affected by the motion event there may be quite different effects. For example, an object may undergo change with respect to its own former position or extension (Brugman and Lakoff, 1988). To my knowledge, these observations have not been integrated comprehensively in any framework, nor have the effects of motion on reference frames been explored in much detail. The following account first addresses motion expressed by general directional terms, followed by motion as perspective. Then the various effects of motion on the roles of relatum and locatum will be spelled out.

2.3.1. Motion expressed by general directional terms

General directional terms such as *to* or *towards* (Bateman et al., 2010) express motion concepts based on the position of the **relatum**, i.e., an entity to which another object currently in focus is spatially related, as in example (11) illustrated by Fig. 4 below. The spatial schema underlying such a description differs from those described so far in that no perspective of any kind (for example based on an origin's view direction or based on absolute, ubiquitous directions) is required. The actual movement direction of the object as well as its destination relative to the relatum (left, right, etc.) are irrelevant; the object is

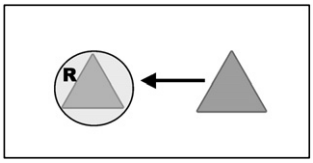


Fig. 4. Movement direction defined by a relatum. This schema differs from the spatial models for projective relations in that it does not require a perspective.

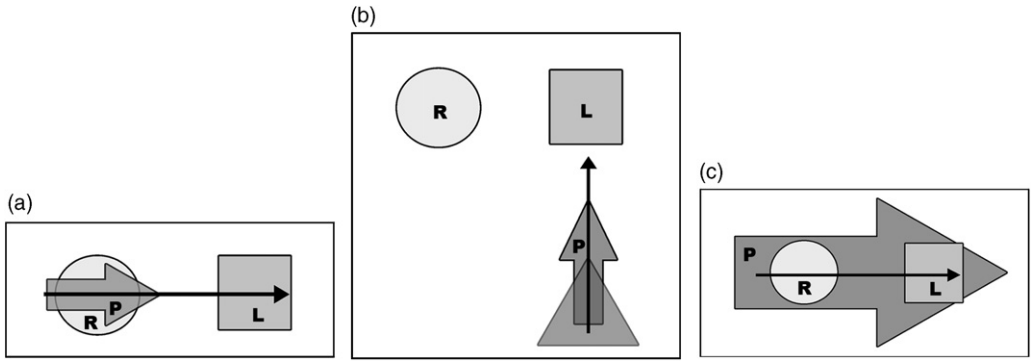


Fig. 5. Movement inducing a perspective for the three types of reference frames. The direction of movement is indicated by a thin arrow. (a) Intrinsic case; the locatum is in front of the relatum, which is currently moving and therefore capable of providing a perspective. (b) Relative case; the locatum is to the right of the relatum using the perspective of another entity in motion, which is therefore capable of providing a perspective. (c) Absolute case; the locatum is in front of the relatum, defined by the perspective of surrounding movement (or sequence).

simply moving closer to the relatum from any (unspecified) start position. For this reason, the object in focus is not referred to as locatum in the present framework.

(11) The box is moved to(wards) the ball.

2.3.2. Motion (or sequence) as perspective: all external reference frames

Directed movement may in some cases replace the origin, providing a perspective not on the basis of perception (a view direction) but on the basis of direction of movement. In such cases the roles of relatum and locatum can be specified in the same manner as with static situations, since the movement does not affect their relative position (see also Talmy, 2000). Here are examples for (external) intrinsic (12), relative (13), and absolute cases (14) with directions induced by movement, represented schematically by the pictures in Fig. 5a, b, and c, respectively:

(12) The mouse is running in front of the ball (that is rolling down the hill).

(13) The wheel is rolling towards the box to the right of the ball.

(14) The box is floating in the river, in front of the ball.

In example (12), relatum (ball) and locatum (mouse) remain in a stable spatial relationship to each other, without requiring an additional point of view, as the described movement provides a direction supporting the interpretation of "in front of". Example (13) involves two spatial concepts: a movement (of the wheel) towards the box, and the location of the box (locatum) to the right of the ball (relatum). The movement description of the first spatial concept provides a direction for the second. Finally, although example (14) does not represent a culturally stable and fixed direction as per Levinson's (2003) definition, it is compatible with Pederson's notion of *local* absolute reference frames (cf. example (5) above) in that a local feature of the environment provides an independent basis for direction. Similarly, concepts of *sequence* (with or without movement) may provide a (functional) direction; example (15) appears to be valid no matter how Peter and Mary are currently oriented, and thus conceptually equivalent to (14).

(15) Peter is in front of Mary in the queue.

2.3.3. Movement from anywhere to locatum: all reference frames

Spatial terms sometimes refer to the destination point (or region) of a motion trajectory, as in the following examples:

(16) The box should be placed in front of me.

(17) Put the box to the right of the ball.

(18) Put the box to the east of the ball.

(19) Put the box towards the wall from the ball.

(20) Place the box in the front of the car.

(21) Place the box in the back of the room.

(22) Place the box in the east area of the town.

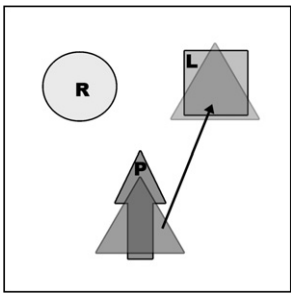


Fig. 6. Dynamic relative reference frame: movement from the origin's position to that of the locatum.

Similar to example (13), all of these descriptions involve two spatial concepts. Here, the first concept **(a)** concerns a movement of the box, starting from an unknown position, and the second **(b)** concerns the definition of the future position of the box relative to a relatum. In such cases, the entity in focus (the box) no longer continually represents the locatum; the reference frame underlying spatial concept **(b)** only holds at **time t_1** after completing the movement trajectory of **(a)**, but not at **time t_0** before or while the motion occurs. At time t_1, reference frames are established that are equivalent to the static reference frames described above; the difference is due to the nature of the verb (dynamic rather than static). All three kinds of basic reference frames can be used in this way, both externally and internally. After completing the movement, example (16) can be interpreted in terms of a dynamic **external intrinsic** reference frame, with the new location of the box representing the role of locatum as defined by its relation to the relatum (the speaker). Example (17) depends on an external perspective (which the context will provide), yielding a dynamic **external relative** reference frame. The dynamic cases of the two proposed types of **absolute** reference frames are shown in (18) and (19), respectively. (20) and (21) are examples for intrinsic and relative dynamic **internal** reference frames, and (22) gives the dynamic internal absolute case. All of these cases are straightforwardly represented by the schemata depicted in Fig. 1(b–d) and Fig. 3, showing in this case the end position of the movement at time t_1. The start position of the moving object and the trajectory of movement are irrelevant in each of these cases, since the perspective and relatum are defined independently of the motion event, and the locatum is defined only by the end point of the trajectory.

2.3.4. Movement from origin to locatum in a dynamic relative reference frame

Example (23) below is similar to the examples just discussed in that, again, two spatial concepts are involved: **(a)** a movement (by the speaker to the box), and **(b)** the definition of the position of the box as being to the right of the ball in a **relative** reference frame (as in example (17)). However, in this example the speaker is also a likely origin[1] of the perspective used in **(b)**, given at **time t_0**, prior to the motion event described in **(a)**. Then the motion event **(a)** starts from the origin's position at time t_0. The two other objects remain unaffected by the motion in **(a)** and can thus straightforwardly (and without considerations of time) be described as relatum (ball) and locatum (box). This situation is represented in Fig. 6, which shows how the entity providing a perspective at time t_0 moves towards the position of the locatum.

(23) I will go to the box to the right of the ball.

Now consider the following, describing basically the same situation except that the locatum is a *place* (the Aristotelian notion of a location with the potential to be occupied by an object) rather than an object:

(24) I'm going to a place to the right of the ball.

(25) I'm going to the right of the ball.

Again, the perspective can only be defined from an external position, for example the speaker's position at time t_0, prior to movement, yielding a dynamic relative reference frame. The end point of the trajectory – the place to the right of the ball – at time t_1 corresponds to the role of locatum, as in example (17) above. In example (24) this place is linguistically represented explicitly, but the implicit case in (25) appears to be pragmatically equivalent and perhaps more natural. Again, the trajectory of the entity that provides the perspective leads from origin to locatum as depicted in Fig. 6. Note that the moving entity may change its orientation during the movement without changing the definition of the goal location (locatum); the perspective relies on the position of the oriented entity at the time of the description (t_0).

2.3.5. Movement from relatum and origin to locatum in an external intrinsic reference frame

So far, all examples contained an explicit relatum, rendering the underlying spatial relationship unambiguous (except for underspecification of perspective). However, neither in static nor in dynamic spatial descriptions does this have to be the

[1] Alternatively, the direction of movement itself may provide the perspective as in example (13) above.

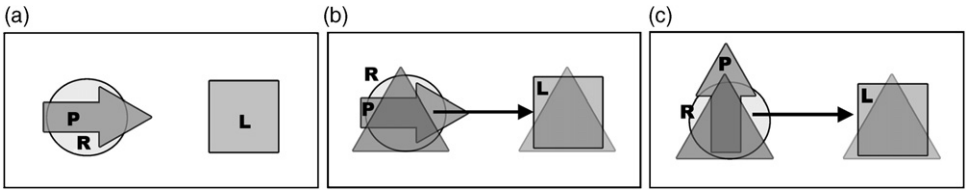


Fig. 7. Intrinsic case: movement from start position (origin and relatum) to end position (locatum). (a) Static intrinsic reference frame (for comparison). (b) Forward movement. (c) Movement to the right of the view direction at the start of the movement.

case. In the examples of static relationships described in sections 2.1 and 2.2, the relatum could unproblematically remain implicit as in example (26) below, without changing the intended reference frame. But how can the dynamic examples (27) and (28) be interpreted in the present model of reference frames?

(26) There is a box on the right.

(27) I'm going to the right.

(28) I'm going right.

Conceivably, the spatial relation underlying a description like (27) is the same as in example (25), using the dynamic version of a relative reference frame, and omitting the relatum (ball). A more likely explanation, however, may be that no additional relatum is intended at all, and the utterance merely expresses a case of self-movement towards a *right* direction – equivalent to example (28) which can only be interpreted in this sense. This can be modelled as the dynamic version of an external **intrinsic** reference frame: the relatum is **reflexive** (cf. Brugman and Lakoff, 1988) and corresponds to the origin, i.e., the speaker's position at time t_0, providing the direction of movement.

This idea can be best illustrated by starting with the front direction as illustrated in Fig. 7(a and b). The schema in Fig. 7a shows the static intrinsic case; the locatum (square) is described with respect to the relatum (circle) which also provides the perspective (big arrow). A corresponding description is example (1) above, repeated here for convenience:

(29) There is a box in front of me.

This is directly mirrored by (30) and – if the end position of the movement is not defined by an object but simply a place – also by (31) (schematically depicted by Fig. 7b). Again, these two utterances involve *two* spatial descriptions each: the goal of the speaker's movement is specified by a noun (''the box'' in (30); ''a position'' in (31)), and the location of these goals is then defined by a static spatial description (''in front of me''). However, essentially the same spatial situation as in (31) can in English be addressed in a shorter form, namely by (32) using an expression that is semantically dynamic (also called *directional*, cf. Winterboer et al., in press), leaving the end point of the trajectory implicit. Fig. 7c shows the situation for a movement towards the *right* with respect to the start position of the mover, as in examples (27) and (28) above.

(30) I'm going to the box in front of me.

(31) I'm going to a position in front of me.

(32) I'm going forward.

Movement from the position of the origin and relatum as described so far may or may not involve a re-orientation of the moving entity. Example (33), in contrast, gives an explicit description of a re-orientation; this is expressed by the verb *turn*. Here, the situation is reversed in that the re-orientation may or may not also imply a movement to a new position. If uttered in a route context, it usually expresses re-orientation combined with a continued movement straight on, yielding a trajectory resembling a quarter of a circle.

(33) I'm turning (to the) right.

2.3.6. Movement from relatum (not origin) to locatum: dynamic relative and absolute reference frames

Another kind of dynamic **relative** reference frame (distinct from the kind described in section 2.3.4 above) emerges if directionals are used to describe the movement of objects relative to their own previous position as described from an external point of view. In example (34), both the source for perspective (origin) and the relatum are unspecified and need to be derived from the context (see Jörding and Wachsmuth, 2002, for an inspiring study exploiting this underdeterminacy). The context may provide possible interpretations for a relatum similar to examples (17) and (20) above. However, the object's original position may also serve this role; then the object is moved to the right of its own position at time t_0. As for perspective, it is perhaps most likely that the speaker is using their own view direction

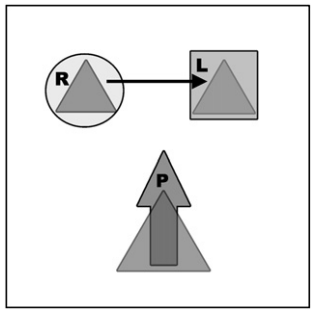


Fig. 8. Dynamic relative reference frame: movement of an object from the relatum (start point) to the locatum (end point).

(which remains unchanged through the time of the movement), which then yields a situation as depicted in Fig. 8. Other sources of view directions are equally possible. The end position of the movement at time t_1 then again corresponds to the role of locatum.

(34) Move the box to the right.

If a non-oriented entity is moved in a *forward* direction as in example (35), the moved object (the box) might move from its own position at time t_0 (the relatum) to a position (the locatum at time t_1) *forward* (or: *in front*) of the relatum, using a perspective provided by a different origin (possibly the speaker in example (35)), as shown in Fig. 9.

(35) Move the box forward.

However, as with the lateral axis, other interpretations are available as well, filling the lexically unspecified roles of relatum and perspective in different ways. Imagine, for instance, a situation in which objects are arranged in order to be photographed. Then an instruction to *move the box forward* could be interpreted to mean moving the object towards the area in front of the camera, with the camera filling the roles of origin and relatum, yielding a dynamic intrinsic reference frame similar to example (16) above. The end position of the movement then again becomes the locatum at time t_1.

Alternatively, the perspective (which in this case determines the direction of movement) may be provided by an externally defined (or **absolute**) type of sequence or movement, as in Fig. 5, example (14) above. Example (36) illustrates that, in this case, no further entity (such as the speaker or camera in the previous examples) is required for interpretation of the direction of *forward* movement. The box moves to a new position that is further *in the front* of the ordered sequence or conveyor belt than its previous position (cf. Fig. 10).

(36) The box is moved forward in the ordered sequence/on the conveyor belt.

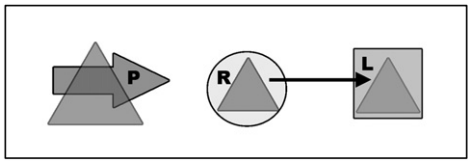


Fig. 9. The object is moved forward with respect to its own earlier position, using an external point of view determining the direction.

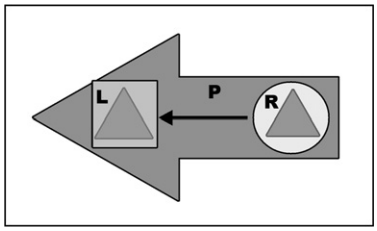


Fig. 10. Absolute reference frame providing a direction of movement. An entity is moved from the position of the relatum (its own earlier position, which the new position is related to) to that of the locatum, based on the encompassing direction given by external movement or sequence.

Table 1
Overview of basic distinctions: spatial reference frames (with example numbers).

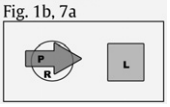
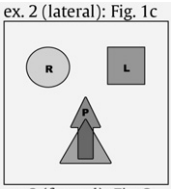
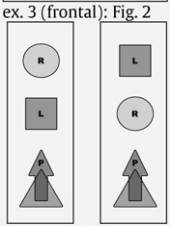
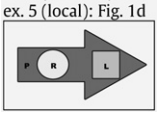
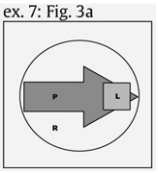
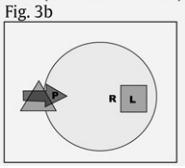
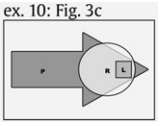
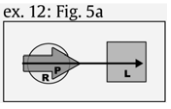
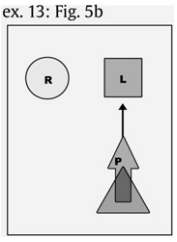
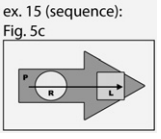
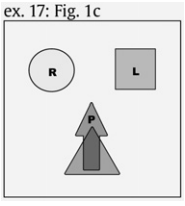
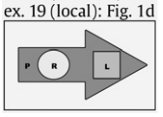
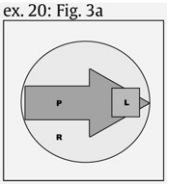
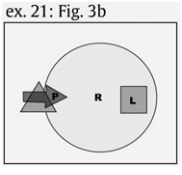
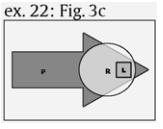
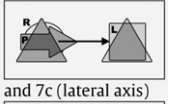
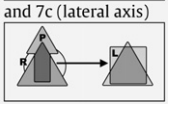
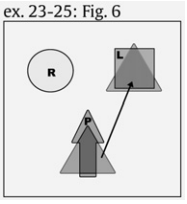
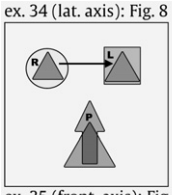
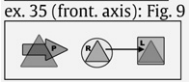
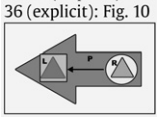
	Intrinsic	Relative	Absolute
Spatial static external	ex. 1; ex. 29: Fig. 1b, 7a 	ex. 2 (lateral): Fig. 1c  ex. 3 (frontal): Fig. 2 	ex. 4 (cardinal) and ex. 5 (local): Fig. 1d 
Spatial static internal	ex. 7: Fig. 3a 	ex. 8 (room as rel.) and ex. 9 (visual field as rel.): Fig. 3b 	ex. 10: Fig. 3c 
Spatial dynamic: motion as perspective	ex. 12: Fig. 5a 	ex. 13: Fig. 5b 	ex. 14 (motion) and ex. 15 (sequence): Fig. 5c 
Spatial dynamic: motion from anywhere to locatum (external)	ex. 16: Fig. 1b 	ex. 17: Fig. 1c 	ex. 18 (cardinal) and ex. 19 (local): Fig. 1d 
Spatial dynamic: motion from anywhere to locatum (internal)	ex. 20: Fig. 3a 	ex. 21: Fig. 3b 	ex. 22: Fig. 3c 
Spatial dynamic: motion from origin to locatum	ex. 27-28 & 30-33: Fig. 7b (frontal axis)  and 7c (lateral axis) 	ex. 23-25: Fig. 6 	

Table 1 (*Continued*)

	Intrinsic	Relative	Absolute
Spatial dynamic: motion from relatum (not origin) to locatum		ex. 34 (lat. axis): Fig. 8  ex. 35 (front. axis): Fig. 9 	ex. 35 (implicit) and 36 (explicit): Fig. 10 
	Intrinsic	Relative	Absolute

2.3.7. Summary of spatial reference frames

Spatial reference frames have been distinguished in the present framework along the following lines:

- intrinsic, relative, or absolute concepts (or none of these, i.e., non-projective)
- external or internal relationships between entities
- static or dynamic situations
- For dynamic situations:

(i) Movement direction as perspective
(ii) Movement from anywhere to locatum
(iii) Movement from origin to locatum
(iv) Movement from relatum to locatum

Table 1 provides a comprehensive overview of these distinctions together with numbers of examples and figures. The distinctions can be combined almost non-restrictively. Further complexities arise by the choice of axis (frontal vs. lateral) as well as perspective (speaker, addressee, or other) and type of relatum (an object or person, a group of objects, etc.). Each of these kinds of variability deserve attention in their own right, as reflected in the vast amount of research literature in this area (see Tenbrink, 2007 for an overview). For instance, if the relatum consists of several objects (such as a group of same-class objects), this may have several repercussions on the language used (cf. Tenbrink and Moratz, 2003). For current purposes, the outlined abstractions and patterns suffice to prepare the ground for subsequent analysis of *temporal* reference frames.

3. Temporal reference frames

Although time and space differ in crucial respects, it is a long-standing research desideratum to achieve a consistent transfer of spatial reference frame patterns to the domain of time. Several of the articles in this volume bear witness to the central importance of this idea. With respect to the endeavours available so far, a range of complications and confusions have been noted, part of which can be traced back to inconsistent accounts of *what is being related to what*, as Núñez and Sweetser (2006) illustrate. Crucially, however, a systematic framework reconciling dynamic aspects with spatial reference frames had been missing. The grammatical features of tense and aspect capture temporal relationships implicitly, sometimes drawing upon basically spatial concepts (for example in the modal use of *have* and *be*). A purely static analysis of these effects has been successfully pursued in the Reichenbachian tradition (Reichenbach, 1947; Hornstein, 1990). In contrast, the pervasive concepts of (metaphoric) motion associated with *explicit* temporal relations presuppose a flexible dynamic spatial framework. The present spatial models provide a new opportunity to account for the wide diversity of temporal concepts identified in earlier research, as they cover dynamic aspects, and the abstract roles and relations allow for systematic comparisons of underlying concepts.

Following tradition in this area (going back to McTaggart, 1908), my proposal will incorporate two basic categories, called **A-series** and **B-series** of time. In general terms, concepts employing the A-series of time are *deictic* (i.e., they rely on an observer's position or perspective), while concepts employing the B-series of time are *non-deictic* (they relate two events to each other without presupposing an observer) (Traugott, 1978). I will start with the (somewhat simpler) B-series, and gradually unfold the various options for representing time spatially. The emerging patterns will finally be summarized in Table 2, mirroring the overview of spatial reference frames given in Table 1 above.

3.1. The B-series of time: non-deictic temporal relationships

From a philosophical perspective (see also Galton, this volume), time has an "inbuilt asymmetry" which is as ubiquitous in the domain of time as the Earth's compass directions (north, south, etc.) are in the domain of space. The spatially based term **directionality** is commonly used to represent this changing nature of future to past as well as the unambiguousness of

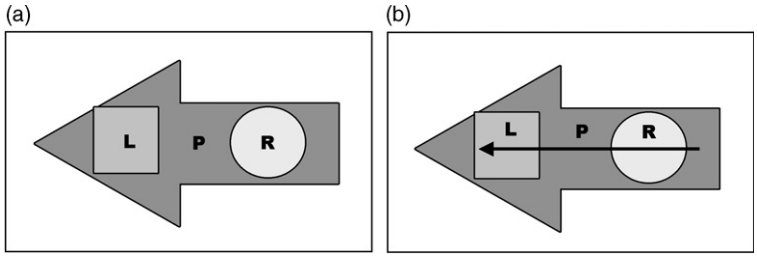


Fig. 11. The B-series of time: an "absolute" temporal reference frame. The direction or "perspective" is provided by the asymmetry of time; the event represented as the locatum is here conceived of as being in front. The relationship can be conceived of as either static (a) or dynamic (b).

temporal order. In this domain, the term is typically associated not only with a vector-like direction but also with potential or metaphoric motion. Moore (this volume) provides a useful account of how metaphorical motion can be distinguished from real motion, which may not be self-evident since motion as such involves both space and time (cf. Galton, this volume).

Interestingly, the direction of time can be conceived of in more than one way. Spatial diagrammatic depictions of temporal order usually show an arrow pointing in the direction of later times, which is felt to be natural (Friedman, 1990). In contrast, the basic sequential notions of *anteriority* and *posteriority* rather suggest a vector pointing in the direction of earlier times (supported by the semantics of these terms). This latter notion appears to be the one most commonly employed for non-deictic ("B-series") references to time in English. Central linguistic expressions associated with it are *before* and *after*. *Before* is generally assumed to correspond to spatial *in front of*, supported by spatial functional usages (McIntyre, 2007) of *before*. In other languages, the opposite assignment – locating the earlier event *behind* the later one – may be more common (e.g., Shinohara and Pardeshi, this volume; see also Kranjec and McDonough's notion of *non-deictic path* in this volume).

Non-deictic concepts of temporal relations correspond most closely to spatial **absolute** reference frames, since no observer or view direction is required. Temporal directionality may then serve as the conceptual **perspective** (depicted by the big arrow in Fig. 11) in a temporal absolute reference frame, replacing the cardinal (or locally based) directions of spatial absolute reference frames. In example (37) below (see Fig. 11a), its direction is derived from the term *before*, associated with *in front of*. Monday is the temporally "located" day and thus can be understood as corresponding to the **locatum** (square) in the spatial model. Tuesday corresponds to the **relatum** (circle).

(37) Monday is before Tuesday.

In this example, the concept is static, as reflected by the verb *be*. However, due to the association of motion conveyed by the directionality of time, motion verbs can be employed unproblematically, as in example (38) below. The relationship between the entities in question remains unaffected by this conceptualized movement, and no deictic interpretation is required. The verb *come* conveys directionality compatible with the direction associated with time; with a sequential reading (independent of an additional observer's perspective) this parallels "A comes before B in the alphabet". These sequential concepts are entirely equivalent to examples (14) and (15) above.

(38) Monday (always) comes before Tuesday.

Similar observations generally hold for all temporal descriptions that are based on the so-called B-series of time (McTaggart, 1908), namely those expressions of time that focus on the sequence of events (their anteriority and posteriority) in time. Such notions are often expressed non-metaphorically, using lexical items such as *before*/*after* that (at least in current usage) primarily refer to the domain of time, although they may also occur in other (particularly sequential) contexts (see Tenbrink, 2007 for further discussion). However, some primarily *spatial* (or sequential) expressions fit into the same pattern if they express a metaphorical concept of temporal motion or sequence independently of an observer, focusing on the sequence of events, as in examples (39) and (40). The dynamic cases are consistent with observer-less instances of the metaphorical concept of MOVING TIME (Clark, 1973), which will be explained below. Such concepts also instantiate what Moore (2006; this volume) refers to as the metaphor SEQUENCE IS RELATIVE POSITION ON A PATH.

(39) Tuesday always follows Monday.

(40) Monday is ahead of Tuesday.

3.2. The A-series of time: deictic temporal relationships

According to Langacker (1999), human spatial and visual experience is central to semantic conceptualization; most of the concepts expressed in language are in one way or another related to an observer. Time concepts as subsumed by the notion of

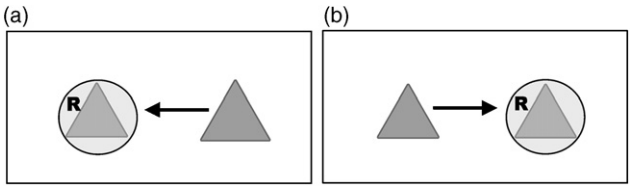


Fig. 12. Movement direction defined by a relatum: A spatial concept transferred to the domain of time. (a) MOVING TIME. (b) MOVING EGO.

the A-series of time (McTaggart, 1908) therefore appear to be more central for human thinking as they are based on an observer's current "position" (in time).

The A-series of time categorizes temporal notions into past, present, and future. Events change their deictic status continuously with time: for the observer, tomorrow becomes today, then yesterday (McTaggart, 1908). These issues are linguistically expressed in different ways than those reflecting the B-series of time. They integrate the observer's current position in the description and thus introduce a further basis for perspective other than that provided by the directionality of time. This opens up a range of options for representing the relationships spatially: (a) by way of non-projective dynamic concepts, (b) by way of projective static concepts, and (c) by way of projective dynamic concepts. I will explore each of these in turn.

3.2.1. Non-projective dynamic concepts

The A-series of time, as is commonly recognized, incorporates a sense of time associated with metaphorical motion, providing the basis for assigning *dynamic spatial concepts* to the domain of time. This may happen in one of two complementary ways (Clark, 1973): In the MOVING TIME metaphor, future events approach the observer and disappear in the past "behind" them; in the MOVING EGO metaphor, the observer moves through time. The following examples (taken from Clark, 1973:50f.) illustrate these notions:

(41) Noon crept up on us.

(42) We are just coming into troubled times.

Since the spatial metaphors underlying these descriptions involve motion, and the linguistic expressions used to describe the motion are not based on projective terms, a good candidate for the underlying spatial schema is the one depicted in Fig. 4 above – repeated here as Fig. 12 – in which the direction of movement is defined by the **relatum**. The two types of motion metaphors then differ in their assignment of the relatum: In example (41), the moving entity is the temporal term *noon*, which is described as moving toward the observer, i.e., the relatum. In example (42), the situation is reversed: the observer is "moving", and the movement is described in terms of the relatum (the *troubled times*). As long as no projective terms (presupposing particular view directions) are involved, no ambiguity arises, and the underlying spatial motion schema is straightforwardly expressed.

3.2.2. Projective static concepts

Some metaphors expressing the A-series of time use *static* expressions to describe the temporal relationship. In this case, they resemble spatial **intrinsic** reference frames. For instance, example (43) which uses the static verb *lie* can schematically be represented by Fig. 13a. The current moment of speaking (linguistically represented by the deictic term *me*) is taken as a reference point (**relatum**) together with the speaker's metaphorical view direction to the future. The **locatum** of this description is *good times*; its position is conceptualized as being in the future, in front of the observer.

(43) Good times lie before me.

Incidentally, the concept of placing the future in front yields a perspective direction that is essentially contrary to the direction expressed by the same linguistic term *before* used in non-metaphorical contexts, as part of the B-series of time (example (37) above). Examples (44) through (46), taken from Clark (1973:51), are equally well represented by this schema (with (46) exemplifying the opposite direction, when the event has already passed). Two variants are possible, corresponding to the static intrinsic spatial reference frame (Fig. 13a) and the variant that derives perspective via motion (cf.

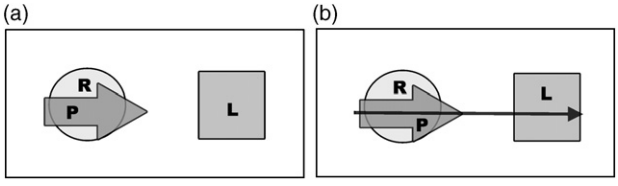


Fig. 13. Intrinsic temporal reference frame using the observer's current "position" in time, either implying a view direction to the future (a) or movement of the observer towards the future (b) as in the MOVING EGO metaphor.

section 2.3.1 above; Fig. 13b). The dynamic version explains the usage of semantically dynamic directionals such as *forward* or *ahead*. The relationship between relatum and locatum remains unaffected.

(44) Trouble lies ahead (of us).

(45) I look forward to Monday.

(46) The worst of it is behind us.

The assignment of the future as being *in front* of the observer as in these examples appears to be widespread across languages. However, it is not universal; for instance, Aymara speakers place the future behind the observer (Núñez and Sweetser, 2006; see also Moore, this volume). Note that this does not affect the nature of the underlying conceptual reference frame, only the assignment of directions *within* the frame.

In contrast to this well-attested employment of temporal descriptions that can be represented by **intrinsic** reference frames, to the best of my knowledge, direct equivalents of static **relative** reference frames are absent in temporal language usage. Since time represents only one dimension, which even provides a direction of its own, there may not be a need for external perspective taking in order to provide a direction for reference. To illustrate, the following invented example would be a proper equivalent of a relative spatial reference frame:

(47) * New Year's Eve is ahead of Christmas from now.

In this example, the direction of *ahead* is intended to correspond to that in (44), i.e., towards the future, derived from the origin *now*. However, the relative position of events to each other in time appears to be restricted to the observer-less (B-series) variant (here categorized as an absolute temporal reference frame), as in example (40) above. Moore (this volume) presents an authentic example:

(48) Polls show a widening lead for democrats ahead of next month's elections.
[27 October 2006, Amy Goodman, KPFA radio]

Notice that this sentence cannot be interpreted to mean that the democrats will be leading after the elections, although such an interpretation is theoretically possible, parallel to example (47). Similarly, example (49) illustrates how the time-based sequential relation between two events would have to be turned around when adopting the perspective of a later position, which is completely out of the question (Fig. 14).

(49) * Viewed from now (January 5th), New Year's Eve is before Christmas.

Thus, the present hypothesis (until evidence to the contrary is brought forward) is that static relative reference frames do not exist in temporal language. However, *dynamic* relative interpretations appear to be available with the (metaphorical) motion of another entity (in addition to observer and temporal locations), namely a scheduled event, as shown below.

3.2.3. Projective dynamic concepts

The spatial example (32) above represented a dynamic spatial intrinsic reference frame reflecting a movement from the origin and (reflexive) relatum to that of locatum. This example can be metaphorically transferred to the domain of time, as in (50) (adequately illustrated by Fig. 7b above):

(50) I'm going forward in time.

Here, the MOVING EGO metaphor is employed in a similar way as in example (42) above, this time employing a projective term. The start position of the movement may be the observer's present serving both as relatum and origin (which are represented by the same entity as in all intrinsic reference frames), and the (implicit) end position of the movement serves as locatum.

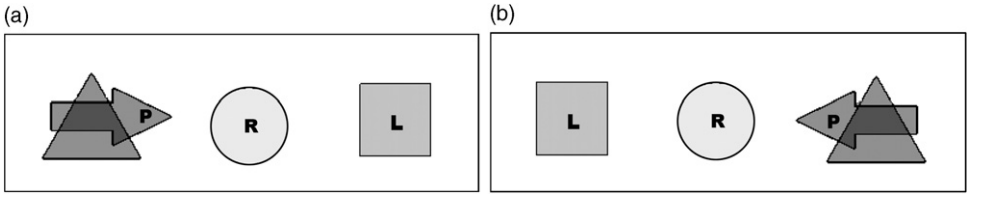


Fig. 14. Impossible relative temporal reference frames: Two events (New Year's Eve, represented as a square, and Christmas, represented as a circle) cannot be related to each other adopting the perspective of an external observer either before (a) or after (b) the events, changing the ways in which their sequential relation would normally be described using terms like *ahead* or *before*.

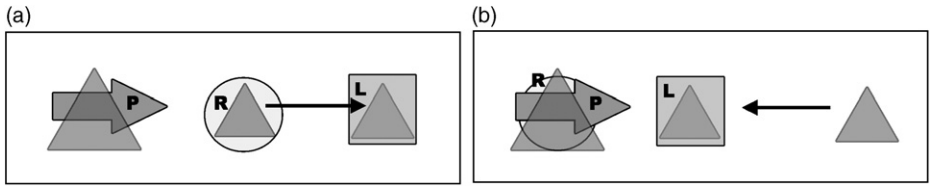


Fig. 15. Moving an entity (an object or event) forward. One possible interpretation (in time) is that the direction is provided by the observer's view towards the future, determining the direction of motion (a). Another possibility is that the direction is towards the observer's front (looking towards the future) (b).

The situation becomes far more complicated if the moving entity is not (as in this example) the observer who also represents the role of origin, but rather a different entity. Time itself, or events described in relation to the observer, cannot be moved around in the same way as objects in space can. Therefore the metaphorical movement of time is rarely in conflict with any other type of motion. However, there is one crucial exception: temporal assignments can actually be moved around as long as they only exist in the human mind or plans. This is the case with *scheduled* events. Then, perspective-based *directional* terms which are used to describe motion events (such as those described in section 2.3.6) may co-occur with the two motion concepts of MOVING TIME and MOVING EGO. McGlone and Harding (1998) demonstrate the ambiguities emerging from such a combination of temporal and spatial dynamic notions in a famous intriguing experiment, later taken up by Boroditsky (2000) and Kranjec (2006). Example (51) (Boroditsky, 2000) yields two contradictory interpretations:

(51) Next Wednesday's meeting has been moved forward two days.

Some people interpret this description such that the meeting is now scheduled for Friday, while others think of Monday. Both interpretations appear to be acceptable, based on the ambiguity of the projective-based directional term *forward* explained for example (35) above, repeated here as (52).

(52) I'm moving the box forward.

Two explanations based on a *dynamic relative reference frame* are possible as follows. The moving entity (*next Wednesday's meeting*) has no intrinsic front and is thus incapable of providing a direction of movement. As explained above, one possible interpretation is based on using the moved object's start position as a relatum; in this case the metaphorical movement direction of MOVING EGO is decisive (based on the observer's view direction to the future), and the meeting will be re-scheduled to *Friday*. This interpretation is represented in Fig. 15a.

An alternative (shown in Fig. 15b) is to use the observer's position as a relatum with a front area into which the moved object is being drawn, employing the observer's view direction. Because of the one-dimensionality of time, which precludes that the meeting is moved to the front from a different position such as right or left, this concept is directly compatible with the movement direction of MOVING TIME. Then the meeting will be re-scheduled to *Monday*. Kranjec (2006) describes the effect as follows:

> "If a person adopts a MT [moving time] metaphor, where the ego is stationary as events in the future move towards the observer, forward motion moves the meeting to an earlier time along the motion trajectory of sequenced events, in a direction towards the position of the stationary observer (leading to a Monday response)."

This concept can be expressed in German by the somewhat more explicit notion of *vorziehen* (lit., "draw to the front"):

(53) Das Treffen am nächsten Mittwoch ist zwei Tage vorgezogen worden.
[Next Wednesday's meeting has been drawn to the front two days.]

Although this representation (using dynamic relative reference frames with two different possibilities for the implicit relatum) already explains the ambiguity of example (51) sufficiently, there are further options.[2] The *absolute* direction of time as in Fig. 11 – employing the B-series of time – also provides an adequate conceptual basis for rescheduling the event. With this interpretation, the rescheduling happens independently of an observer, which is possible in this case as the sentence does not explicitly refer to an observer. Then the end position of the movement can be conceived of as being *in front* in the same sense as in example (37) repeated here as (54): the direction of *forward* is equated with the frontness of *before*,

[2] Fig. 3 in Kranjec and McDonough (this volume) provides a nice illustration of four ways (two of them deictic, two non-deictic) in which the forward movement of the meeting can be conceptualized.

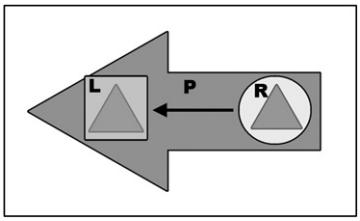


Fig. 16. The direction of movement of a scheduled event provided by the ubiquitous directionality of time, employing a concept related to the B-series of time. Time's arrow may either point to earlier or to later times.

yielding *Monday* as an endpoint of the forward movement (cf. Boroditsky, 2000). An explicit version of this interpretation is given in example (55). Additionally, given that the direction of the timeline can be conceived of as pointing to the future just as well as to the past (although such a concept is never expressed by *before* and *after*), the opposite assignment is also possible, as made explicit in example (56). Both conceptual schemas are adequately represented by Fig. 16, with opposite interpretations.

(54) Monday is before Tuesday.

(55) The meeting has been moved forward: It is now re-scheduled to a time before the time it was previously scheduled.

(56) The meeting has been moved forward: It is now re-scheduled to a time that is farther ahead on the timeline than the time it was previously scheduled.

3.2.4. Transferability

All of the temporal relations presuppose only a single dimension, based on the one-dimensionality of the domain of time, expressed metaphorically by the front–back direction of space. For this reason, it is possible in all cases to transfer the expressed temporal relationship from one reference frame to another. To illustrate, consider example (43) above, repeated below as (57). Although this example expresses a temporal relationship using *before* which is directly in contrast to the situation expressed non-metaphorically by examples such as (58), it is still possible to transfer one to the other, as in (59) and (60). While the linguistic environment needs to be adapted in such transfers to compensate for the metaphoric connotations, it is at least possible to derive the underlying temporal relation unambiguously. Such a transfer is not consistently possible between absolute and other types of spatial reference frames, as shown in detail by Levinson (2003).

(57) Good times lie before me.

(58) Good times happened before bad times.

(59) Good times will happen after the present moment.

(60) Good times were behind me when I experienced bad times.

3.2.5. Summary of temporal reference frames

Summing up the findings so far, temporal reference frames can be distinguished mostly along the same lines as summarized above for spatial reference frames:

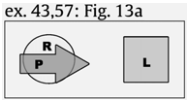
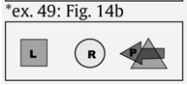
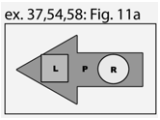
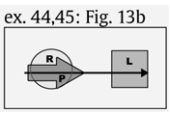
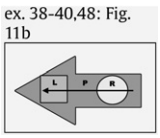
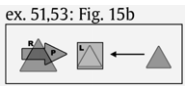
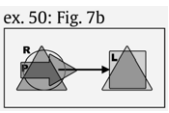
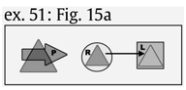
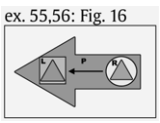
- intrinsic, relative, or absolute concepts (or none of these, i.e., non-projective) and
- static or dynamic situations.
- For dynamic situations:

(i) Movement direction as perspective.
(ii) Movement from anywhere to locatum.
(iii) Movement from origin to locatum.
(iv) Movement from relatum to locatum.

Notably, no internal relationships with temporal reference frames were found, which may be somewhat surprising since time is regularly conceptualized as a container (Lakoff and Johnson, 1999). Grammatical aspect may express the concept of one event being "located" within a time period, as in

(61) I was walking home when I suddenly heard a voice.

Table 2
Overview of all temporal reference frames (with example numbers), modelled on the distinctions identified in the spatial domain (Table 1).

	Intrinsic	Relative	Absolute
Temporal static	ex. 43,57: Fig. 13a 	*ex.47: Fig. 14a  *ex. 49: Fig. 14b 	ex. 37,54,58: Fig. 11a 
Temporal dynamic: motion as perspective	ex. 44,45: Fig. 13b 		ex. 38-40,48: Fig. 11b 
Temporal dynamic: motion from anywhere to locatum		ex. 51,53: Fig. 15b 	
Temporal dynamic: motion from origin to locatum	ex. 50: Fig. 7b 		
Temporal dynamic: motion from relatum (not origin) to locatum		ex. 51: Fig. 15a 	ex. 55,56: Fig. 16 

Consequently, events might equally be assigned an internal location within a temporal reference frame, for instance an intrinsic one. Mapped onto the spatial example (7) above, repeated here as (62) for convenience, this would yield an example like the following:

(62) The box is *in the front of* the car.

(63) * The meeting took place in the front part of Monday.

More generally, temporal intrinsic reference frames appear to rely on the event or time as **locatum**, rather than **relatum** as in (63); the associated relatum is typically a person (metaphorically) conceptualizing the event or time relative to their own (temporal) position, as in example (57). In such cases, internal reference frames are unlikely since that would require times or events to be conceptualized as located in a region within the body:

(64) * Good times are in my front.

Altogether, temporal reference frames appear to be less complex than spatial reference frames. Internal as well as static relative reference frames are absent in the temporal domain, and there appear to be considerable conceptual or pragmatic restrictions concerning the allocation of locatum and relatum in the temporal domain. Furthermore, the flexibility of axis assignment is inherently reduced by the one-dimensionality of time (as compared to three-dimensional space). Complications are mostly due to the fact that the directionality of time is ambiguous, and to the possibility of combining two distinct concepts of movement (temporal directionality, and metaphorical movement of a scheduled event). All of the identified distinctions with examples and figures are summarized in Table 2.

4. Conclusion

Spatial and temporal concepts are intricately intertwined in the human mind—and so are their reflections in English as well as other languages. In this paper I have pursued two related aims. The first aim was to extend former, widely used accounts of spatial reference frames by integrating dynamic concepts and some further fundamental distinctions made in language. The second aim was to reconcile various temporal concepts and relationships consistently with a comprehensive account of spatial reference frames. As an outcome, I have proposed a systematic framework encompassing external and internal, static and dynamic spatial situations as well as temporal relationships, distinguishing (as language does) between

expressions that represent the direction of a relation and those that do not convey this information. The framework is based on simple spatial models and thus provides a basis for comparing spatial and temporal reference frames systematically. It captures both metaphorical and literal (or at least completely frozen) representations and highlights how these are conceptually distinguished via systematic assignments of conceptual roles and relations. These abstract assignments are also suitable for representing the complementary metaphorical notions of MOVING TIME and MOVING EGO. The distinction between deictic (observer-related) and non-deictic concepts is represented via the assignment to different reference frames (absolute for non-deictic, and intrinsic or relative for deictic concepts).

Various applications of this novel framework are conceivable. A range of controversies in the literature on this complex topic may be reconciled by realizing the diversity of spatial concepts (static and dynamic, non-projective and projective, etc.) that may potentially support the temporal descriptions. This is true for the well-researched English language, which served as the basis for the current framework, but also for other cultures and languages, which have only partly been explored so far with respect to their spatiotemporal conceptualizations. Some relationships to other approaches and prominent cross-cultural findings have been made explicit in the present paper at appropriate places, highlighting the ways in which languages differ with respect to their spatiotemporal mappings. However, no attempt was made to be anything more than suggestive in this regard. Rather than representing a finalized account, this framework is intended as a basis for further exploration. Its main purpose is to facilitate further discussion by providing a comprehensible toolbox for research within the domains of space and time, based on a more flexible and integrative representation of spatiotemporal relationships than has been available before. This toolbox may be employed and further explored also for those cases that are not currently directly represented by the available models. It supports systematic explorations concerning the extent to which particular spatial models are transferred in a language to the temporal domain, highlighting universal as well as idiosyncratic principles in cross-linguistic research. As research progresses and further cognitively relevant distinctions are revealed, these can be incrementally incorporated using the proposed roles and relations as basic ingredients. Finally, beyond the description of general principles of conceptualization, the framework can be used as a tool for analysis of discourse expressing concepts of space and time, contrasting speakers' pragmatic choices in actual language usage with the generally available repertory of a language.

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