

# Representing time in terms of space: Directions of mental timelines in Norwegian

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## Abstract

People often use spatial vocabulary to describe temporal relations, and this has increasingly motivated attempts to map spatial frames of reference (FoRs) onto time. How people assign FRONT to time and to temporal entities depends on cultural conventions, and is crucial for diagnosing which temporal FoR a person actually adopts. Here, we report findings from a survey with speakers of Norwegian that aimed at assessing the cultural conventions involved in FRONT assignment. Data on temporal movements of events, on the temporal order of events, and on explicit FRONT assignments to events, time units, and “time itself” suggest that participants use different principles for describing fixed relations (static time) versus moving events (dynamic time).

**Keywords:** space; time; space-time mapping; frames of reference; mental timeline.

## Introduction

When talking about time, people tend to do so with vocabulary and concepts borrowed from the domain of space. Yet, while research in the two domains and the acknowledgement of cross-domain transfers do have a venerable tradition (reviewed in Núñez & Cooperrider, 2013), the challenge of mapping a taxonomy of spatial representations onto the domain of time has been taken up only recently, and respective attempts differ considerably in terms of theoretical conceptualization and subsequent interpretation of data. Based on a review of advances in this field, we outlined how such taxonomies may be transferred from space to time (Bender & Beller, 2014), with a focus on accounts that deal with frames of reference (FoRs).

Taking Levinson’s (2003) well-established taxonomy of spatial frames of reference as starting point, the *t-FoR account* (Bender et al., 2010, 2012; Rothe-Wulf et al., 2015) derives a set of temporal frames of reference (t-FoRs) following general design principles as described below. Yet, while these design principles provide an abstract structure for distinct frames of reference, their concrete specification depends on cultural conventions involved in how people assign FRONT to temporal entities *per se*. Previous accounts drew on intuitions regarding such conventions for speakers of English and related languages (such as that FRONT of an event is considered to be at its beginning). Here, we report findings from a survey that empirically assessed such conventions.

## Spatial and Temporal Frames of Reference

A frame of reference (FoR) is a coordinate system required to localize a figure *F* in reference to a ground *G* from an observer’s point of view *V*. Levinson’s (2003) taxonomy distinguishes three basic types of spatial FoRs, absolute, intrinsic, and relative, as well as different variants of the latter. In line with the underlying design principles, these FoRs can be mapped from space onto time as follows (Bender & Beller, 2014; and see Table 1):

The *absolute FoR* is anchored in a superordinate field outside *F*, *G*, and *V*. As space itself is the superordinate field in the spatial domain, so is time in the temporal domain. Assignment of orientation to the field follows cultural conventions and may recruit, for instance, cardinal points, mountain slopes, rivers, or the land-sea axis on small islands (in the case of space), and correspondingly the asymmetry inherent in the ‘arrow of time’ (in the case of time), which is (presumably) pointing towards the future.

The *intrinsic FoR* is anchored in the reference or ground entity *G* and can thus only be adopted if *G* is perceived as being oriented itself (this includes an observer if serving as ground). Assignment of orientation again follows cultural conventions and may recruit, for instance, moving directions of objects such as cars (in space) and the beginning versus end of events (in time).

**Table 1:** Frames of reference and forward movements (indicated by the tips of the arrows) according to the t-FoR account (for more details, see Bender & Beller, 2014), based on assumed cultural conventions for assigning FRONT in English speakers.

<i>Linear</i>	<i>Point-symmetric</i>
<p><i>Absolute</i></p>	<p><i>Relative-reflection</i></p>
<p><i>Intrinsic</i></p>	<p><i>Relative-translation</i></p>

The *relative FoR*, finally, is anchored in the viewpoint V of an observer (separate from G). V's position can be established both in space (as the observer's location) and in time (as the observer's subjective present). In order to still be able to localize F in reference to G, the coordinate system primarily anchored in V needs to be shifted into G. This can be done in several ways, two of which are relevant here: the *reflection* variant under which FRONT is assigned to a position or time between G and V, and the *translation* variant under which FRONT is assigned to a position or time beyond G. In either case, FRONT assignments are point-symmetrical to the present, but have diverging directions (*reflection*: towards V; *translation*: away from V).

Each of these FoRs hinges on cultural conventions: the absolute FoR on how orientation is assigned to the superordinate field (for variation, see Núñez & Sweetser, 2006), the intrinsic FoR on how orientation is assigned to the ground entity, and the relative FoR on which variant is preferred for shifting the primary coordinate system. So far, assumptions on these conventions are based more on intuitions than on data, especially for the domain of time. In the following, we explicate these for three Germanic languages.

### Frames of Reference in Germanic Languages

Empirical research in the *spatial* domain on three Germanic languages—English, German, and Swedish, (e.g., Beller et al., 2015; Grabowski & Weiß, 1996; Majid et al., 2004)—indicates that speakers of these languages make use of all basic spatial FoRs for describing locations and movements in space, with a pronounced preference in small-scale space for the reflection variant of the relative FoR and, albeit to a lesser extent, the intrinsic FoR.

In the *temporal* domain, the metaphorical space-time mapping emerging in language suggests a set of conventions for FRONT assignment that appear similar across the three languages. With regard to time itself (as the superordinate field in the *absolute* FoR), FRONT seems to be assigned to the future, as reflected in the 'arrow of time' pointing towards the future or in expressions such as "the future ahead", and "olden days passed by". With regard to events (as the ground entities in the *intrinsic* FoR), FRONT seems to be assigned to that part of time pertinent to the beginning of events, as reflected in expressions such as "the quiet before the storm". When it comes to the subjective viewpoint V of an observer (as the central point in the *relative* FoR), it might be ventured that none of its variants are frequent in Germanic languages, as the point-symmetric patterns arising from them have been observed only infrequently (with 2.5% or less in any of the languages under investigation; see Rothe-Wulf et al., 2015).

Based on these assumptions, an absolute FoR would be diagnosed when events "in front of" other events or "moved forward" from their previous position are localized as further in the future, while an intrinsic FoR would be diagnosed when they are localized as further in the past (Table 1). Interestingly, the latter pattern has been described as canonical for all three Germanic languages for describing

fixed relations such as "the quiet *before* the storm" (German: "die Ruhe *vor* dem Sturm", Swedish: "lugnet *före* stormen"), while patterns in the three languages differ fundamentally when it comes to movement: Moving a meeting "forward" results in a later date (futurewards movement) for the vast majority of Swedish speakers, in an earlier date (pastwards movement) for the vast majority of German speakers, and in dissent between these variants for English speakers (Rothe-Wulf et al., 2015; and see Boroditsky & Ramscar, 2002; McGlone & Harding, 1998).

Whether, however, these diverging patterns can be diagnosed as arising from an absolute or intrinsic FoR, respectively, depends on whether our assumptions regarding the cultural conventions for FRONT assignment are correct. Data on this question was collected in the current study for a fourth Germanic language, namely Norwegian, for which research on spatial FoRs revealed the same preferences for references in small scale space (Beller & Bender, 2017) as in the other three Germanic languages.

### Study

The study aimed at assessing whether and how FRONT is assigned to time itself (relevant for the absolute FoR) and to temporal entities such as events (relevant for the intrinsic FoR). We also remained open to the possibility of point-symmetric response patterns indicative of a relative FoR.

### Methods

**Participants.** 81 volunteers participated in the survey; three were excluded from further analyses because they indicated a language other than Norwegian as their mother tongue. The resulting sample therefore consisted of 78 participants (59 female; age  $M = 25.3$  years,  $SD = 7.6$ , range 19-62, with 5 not indicating their age).

**Materials.** The tasks described in the following were part of a larger paper-and-pencil survey, provided in Norwegian (*bokmål*). Here, we focus only on those tasks that are relevant for the questions under scrutiny in this paper.

**The Event-Moving Task** consisted of four items, with an event to be moved forward (Norwegian: *fram*) or backward (*bakover*) in time. Two items used the time scale *days*:

- The concert scheduled for Thursday last week was moved {forward/backward} two days. On which day of the week did it actually take place?
- The meeting scheduled for Wednesday next week will be moved {forward/backward} two days. On which day of the week will it now take place?

The other two items used the time scale *hours*:

- The departure scheduled for 9 a.m. yesterday was moved {backward/forward} three hours. At what time did it actually take place?
- The power cut scheduled for 4 p.m. tomorrow will be moved {backward/forward} three hours. At what time will it take place now?

For each time scale, a past and a future event was included;

this is necessary to be able to distinguish linear from point-symmetric t-FoRs (cf. Table 1) that participants might adopt (Bender et al., 2010). The original scheduling of the events and the moving span were chosen so as to remain within the respective time cycle (e.g., for weekdays between Monday and Saturday), and hence to prevent ambiguous responses.

The items were implemented in four arrangements, crossing between-subjects two *orders of time scales* with the two *moving directions*. The task started either with the time scale *days* (first meeting, then concert), followed by *hours* (first power cut, then departure), or vice versa, and either with “forward” as moving direction for the first two events, followed by “backward” for the other two, or vice versa.

**The Order Task** consisted of six items that asked for the order of events, that is, whether a target event (figure F) is “in front of” (Norwegian: *foran*) or “behind” (*bak*) a reference event G. Four items used a forced-choice format:

- Lunch is normally ...
  - in front of /  behind ... breakfast.
- Good Friday is two days ...
  - in front of /  behind ... Easter Sunday.
- New Year’s Eve is one week ...
  - in front of /  behind ... Christmas Eve.
- The Stone Age was ...
  - in front of /  behind ... the Middle Ages.

Two further items used an open format:

- The exam is generally nine days  
{in front of/behind} the 17<sup>th</sup> of May.  
So, at which date does it take place?
- This year, Peter’s birthday is three months  
{in front of/behind} midsummer.  
So, in which month is his birthday?

The items were implemented in four arrangements, crossing between-subjects two *orders of items* either with two *orders of response options* for the items in the forced-choice format (“in front of” as the first vs. the second option) or with the two *phrasings* for the items in the open format (“in front of” for the *birthday* item and “behind” for the *exam* item, or vice versa). One item order was determined randomly with the second order being the exact reversal<sup>1</sup>.

**The Front Task** consisted of eight items that asked for indicating whether or not a time segment has a front (Norwegian: *forside*) or back (*bakside*), and if so, in which direction FRONT or BACK is pointing. All items followed the same schema and had four response options, here exemplified for the item on time in general:

- {*Front/Back*} of time in general ...
  - is at the beginning of time.
  - is at the end of time.
  - Something like that does not exist.
  - Something else, namely \_\_\_\_\_.

As the two last response options were the same for all items, we explicate only the item-specific options for the remain-

ing items. Three items referred to the units of time *day*, *month* and *year*:

- {*Front/Back*} of today ...
  - was early in the morning /  will be late at night.
- {*Front/Back*} of August ...
  - is the 1<sup>st</sup> of August /  is the 31<sup>st</sup> of August.
- {*Front/Back*} of the current year ...
  - was in January /  will be in December.

Four other items referred to events:

- {*Front/Back*} of a meeting ...
  - is at the introduction /  is at the summary.
- {*Front/Back*} of a dinner ...
  - is at the appetizer /  is at the dessert.
- {*Front/Back*} of Easter ...
  - is on Maundy Thursday /  is on Easter Monday.
- {*Front/Back*} of your life ...
  - is when you were born /  is when you will die.

The items were implemented in four arrangements, crossing between-subjects two *phrasings* (asking for all items either for “front of X ...” or “back of X ...”) with two *orders of items* (one random order starting with time in general, and the exact reversal<sup>1</sup>).

**Design and Procedure.** Four versions of questionnaires were constructed. The various types of tasks were presented within-subject in a fixed order (i.e., *event-moving task* followed by *order task* followed by *front task*) in line with the increasingly explicit nature of the task (asking for the “front” of time highlights the topic of interest more strongly than asking for the date to which an event is moved). The four item arrangements of each task were randomly assigned to one of the four versions of questionnaires, and varied between-subjects as indicated in the Materials section. Participants were instructed to work on all tasks in the given order.

## Results

For each task, we first describe how FRONT assignments were coded and then report participants’ preferences.

**Event-Moving Task.** In this task, participants had to move an event either forward or backward in time. The responses were coded as whether they indicated that FRONT of the moving direction pointed towards the future or towards the past. For the items with “forward”-phrasing, the coding is obvious: If, for example, Wednesday’s meeting is moved “forward” to Monday, then the assignment of FRONT and the moving direction points pastwards. For items with “backward”-phrasing, coding is reversed: If Wednesday’s meeting is moved “backward” to Monday, then the assignment of FRONT and the corresponding forward direction point futurewards.

Each single item was tested first for potential influences of the *order of time scales* (days first vs. hours first) and the requested *moving direction* (forward vs. backward) on the actually chosen direction (futurewards vs. pastwards). No

<sup>1</sup> Each set of items also included some non-temporal items, which are not discussed here.

**Table 2:** FRONT assignments (%) in the *event-moving task*.

FRONT pointing	<i>Single items</i>				<i>M</i>
	Concert ( <i>N</i> = 77)	Meeting ( <i>N</i> = 77)	Departure ( <i>N</i> = 77)	Power cut ( <i>N</i> = 76)	
futurewards	63.6	71.4	58.4	68.4	65.5
pastwards	36.4	28.6	41.6	31.6	34.5
<i>Future/past items of time scale</i>					
		Days ( <i>N</i> = 77)	Hours ( <i>N</i> = 76)		
futurewards	(abs.)	63.6	57.9	60.8	
pastwards	(intr.)	28.6	31.6	30.1	
towards V	(refl.)	—	—	—	
away from V	(trans.)	7.8	10.5	9.2	

significant effects were found (all  $G^2 \leq 5.88$ ;  $df = 3$ ;  $p \geq .118$ ). Across items, futurewards movements dominated (65.5% on average; Table 2, upper half).

Then, we determined for each of the two pairs of items with the same time scale the pattern of FRONT assignments that resulted from considering both the future and past event as pointing futurewards, pastwards, towards V (present), or away from V (cf. Table 1). We checked whether the distribution of the four patterns for the time scale *days* differed from the distribution for the time scale *hours*, which would be indicative of an influence of time scale on temporal movements. According to a marginal homogeneity test for paired tasks, this was not the case (*std. MH statistic* = .906,  $p = .365$ ), thus justifying an aggregation across the time scales. Overall, the two linear patterns prevailed by far (Table 2, lower half). The majority of participants (60.8% on average) made futurewards movements, about one third (30.1%) made pastwards movements, while of the two point-symmetric patterns, only the one with moving directions away from V (present) was chosen (9.2%).

**Order Task.** In this task, participants had to specify whether a target event is “in front of” or “behind” a reference event. The responses were coded as whether they indicated that FRONT of the reference event was assigned to the end of the event, and hence pointing towards the future, or to the beginning of the event, pointing towards the past. For instance, Good Friday is always *earlier* in the year than Easter Sunday. The response “Good Friday is *in front of* Easter Sunday” therefore implies that FRONT of Easter Sunday is assigned to its beginning and points pastwards. With lunch as target event in reference to breakfast, coding would be reversed: As lunch is the *later* event, the response “Lunch is *in front of* breakfast” implies that FRONT of breakfast is assigned to its end and points futurewards.

Each item was tested first for potential effects of two factors on the coded FRONT of the event: the *order of items* (for all 6 items) and either the *order of response options* (for the 4 items with forced-choice format) or the *phrasing* (for the 2 items with open format). For the forced-choice items, no

significant effects were found (all  $G^2 \leq 3.77$ ;  $df = 1$ ;  $p \geq .052$ ). With some variation between events, the majority of responses indicated that FRONT of an event was assigned to its beginning and pointed pastwards (83.6% on average; Table 3, upper half). For the items with open format, main effects of the *phrasing* were found ( $G^2 \geq 12.95$ ;  $df = 1$ ;  $p < .001$ ). Responses indicating that FRONT pointed pastwards were more frequent when participants had to specify whether the target is “in front of” the reference event (100%) than when they had to specify whether the target is “behind” the reference event (76.4% on average; Table 3, lower half)<sup>2</sup>.

Finally, we determined how consistently the two possible FRONT assignments were made across the whole set of items. To this end, we counted for each participant how often FRONT pointed futurewards and how often it pointed pastwards. FRONT assignments were highly consistent. Participants used the same type of assignment on 5.17 (86.1%) of the 6 items. Overall, 65 participants (83.3%) had a preference for a pastwards directed FRONT and four participants (5.1%) for a futurewards directed FRONT; the remaining 9 participants (11.5%) had no preference.

Taken together, the results from the *order task* support the idea that FRONT of a time segment is at its beginning and that it points towards the past, at least for most of the participants. While in this task FRONT assignments were assessed indirectly from the order of events, the next task explicitly asked participants to indicate the “front” or “back” of events, time units, and time in general.

**Front Task.** In this task, participants had to specify whether “front” (or “back” respectively) of a temporal entity is at its beginning, at its end, does not exist, or something else. FRONT assignments were coded in four categories, with FRONT pointing futurewards, or pointing pastwards, is non-existent, or something else (“other”). For the items asking to indicate the “front” of an event, coding is again obvious:

**Table 3:** FRONT assignments (%) in the *order task*.

FRONT pointing	<i>Items with forced-choice format</i>				<i>M</i>
	Lunch ( <i>N</i> = 77)	Good Friday ( <i>N</i> = 78)	New Year ( <i>N</i> = 78)	Stone Age ( <i>N</i> = 78)	
futurewards	14.3	16.7	9.0	25.6	16.4
pastwards	85.7	83.3	91.0	74.4	83.6
<i>Items with open format</i>					
FRONT pointing	Exam ( <i>N</i> = 41, 37)		Birthday ( <i>N</i> = 34, 35)		
	In front of	Behind	In front of	Behind	
futurewards	—	21.6	—	25.7	11.6
pastwards	100.0	78.4	100.0	74.3	88.4

<sup>2</sup> That references using complementary prepositions (such as “in front of” vs. “behind”) need not result in perfectly complementary response patterns was also observed for the spatial domain (e.g., Grabowski & Weiß, 1996).

Choosing, for example, the beginning as the “front of the event” implies that FRONT points towards the past. For the items asking to indicate the event’s “back”, coding was reversed: Choosing the beginning as its “back” implies that FRONT is assigned to the end of the event and points towards the future. Therefore, the response “the *back* of a meeting is at the summary” implies that FRONT is assigned to the beginning of the meeting and hence points towards the past.

Each item was tested first for potential effects of the *phrasing* and the *order of items* on the coded FRONT. A main effect *phrasing* was found in all cases (all  $G^2 > 8.03$ ;  $df = 3$ ;  $p < .046$ ), a main effect *order of items* in three cases (*life*, *year*, and *time*;  $G^2 > 9.38$ ;  $df = 3$ ;  $p < .025$ ), and an interaction of the two factors in two cases (*dinner* and *Easter*;  $G^2 > 11.15$ ;  $df = 3$ ;  $p < .011$ ).

A joint log-linear analysis of the four event items (meeting, dinner, Easter, and life) suggested that the model *phrasing*  $\times$  *order of items* was the simplest model that fitted the data ( $G^2 = 39.69$ ;  $df = 36$ ;  $p = .309$ ), justifying the aggregation across these items. As in the order task, a pastwards directed FRONT occurred more frequently when participants had to specify the “front” of an event (as compared to the “back”), but this was the preferred response only when the task did *not* begin with the item on time in general (cf. Table 4). In the other cases, the majority of participants indicated that something like “front” does not exist. Among the two directions *future-* and *pastwards*, pastwards assignments clearly prevailed (87.2%; 129 of 148 responses).

A joint log-linear analysis of the four time and units items (day, month, year, and time) suggested again that the model *phrasing*  $\times$  *order of items* was the simplest model that fitted the data ( $G^2 \geq 40.903$ ;  $df = 36$ ;  $p = .264$ ), justifying to aggregate the data across these items. The results were quite similar to those from the event items: The pastwards directed FRONT occurred more frequently when participants had to specify the “front” of an event (as compared to the “back”), but this was the preferred response only when the

task did *not* begin with the item on time in general. In the other cases, a majority of participants indicated that something like “front” does not exist. Among the two directions *future-* and *pastwards*, pastwards assignments again prevailed (81.3%; 117 of 144 responses). This pattern includes the item on *time* in general. Futurewards directed FRONT assignment, which was the prevailing pattern in the event-movement task (65.5%) (cf. Table 2), occurred rarely when asked explicitly, and almost only when “back” had to be indicated (6 of 37 responses = 16.2%).

Finally, we determined how consistently different responses were given across the whole set of items. To this end, we counted for each participant how often FRONT pointed futurewards, how often it pointed pastwards, and how often it was declared as nonexistent. Responses were fairly consistent. Participants gave the same type of response on 6.37 (79.6%) of the 8 items. 29 participants (37.2%) had a preference for a pastwards directed FRONT, and four participants (5.1%) for a futurewards directed FRONT; 31 participants (39.7%) were consistent in declaring that something like “front” or “back” does not exist; the remaining 14 participants (17.9%) had no preference.

Taken together, the *front task* yields three results: First, the high number of participants indicating that something like FRONT or BACK does not exist for temporal entities is eye catching. Second, if FRONT was assigned to an entity at all, then it was assigned to its beginning and pointed towards the past. Finally, this tendency was also found for the item representing time in general.

## Discussion

Summarizing the findings across the three tasks presented here, the results indicate a preference among speakers of Norwegian for a *futurewards* orientation when “moving forward” an event (about 60%), but a *pastwards* orientation when localizing earlier events as “before” later events (about 80%). The latter is largely in line with the explicit assignment of FRONT to the beginning (rather than end) of events and time units—in fact, even to time itself—but assignments also depended on the order of items to some extent. These findings are surprising in at least three ways.

First, assignment of FRONT to temporal entities does not seem to follow the same principles across tasks, even though they were aimed at tapping the same underlying concepts. This is not unexpected per se, as people may have more than one timeline (Miles et al., 2011; and see Bender & Beller, 2014, for a review of respective data). Here, the static versus dynamic nature of the tasks seems to make the difference: While the pastwards orientation prevails for fixed relations (revolving around the order or orientation of events), the futurewards orientation takes over when movement is involved. A similar pattern was observed for spatial referencing, in a task where participants had to pick the “front” token (from a set of several tokens) and move it “forward” by a given number of fields. In this case, FRONT was assigned to the token and the movement in diverging ways: closer to Ego for the former, and away from Ego for

**Table 4:** FRONT assignments (%) in the *front task*.

FRONT (pointing)	Order of items			
	Time item first		Time item last	
	Phrasing		Phrasing	
	Front	Back	Front	Back
	<i>Event items (meeting, dinner, Easter, life)</i>			
futurewards	—	7.4	2.5	15.2
pastwards	39.8	30.9	73.8	20.3
Nonexistent	51.8	50.0	13.8	53.2
Other	8.4	11.8	10.0	11.4
	<i>Unit items and time (day, month, year, time)</i>			
futurewards	2.4	13.6	—	20.0
pastwards	35.7	18.2	81.3	12.5
Nonexistent	53.6	51.5	18.7	65.5
Other	8.3	16.7	—	5.0

the latter (Bender et al., 2012). Since movement itself provides orientation, it may serve as a direct source for FRONT assignment and thereby even override possibly conflicting orientations of the entities involved (Talmy, 2000). Interestingly, however, in the cases discussed here, the direction of movement is not specified beforehand, but is a *consequence* of FRONT assignment. This suggests that FRONT assignments follow different a priori preferences, but where these preferences are grounded in remains an open question.

Second, in the front task, time itself is treated similar to the smaller units *year*, *month*, and *day*, which themselves are treated similar to events in time. This appears at odds with the observation that for speakers of most languages (and especially English and related languages), FRONT is typically pointing towards the future (evidence summarized in Bender & Beller, 2014). However, we hesitate to interpret our current data as strong evidence to the contrary for three reasons: The high proportion of “does not exist” responses observed for all items alike hints at the possibility that the phrasings (i.e., *forside* and *bakside*) have been infelicitous. Even if one were willing to assign a FRONT or BACK to a virtual, one-dimensional notion as time, assigning a whole front or back *side* may seem undue. In addition, the response options “beginning of time” and “end of time” may have evoked a notion of time that resembles an (excessively long) event rather than the superordinate field the item was meant to refer to. And finally, since the time question was embedded in questions on events and smaller time units, set effects may have led to an overgeneralization of assignment patterns that are applied to events.

The third way in which our findings are surprising concerns cross-linguistic patterns. What we found for speakers of Norwegian is more similar to previous findings on English than on Swedish—despite the fact that Norwegian and Swedish are much more closely related, and actually mutually understandable. Besides sharing almost identical proportions of the reflective versus translational variant of the relative FoR in the *spatial* domain (Beller et al., 2015; Beller & Bender, 2017), speakers of English and Norwegian also exhibit a mix of preferences in the event-moving task, whereas speakers of Swedish strongly prefer the futurewards direction (Rothe-Wulf et al., 2015). Only in terms of relative preferences of the futurewards over the pastwards direction is Norwegian closer to Swedish.

Two conclusions may be drawn from these patterns. Most importantly, they indicate that cultural conventions are indeed crucial for establishing concrete frames of reference, as they determine how FRONT is assigned to temporal entities such as events or to time itself, both for fixed relations and for movement. In order to be able to identify which temporal FoRs people actually adopt, these conventions need to be assessed independently on an empirical basis. Furthermore, while FRONT assignment and FoR selection obviously differ across languages, it is not the languages themselves that are decisive here, but rather the agreement among their speakers, as attested to by the greater similarity of the Norwegian pattern with the English than the Swedish pattern.

This, we propose, renders the observed pattern a matter of negotiation and consensus, and hence a *cultural* phenomenon.

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