
Toward an Abstract Relative Timeline

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Abstract

In this paper, we propose an interaction style devoted to the specification of subjective and conceptual temporal expressions. We propose an abstract relative timeline as the central support for this interaction style. Our aim is to reach a satisfactory level of expressiveness while preserving concision and clarity. We provide results from preliminary attempts to use this approach to express twenty typical target challenging conceptual temporal expressions.

Author Keywords

Time representation; timeline ; design.

ACM Classification Keywords

H.5.2 User Interfaces.

General Terms

Design.

Introduction

Interaction styles or notations designed to *express* temporal information for input purposes [4] usually differ from interaction styles proposed to *display* and *explore* temporal information [2][1]. This paper focus on the first type of interaction, e.g. to *express* temporal information, however our proposal builds on previous work on both. As far as expressing temporal information is concerned, a first set of approaches favor direct manipulation with graphical representations of

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- q1. *pendant 20 ans*
- q2. dès lundi prochain
- q3. après les élections
- q4. fréquemment
- q5. parfois
- q6. 3 fois par semaine
- q7. 1 fois par mois
- q8. *le premier lundi du mois d'avril*
- q9. le troisième jeudi du mois
- q10. les fins de semaine paire
- q11. la semaine prochaine
- q12. dans une semaine
- q13. *à partir de la date du jugement*
- q14. comptant
- q15. à échéance fin de mois
- q16. *fin de mois le 10 ou le 5*
- q17. 30 jours fin de mois le 10
- q18. 60 jours ouvrés à compter de la date indiquée pour la livraison du bien
- q19. *l'hiver dernier*
- q20. 3 jours avant la fin du mois

Figure 1. Selected time expressions.

Gregorian calendar elements such as days, weeks, months, etc. or other temporal objective elements such as hours, minutes, seconds. Graphical representations are built from analogies with existing real world artifacts such as calendar or clocks or based on abstractions such as spirals suitable for objective time representations [7]. A second set of approaches consists in designing specific languages or language extensions. Such approaches typically found in knowledge representation [5], document annotation [6], or query languages [4] have led to lots of different languages from SQL extensions [3] to xml based representations such a TimeML [6]. Lastly, a third type of approaches consists in designing ad-hoc WIMP UI based on most frequently used temporal expressions or queries. For example, an ad-hoc dialog box is depicted in Figure 2 to express frequent room reservation requests limited to seven time slots, one day per week repeated over a contiguous period of time defined by a starting and ending week. Another example is the chronological filters made of hierarchical menus of frequent but limited temporal expressions [8].

Our approach differs from these three types of approaches in several ways. First, the Gregorian calendar, central for the first approach is secondary in our approach and mainly used to structure levels of time granularity. Second, language syntax and semantic are central in the second approach but secondary in our approach that favor visual sketching instead of language to express temporal expressions. Third, contrary to the specificity of WIMP ad-hoc UI solutions typical of the third approach, our objective is to provide a solution general enough to cover a wide range of temporal expressions.

Expressiveness, Concision and Clarity

In this paper, we are interested mostly in subjective and conceptual information. Such temporal information is easily expressed in natural language and frequently found in human interaction.

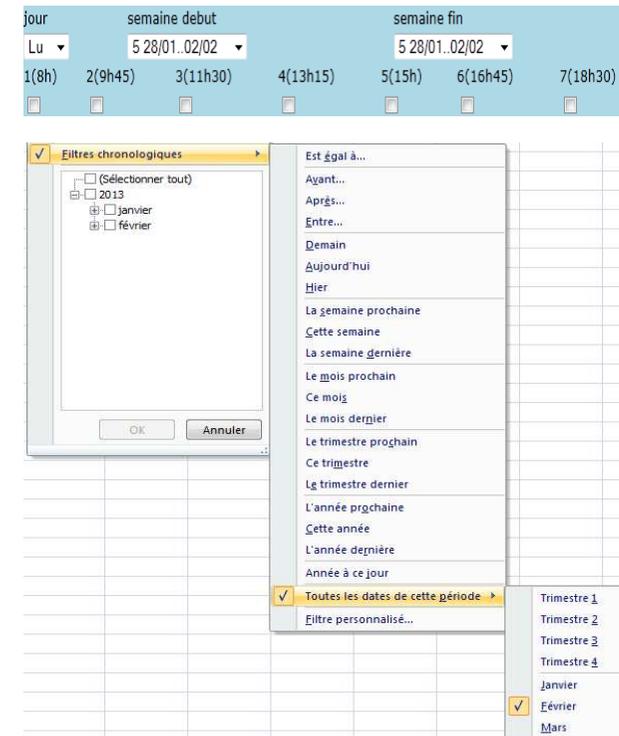


Figure 2. Ad-hoc WIMP menus (bottom) or dialog boxes (top) found in current applications to express temporal information

Providing the most concise and unambiguous notation or interaction style to reach a given level of expressiveness is challenging. To best describe the level of expressiveness we aim at, we chose a set of temporal expressions expressed in

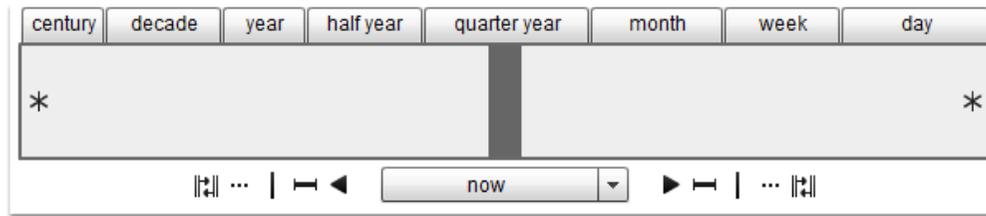


Figure 3. Empty abstract relative timeline.

the French language and extracted either from casual interaction between people or from legal documents (see Figure 1).

Abstract Relative Timeline

Many variations of timeline based diagrams have been used in information visualization for *displaying* temporal data. The idea underlying our proposal is to use a timeline as an editor of temporal expression. Building on experience and previous work descriptions of various categories of time expressions [9][10], we selected the following important conceptual temporal expression needs:

- (1) *time granularity* - century, decade, year, etc.
- (2) *time focus (or time center)* - today, date of birth, date of elections, date of delivery, etc.
- (3) *relative time interval* – in 10 days, in a week, in 3 years, etc.
- (4) *relative time jumps* - next month, previous year, next weekend, etc.
- (5) *repetitive patterns* - twice a month, every Monday, the first Monday of each month, etc.
- (6) *ordering* - past, present, future.
- (7) *selection of events, sequence, or duration.*

All these aspects are represented and can be edited in the Abstract Relative Timeline (ART). The empty form of ART is depicted in Figure 3. It contains the time in the middle depicted by both a vertical bar and a legend below. The ART further displays past area (left to center) and future area (right to center). Stars at the end of both areas indicate that the timeline is open,

possibly endless. This is default value and can be changed to represent a closed timeline. The default value for the center of time is now.

Building a temporal expression is achieved by adding new conceptual temporal elements to the time line thanks to tools situated below the timeline at the right (future elements) and left (past elements) of the center. Five types of tools are available and work symmetrically for both past and future areas. These tools together make possible the expression of the aspect (3), (4) and (5) of the conceptual temporal expression needs mentioned above. Granularity of time is displayed on top of the time line. Granularity can be edited and can affect all displayed time elements.

Preliminary results, discussion and perspectives

We have developed a prototype of the Abstract Relative Timeline (ART) and used it to express all the challenging temporal expressions of Figure 1. To evaluate the performance in terms of concision we used a keystroke evaluation. The keystroke results for 5 expressions from Figure 1 are given in Table 1. Keystroke representations are specified according the operators and values given in [11].

Like all abstract representation and artefacts, ART might require some practice. To better describe interaction, we present three different ART specifications in Figure 4. The “first Monday of April” (q8) is expressed by (1) centring the timeline on the beginning of year; then (2) jump to next April by adding a *relative time jump* element; then (3) jump to next Monday and lastly (4) select the day pointed at the end of the next Monday element (see Figure 4, top

	sec	Keystroke details
q1	11.26s	7P+10B+2H+2K+M
q8	12.8s	8P+16B+2M
q13	5.4s	4P+8B+M
q16	16.16s	10P+18B+4H+2K+M
q19	5.4s	4P+8B+M

Table 1. Estimated keystroke of ART construction of some expressions of Figure 1.

screen capture). The "fin de mois le 10 ou le 5" (q16) corresponds to a French regulation of some payments that can be translated by "due on the 5th or the 10th of the month following the acquisition". It is specified in ART by (1) changing the center of the timeline to be "acquisition date", (2) jumping from there to the next element with granularity "end of month", (3) inserting from there an interval of 5 days, and (4) another interval of 5 days and lastly (5) selecting the end of both intervals as possible dates for payment (see Figure 4, middle). Finally, the "last winter" (q19) is expressed thanks to (1) a single jump in the past direction with granularity set to winter and (2) selection of the "previous winter" at the end of the jump (Figure 4, bottom).

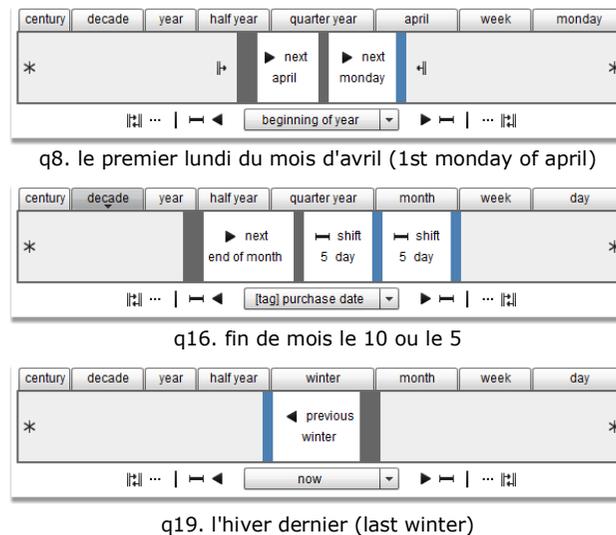


Figure 4 - Abstract Relative Time description for expression q8, q16 and q19 of Figure 1.

Preliminary results suggest that the expressiveness of ART is sufficient for the target queries of Figure 1. Future experiments are planned to see how these preliminary results generalize. Future work also includes the improvement of granularity selection and editing to improve the concision of ART.

References

- [1] Daassi, C., Nigay, L., Fauvet, M.-C. A taxonomy of Temporal data visualization. 2006. In *Revue Information Interaction Intelligence*. P. 41--63.
- [2] Kangnikoé Adjanor, Eric Lecolinet, Yves Guiard, and Myriam Ribière. 2010. Visualisation interactive de données temporelles: un aperçu de l'état de l'art. In (IHM '10).
- [3] K. Kulkarni and J.-E. Michels, "Temporal features in SQL:2011," *SIGMOD Rec.*, vol. 41, no. 3, pp. 34-43, Oct. 2012.
- [4] J. Chomicki, "Temporal query languages: A survey," in *Temporal Logic*, 1994, pp. 506-534.
- [5] James F. Allen. 1983. Maintaining knowledge about temporal intervals. *Commun. ACM* 26, 11 (November 1983), 832-843.
- [6] <http://www.timeml.org/site/index.html>
- [7] Pierre Dragicevic, Stéphane Huot, SpiraClock: a continuous and non-intrusive display for upcoming events, CHI '02 extended abstracts, April 20-25, 2002, Minneapolis, Minnesota, USA
- [8] <http://blogs.office.com/b/microsoft-excel/archive/2009/10/01/excel-2010-new-search-filter.aspx> [last accessed, 2013-01-18]
- [9] Wendy Mackay, Max Van Kleek and Aurélien Tabard *Interacting with Temporal Data, A workshop at CHI 2009*, <http://www.tabard.fr/temporal/>.
- [10] C. Teissedre, 2012, *Analyse sémantique automatique des adverbiaux de localisation temporelle : application à la recherche d'information et à l'acquisition de connaissances*, phd, http://tel.archives-ouvertes.fr/docs/00/76/24/40/PDF/thA_se_charles_teissa_dre.pdf.
- [11] Kieras, David. "Using the Keystroke-Level Model to Estimate Execution Times." 1993.