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Semantic Timeline Tools for History and Criticism

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New concepts in the visualization of time-based events are introduced and applied to the fields of historiography and criticism. These techniques (perpendicular timelines, dynamic confidence links, and time-slice relationship diagrams) extend the semantic power of timelines so that they can show the development of complex concepts and interpretations of underlying events. An interactive software tool called "TimeVis" illustrates these techniques with both 2D and 3D views.

History is a referent discipline. Later events build on earlier events, though in unpredictable and complicated ways. Historiography and literary criticism are the histories of accumulated comments on a subject. The underlying history and literature (the "base events") occur in one era, and commentary and subsequent events ("secondary events") are added later. However, commentary is not made in the same order as the base events; scholars might spend decades analyzing a writer's later works, and subsequently change emphasis to her earlier works.

Visualizing such referent-based relationships through time is very difficult with a single, conventional timeline. The concept of stacked timelines of different eras [Jen03] was introduced to align commentary and consequent events with their referents (Figure 1). This is useful when secondary events are evenly distributed, but less useful when they are concentrated on subsets of the base events. Crossing lines are difficult to interpret, and important early events can end up leading to a forest of arrows. What is more, the x-axes of the two timelines have no relation to each other. This lack of relation is in fact the cause of the criss-crossing lines.

This paper describes three new timeline techniques that can be applied to the study of history, criticism, and other fields with a temporal or referent component. Each technique serves a different research need.
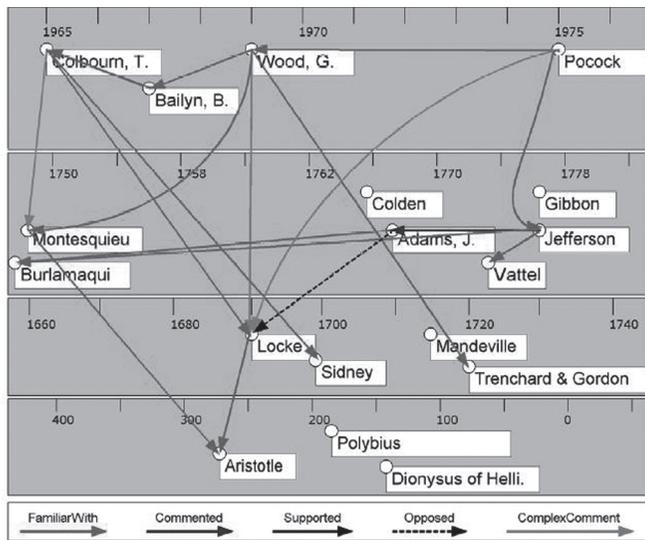
Figure 1. Stacked semantic timeline shows references to earlier timespans.

Techniques

"Perpendicular timelines" are like stacked timelines, but with the second turned 90 degrees, and a second dimension added (Figure 2). The added dimension is the time dimension of the first timeline. This means that secondary events can be visually grouped by the base events that they refer to, yet also be ordered by their own time. In effect, perpendicular timelines allow each original event or topic to spin off its own timeline of commentary and follow-up, arranged perpendicular to the base events.
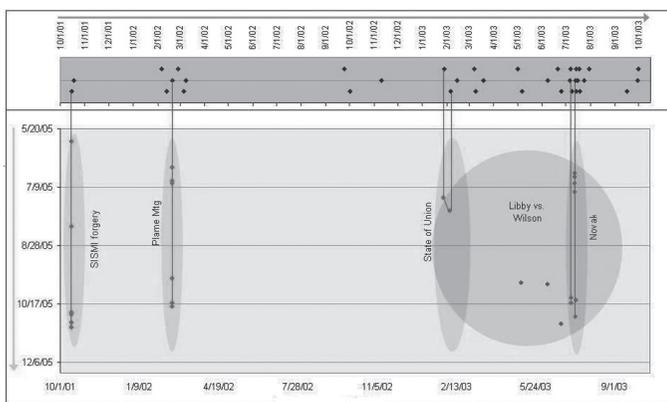

Figure 2. Perpendicular timeline shows subsequent development of older events.

"Dynamic confidence links" build on perpendicular timelines, and provide interactive feedback. Each timeline within TimeVis can have one or more "time slices", which are markers indicating the current point of interest in that timeline (Figure 3).
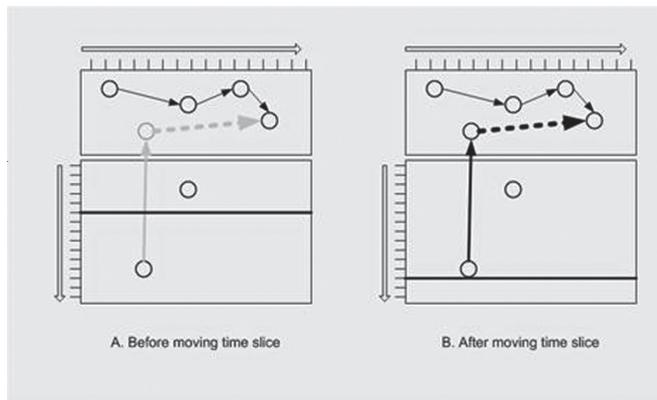

Figure 3. "Dynamic confidence links" are illuminated as the focus in the secondary timeline is shifted (via a slice marker), highlighting revelations of older events.

As we move the current time slice marker in the secondary timeline, we are focusing on "what we knew at time t about the events in the base timeline". As those secondary events occurred in the real world, it changed our interpretation and understanding of the base events. (For example, when Boswell's papers, thought to be lost, were discovered in the early 20th Century, they revealed details of his life that were formerly hidden.) These changed interpretations and understandings can be represented by gray event or concept markers in the base line, connected to the revelatory events of the secondary timeline by gray lines. When the current time slice marker passes a secondary event, its lines and the base events to which it connects can turn from gray to black, indicating that this was the time at which those facts or interpretations became more plausible. That is, the tool dynamically indicates our confidence in different claims, as a function of time.

(Note that the inverse applies as well. If secondary events tend to reduce our confidence in earlier interpretations, those revelations can cause the base events to turn gray.)

Perpendicular timelines, and the dynamic confidence links they enable, can also be extended from two dimensions to three dimensions (Figure 4). Just as the move from one simple timeline to perpendicular timelines frees the secondary events to be organized both by topic and by time, the extension of perpendicular timelines into an

additional dimension allows data to be organized by time as well as two other criteria.
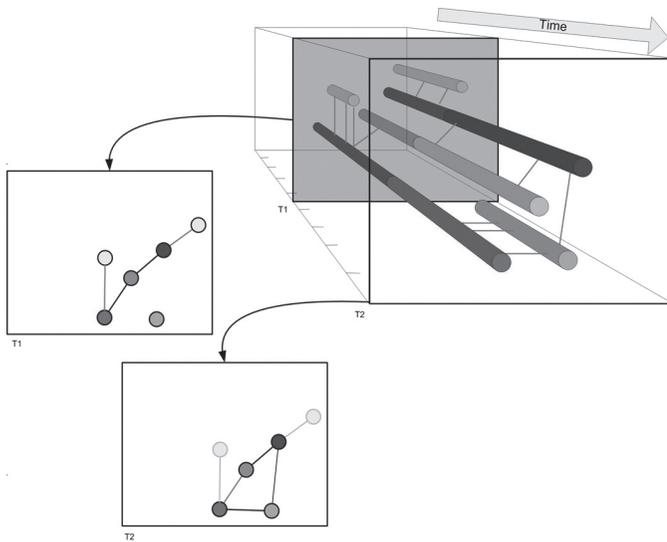

Figure 4. 3D timeline, with two slice markers showing time-slice relationship diagrams. This illustrates the growing importance of the green actor as we compare time T1 to time T2.

Both the base timeline (now a 3D timeline space) and the secondary timeline (also a 3D timeline space) have more flexibility. Rather than use strict definitions for the two free axes in the base 3D space, they can act as a 2D surface for organizing the time-oriented topic/subject bars. By shuffling the time-oriented bars around, the links between them can become more understandable. This is similar to the behavior of force-directed 2D network graph tools such as Visual Thesaurus.

The secondary 3D space can now be organized with one axis for its own events' time, another axis for theme or subject, and the third axis for actor. This allows us to illustrate concepts such as "who knew what when?"

"Time-slice relationship diagrams" show how different actors are related to each other at the time pointed to by the current time slice marker. If events are organized around the concept of actors, and laid out in a 3D space, then a 2D time slice through the 3D space can show a relationship diagram, indicating the "small world" connections from one actor to another. The diagram is equivalent to looking down the time axis of the 3D space, backwards in time, with older connections appearing distant (and thinner) and newer connections appearing

large. As the current time slice marker is moved through time, the user can see relationships forming and decaying.

Applications

TimeVis is being used to visualize controversies and cover-ups in history, including Watergate and the Dreyfus Affair. It is being used to investigate the historiographical record of acceptance of Vertot's Roman Revolutions (1719), and the literary response, over the centuries, to Boswell's writings. Those studies should conclude shortly, and while no scholarly breakthroughs are to be expected, what should emerge is a set of visualizations (diagrams, videos, and data files) of use to students and researchers who seek to capture the big picture of such topics that stretch out over time.

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The Inhibition of Geographical Information in Digital Humanities Scholarship

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Introduction

Information about place is an essential part of the study of the humanities. People live, events occur, and artefacts are produced by human hand at specific geographical locations and much of what people do is spatially determined or leaves spatial signatures. In order to gain insight into human activity, past and present, the influences of geography must be taken into account. Digital scholarship makes powerful new methodologies freely available at relatively low cost. However, the new research opportunities offered by spatial and spatial-temporal data remain relatively unexplored. This paper examines the reasons for this and discusses possible ways forward for the community.

GIS methodology is much more than digital cartography, it gives the researcher the ability to analyse and display data in a variety of maps, networks or hierarchy trees. The need to represent and model time is leading humanities scholars to experiment with the emerging methodologies of dynamic mapping, an approach that was impossible before the advent of digital scholarship.

There are many ways that methods and tools for structuring, visualising and analysing space, spatial behaviour and spatial change can benefit humanities research. It is over fifteen years since GIS software with reasonable functionality became available in a PC environment at a relatively low cost. Despite this the use of geographical information in digital scholarship by humanists has been poor. This paper will explore some of this potential but,