

# Time in Personal Information Management

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## ABSTRACT

A rising trend in personal information management is the classification of items by date. This time-centric approach seems more natural to human users. However, that new approach needs new tools, very far from the traditional folder hierarchy that has been used in systems since the beginnings of personal computing.

This paper gives an overview of four systems that use time as main parameter to classify, organise, compare and retrieve personal data. Three of them display items on a traditional timeline, and the last one saves images of the desktop through time.

## 1. INTRODUCTION

### 1.1 Main Aspects

The visual representation of information is a fundamental topic of Computer Science. In particular, as digital personal information grows in quantity and diversity of formats, software designers are looking into new ways of organising, retrieving and displaying information.

At this time, the most widely used data representation is certainly the folder hierarchy, which is intimately bound to the way operating systems are designed. Even though the file system of our machines is unlikely to fundamentally change in a near future, we are starting to see some higher level abstractions. Examples include photo viewing with Picasa<sup>®</sup> and e-mail browsing, which rely on previously seldom used properties such as date and tags.

### 1.2 Relevance of Time

A simple way of organising data is on a temporal basis. This approach may appear simplistic at first glance, but the truth is, for most of our personal digital items, it is relevant to classify them by date, should it be e-mails, photographs, or work documents.

One question that quickly arises when organising items by date is *what date to choose?* A file can have a creation date, a last modification date, a last access date, . . . In a medical context, how would we represent a pneumonia (a durable event) in a timeline display? Another question would be *are all items classifiable by date?* For example, where would I put my favourite *Norah Jones* album?

These issues are addressed (sometimes partially) in the visualisation systems described here.

### 1.3 Visualisation systems

This paper gives a quick insight into four time-based visualisation systems:

- LifeLines (in: [1])
- LifeLines2 (in: [2])
- Stuff I've Seen (in: [3])
- Time-Machine Computing (in: [4])

Each system belongs to one of these two categories:

1. standalone timeline visualisations
2. time-based system integration.

The first three systems, namely *Lifelines (1 & 2)* and *Stuff I've Seen* belong to the first category, whereas the last system corresponds to the second category.

#### 1.3.1 standalone timeline visualisations

This category of visualisations describes systems that are not integrated in the operating system. They work as standalone applications and are more relevant for specific applications such as consulting a medical record.

#### 1.3.2 time-based system integration

This second type encompasses systems that are integrated directly into the operating system desktop view. Its use is therefore restricted to personal documents management, and cannot be used as a visualisation tool to display say, a medical record.

## 2. LIFELINES

The first visualisation tool we will study here is called *Lifelines*.

### 2.1 Objectives

*Lifelines provide a general visualization environment for personal histories that can be applied to medical and court records, professional histories and other types of biographical data.*<sup>1</sup>

The whole idea emerged from the constatation that present techniques to organise data in the scope of a trial or a medical condition was cumbersome and took too much time. In the event of a sickness, the speed at which doctors can recover a patient's medical history is crucial.

At present, the reader has to browse through a record that resembles much to a puzzle, made of quite diverse and lengthy pieces. The idea is to gather all the information into a single view, with an adequate ordering method. A timeline visualisation thus comes in as a natural solution.

### 2.2 Description

*We propose LifeLines as a general technique for visualizing summaries of personal histories. On a one screen overview multiple facets of the records are displayed. Aspects with varying status, such as medical conditions or legal cases, are displayed as horizontal lines, while icons indicate discrete events, such as physician consultations or legal reviews. Line colour and thickness illustrate relationships or the significance of events. LifeLines always begin with a one screen overview of the record, and rescaling tools or filters allow users to focus on part of the record and see more details, providing a general visualization environment. (...) In response the LifeLines were designed to 1) present a youth record visual overview on a single screen, 2) provide direct access to all detail information from the overview with one or two clicks of the mouse, 3) promote critical information or alerts to the overview level.*<sup>2</sup>

Instead of a lengthy textual description of the system, let's look at the example depicted by fig.1.

The initial view is always a complete overview of the record. The user can then zoom into a specific time frame, and get details about events and people by clicking on them. He can also highlight an item and all related items will be highlighted as well, showing dependencies between items in different facets.

The users decided to restrict the view to the *cases*, *placements*, *assignments* and *reviews* facets.

### 2.3 Remarks

Lifelines seems to be an essential tool to cope with medical histories or a any such records, where the chronology of events is highly relevant and where any omission of data can have severe consequences. One can probably not think of a better and a more natural way of presenting information in these cases.

<sup>1</sup>These lines were extracted from the original article [1]

<sup>2</sup>These lines were extracted from the original article [1]

However, the whole system seems narrowed to representing a person's life records for medical or justice use. Thus, it is hard to see an application in the scope of personal information management. It is bound to remain of third party use, and not to store personal documents like photographs. Nevertheless, the idea of representing items on a timeline (which, by the way, has nothing of a new idea) is interesting enough to be used for personal information management, as we will see in the third system (*Stuff I've Seen*).

## 3. LIFELINES2

*Lifelines2* is an evolution of *Lifelines*, which is oriented in the same direction as the former project, but which has features that boost the usability of the system.

### 3.1 Objectives

The former *Lifelines* project was not equipped for comparing separate lifelines. This new version is now aimed at being able to put two distinct lifelines together, and align them using so-called *sentinel events*. That does not seem like a big improvement at first glance, but the project was developed in tight collaboration with some medical experts, who wished to have a tool able to detect *cause-and-effect* patterns in a big number of cases. Aligning a large number of medical records on an event such as a heart-attack, allows to easily detect precursor, co-occurring, and after-effect events, and permits to generalize some patterns if found in numerous cases.

The focussing on areas of interest (e.g. using filters) was also made a priority of the project, while *Lifelines(1)* showed the entire timeline of a person in order to get the most exhaustive view as possible.

### 3.2 Description

fig.2 is a screenshot of the *Timelines2* application comparing records of several patients. Patients are ordered by number of *pneumonia* and *influenza* events. Each triangle represents an event. It is easy to see the rate of occurrence of events, but not so much they order. For example, it is hard to see if asthma is generally declared before or after the *1<sup>st</sup> pneumonia* or *influenza* event.

In fig.3, the program's aligning feature has been used and all timelines are now aligned on their *1<sup>st</sup> Pneumonia* and *influenza* event, which is yet the *sentinel event*. It is now easy to see for which patients did *asthma* events occur before *influenza* events.

### 3.3 Remarks

*Lifelines2* introduces a very useful tool that has no earlier equivalent. Aligning data by sentinel events is an excellent way of spotting patterns in a large number of medical records, which are often messy and recurrent. The controlled experiment lead by the team showed that not only does the system achieve it's role very efficiently, it has also been found easy to apprehend, consisting of a clear timeline interface and simple intuitive functions.

The negative remarks are the same than for the first version. It is clear that *Lifelines2* requires very specific, standardised and uniform data. It will not be applicable outside of just



Figure 1: LifeLines: representation of a youth record.

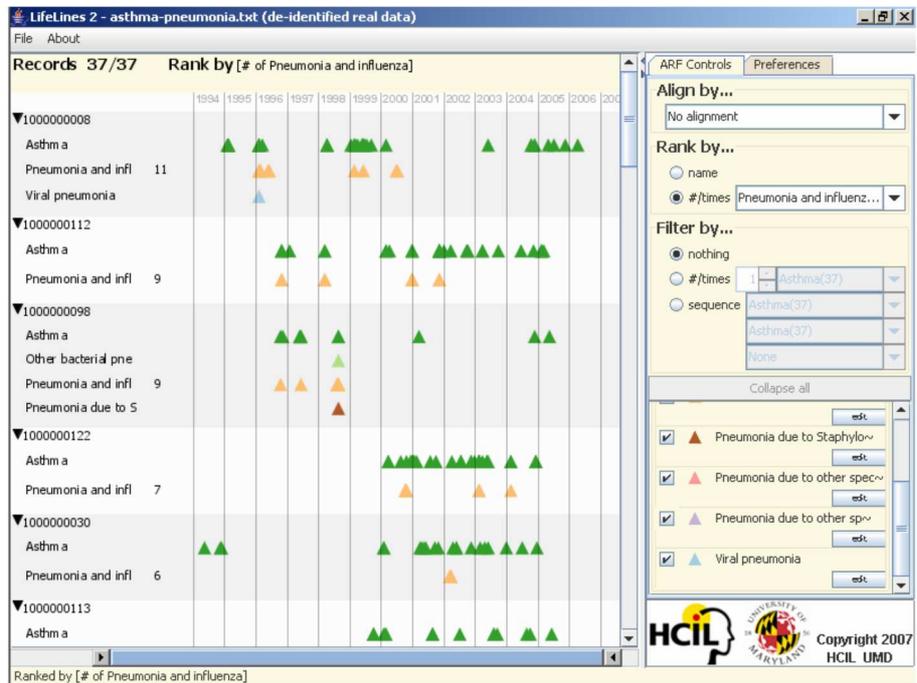


Figure 2: LifeLines2: non-aligned medical histories.

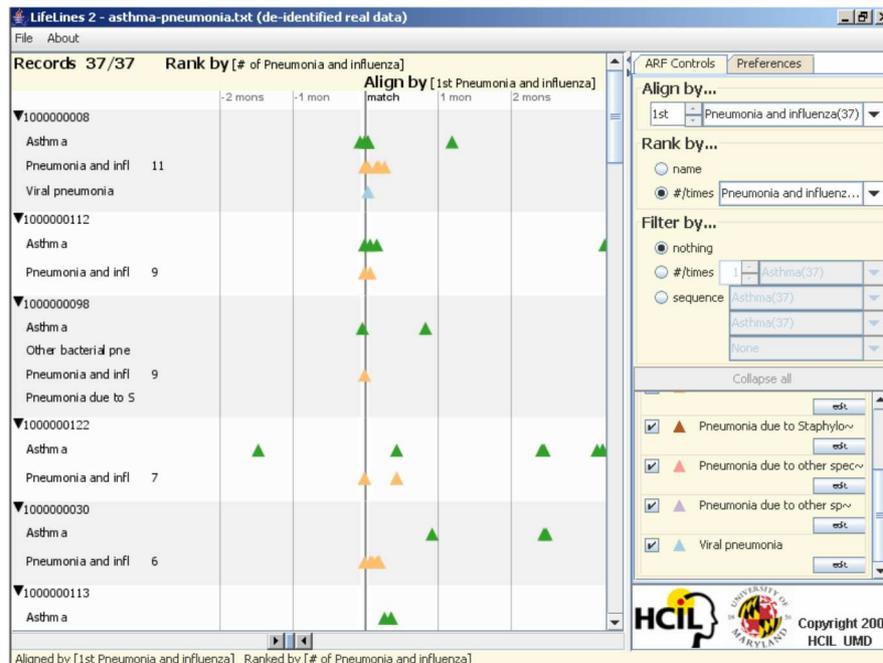


Figure 3: LifeLines2: medical histories aligned on the 1<sup>st</sup> *Pneumonia and influenza* event.

medical data without a huge work of tagging events in a specific way.

Then again, it is of limited interest in the scope of personal information management, but a somewhat similar idea was developed in the following project (*Stuff I've Seen*), where a timeline is structured by milestones (from which certain are common between different persons). But once again, putting side-to-side the personal data of multiple users makes little sense.

#### 4. STUFF I'VE SEEN

This project is more oriented towards our specific subject than the two projects above. It is also strongly based on cognitive psychology. Psychologists have studied episodic memory a lot in recent years, but seldom have they been listened to by software designers.

##### 4.1 Objectives

Briefly said, the project aims to answer to the recurring question: *Where in the world did I put this file?* In contrast to the systems above, this project's goal is to organize personal data in an intuitive way. The concept of *episodic memory* encompasses our ability to recall events relative to nearby events. We may not remember a specific date of an event, but we are often able to put it in relation (before, after) to a more important event (birthday, travel, 9/11,...).

*Stuff I've Seen* uses this wisdom and correlates a time-line view of a user's information items with milestones (that are more or less specific to the user).

#### 4.2 Description

The result of this method is depicted by fig.4. We see that all personal files (including e-mails) that correspond to the search query are displayed in order on the right side of the window. The particularity of this presentation lies on the left side, where important events (*landmarks* drawn from news headlines, holidays, calendar appointments and photographs), are displayed in order to give a sense of structure to the personal data.

The user may also zoom in and out of the view, which will change the granularity of the dates displayed. Hovering over an item displays more information about the object (first lines of text, file path,...).

A great deal of thinking must be put into choosing what landmarks to display. Too many landmarks would saturate the display, too few would render the feature useless. Choosing landmarks that users *really* need is a difficult task. The authors have seen two types of landmarks:

- public landmarks
 

All public landmarks are given a priority ranking, and only landmarks that meet a threshold priority are displayed. The big question is: *how to prioritize these landmarks?* Holidays depend on geographical location, news headlines depend on region, country, area of interest,...
- personal landmarks
 

Personal landmarks are easier to cope with. They can simply be taken out of the user's calendar or photo album. Appointments with high priority will be displayed first and those of lower priority will appear only

The screenshot shows the 'Stuff I've Seen' application interface. On the left is a vertical timeline from 1/20/1998 to 3/12/2002. The main area displays search results for the query 'earthquake', showing a list of items with their dates and descriptions. On the right, there is a search control panel with a 'submit' button, '59 results found', and options for 'AND/OR' and 'fuzzy match/exact match'. A zoom slider and a 'study' checkbox are also visible at the bottom right.

Date	Item Description
3/12/2002	Easter Day
4/15/2001	history.xls
4/3/2001	PowerPoint Presentation
3/10/2001	from Michael B. Smith - Re: Greetings
	from John Smith - RE: Followup from Earthquake Meeting
	from Tim Steven - RE: followup from the "earthquake meeting"
	from Janet S. Hazeltine - Re: Rockin and Rollin ...
	from Bart Thompson - Followup from Earthquake Meeting
	from Bart Thompson - Greetings
	re jcdi 2002-3.txt
	from Richard Roy Bamfordly - Re: Shakin Sue ...
	from Richard Feynman - Re: lost letters
	from Linus R Pauling - RE: quake?
	from Arundati Royald - A bit shaken?
	Proceedings Template - WORD
	from Mathilda Gin - RE: followup from the "earthquake meeting"
	from Salvadore Dall - Earthquake Report
	from Bill Borro - RE: Relevance test review 1
	from Tina Stormrock - are you ok?
	from Guinivere Sorrow - FW: Earthquake
	from Jennifer Silas Strongeye - Earthquake coverage
	from Billy Bottomly - Earthquake
2/28/2001	Seattle Earthquake measures 6.8
2/24/2001	
1/1/2001	"MyLife"
	"MyLife"
	"MyLife"
9/15/2000	"MyLife"
9/15/2000	from Sally Jimi - Re: Non-english Categorization Reference Collections
8/1/2000	
7/21/2000	SIGIR and vacation
1/1/2000	sigir 2000 - venue.htm
1/1/2000	World Celebrates New Millennium
12/20/1999	vacation
	from Hendricks James - RE: Seattle plans
	sigir99_report.txt
	1999-earthquake-graph.gif

Figure 4: Stuff I've Seen: result of the *earthquake* search query

when zooming in. The number of photographs showed will also depend on the zoom level.

### 4.3 Remarks

The evaluations conducted by the authors showed that users found information more quickly with some landmarks displayed rather than without. Unfortunately, this test was realised within the Microsoft staff, so supposedly, the testers were all highly-trained computer scientists. The whole purpose of having information stored in a time-wise manner, is that people with little or no knowledge of how folder hierarchies work, would find their way quickly.

At the time, the *Stuff I've Seen* software was quite basic and not very user-friendly. The goal of the project was not to have a wonderful interface, but just to prove that adding landmarks to a timeline is a helper when looking for personal information. In that sense, it was a success.

However, the question of *what landmarks should be displayed?* has not been answered thoroughly. An interesting task would have been to test the program on common users' messy computers.

## 5. TIME-MACHINE COMPUTING

The last system is very different from the timeline visualisations that have been presented so far. It is based on the observation that many people have a messy desktop (full of documents and links, ...).

### 5.1 Objectives

A big drawback that exists when we store a file in a folder somewhere on the disk is, we lose the context in which the file was used. For example, while writing these lines, the author had the following things on his desktop:

- the latex version of this document
- the .dvi version of the document
- the different screenshot picture files
- the e-mail client open on the last e-mail sent by the responsible of the seminar
- a web browser opened on the webpage of the seminar course

All these items could just remain on the desktop for ease of access, but that desktop would quickly become saturated. So we store files in directories, which can be a cumbersome task (finding the right location for a file, finding an appropriate folder name, ...), as much as the retrieval of these files is often laborious (*what was that folder name again?*).

The idea of *time machine computing* is the following:

Keep all your files on the desktop. If you've stopped using the file, move it to the trash! If you want to have that file back, set the desktop time to the moment you were working on it and it will reappear on your desktop, with all the other files you were working with at the same time.

*Since our personal activity is tightly coupled to the flow of time, there are a number of reasons why time-ordered systems work. However, if we store all the information in a 1D list, we give up many possible advantages of 2D graphical interfaces. In many cases, what we need is not only to find files but also to reconstruct the activity status (what we were doing at that time). For this reason, time-ordered lists are more suitable for archiving data than for providing workspaces. In addition, there can still be ambiguity for ordering. If the list is sorted according to file creation date, a thesis you have been working on for a year would be listed far from the current position of the time-ordered list.*<sup>3</sup>

### 5.2 Description

*A system based on Time-Machine Computing allows a user to visit the past and the future states of computers. When a user needs to refer to a document that he/she was working on at some other time, he/she can travel in the time dimension and the system restores the computer state at that time. Since the user's activities on the system are automatically archived, the user's daily workspace is seamlessly integrated into the information archive. The combination of spatial information management of the desktop metaphor and time travelling allows a user to organize and archive information without being bothered by folder hierarchies or the file classification problems that are common in today's desktop environments.*<sup>4</sup>

A new software, called *TimeScope*, supporting *Time-machine computing* was designed to eventually replace existing user environments (e.g. the Windows desktop environment). An illustration is on fig.5.

All the items (files icons, application icons, PostIt notes) are placed on the desktop, removing the need for a folder hierarchy.

The user can travel through time using the time-travel dial in the top-right of the screen. He can also select an object and go to the time it was created. All modifications of the desktop are archived automatically.

Inter-application exchange of time information also allows the user to find, for example, the webpage he was visiting at the time.

TimeScope allows navigation in the future, so a PostIt note becomes a reminder.

TimeScope includes search fields that makes finding of files through time easy. "More common" calendar and timeline views are available to visualize the desktop evolution through time.

Using a positioning device, TimeScope can also be extended to record the location of events. It is then possible to find items through location, as well as through time.

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<sup>3</sup>These lines were extracted from the original article [4]

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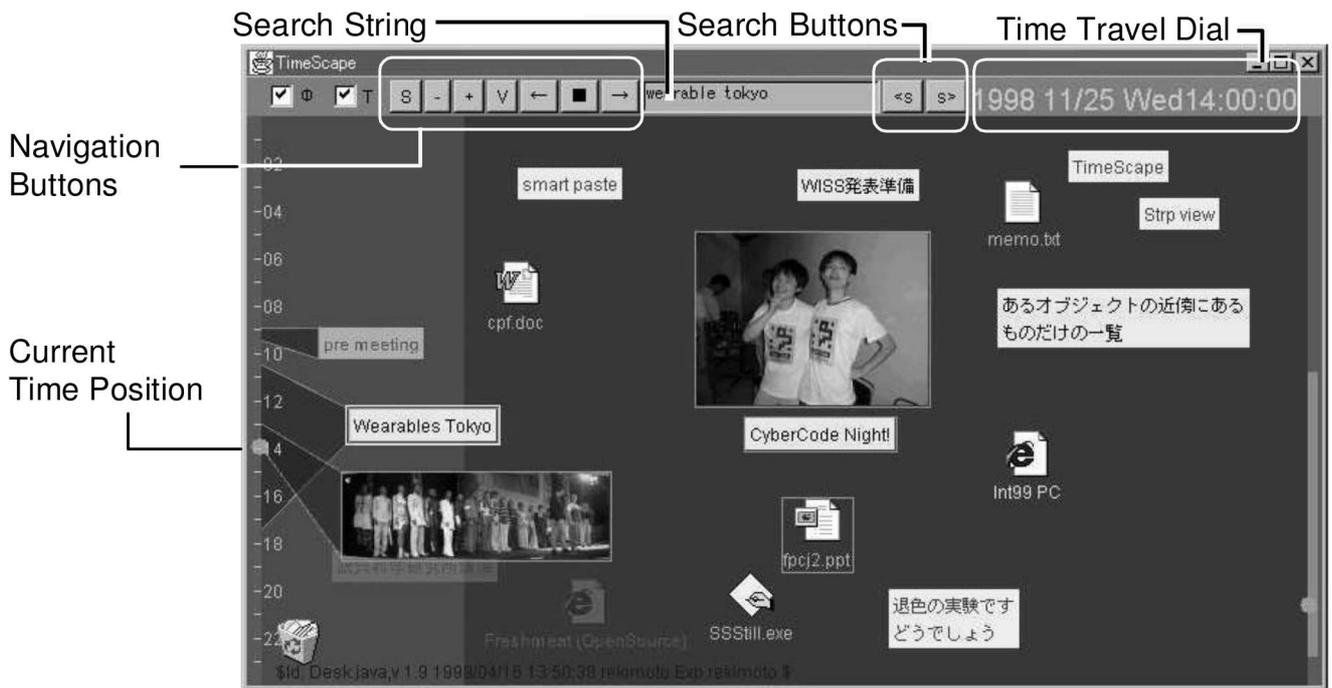


Figure 5: Time-machine computing: a screenshot of the TimeScope software

### 5.3 Remarks

No serious user evaluation had been done at the time of writing of the paper. Nevertheless, the authors wrote down some feedback they got from their co-workers. *They seem to have liked it* is what we can extract from the study. Some users would have liked to *alter the past* whereas past images of the desktop are immutable. Another issue is that users were uncomfortable sending items to the trash.

The authors talk little about the rate at which the desktop is saved to the memory. There is always a trade-off between the granularity of the timeline and the memory usage. In particular, large files such as videos may have to require special treatment to avoid a fast saturation of the memory.

The fact that there exist files that are not classifiable by date (e.g. a music album) is also put aside. A system relying completely on a time-based archival method seems limited.

However, the project comes with no doubt from a great idea, but gives the impression of being an uncompleted job.

## 6. CONCLUSION

The overview of these papers show that there exists a certain dynamic in favour of time-base visualisations.

The first two projects are mostly oriented on specific uses such as medical or court records, and don't seem to be adaptable to suit our needs, namely personal information management. However, the way that these systems are designed is of great interest and some concepts can be applied to personal documents, notably the timeline feature.

In contrast, the last two projects pinpoint our specific sub-

ject, but are both quite far apart. *Stuff I've Seen* uses the very classical timeline structure, while *TimeScope* uses a totally awkward navigation method based on desktop images. None of these two systems seem to be ready for real-life yet, but the concepts must be developed further. What next? Are users ready for that kind information presentation? Not sure ... The article describing *TimeScope* is ten years old...

## 7. REFERENCES

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