



# Research on Personal Life Data Interface Design Based on Timeline Narrative

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**Abstract.** This paper discusses how to integrate data visualization into narrative stories in a limited interface of personal life data, and studies the method and significance of integrating timeline narrative into information visualization design. Based on the literature method, this paper analyzes the relevant theories of personal life data, timeline narrative and visualization, and the case study of timeline interface design, this paper proposes two timeline narrative visualization design methods. Through the investigation of 16 design space combinations, the feasibility combination design scheme of narrative visualization design elements of personal life data is further verified: time expression + relative time scale + faceted time design in narrative data visualization design based on event interoperability, linear time expression + continuous time scale + single line time design in narrative data visualization design based on time continuity. It lays a foundation for the research on narrative visualization of personal life data, and further looks forward to the future prospects of narrative visualization.

**Keywords:** personal life data · timeline narrative · visualization · interface design

## 1 Introduction

As people increasingly use data tracking technology to collect, record their personal location and conduct self-data management, the value of data-driven self-awareness is slowly increasing, and people are beginning to use various technical practices to help data understand themselves (data self-awareness). More and more people want to quantify their data in the form of storytelling and present known information in an appropriate and attractive way. This paper aims to explore the design method of personal life data in the timeline narrative visualization space.

## 2 Timeline Narrative and Visual Design Definition

### 2.1 Concept of Timeline Narrative

Time is the fourth dimension, time and space are inseparable 1. Most of the timelines are still static, and it is difficult to integrate these event data into a larger data-driven story composed of multiple narrative points. Since the 18th century, the timeline has

developed to be known and understood by more people. It has even played a key role in ‘the linearity of historical time, the logic of time and the modern understanding of the flow from the future to the past’, and has enabled people to compare different events in history.

The Oxford English Dictionary defines narrative as “the narrative of a series of events, facts, etc., given in order, and the establishment of connections between them 15.” Narrative is about things, through language, text, sound, image and other ways to express the original appearance of the event, is our basic way of expression and a way of communication with others, but also an important way for people to understand the world and self-understanding. A storyteller may incorporate multiple timeline designs into a single story, helping to maintain story coherence through smooth animation transitions and by helping viewers interpret unfamiliar visual coding 8. Timeline narrative is a narrative way, which presents events and plots in chronological order to form the framework of the story. This narrative method can help readers or audiences to understand the cause, process and result of the event more clearly, and it is easier for people to understand the relationship and influence between events, which helps readers or audiences to better understand and experience the events and plots in the story.

## 2.2 Narrative Visualization Design Definition

Narrative is to construct a series of events into meaningful stories 2. The narrative structure is the most natural and friendly text structure for human beings (Gottschall, 2012) 9. On the basis of time and space elements as clues, the interface information design of personal data of narrative structure is presented in the form of tasks and themes 3. In the data age, we are more inclined to organize the flow of events in a narrative structure, where the narrative structure is a set of events about one or more entities in chronological order.

One of the most common parameters in visualized data is time 4. Visualization presents vivid data in a storytelling narrative way, forming a narrative visualization. The visual feature is to provide the ability to tell stories, which has a guiding and emphasizing role, and is reader-oriented. The interactive storyboard and interactive narrative visualization (such as interactive slides 15) designed by Lu et al. 10 visualize the overall time evolution and salient data features of time-varying datasets with a clear storyboard layout. Brehmer et al. 14 proposed a timeline visual design space for story narration with both expressiveness and effectiveness, and realized a smooth animation transition effect between narrative nodes. The information is prioritized and sorted by spatial sorting, animation and prompt default view. 11 15. By emphasizing the visualization technology and visual function of the storyline, visual prompts and visual combinations, a timeline narrative design space for personal data events in daily life is proposed 12. In narrative visualization design, visual elements such as various charts, images and animations, as well as auxiliary elements such as text descriptions and annotations, are usually used to express information and stories.

### 2.3 Definition of Personal Life Data

The scope of personal data is very wide. Among the many laws and regulations on EU protection, the definition of personal data is as follows: ‘All information related to the existence of a natural individual can be identified or has been distinguished<sup>5</sup>. Jones and others pointed out that data can be personal information in many ways, including ‘owned by me’, ‘about me’, ‘pointed to me’, ‘published by me’, ‘experienced by me’, ‘related to me’<sup>6</sup>.

People generate data all the time in real life, such as daily working status, physiological status data and interaction data between people. We call these data closely related to individuals as life data. These data can be collected and stored through a variety of sensors, devices and applications, and provide users with information and insights about themselves. The sources of personal life data include traditional paper media data, data generated by wearable devices in environmental conditions, and ‘digital traces’ of behavior data left by people in digital products. This paper mainly studies the personal life data recorded and retained in digital products. How to effectively manage personal life data with narrative visualization to help users better understand themselves and purposefully manage daily behaviors has urgent practical needs and practical value.

## 3 Innovative Opportunities Based on Timeline Narrative Visualization

### 3.1 Case Analysis of Timeline Narrative Visualization Interface

ChronoZoom is an educational tool for teachers and students who want to treat historical events correctly. To find articles, images, videos, sounds and other media forms of data. ChronoZoom enables users to record history by creating timelines that span from billions of years to a day or two. The ChronoZoom Central European Nuclear Research Center case records the events of each officer’s experiment from 196 to 2013. It is divided into four topics(a): discovery, calculation, machine, and experiment. Multiple event data are recorded in chronological order within each topic. The scrolling mouse timeline can be scaled to display content. The theme data event content is placed in a ‘circle’ shape(b), and can be divided into multiple small themes, all displayed in video, pictures, and text(c). The design of the slider can read the content up and down, which greatly saves the interface of the digital space. According to the theme screening, the custom time direction is from top to bottom, from bottom to top, from left to right, from right to left, showing multiple interpretations. Support download and share functions, as shown in Fig. 1.

TimelineJS is an open source tool that anyone can use to create a visual rich timeline. As shown in Figs. 2, the historical evolution of the user interface is recorded in a timeline in the ‘revolutionary user interface’. In 1900, sponge divers used an excellent mechanical computer to track the solar system cycle without any input (a). By 1946, the first real modern computer keyboard was used as input. The 2012 speech recognition interface has been tested and improved (b). The TimelineJS is divided into two parts: the content and the timeline. The picture /videos and texts in the content part are arranged left and right. The timeline below is horizontal linear, and the time scale is year. Each event is



**Fig. 1.** ChronoZoom screenshot (source: <https://www.microsoft.com/en-us/research/project/chronozoom/videos/>).

designed with small beads. Click on the thumbnail of the content block on the timeline, and display the detailed information above. The timeline provides page navigation and shows the location of the current event throughout the story.

Preceden has always been a tool for learning history. The layer and color options can see the historical background of the event at a glance. Quickly add topic events, customize the timeline for the topic and create a timeline that can be inserted into the presentation and shared. The horizontal timeline shows different themes. As shown in Fig. 3, the historical events of the Second World War are described. On the theme of leadership, beautiful color blocks are used to show the time of different leaders in office. On the theme of important events, beautiful color blocks are used as tips to display the title, time and scene pictures of events.

Tiki-Toki is a web-based software for creating interactive timelines that integrate images and videos. It can embed videos and share timelines with others, and fill in some basic information (such as title, introduction, start date and end date). Add content, including text, images and videos. Categorize events and highlight them with color code. The horizontal linear time axis, with the year, month, day and week as the time scale, uses the design method of the pop window to show the information of the theme event, as shown in Fig. 4.

Through the analysis of four time axis interface cases, the interface theme and data visualization, time representation, time scale, time layout and other dimensions are compared and analyzed, as shown in Table 1. Therefore, based on the theme content, this



**Fig. 2.** TimelineJS Screenshot (source: <https://timeline.knightlab.com/examples/user-interface/index.html>).

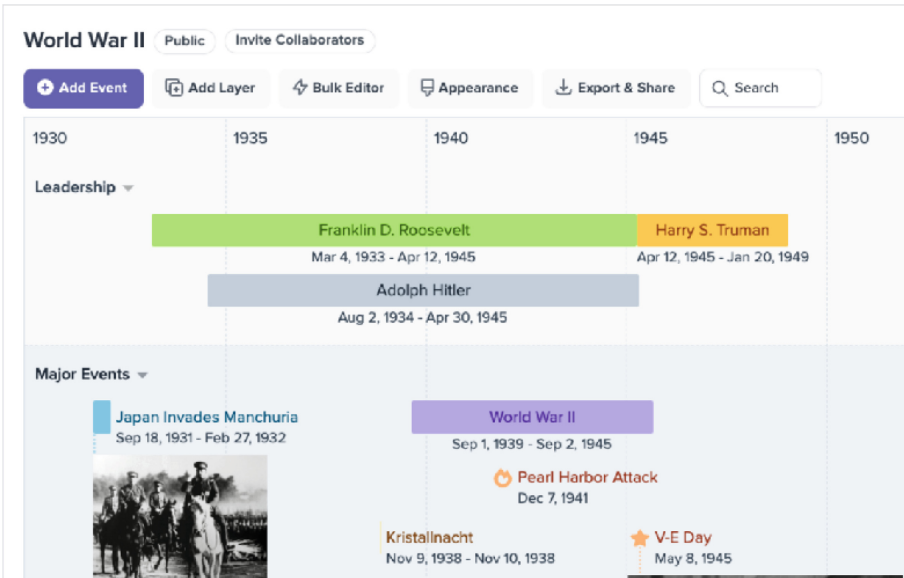


Fig. 3. Preceden screenshots (source: <https://www.preceden.com/signup>).

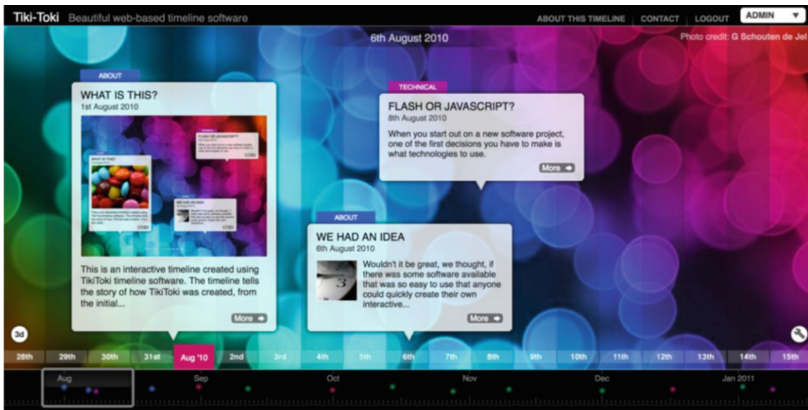


Fig. 4. Tiki-Toki Screenshot (source: <https://blogs.umass.edu/onlinetools/knowledge-centered-tools/tiki-toki/>).




paper proposes two timeline narrative visualization methods: narrative data visualization based on event interoperability and narrative data visualization based on time continuity.

### 3.2 Design Space Analysis

This paper proposes two timeline narrative visualization methods based on the theme content proposed above. In the design of personal life data interface, which time representation, time scale and time layout are used for combination. In this paper, linear

**Table 1.** Comparative analysis of time axis interface cases ( Source: self-made)


<i>item</i>	<i>content</i>	<i>representation</i>	<i>scale</i>	<i>layout</i>	<i>visualization</i>
ChronoZoom	time	linearity	relative scale	single line	Bullet window, slider,
TimelineJS	event	grid	sequential scale	Split timeline	Color block, drop-down box
Preceden	event	grid	relative scale	Split timeline	Small bead point, slider,
Tiki-Toki	time	linearity	sequential scale	Split timeline	round ^ shape,

expression + grid expression , relative time scale + continuous time scale , single line time layout + faceted time layout , 16 kinds of color plates representing the design of feasible time axis are proposed, and 200 different industries, ages, and other users are sampled. In order to evaluate the feasibility of time representation, time scale and time design combination. This paper puts forward the following four questions: Does design achieve the purpose of driving self? Does the timeline design help users understand? Is the timeline design consistent with the narrative point of user-generated data? Is this design universal?

Through the investigation of each combination and problem of time representation, time scale and time design, it is unexpected that most users think that linear time expression + relative time scale + faceted time layout is the best in narrative data visualization based on event interoperability, as shown in Table 2. Most users choose linear time expression + continuous time scale + single line time layout in narrative data visualization based on time continuity, as shown in Table 3.

## 4 Timeline Narrative Personal Data Interface Design Innovation Method

Through the above research, two timeline narrative visualization methods based on theme content are proposed.

Narrative data visualization based on event interoperability adopts linear time expression + relative time scale + faceted time layout . Personal life data is recorded in the form of event dimensions, such as learning events, health events, tourism events, etc. An event is usually not only a date, but also a time period like a story narrative, consisting of a start date and an end date. Duration, or cyclical or even irregular. In the design method, based on the linear time axis, the time scale design is carried out according to the year, month and day. Multiple time axis events can appear on a time node, such as a person’s travel event biography, recording that they live at the same time. They can be linked and integrated into a common interactive slide show format for comparison. Through visualization, including annotations (labels, pointers, text, color blocks, etc.) or narration, the event is clearly highlighted and emphasized, and the interoperability narration of the event is realized.

**Table 2.** Spatial combination analysis of narrative data visualization of event interoperability ( Source: self-made)

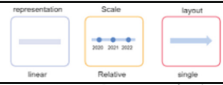

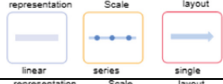

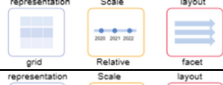
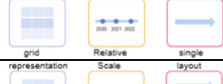


<i>Design space combination</i>	<i>Driving self-purpose ?</i>	<i>understand ?</i>	<i>Generate data narrative points ?</i>	<i>Univer-sality ?</i>	<i>total</i>
	50/200	60/200	21/200	60/200	182
	80/200	82/200	120/200	88/200	353
	10/200	10/200	40/200	12/200	72
	30/200	14/200	20/200	28/200	92
	10/200	22/200	14/200	4/200	50
	6/200	8/200	11/200	5/200	30
	8/200	6/200	5/200	6/200	25
	6/200	8/200	9/200	5/200	28

Narrative data visualization based on time continuity, using linear time expression + continuous time scale + single line time layout . The content of the linear sequence is very intuitive, and the dots show uncertain dates. When creating a timeline data set, users can tell people the time when things happen by naming the hours of the day, even minutes, seconds or nanoseconds. The use of pop-up windows, text box annotations, sliders, multiple interpretations, and smooth sliders can help users only look at the past, present, and future, maintain the coherence of the story, and can do a narrative point to the next narrative point. The context helps users understand unfamiliar visual coding.

## 5 Conclusion and Future Work

In today’s environment where personal life data is exploding, people want to record their own data, record their own life data in a narrative form, and through visual presentation, users can freely explore their own data. This paper proposes two timeline narrative visualization design methods and further verifies the feasible combination design scheme

**Table 3.** Spatial combination analysis of narrative data visualization design in time continuity ( Source: self-made)

<i>Design space combination</i>	<i>Driving self-purpose ?</i>	<i>under-der-stand ?</i>	<i>Generate data narra-tive points ?</i>	<i>Uni-versality ?</i>	<i>total</i>
	12/200	10/200	10/200	5/200	37
	10/200	30/200	21/200	20/200	81
	90/200	70/200	110/200	80/200	370
	30/200	32/200	35/200	70/200	112
	30/200	14/200	5/200	4/200	53
	10/200	11/200	6/200	5/200	32
	10/200	3/200	4/200	6/200	23
	6/200	10/200	9/200	10/200	35

of narrative visualization design elements of personal life data according to the characteristics of personal life data: time expression + relative time scale + faceted time layout in narrative data visualization design based on event interoperability, linear time expression + continuous time scale + single-line time layout in narrative data visualization design based on time continuity. The viewpoints proposed in this paper hope to lay a foundation for further research on the narrative visualization of personal life data. In future research, we hope to explore how data can be more effectively integrated into stories? How to visualize and share personal life data with personal life logs on the basis of timeline?

### Bibliography

1. Fulda, Johanna. “The Line of Time : Backgrounds and Usage of Event-Timelines.” (2014).
2. E. Segel and J. Heer, “Narrative Visualization: Telling Stories with Data,” IEEE TVCG (Proc. InfoVis), vol. 16, no. 6, pp. 1139–1148, 2010.
3. Lianxian Qin, Ganwei. Research on information integration design of personal data APP based on narrative structure [ J ].Industrial Design, 2020, No.163 ( 02 ) : 58–59.J.



4. Hullman and N. Diakopoulos, “Visualization Rhetoric: Framing Effects in Narrative Visualization,” *IEEE TVCG (Proc. InfoVis)*, vol. 17, no. 12, pp. 2231–2240, 2011.
5. Qi Aimin, Wang Jiyan. The application and extraterritorial effect of personal information protection law in the era of big data [ J ]. *Social scientist*, 2015 ( 11 ) : 101-104.
6. Huang Guobin, Zhang Shasha, Yan Xin. Research on the conceptual category and basic types of personal data [ J ]. *Library and information work*, 2017,61 ( 05 ) : 41-49.
7. Jones W . The Future of Personal Information Management, Part I: Our Information, Always and Forever[J] . *Synthesis Lectures on Information Concepts Retrieval and Services*, 2012, 4(1):1-125.
8. C. D. Stolper, B. Lee, N. Henry Riche, and J. Stasko. Emerging and recurring data-driven storytelling techniques: Analysis of a curated collection of recent stories. Technical report, Microsoft Research, 2016.
9. Gottschall J. The storytelling animal: How stories make us human[M]. Houghton Mifflin Harcourt, 2012.
10. Lu A D, Shen H W. Interactive storyboard for overall time-varying data visualization[C] //Proceedings of the IEEE Pacific Visualization Symposium. Los Alamitos: IEEE Computer Society Press, 2008: 143–150
11. J. Hullman and N. Diakopoulos, “Visualization Rhetoric: Framing Effects in Narrative Visualization,” *IEEE TVCG (Proc. InfoVis)*, vol. 17, no. 12, pp. 2231–2240, 2011.
12. Lianxian Qin . Research on event timing information design method and its application of personal life data [ D ]. Guangdong University of Technology, 2020.DOI : 10.27029 / d.cnki.ggdgu.2020.000694.
13. F.B. Viegas, M. Wattenberg, F. van Ham, J. Kriss, and M. McKeon. “ManyEyes: a Site for Visualization at Internet Scale.” *IEEE TVCG (Proc. InfoVis)*, vol. 13, no. 6, pp. 1121–1128, 2007.
14. Brehmer M, Lee B , Bach B, et al. Timelines revisited: a design space and considerations for expressive storytelling[J]. *IEEE Transactions on Visualization and Computer Graphics*, 2017, 23(9): 2151-2164
15. E. Segel and J. Heer, “Narrative Visualization: Telling Stories with Data,” *IEEE TVCG (Proc. InfoVis)*, vol. 16, no. 6, pp. 1139–1148, 2010

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