

A Presence Timeline

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Abstract

This paper describes an ISPR-sponsored project in which an online, interactive, multimedia timeline of events related to telepresence is being created and refined. The Presence Timeline includes events in five categories (Technology, Ideas, Culture, Institutions and Literature) and is being designed to provide new perspectives on the history and evolution of the concept and phenomena related to it, serve as a pedagogical tool to introduce presence to scholars, students and professionals in diverse fields, and reveal trajectories of events to predict and possibly shape how future events involving presence will unfold. After a brief introduction, the procedures and design decisions of the project along with early conclusions regarding it, are presented and discussed.

Keywords: Presence, timeline

As the work in any field advances, the individuals and organizations that conduct the scholarship, develop the innovations, and utilize both, understandably focus on their particular projects and day-to-day tasks. But they can benefit from pausing to look back (and ahead) at the larger trajectories of the field. One of the most common and potentially useful tools available to accomplish this is the timeline. This paper outlines an ambitious effort to develop a timeline for (tele)presence. Following a little background on timelines and their use, the paper reviews potential benefits of a presence timeline, describes the process and tools used to create the current version, and outlines lessons learned and future steps for the project.

1. Timelines

While the timeline seems intuitively logical today, this visual representation of events occurring in different places over time using a straight line with equal intervals did not emerge until the 18th century, following advances in astronomy and cartography, that modern timelines emerged (Rosenberg & Grafton, 2010). In an era in which

sophisticated and readily available computer software can manifest nearly any plan for a novel and creative display of information (see Tufte, 1997, 2001), representing evolution and change in virtually anything *without* timelines is hard to imagine.

A complete list of timelines would be impossible, but timelines have been used to display developments in fields including anthrax research (Morris, 2005), work-family ties (Pruitt & Rapoport, n/d), agriculture (Agricultural Research Service, 2008), operations research (Gass & Assad, 2005), genomics (Collins, Green, Guttmacher, & Guyer, 2003), electronic commerce (Rico, Sayani, & Field, 2008), the movement toward Open Access to science and scholarship (Open Access Directory, n/d), public relations (Harlow, 1980), stem cell research (Yong, 2011), and history (Gascoigne, 2001). They are common in both the humanities (e.g., Brown, 2010; Drucker & Nowvieskie, 2005) and the hard sciences (*Nature* publishes a regular feature, “Nature Milestones,” n/d). Timelines are also used to illustrate the history and evolution companies, by the companies (e.g., Microsoft Corporation, 2012) and the press (e.g., WSJ Research, 2012).

A few timelines involve telepresence, but they are either focused on only technology (Dickert, n/d; Gall, 2011; Thurston, 2008) or corporate history (Cisco, n/d), or only address telepresence indirectly (Packer & Jordan, 2000).

2. Benefits of a Presence Timeline

Developing and maintaining a timeline of a field, including the many facets of presence, has many benefits.

- Placing events related to presence in a single chronology would reveal the historical development of the concept, theories and phenomena around it, giving us a better view of how and when it appeared in history and how it has evolved over time.
- It should also demonstrate and clarify the types of influences that have come to bear on those concepts, theories and phenomena.

- Having to decide which events to include in the timeline should help us answer questions raised in many contexts regarding what does and does not constitute a presence experience or technology.
- A timeline would combine input from the many academic fields and industries related to presence, providing a vivid image of that diversity; the process and result should help us learn and understand the reasons for our diverse views and priorities regarding presence and build a sense of community.
- The timeline could also be used to introduce presence to those in other fields (especially since so many academics and professionals conduct work related to presence concepts and phenomena without using or knowing the term).
- It could also be an engaging pedagogical tool to help teachers introduce students to presence.
- And a timeline would allow us to see a trajectory of events and predict how future events involving presence will unfold, which might even help shape those events.

3. Method

At a panel near the end of the ISPR 2011 conference in Edinburgh, Scotland (Lombard, 2011), attendees divided into groups and reviewed lists of potential items to be included in a presence timeline. The items, drawn from a variety of sources including an article about a ‘core literature’ in presence (IJsselsteijn, Lombard, & Freeman, 2001) and google searches, were divided into five categories:

- ideas (in subcategories of conceptualizations/theories regarding mediation, futurist visions of presence experiences before they exist, concerns about effects of presence, etc.)
- publications (e.g., Marvin Minsky's 1980 article in *Omni*)
- technology (e.g., Cisco's 2006 TelePresence conferencing product launch)
- institutions (e.g., the EU Presence FETs, the 13 Presence conferences and the founding of ISPR)
- culture (e.g., the release of presence-related films such as *The Matrix* [Wachowski & Wachowski, 1999] and *Blade Runner* [Scott, 1982])

Matthew Lombard and Ingi Helgason of Napier University provided a brief overview of the project and

guided a discussion of the appropriate criteria for the inclusion/exclusion of items and categories and then each group of attendees developed nominations for items and categories they believed should be added, removed or changed. Each group was specifically asked to include suggestions for relevant events predicted to take place in the future.

Following the conference, Temple University doctoral student Stephanie Palmieri compiled the written responses and Darren Bau-Madsen began developing the actual timeline using the procedures and parameters described below. The goal was, and is, the creation and refinement of a rich, interactive, multi-media resource that users in the presence and broader academic and professional communities can search and update (via moderation), all made accessible via the ISPR web site.

3.1. Timeline Software.

A wide variety of specialized tools are available for the development and display of timelines. Timeglider (<http://www.timeglider.com>) was selected for the Presence Timeline project for a variety of reasons, the most important of which follow here. Timeglider is designed to present general-purpose historical timelines; many other tools cater to more specific purposes, such as for project management, genealogy, or organizing personal media collections. It also balances simplicity and sophistication: The presentation to the end-user is generally straightforward, but also highly customizable. Moreover, Timeglider handles large amounts of data—timelines with a large number of events—relatively well by, e.g., sizing events based on their relative importance and allowing the user to pan or zoom. Timeglider is available either as a Web application, or a JavaScript widget (Timeglider JS) that can be customized, extended, and embedded within Web pages. Finally, Timeglider is free for non-commercial purposes. In short, Timeglider was selected for its aesthetic appeal and flexibility, its efficient display, its ease of use, and its low cost.

As noted, a benefit of Timeglider is that it comes in two forms: a Web application and a widget, Timeglider JS, and each has advantages and disadvantages. The principal advantage of the Web application is its interactive interface, which allows the user to see the effects of changes as they are made. However, the interface is not well suited (a) to changing many events at once, or (b) to ensuring that events are presented consistently. For example, if a change in style requires that all event titles be revised, opening a separate dialogue to change each event could be cumbersome.

Alternatively, to add an image or icon to all events in a particular category, developers would have to change each individual event.

In contrast to the Web application, the Timeglider JS widget offers many customization and data management options. The widget is simply a JavaScript program that generates dynamic HTML, so developers can use common tools to customize its appearance and behavior. For example, JavaScript can access the underlying timeline data to augment the presentation, and Cascading Style Sheets (CSS) can customize the timeline's appearance.

Whereas the Web application provides data entry and editing, storage, and presentation, the Timeglider JS widget is a presentation tool, displaying data from an external source. As a result, the developer must supply a source—a file in either JavaScript Object Notation (JSON) or HTML table format—that contains the timeline data.

The decoupling of data and presentation with the widget has several useful consequences. First, the developer can manage the data in any format from which a compatible file can be derived. For example, a spreadsheet or database can facilitate large-scale changes and ensure consistency among events, and software or scripts can export the timeline data to the file. Second, the timeline data are stored separately from the timeline, so they can be copied, divided or filtered, and moved to different platforms easily. Third, the developer can add fields to the data. This additional information is useful, e.g., for managing events, structuring content, and otherwise extending the widget's capabilities.

The principal disadvantage of Timeglider JS is that it requires some technical savvy. Creating a data file from a spreadsheet may require scripting; embedding, customizing, and extending the widget requires Web development expertise. In short, the Timeglider Web application limits data management and display options, but is easy to learn and use, whereas the widget is flexible and may simplify tasks with large data sets, but requires technical expertise and work to build the supporting tools.

4. Data Management.

Microsoft Excel was chosen to manage the data for the Presence Timeline because it is powerful, flexible, mature, and widely available spreadsheet software. Although it offers advanced features, users easily can learn and execute basic tasks, such as data entry.

As discussed above, Timeglider software lacks some features of spreadsheets that are useful for managing timeline data. With a spreadsheet users can add and modify events more easily, particularly when many are involved. They can use one set of events to generate different presentations. They can add properties that are not supported by the timeline software. Users need technical expertise to implement some advanced features, but once those are implemented, basic tasks remain simple for new users to learn and perform.

The Excel workbook developed for the Presence Timeline is designed to make basic tasks (e.g., adding and editing events) easy, to make data processing transparent, to be flexible, and to allow the user to control the spreadsheet as much as possible without programming. To these ends, the workbook is divided into eight sheets: two for user input, two for output previews, two for spreadsheet and output settings, one for timeline metrics, and one with buttons that run scripts.

The data file for Timeglider JS can contain multiple timelines, and each timeline is associated with a collection of events. Timelines and events each have a set of properties that control display and content and capture other information. The most important of these properties, for our purposes, are the following: title, description, start and end dates, importance, and category. The title is the label shown in the primary display of the timeline, whereas the description contains additional content shown when the user clicks on an event. The importance property is a number from 0 to 100 that can control the relative size of the event's title on the main displayed timeline. The date properties control the location and span of the event on the timeline. The category property associates the event with a single class of similar events; it can ensure that all like events are displayed similarly and can associate them with an entry in a legend displayed on the timeline.

4.1. Timeline Content.

4.1.1. Categories. Each timeline event can belong to one of several categories, but for some events, more than one category is plausible. These ambiguities are resolved in two ways. First, events can be divided into more granular constituent events whose category membership is clearer. Second, only the best or most relevant category is assigned, and the less relevant category can be added to the event's tags property. Ultimately, each event must be assigned to one and only one of the following categories: technology, ideas, institutions, culture, literature, or people.

- **Technology:** The technology category captures milestones of presence technologies, including influential prototypes and commercial introductions. It does not include unimplemented designs, fictional technologies, or other cultural products created with or utilizing new technologies. For example, the category includes video gaming consoles and hardware, but is unlikely to include games developed for them. The technology category is the largest in the Presence Timeline.
- **Ideas:** The ideas category contains conceptualizations of presence and associated constructs; visions of or predictions about future presence technologies, experiences, and effects; and unimplemented designs of presence technologies. It does not contain, for example, fictional depictions of presence experiences and technologies.
- **Culture:** The culture category includes works of art, literature, television and film that are noteworthy as depictions of presence or as vehicles of presence experience and awareness.
- **Institutions:** The institutions category captures important events concerning presence-related organizations, such as ISPR and Peach. It can also include organizational activities in industry, such as the establishment of private-sector research laboratories and companies that develop presence technologies.
- **Literature:** The literature category captures important

publications in the scholarly presence literature. It does not include, e.g., depictions of presence in popular fiction.

- **People:** The people category contains individuals who have influenced the development of presence research, technology, and culture. However, it currently contains few events because of the preference to represent events in terms of products rather than producers, as discussed further below.

4.1.2. Criteria for including events. Additions and removals of events have been informed by consideration of each event's importance. Criteria for including events help to maintain the coherence and cohesiveness of the timeline by setting its boundaries and preventing the timeline from growing to include an unmanageable number of events.

The importance of an event is evaluated in terms of four factors. The *relevance* of an event refers to the salience or centrality of presence in it. The *influence* of the event refers to its subsequent effects on the development of ideas and technologies and on culture and society. The *precedence* of an event refers to its temporal relation to other similar events, the degree to which it is original, seminal, or revolutionary. An event is high in precedence when it represents a dramatic change in thought, technology, or culture, rather than an incremental one.

For example, one could argue that the iPad is little more than an incremental advancement beyond smart phones and other touch-screen and handheld devices.

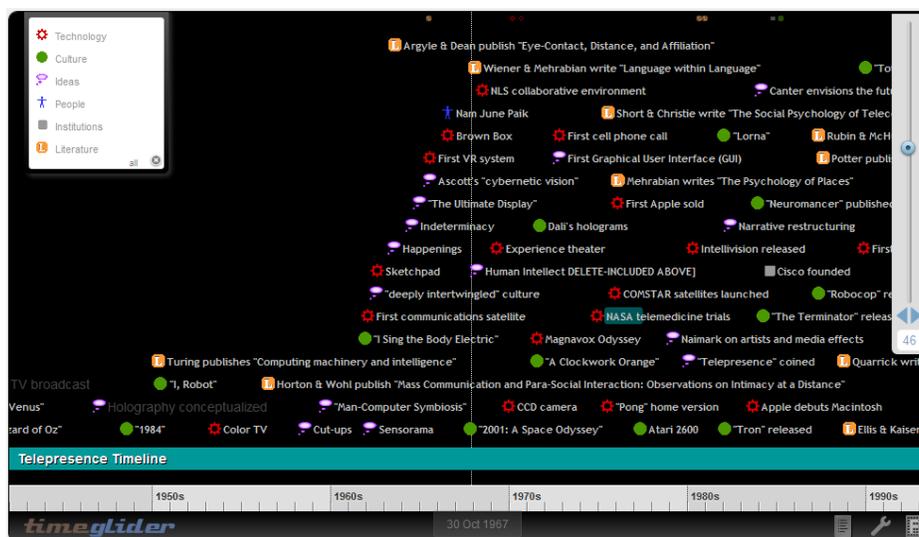


Figure 1. The Presence Timeline, with the timeline legend in the upper-left corner and zoom controls along the right edge.

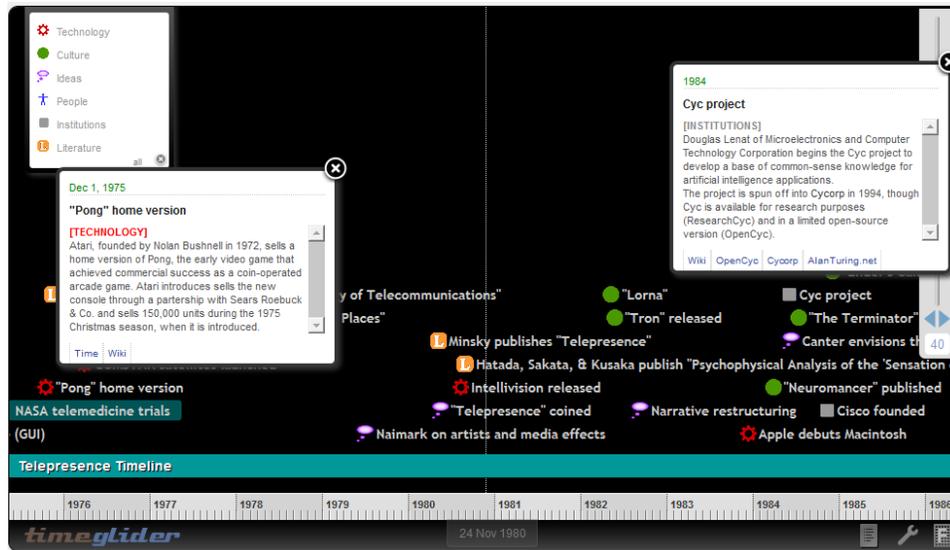


Figure 2. The Presence Timeline, zoomed in relative to Figure 1, showing event details in pop-up windows.

Moreover, it could be argued that it is no more than moderately relevant to presence, given that its most common uses—such as reading, Web browsing, or playing simple games—do not evoke intense presence experiences compared to, e.g., new video gaming systems. However, granting such arguments, one could also argue that the iPad’s high rate of adoption powerfully influenced the frequency and quality of presence experiences in society and that the iPad has a similar powerful effect on software development. While use of the FaceTime video conference application is not yet common, it may become so. Thus, the iPad might be included in the timeline less for its technological innovation or self-evident relevance to presence than its influence on (current and future) presence experiences in society.

5. Results and Discussion

The current version of the Presence Timeline can be viewed at <http://www.presencetimeline.com> (see Figures 1 and 2). A cursory review of the timeline reveals several noteworthy properties. The early timeline is dominated by technological events, although cultural events begin to appear in the 1920s. The number and diversity of events increases suddenly beginning around 1960. The early portion of this increase, from about 1960 until the early 1980s, is dominated by technology and ideas events. The cluster of ideas events diminishes in the late 1980s, and is replaced around 1990 by the rise of literature and

institutions events, which are very rare in earlier periods. The number of cultural events also increases during this period, although modestly.

The patterns described above suggest several generalizations about the history of presence phenomena and attention. First, it was preceded by a long history of gradual technological and cultural development. That gradual development gave way to more rapid development beginning in the 1960s with important changes in telecommunications, computer interfaces, and electronic gaming. At the same time, a flurry of influential ideas—predictions, explanations, hopes and fears—formed and responded to technological and cultural developments. These intellectual developments achieved formal recognition around 1990, with the formation of the field’s institutions. If we accept this pattern, we might point to the Gutenberg Press—or earlier—as the technological beginning of presence. More importantly, the late 1950s and early 1960s appear to be an important turning point in technological and intellectual development, which could mark the birth of presence as a field of inquiry. Finally, the late 1980s and early 1990s appear to mark the birth of presence as a formal, institutionalized field of study.

These observations demonstrate some of the analysis that the timeline facilitates. However, they should be viewed skeptically, as the content of the timeline requires much refinement. Developing content and other aspects of the timeline has led to challenges, from which important lessons were learned, limitations recognized,

and plans for future work developed. These are discussed in the next section.

5.1. Lessons Learned

A number of challenges arose during the development of the current timeline. In some cases these challenges were purely technical. In other cases, they required stylistic or content decisions that might have been obviated by using different tools. In other cases, they were more or less necessary consequences of imposing a particular view on history. What follows is a discussion of the most interesting and edifying of these challenges and the means by which they were resolved.

5.1.1. Limit the number of events in the timeline.

Presence can be construed very broadly, connecting it to many ideas, technological developments, cultural products, and other events. Thus, a presence timeline without clear boundaries might quickly grow to include more events than the presentation or the user can reasonably manage.

The threat of excess events can be mitigated in at least four ways. First, events can be rejected when they fail to meet the importance criteria discussed above. Second, an event that would be discarded on its own merits can be retained within another more prominent event. Similarly, related events that are not individually important enough to include can be combined to create a new event that is. Finally, the display can be adjusted to make more important events more prominent relative to less important ones.

5.1.2. Divide and combine events to keep important information accessible. As construed here, a timeline presents a set of discrete events, belying the many connections among them. A group of related events might be construed as a single event, or vice versa, and deciding whether to present them individually or as an aggregation is not straightforward.

There are therefore two ways to address these choices:

- Combining events: The Presence Timeline consolidates events when possible to reduce the number of events on the timeline. These consolidated events are labeled with the concept, theory, quote, article, technology or person that is most important or central from the perspective of presence. However, because of the conceptual orientation of the timeline overall, concepts and

theories tend to take precedence over quotes, articles, or people in such cases.

- Dividing events. Single events have been divided into two or more independent events for several reasons. First, a detail in the description of one event might warrant its own event on its own merits—based on its importance to presence. Second, the new event might belong to a category different from that of the original event. Finally, a large temporal separation between the original event and the new event suggests that they should be divided.

For example, Sutherland's description of the ultimate display and the virtual reality technologies he developed might be included in a single event about the ultimate display. However, the idea of the ultimate display and the prototypes that can be seen as attempts to implement it clearly belong to different categories: ideas and technology, respectively. More importantly, the idea and the technologies are likely important enough to warrant their own events. In other cases, however, the technologies and the ideas that inspire them might not be independently important enough to warrant such division.

5.1.3. People versus products. A common example of an aggregated event in the Presence Timeline is one centered around a person, where the constituent events are important, influential examples of the person's inventions, ideas, works of art, etc. The constituent events can be viewed in two obvious ways: aggregated, with a biographical or person orientation; or individually, with a product orientation.

The product orientation implies numerous events, each representing a different product, whereas the person view implies a single event that represents a kind of biography of the producer, capturing the set of products in the event's duration and description. Moreover, a truly biographical presentation might also imply an event properly demarcated by the beginning and end of the person (birth and death), rather than his or her contributions to the development of presence.

Although neither the product- nor the person-oriented approach is intrinsically correct or superior, the product orientation is preferred in the Presence Timeline for three reasons. First, the product orientation aligns better with the Presence Timeline's goals, discussed above. For example, those new to presence will likely learn the concept and its boundaries more readily from exemplars presented directly rather than exemplars nested within a biography. Second, the product

orientation facilitates categorization of events. Some individuals might be readily categorized in terms of their influence within, e.g., culture, technology, or ideas; however, others have made notable contributions to more than one category, and placing them into a single category would obscure information about contributions in other areas. For example, a biographical presentation of Ivan Sutherland's contributions to the field would combine his description of "the ultimate display" (ideas) with his virtual reality system, *The Sword of Damocles* (technology). Third, a product orientation generally yields a clearer, more navigable presentation. It is simpler, for example, to trace the overall technological development of presence by viewing a presentation of the timeline filtered by the technology category than it is to wade through a series of biographical sketches about individuals who have contributed noteworthy technologies. A product orientation places more information about an individual's specific contributions to presence on the surface of the timeline. However, a person orientation has its merits, especially as a way to capture the evolving identity of the field. A worthy future project would be to augment the timeline to include this biographical information.

5.1.4. Keep Event Titles Short. In an early draft of the timeline, the titles of all events were revised to reflect a consistent, coherent style: Each title consisted of a complete clause or verb phrase, comprising at least a verb and a noun—something that happened and something to which it happened, or by which it was performed. As the timeline grew, the display became cluttered, and titles often were unnecessarily explicit, especially considering graphic and typographic cues to, e.g., an event's category. Event titles were therefore revised according to the following guideline: Event titles should be only as long as necessary to convey the core event, implicitly or explicitly, to a user with basic familiarity with the timeline. This approach should yield a relatively compact presentation that remains readily interpretable to the end user. However, it assumes that authors of titles can anticipate what users will or will not interpret easily. Less importantly, it yields titles that are not structurally consistent, as some might contain only noun phrases, others verb phrases or clauses.

5.1.5. Store all events in a single repository. Events have entered the Presence Timeline at different times and in different ways: from surveys or suggestions by diverse project participants, and from dividing and combining events. They were captured in word

processing or spreadsheet files or manually entered on the Timeglider Web site. As a result, it was difficult to ascertain how, when, or why events were added. With a large number of events, other content development tasks, such as eliminating redundancies and inconsistencies or proofreading, became difficult. These tracking and interface problems were addressed by moving the data to a single repository—an Excel spreadsheet—independent of Timeglider. Thus, in addition to other advantages discussed above, using a single spreadsheet or database to store all events, and deriving data files from it, greatly simplifies data management.

5.2. Limitations

In its current form the Presence Timeline has several important limitations which need to be addressed for the project to be considered successful.

5.2.1. Limited community involvement. The Presence Timeline is intended to be a community project, and the community must participate if the timeline is to represent its various perspectives. However, so far the presence community at large has been involved only through a discussion conducted during the ISPR 2011 conference. This problem has been addressed technically by integrating a feedback form into the timeline.

5.2.2. Limited industry involvement. The Presence Timeline and all of its content originated within the academic presence community, and the perspectives of community segments outside of academia have not been captured directly. One such broad segment comprises those in presence-related sectors of industry. Although the perspective of industry might overlap in many ways with that of academia, it is also distinct. The unique contribution from industry might be especially beneficial to those already familiar with the history of presence from the academic perspective.

5.2.3. Gaps in the timeline content. The most time-consuming and difficult aspect of the Presence Timeline project has been the development of content. Identifying relevant events is a critical component of the process and, predictably considering the interdisciplinary nature of the field, there are considerable gaps.

In some cases, gaps in the timeline content exhibit clear biases. One evident bias in the current data is toward Western history. For example, the first event in the timeline is the invention of the Gutenberg press. If movable type belongs in the timeline, then printing

technologies developed in Asia prior to the Gutenberg press might also warrant representation.

5.2.4. Crowding and a lack of importance values.

Although less important than content, the current Presence Timeline has some presentational problems, the most salient of which is crowding of events in the interface. Timeglider automatically forces some events out of the interface when it becomes over-crowded, and the user can zoom in to reduce the number of events that are visible, but these solutions are not ideal. In either case, some events are removed from view. Zooming is preferable on the grounds that the events that disappear do so only because they fall outside the displayed time span. However, zooming in too far prevents the kind of macro-level view of presence history that is a core objective of the project.

Another solution, discussed above, would be to consolidate events. However, this approach might not be feasible—particularly for events within the last few decades—because of the breadth of the concept and the number of perspectives in the field.

A similar, better, solution, is to display the most important information most prominently. Timeglider accomplishes this by sizing events according to their importance values. Presently, no importance values have been assigned, except randomly to demonstrate their effect. Although assigning a single importance value to each event is still limiting (e.g., only one view is represented), it would might allow other more flexible solutions, beyond the Timeglider software.

5.2.5. Dependence on Timeglider.

The design of Timeglider likely has influenced some decisions about what information to capture and how best to represent it. Such effects have been at least partly addressed by using the Timeglider JS widget and managing data separately from its presentation. But the widget is not mature software and has exhibited bugs at times, which may not be resolved since it is not Timeglider's core product. However, as noted above, the timeline data can be readily migrated to other platforms.

5.2.6. Elided information.

Much information that could be represented more saliently in the timeline has been deemphasized or elided entirely out of necessity. For example, representing the history of presence in terms of discrete events elides connections among them and artificially discretizes them in some cases. In a different vein, some classes of information about events have not been included. For example, the map property

in Timeglider JS captures geographical information and uses it to plot a position on a map through integration with Google Maps. This information could be useful for visualizing the ways in which different regions have contributed to the development of presence in different ways or during different time periods.

5.3. Future Projects

5.3.1. Elicit feedback from the presence community.

Most important to the future development of the Presence Timeline is feedback from the presence community. Although the timeline has the technical capability to gather feedback in a convenient way via Web forms, the more difficult problem of persuading the community to view the timeline and respond to it remains. This feedback could not only improve the quality of the content in general, but could also provide specific details, such as importance values for events, to improve the timeline in specific ways.

5.3.2. Engage other communities.

As discussed above, the Presence Timeline lacks input from some important non-academic constituents of the presence community. Attempts to engage these constituents, such as those in industry, might provide useful additional perspectives on existing events, as well as events to which the timeline has not yet attended.

5.3.3. Predictions.

One category which has been planned, but not implemented, is a predictions category, which would capture expectations about the technologies, uses, and effects of presence in the future.

5.3.4. New views and interfaces.

As noted, other visualizations of the Presence Timeline content, which would require additional data or data manipulation, could provide valuable different perspectives. For example, biographical timelines for influential people in the field might help cultivate its identity. However, such visualizations would require much work to systematically tag events and enable filtering. A more powerful approach would be to move the data to an online database that users could query to build their own views. However, until the timeline content is more developed, the effort required to implement such as system is not warranted. The Excel spreadsheet used to store the data already produces charts to facilitate data management, but many other visualizations are possible. The timeline itself is the focus of this project, but the data that it displays could be used differently. For example, a time

series plotting the number of events in different categories could provide a clearer picture of how the numbers of presence ideas, technologies, and cultural products have been correlated. Plotting the same series in terms of importance values instead of the number of events could illuminate influential periods in the field's history. Again, these efforts would need to follow the expansion and refinement of the content.

5.3.5. Data access. The timeline data are only accessible via the online Presence Timeline. However, the raw data, in JSON, Excel, CSV, or other formats, might prove useful to some audiences. If the community so desires, data files could be made available for download in conjunction with the timeline. If demand is sufficient, and if other circumstances justify the development effort, an online database could allow various audiences to extract various subsets of the data, set to display in different ways, via a single interface.

6. Conclusion

While there is much additional work to be done, we have created the framework - both form/technical and content-based - and a working prototype of the first comprehensive online, interactive, multimedia Presence Timeline. The ultimate success of the project depends in great part on the contributions and involvement of many people in the next months and years, but we are optimistic that the personal and collective time and effort will provide our community and those beyond it with a resource that is valuable for a variety of important goals.

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