

# Interactive Folding Fan Charts: Improving User Efficiency Through Seamless Fusion of Multiple Levels of Detail

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## ABSTRACT

Fan charts have become very popular with users of family history websites and software over the past several years. One shortfall of existing fan charts is the tendency for users to quickly become disoriented as they explore the chart. We present “Folding Fan Charts,” which reduce the problem of disorientation by combining: 1) a small thumbnail overview of the chart, 2) animated folding/expansion of areas of interest, and 3) a pan-and-zoom user interface. This combination allows users to explore details of a fan chart— even many generations out— without losing the context of the overall chart. We also briefly describe our incorporation of folding fan charts with maps and other tools on the Historic Journals website.

## 1. INTRODUCTION

Fan charts have been used by some in the genealogical community for decades, and the mainstream popularity of fan charts has grown significantly in the past few years. Coinciding with the increase in popularity, very useful research related to user interaction with fan charts has been presented at previous FHT workshops [1, 6]. However, a few issues remain that negatively impact fan chart usability. Most notably, it is easy for users to become disoriented while using the charts. Since the number of ancestors is doubled for each subsequent generation, there is not room for text in the chart (the ancestors’ names, for example) beyond the first few generations. As a result, only a few generations are shown at a time. Current strategies either for increasing the amount of detail that can be displayed at the same time or for exploring additional generations (beyond the first few) result in the user losing context of the overall pedigree.

The ring style of fan chart [1] makes use of the entire 360° circle in order to allow more detail to be seen for a given number of generations. Not only is there twice as much space as the traditional fan layout, but cells of interest can be expanded to take up more space on the circle (at the expense of cells that are of less interest). While it is an efficient use of space, the cells of the chart are constantly shifting all over the place. The context about which part of the family is being viewed (paternal vs. maternal ancestors, etc.) is quickly lost, and the user easily becomes disoriented.

The more traditional style of fan chart ([6], for example) is more intuitive to most people because it preserves the spatial location of cells in their expected locations. However, when the user decides to explore beyond the first few generations, a new person becomes the root of the chart, and the user loses the context of the rest of the ancestor tree. In effect, the user is looking at a new chart of an isolated subtree on the screen, and may become disoriented as to which part of the entire tree is in view.<sup>1</sup>

Disorientation directly and negatively impacts a user’s efficiency when performing family history research and tasks. Attention and mental energy that could be focused on the research and tasks at hand is, instead, wasted by trying to keep track of which part of the family pedigree is currently in view and to remember how the current part of the pedigree relates to the bigger picture of the entire family tree.

We reduce user disorientation by fusing multiple levels of detail of the fan chart (thumbnail, detail, and constrained folding/expansion of areas of interest) into a pan-and-zoom user interface that allows users to seamlessly transition to whatever level of detail is desired, without ever having to change the root of the chart to a new person. Users are relieved from the burden of mentally trying to keep their bearings as they explore their family tree, and can focus their attention on efficiently accomplishing their research tasks, instead.

## 2. RELATED WORK

Our solution takes some cues and inspiration from much earlier interactive pedigree research by Dr. Sederberg and his collaborators (Takafumi Saito and Thomas Finnigan) [4, 5], from Dr. Sederberg’s *One Page Genealogy*, and from the more recent *Virtual Pedigree* work (demonstrated at FHT 2013 by Ryan Cheatham and Dr. Barrett). From all of this previous work, the enormous benefit of being able to see many generations of a family all at once is evident. We also see the benefit of a pan-and-zoom style interface, as well as interactively adjusting how much space parts of a chart take up, depending on whether it is a part of the chart that is of interest or not. Dr. Sederberg’s work also suggests the benefit of providing mechanisms as a part of the user interface to find errors or other problems in a person’s tree.

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<sup>1</sup>Note that when we use [6] as an example of a traditional fan chart, we refer to its traditional layout and style of user interaction. Additional details and features such as color coding and search to specifically facilitate finding research holes are also described in that paper.

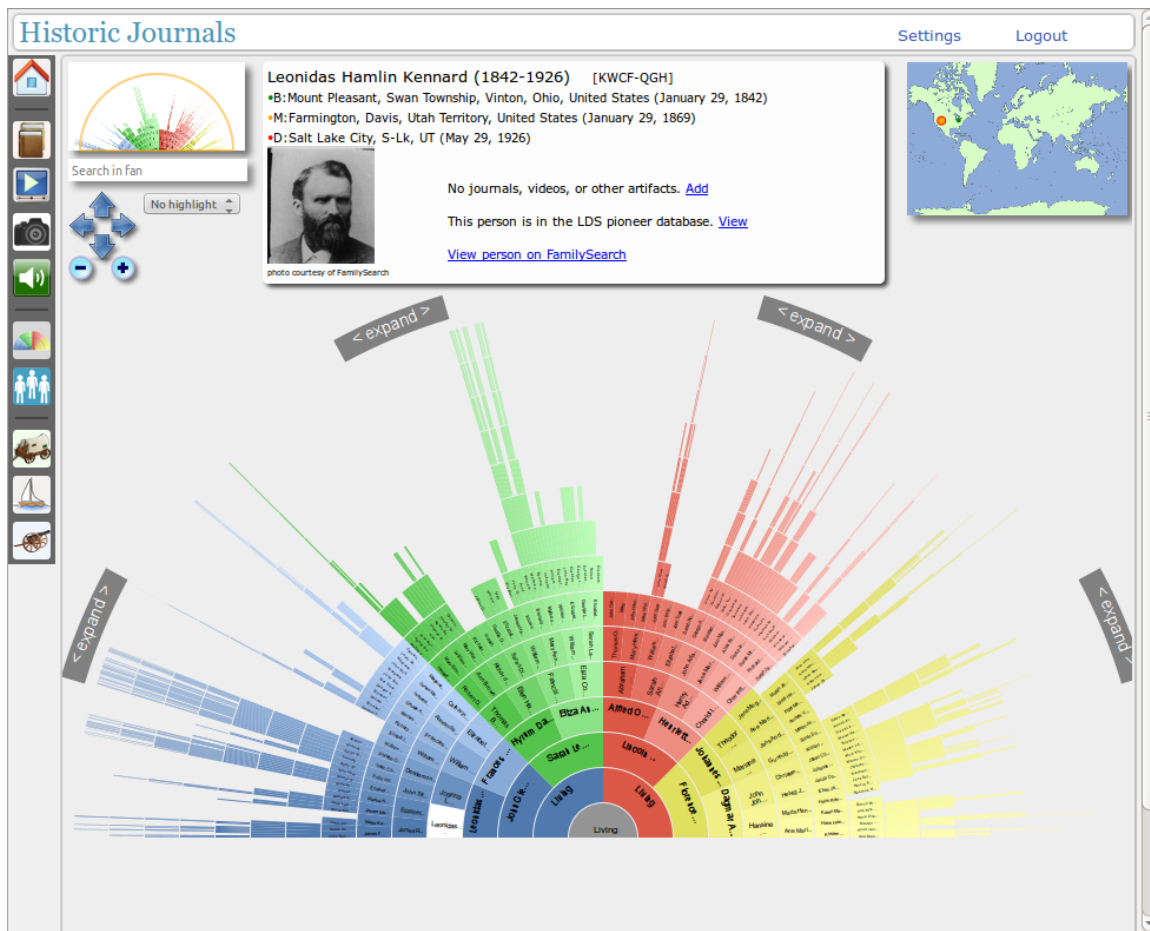


Figure 1: Initial view of 15 generations. Details for one ancestor (white highlight) are shown and his birth, marriage, and death places are mapped.

### 3. FOLDING FAN CHARTS

We use a pan-and-zoom style interface that allows the user to see the entire fan chart at once or zoom in to see portions of the chart in more detail (Figure 1). We allow interactive “folding” (expansion/contraction) of quads of interest to quickly increase the level of detail and the number of generations that can be reasonably displayed or interacted with in the portions of the tree that are of particular interest (Figure 2). This folding is somewhat similar to the expansion in the ring-style fan charts described in [1], but we spatially constrain the expansion to be more intuitive. Animated transitions during folding help the user stay oriented. In case the user ever does become disoriented, we provide a small “radar”-style thumbnail overview of the entire fan in the top-left corner of the screen to highlight the expanded section of the chart as reference, so the user can instantly regain his or her bearings.

Although our current implementation only shows 15 generations (that is all we currently download from FamilySearch and store for our users), the same interaction sequence (expansion of quads followed by adding additional generations, combined with pan/zoom) could be continued outward indefinitely, and a chart would not ever have to be redrawn with a new person at the root unless a new root were desired.

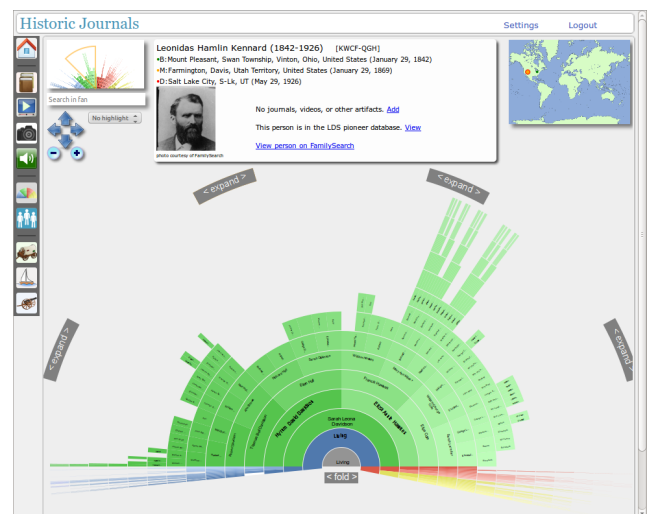


Figure 2: Unfolded green quadrant (paternal grandmother's line). The thumbnail overview highlights the expanded portion.

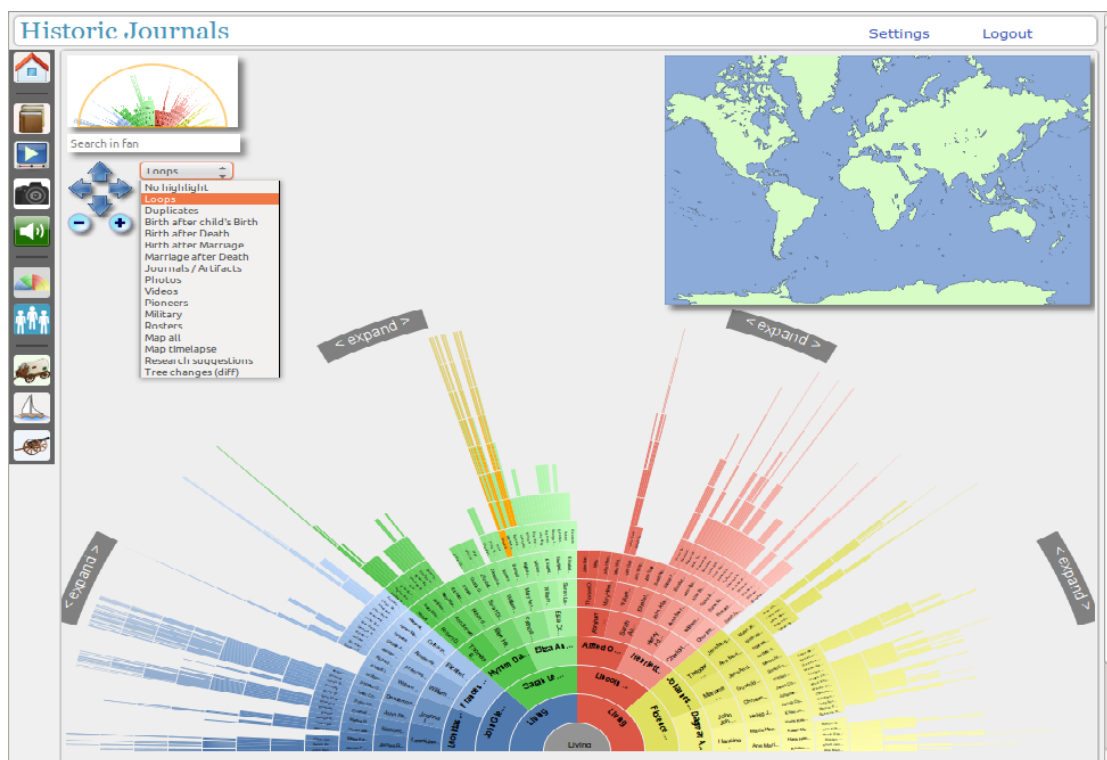


Figure 3: Loops detected in the tree (orange highlight).

User interaction for our chart is similar to that used in other pan-and-zoom interfaces (either mouse / mousewheel / drag / touch events can be used, or the provided icon buttons can be used instead). We do not yet include accessibility keystrokes for use by those with physical disabilities, but plan to include those in the near future. Other interactive elements that are standard fare on many other genealogy charts are also included (search, mouse-over highlights and person details, click for more detail, photos, links to digital artifacts, etc.).

#### 4. FOLDING FAN CHARTS ON THE HISTORIC JOURNALS WEBSITE

We started the Historic Journals project at BYU in early 2008. Various research related to the project has been reported or demonstrated since then at the FHT Workshop (2009, 2011, 2012), and other venues [2, 3]. When the prototype neared its end-of-life, BYU granted permission in 2013 for the project to be moved off campus in order to give it longevity. The project will continue to allow users to share and find digital artifacts (journals, letters, photos, etc.) by or about their ancestors, and collaborate to tag and transcribe those materials. The service is also being expanded to include additional types of digital artifacts (video, audio), and allow artifacts or links to be pinned/attached directly to one another (for example, photos or recordings of a person or event could be pinned/attached or linked to a diary entry or letter that talked about that person or event). Additional features and services will continue to be added to the site in the future. The new website is <https://hjournal.com/>.

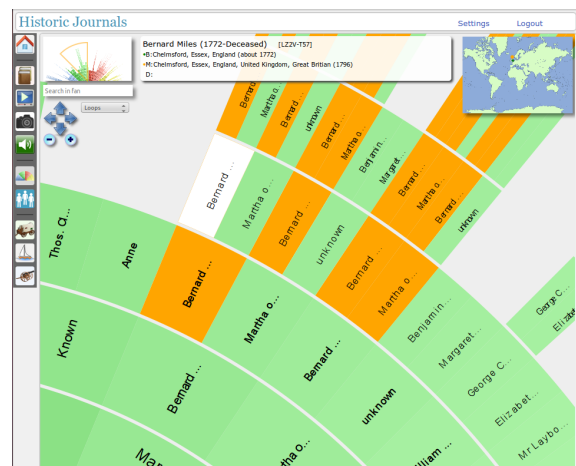


Figure 4: Zoomed-in view reveals that Bernard is listed as his own father, causing the loop.

On the site, we integrate folding fan charts with maps, additional data sources, and tools to find and highlight potential problems in the user's pedigree data. For example, when the user selects loop detection (Figures 3), the loops in the tree are highlighted, allowing the user to easily see what corrections they need to make in their pedigree data. Zooming in on one the highlighted area reveals that a man named Bernard is listed as his own father (Figure 4). Other potential problems that we currently detect include duplicates and dates out of order (marriage before birth, etc.).

We provide time-lapse animations showing the ancestors' locations on the map as time passes (using birth, marriage, and death locations), synchronized with the same ancestors being highlighted on the fan chart as their locations are displayed. We will also highlight people of interest in the pedigree (ex: pioneers, soldiers, people who have photos, journals, or videos available about them), places in the pedigree that are likely to be productive for the user to do additional research (ex: location and time periods that have good records, or name combinations that are more likely to be unambiguous, etc.), and recent changes to the pedigree (a "diff" for pedigrees). Since our fan chart and tools are built as a client-side web interface, we can easily allow users to download their folding fan chart as a single web page file (with all necessary images, scripts, and other data embedded) that can be used in the web browser on their computer or mobile device even while offline.

## 5. RESULTS

We have not performed any formal analysis yielding quantitative results, nor have we compared our chart to those in every other genealogy software package or website. However, using charts such as the ring-style fan chart and the fan chart on FamilySearch as baselines, our own experience is that the folding fan chart discussed in this paper significantly increases user efficiency and is an overall much better user experience. Disorientation with the folding fan chart is much less common, and it is easy to regain our bearings when we do lose track of where we are in the tree.

We are able to quickly browse 15 generations of our pedigree, zoom in or out for more or less detail as desired, and easily keep track of exactly what portion of the pedigree we are looking at. Details about people in the chart are readily available without annoying delays after each user interaction, and we can see at a glance whether birth, marriage, or death information (date/location) is missing or garbled, or if a name appears to be incomplete or just an obvious placeholder like "unknown."

The integrated tools allow us to instantaneously find common problems with our pedigree data, such as loops and impossible date combinations. We can see on the map where a given ancestor was born, married, and died, or we can see that information for all of our ancestors at the same time.

In short, we are able to focus on interesting or useful tasks and information instead of worrying about what part of our pedigree we got ourselves lost in.

## 6. CONCLUSION

In this paper, we have presented folding fan charts, which combine multiple levels of detail into a single user interface. This fusion of levels of detail, combined with smooth interaction and transition animations, results in an improved user interface in which it is easier to navigate a large fan chart without becoming disoriented. Users are able to focus more of their attention on their important tasks and perform those tasks more efficiently. In addition, we have provided tools to help users easily find problems in their pedigree data so they can fix those problems, and we have provided other tools of interest such as integration with maps and other data sources.

## 7. FUTURE WORK

For ease of implementation, text labels in the fan cells are currently made visible or invisible depending on how many generations out they are and how many expansions/folds have been performed. It makes sense to also account for the amount of zooming that has been performed (as done by Dr. Sederberg and his collaborators) when determining whether to show a text label and how much information to show in that label. When a user zooms in close enough, there may be room to show details besides the person's name (and possibly even photos, etc.) in the chart itself instead of in a separate detail area. Text is also rendered without any curvature. This sometimes looks a little funny (particularly with longer strings of text) and limits how much information can be placed in expanded areas of the chart without ruining the look. We previously rendered text with curvature, however the rendering was extremely slow. Future work on speed optimizations may allow us to render text with curved paths to improve how the chart looks.

Folding/expansion is currently done by manually clicking on one of four buttons on the perimeter of the fan chart. It may be better to automatically expand as the user moves the chart to a position of interest, like is done for tree-style charts with *Virtual Pedigree*.

Finally, we find that despite some advantages fan charts have over traditional tree-style views of pedigree information, one lingering annoyance is that it is hard to tell at a glance which people form couples, because all of the cells are crammed together. Some possible solutions we are considering are to group each couple by using the same color for both people in the couple, by creating a border around the couple, by adding a colored arc along the top/bottom of each couple to group them, or by adding a small amount of empty space on either side of the couple to separate them from the adjacent couples in the chart.

## 8. REFERENCES

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