

Interactive Fan Charts: A Space-saving Technique for Genealogical Graph Exploration

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Abstract

Fan charts are a popular method for displaying family trees in a compact way. We extend the concept of fan charts to include a number of interactive metaphors, thus transforming what was a static display medium into an interactive tool for browsing and editing genealogical data.

Keywords: genealogy, information visualization, radial space-filling layouts

1. Introduction

A *fan chart* is a radial space-filling technique for displaying genealogical graphs. In a fan chart, a person's name is drawn in the center of the graphic, surrounded by concentric rings containing the names of the person's ancestors.¹ Most commercial family tree-generating software packages, including Family Tree Maker [2] and PAF Companion [5] support the creation of fan charts. More recently, open source projects such as PhpGedView [1, 4] also support fan charts. Fan charts are a popular method for visualizing family trees, due perhaps in part to their aesthetic appeal as well as their compact appearance relative to the more common tree-based pedigree chart (Figure 1).

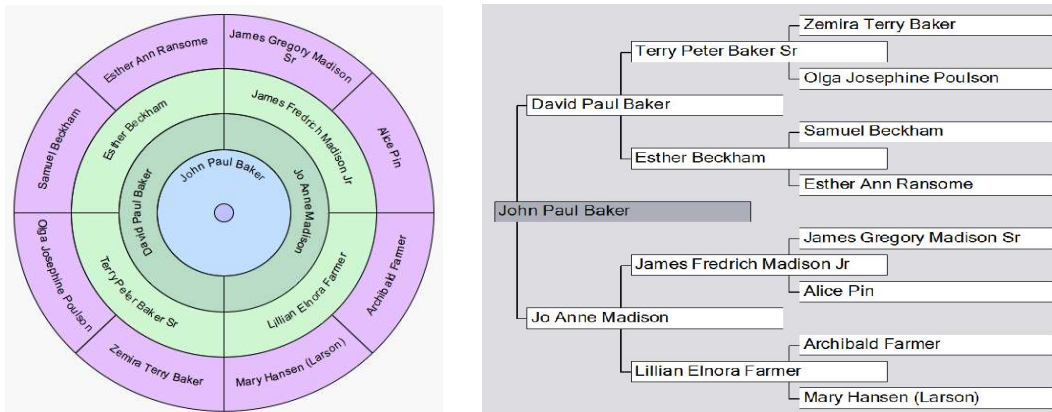


Figure 1. (left) A fan chart. **(right)** A standard pedigree chart.

Although pedigree charts are easy to understand, they do not necessarily make optimal use of the available space. Indeed, much recent research has been devoted to finding better layout algorithms for pedigree charts [3, 6]. A natural argument in favor of fan

¹ Fan charts exist in a number of sizes; the most common variants are quarter-circle, half-circle, and full-circle. To simplify the present discussion, we focus exclusively on full-circle fan charts in this paper, recognizing that the techniques introduced herein are applicable to fan charts of any size.

charts over ordinary pedigree charts is that the circumference increases with each successive generation, thus, as the number of nodes grows, so does the available space in which to render them. This quality of fan charts is immediately appealing, but unfortunately it does not grow fast enough. Recall that the number of ancestors in the chart grows exponentially, doubling with each generation. Assuming each ring has the same width, we see after a little analysis that the area of the chart only grows linearly with each generation. Some more elaborate schemes, like the ones shown in this paper, give increasing width to each successive outer ring; each ring width is increased by an additive constant. This defers the space crisis somewhat by introducing a (slow) quadratic growth rate for the area of each new ring. However, we are still faced with fundamentally mismatched growth rates. Relatively quickly, the slow polynomial area growth will be inundated by the exponential growth in the number of ancestor nodes. Therefore space remains a scarce commodity even in moderately-sized charts, despite the ever-increasing circumference.

To address this concern, we propose the *interactive fan chart*: a radial graph in which nodes can be selectively expanded or collapsed so that a greater proportion of the available space is dynamically allocated to nodes of current interest. In addition, we introduce a number of interactive techniques that transform fan charts from a static display medium into a tool for real-time data browsing and exploration.

2. Interactive Techniques

We present a detailed discussion of each of our proposed techniques below.

2.1 Expand and Collapse

At each concentric level of a static fan chart, each ancestor is normally allotted the same proportionate space. However, for interactive browsing, this is likely not optimal, for a user may wish to commit more resources to one particular branch as he or she explores a given line of the family.

We propose a method for selectively reassigning space from nodes of lesser interest to improve the readability of the line of focus. In an interactive fan chart, the user can collapse a node by selecting it with a mouse or other pointing device. The selected node and all of its ancestors diminish in size, while the adjacent nodes grow to absorb the vacancy. (An alternate scheme would be to select the node that one wishes to expand, rather than the node to be collapsed. In our implementation, this behavior can be toggled via a menu option.) The enlarged node is rendered with a thick border as a visual reminder that it has been expanded (Figure 2). Selecting the expanded node reverts the diagram to its previous size. The transitions of expanding and collapsing nodes are smoothly animated so that the user's sense of context is preserved [7].

The ability to expand and collapse nodes in a fan chart is especially useful in the situation where one branch of the family tree has been more thoroughly researched than another. In a static fan chart, space is allocated for all ancestors regardless of whether their names are known. This results in large blank areas in the chart, meaning less available space for

regions of the chart that are more dense with information. By allowing the user to temporarily hide such sparsely populated regions of the chart, interactive fan charts provide opportunities for inspecting the denser regions of the graph in more detail.

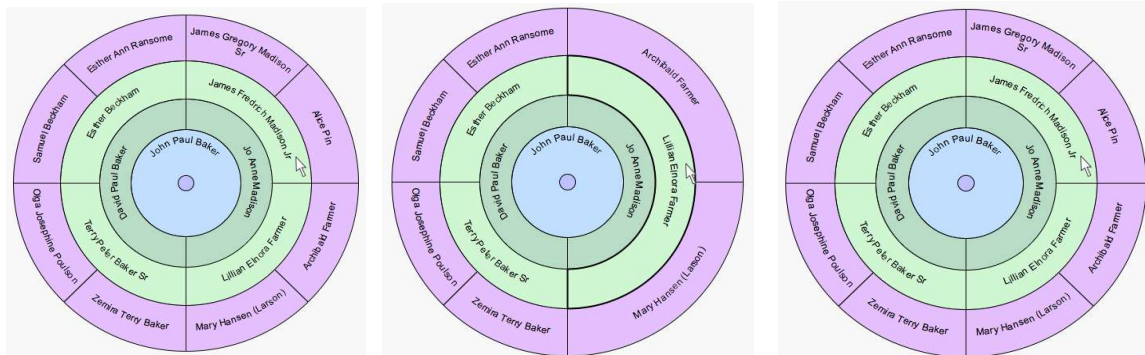


Figure 2. (left) Original view. **(center)** Selecting a node causes it to collapse, while its adjacent node expands. **(right)** Selecting the expanded node restores the nodes to their original sizes.

2.2 Selecting a New Root Node

In a static fan chart, the root node is rigidly assigned at the time the chart is created and cannot be modified. However, some systems now relax this constraint by allowing new roots to be chosen dynamically [4]. Our interactive fan charts likewise allow the user to select a new root for the chart, be it a child of the current root node or an arbitrary node from the database. The following two subsections describe how this is done.

2.2.1 Selecting a Child of Current Root Node

If the current root node has at least one child, a small circle is drawn in the center of the chart. Selecting this circle with the pointing device gestures that a child of the current root node should be the new root node. If the root node has only one immediate descendant, then that is the only action required; the chart expands immediately, and each of the ancestor-nodes moves up one level in the chart. If the root node has more than one child, then a pop-up menu allows the user to select which one of the children should be the new root node (Figure 3). The addition of the new root node, and the promotion of the existing nodes to a higher level of the chart, are rendered as a smooth animation to preserve the context.

2.2.2 Selecting an Arbitrary Root Node

To select a node other than a child of the current root as the new root, two options are available. If the desired node appears somewhere in the chart, the user can “drag and drop” the wedge from its current location into the center of the chart. The chart is immediately redrawn with the new node as its root (Figure 4). If the desired node is not currently visible in the chart, the user can also select an arbitrary node as the root. (In our implementation, this latter functionality is accessed via a menu option rather than via the chart itself.)



Figure 3. (left) The user clicks in the center of the chart, revealing a menu of the root individual's children. **(right)** The chart expands, with the new root at its center.

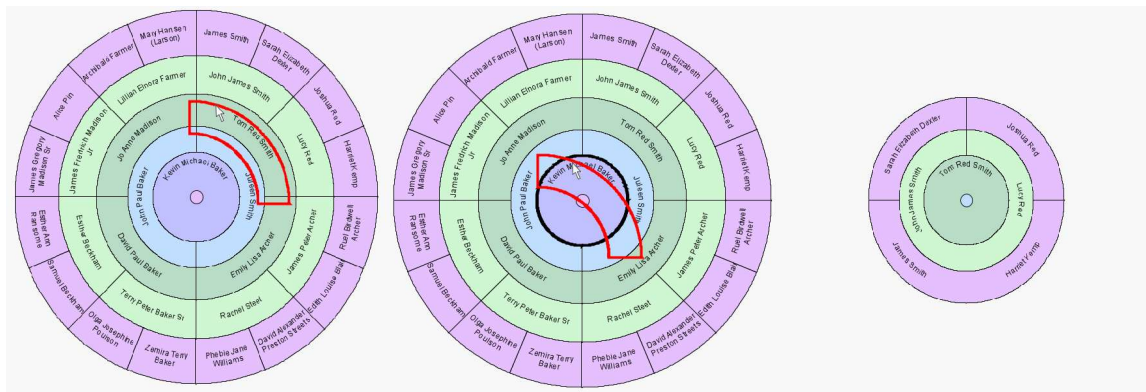


Figure 4. (left) The user selects and drags a displayed node. **(center)** The node is dropped into the center of the chart. **(right)** The chart is redrawn with the newly designated node as its root.

2.3 Selective Browsing

Fan chart software typically allows the user to specify a maximum number of generations to include in the chart. In addition, interactive fan charts also permit the user to selectively extend certain lines of the family beyond the specified maximum. If the database contains additional information on a given family line, beyond the user-specified limit for visible generations, this is shown by a thin curved button on the outer edge of the node. Figure 5 illustrates how to display additional generations of ancestors for a given node; the user simply selects the curved button with the pointing device.

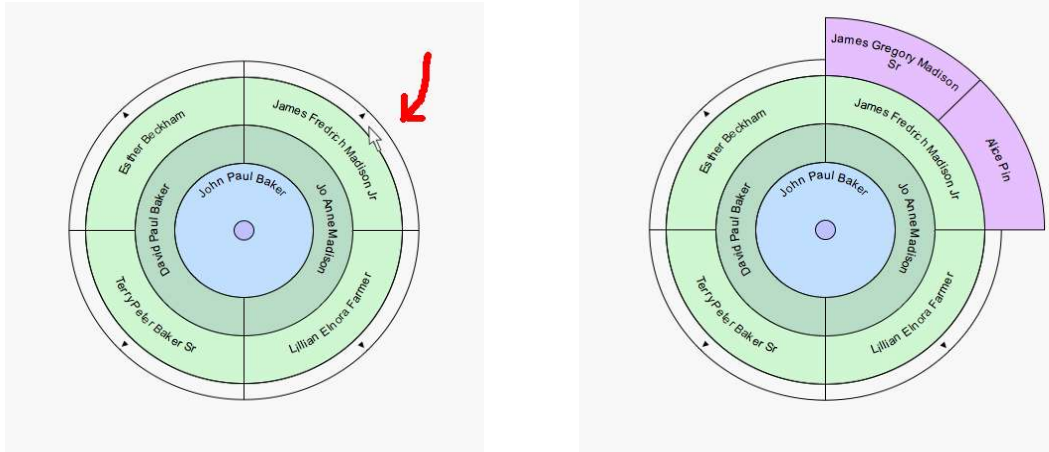


Figure 5. (left) A fan chart with a user-specified limit of three generations. Curved buttons are displayed along the chart’s outer edge, indicating that additional data is available. **(right)** After clicking on the curved button for one of the nodes, the chart reveals the node’s parents.

2.4 In-place Editing

Most genealogy software packages allow data to be edited freely in a standard pedigree chart, whereas fan charts are implemented as “read only.” Interactive fan charts relax this restriction, allowing the user to modify the data within the fan chart itself.² To change an individual’s record within the fan chart, the user “right clicks” on the node to be edited. A pop-up dialog is shown, allowing the user to edit the individual’s information. When the dialog is dismissed, the changes are reflected immediately in the chart.

3. Implementation

To demonstrate the interactive techniques outlined above, we have implemented a software prototype of an interactive fan chart. While interested users are welcome to try out our prototype for themselves, we emphasize that it is a strictly a “proof of concept” rather than a fully-developed product. As such, it lacks the capability to import data from GEDCOMs or other standard genealogical file formats. Nevertheless, we feel that the prototype adequately demonstrates the essential notions introduced in this paper. Our goal in creating this prototype was not to introduce “yet another” new genealogical software system to the market, but rather to inspire developers of existing family history software to adapt the ideas in this paper into their current products.

We have successfully tested the prototype on Windows, MacOS X, Linux, and Solaris, however, it should work on any platform for which a Java 1.5-compatible virtual machine exists. Although initially developed as a standalone application, an applet version of the program, preconfigured with a sample data set, is available for testing at <http://www.cs.utah.edu/~draperg/research/fanchart/demo/>.

² The current implementation only permits an individual’s name to be modified, but there is no technical reason why other fields (birthdate, birthplace, baptism/christening date, etc.) could not be included as part of this operation.

4. Evaluation

To gain some informal feedback on our ideas, we gave a demonstration of our prototype system to several workers and patrons at the Family History Library in Salt Lake City, Utah. The response was highly enthusiastic, especially among those who were already familiar with existing software-based fan chart tools. After seeing our system, one patron commented that fan charts are just naturally suited for interactivity. Another worker speculated that interactive fan charts would be a good way to get people interested in genealogical research. More than one person suggested that this would be a great resource to have at a family reunion. Some additional features suggested include:

- ◆ a feature for zooming in to sections of the chart
- ◆ a control to vary the speed of the animation
- ◆ ability to “mouse over” a node to see a photograph of an individual

The positive responses and helpful feedback were encouraging.

5. Further Work

In addition to the feedback offered by the staff of the Family History Library, other ideas for future enhancement might include the following. First, the current system only supports the ability to collapse a given node *completely* (see Section 2.1). While this does free up space for other nodes, it may be preferable in some cases to collapse only *partially* a given node, analogous to “iconifying” a window. That way, the collapsed node would still retain a small proportion of the available circumference, keeping the adjacent node in context while still giving its ancestry due emphasis.

Another potential avenue for future work is to use interactive fan charts in conjunction with a touchscreen device. For some applications, touch-sensitive displays can be more intuitive than a mouse-driven interface, and they have the ability to accept multiple simultaneous input points. This immediately suggests a possible interface for the arbitrary resizing of nodes (Figure 6).

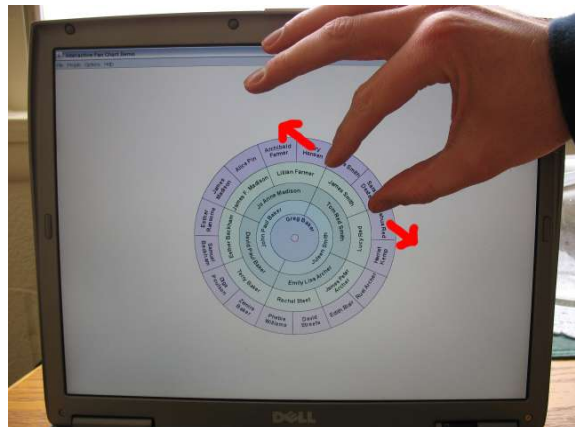


Figure 6. Possible extension for a touchscreen interface.

6. Conclusion

This paper presents several generalizations to the traditional fan chart paradigm that elevate it from a static display medium to an interactive method for exploring and modifying genealogical data. While the techniques described herein do not resolve all of the issues with fan charts, namely, space is still a concern when rendering large, densely populated family trees, it does significantly improve the fan chart's usability through interactivity and thereby extends its potential to appeal to a considerably broader audience of users representing more general needs. We invite producers of existing genealogy software to incorporate the ideas presented in this paper into their products, and welcome additional user feedback.

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