A Highly Interactive Pedigree Viewer

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Abstract

Viewing large amounts of pedigree "family tree" data can be a challenge. Many current software viewers force users to see only a portion of the tree "through a straw." These trees also have minimal interaction with the user, save navigation. The pedigree chart is a central navigational interface in most genealogical applications. Because of this, it is critical that a new pedigree viewer be exceptionally intuitive to users. This paper describes a methodology that overcomes these issues by providing: (i) a novel visualization of the tree that compresses space and allows dynamic generation-stack positioning to visualize much more of the tree within a screen; (ii) a highly dynamic and rich interactive user interface; (iii) a development process which facilitates early and ongoing user interaction and feedback. This methodology has been implemented and deployed as a rich-UI web-based tool at www.FamilySearchLabs.org.

1. Seeing Relationships - The Challenge of the Pedigree Viewer

People involved in genealogy need to be able to visualize the data contained in their pedigrees. However, as the pedigrees grow and contain hundreds of names and many generations, the problems of visualization become complex. In the past, we have relied on printing pedigree charts on paper. While paper has generally been easily available, there are serious limitations in its use. Large charts require special printing and delivery with associated increased costs. Once a chart is printed, it is static and needs to be reprinted as research progresses. Today we are relying on computers for genealogy tools and shifting the visualization to electronic medium.

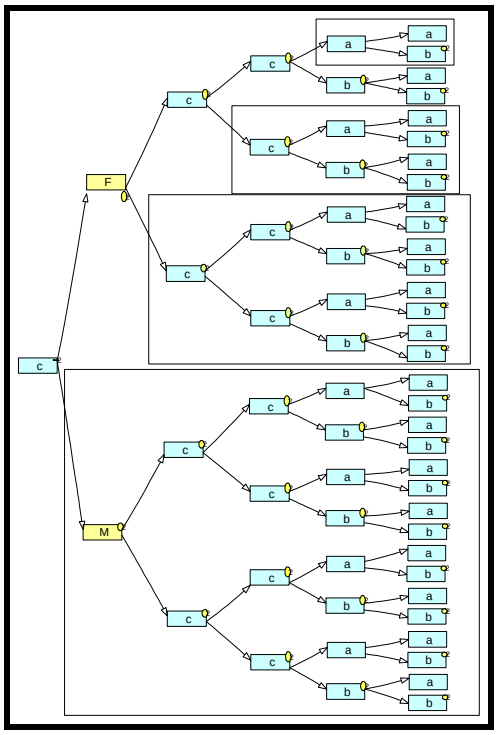

Figure 1. Block layout of a pedigree chart

A computer screen, even the large high resolution displays, cannot match the detail and sheer size of say a 4 foot by 6 foot print out. The screen is constrained by physics, display resolutions and cost. Yet it is on the computer that we must visualize the pedigree. The pedigree chart is a powerful visualization and method to navigate to a desired family or individual: the pedigree chart provides the crucial relationship information to ascertain if you are looking at the "correct" John Smith. Only then, having chosen the correct target individual, can the user select an individual and perform actions, like correcting and extending the pedigree.

Pedigrees are typically visualized using a "block layout" view (Figure 1). For instance, as you scan down a pedigree chart, with generations left to right, the block of individuals on the left horizontally aligns with the next generation block to the right. As the number of generations increase the space between the father and mother in the earlier generation doubles. This makes it increasingly difficult to see relationships across increasing generation spans. Many applications deal with this problem by limiting the number of generations simultaneously visualized, usually three to five generations and then scrolling though this viewport (Figure 2). The effect is like "looking through a straw." The user can not see their tree in entirety.

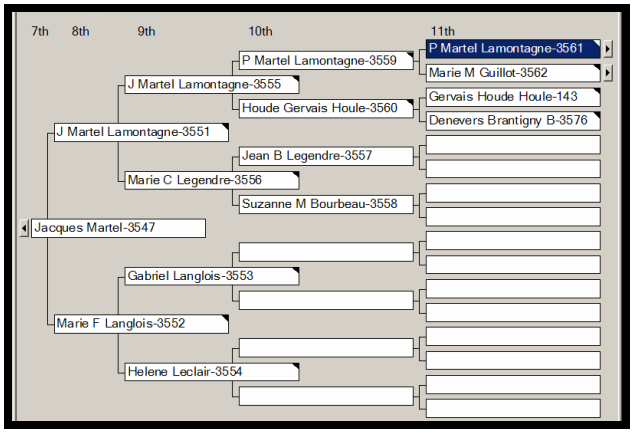

Figure 2. Only 5 generations visible in PAF, (Version 5.2.18.0 Intellectual Reserve, Inc.)

These visualization problems are exaggerated when viewing a descendant view. For example, an ancestor view is typically an "n-squared" problem: each added generation doubles the number of parents. However, for descendant view this becomes an "n to the power of m" problem: where m is the number of children.

Thus the core pedigree visualization problems are:

- The visualization of the pedigree is constrained by current thinking
- Real world factors like screen size and resolution
- Relationships are obscured as fathers and mothers become further apart as the number of generations increase
- Context is lost as only a limited number of generations is displayed
- Not being able to see the entire "30,000 foot" view of large pedigrees

A second set of factors come into play as we discuss what is necessary to create a well-designed pedigree viewer. We need to provide the user with tools and guides to accomplish browsing and contributory tasks:

- Ability to see and distinguish details of an individual, such as vital events of birth, marriage and death
- Be able to see a terminating (dead-end) branch, identifying areas where they can extend the tree with additional research
- Interact with the tree to see alternate spouses
- Alter the type of tree view, whether ancestor and descendant view
- Available on a widely accessible technology platform
- Provide an intuitive user interface and usability to a wide experience-level audience

2. The Dynamic Compressed Pedigree Visualization Method

There are a number of ways to visualize large amount of pedigree information. They each have advantages and disadvantages. Most are traditional 2-dimensional block solutions. The 2-dimensional views are perhaps more familiar and intuitive to users than other unique approaches like rotational (pie) representations. We focused on a 2-dimensionl approach.

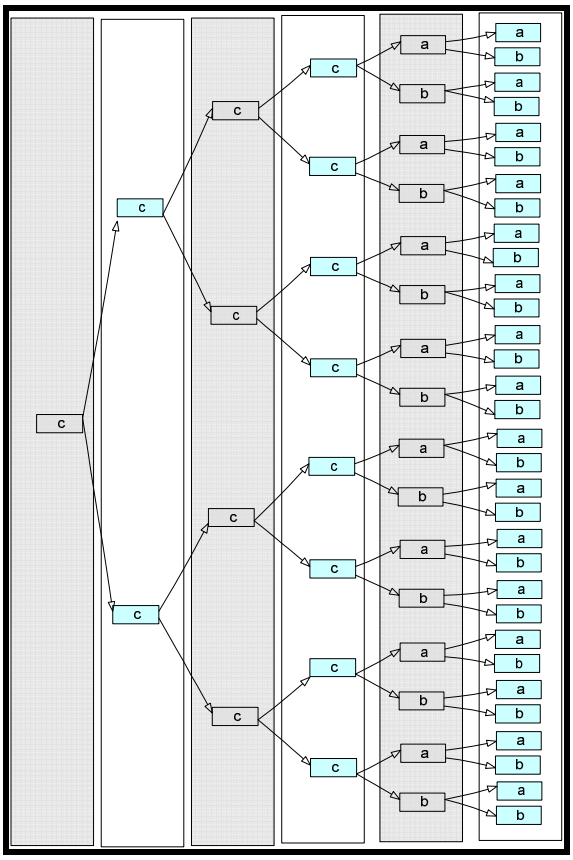

Figure 3. Stack in block layout

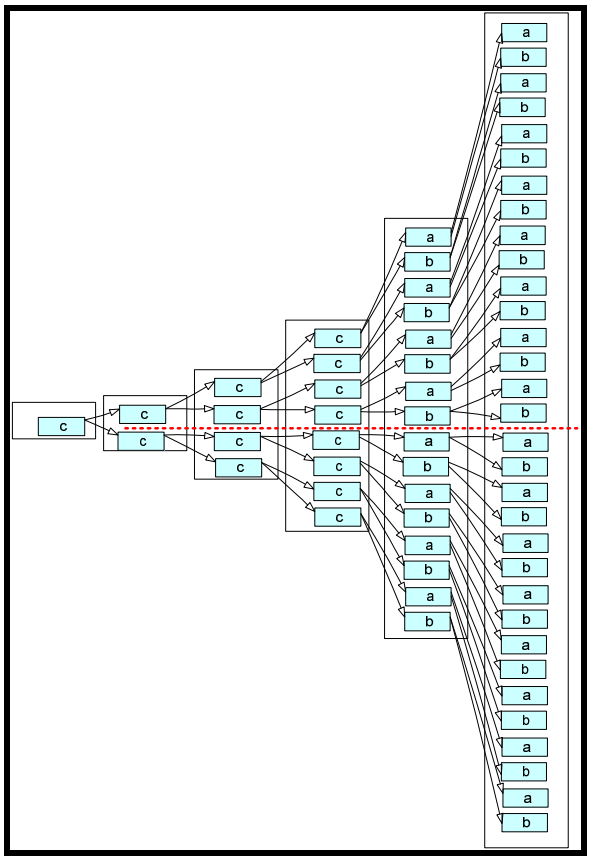

Figure 4. Compressed and aligned layout

Our solution involves considering the view from a more "relaxed" methodology. Still in a 2-dimensional approach, rather than a "block" layout the view, we consider each generation a stack (Figure 3). This stack is independently adjustable from a neighboring stack. This affords us (the software algorithm) the ability to collapse or compress the spacing of the individuals in the stack. In this view, note how the father and mother are immediately adjacent the child, irrespective of which generation you are focused on (Figure 4). Furthermore, this adjacent proximity nature stays fixed regardless of how many generations are being displayed. If Figure 3 had to be printed on multiple sheets it is likely that the couples of the leftmost generations would be printed far apart, on different sheets, whereas in Figure 4 the couple would likely be adjacent.

An added feature of the compressed, independent vertical placement of the stack is that depending on where the user is focused the stacks can re-align. This keeps the appropriate relationships in the neighboring generations in adjacent horizontal alignment. Coupled with this

interactive approach the user is able to focus on areas of interest in the pedigree, and the tree can both align and highlight this line in the pedigree chart (Figure 5). Highlighting the pedigree line is useful in communicating the concept of relationship between individuals who are separated by any number of generations.

Zooming (scale) is supported to see more detail. Panning (translate) the tree is accomplished by dragging to a point of interest similar to many map-based products like Google Earth. Seeing the entire pedigree is now possible and intriguing (Figure 6).

There are a number of other visualizations and visual clues that allow for:

- Expanding a person to see detail like vitals
- Hinting of multiple spouses
- Re-displaying the pedigree based on a different spouse
- Seeing dead-end, terminating lines
- Re-displaying the pedigree to see an Ancestor or Descendant visualization

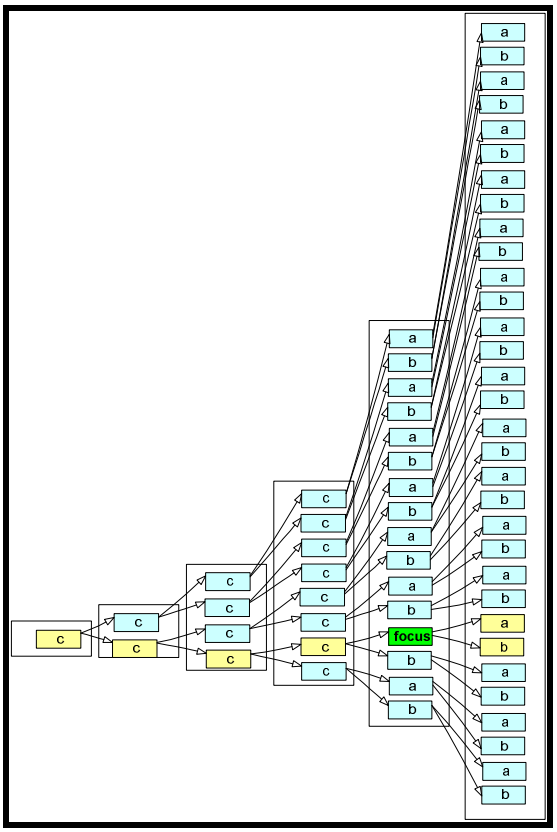

Figure 5. Realignment and highlighting based on Focus

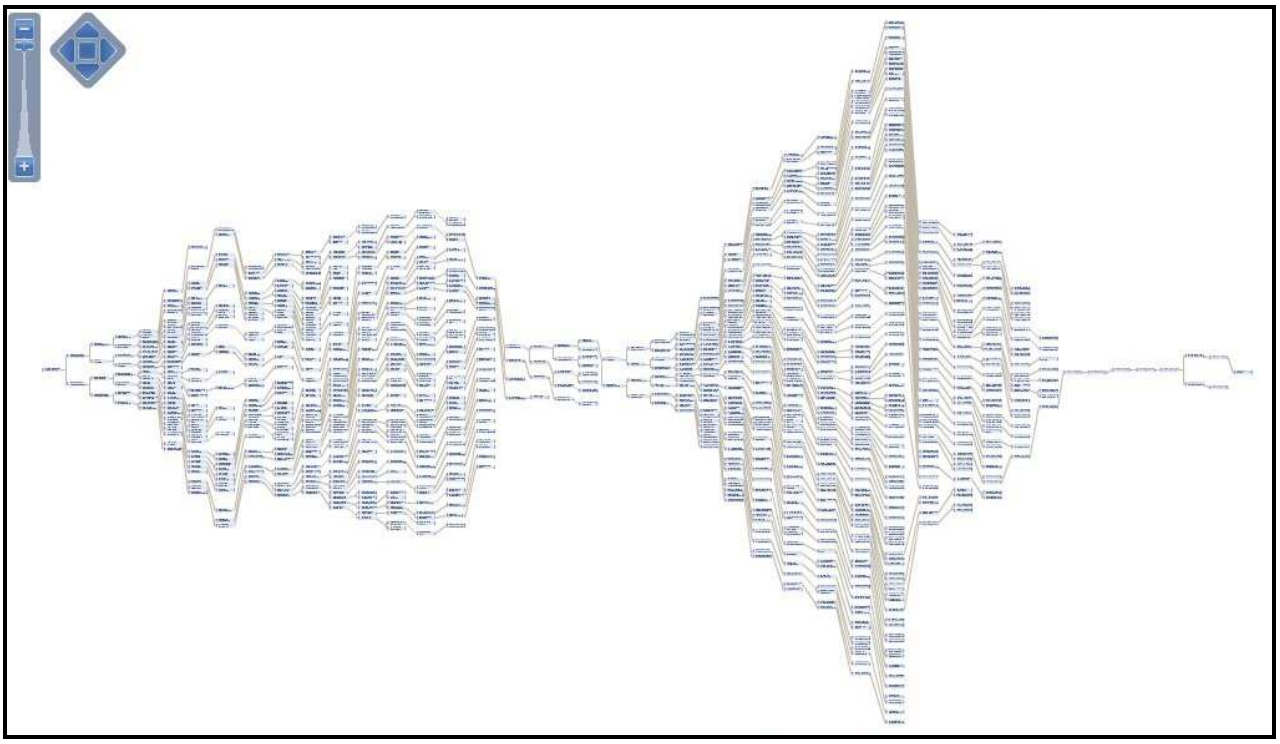

Figure 6. Whole pedigree view of 45 generations, 2108 individuals

3. Rich User Interface and Usability

The novel approach of this new pedigree visualization and functionality is powerful. However, if the user interface (UI) were cumbersome users would be unable to discover and utilize its potential. Furthermore some users are more computer-savvy than others. The core non-functional requirements were a rich, easy to use user interface. Additionally this should be accomplished with minimal impact to the user's computer environment. The download should be seamless, and the pedigree viewer tool should be available on the host of platforms (Windows, Mac, and Linux), browsers (Firefox, Safari, and Internet Explorer), and their respective versions.

With requirements set we chose a framework to support those requirements. Rich UI, and Web2.0 applications are increasingly becoming prominent on the Internet. Dynamic HTML, Ajax, and similar technologies were considered. We chose the Adobe Flex 2.0 environment. Adobe's Flash Player is ubiquitous with over 98% penetration (www.adobe.com/products/player_census/flashplayer/version_penetration.html). Since the application runs in the Flash Player container, we only have to test it in that context and do not have to test it in every platform and browser version combination. It has a clean and useful UI facilitating the potential for a rich UI experience.

To achieve a highly interactive UI, animation becomes a critical piece of the user experience. It is instrumental at conveying and providing a point of reference for the user and then transitioning to a new perspective. For example, when the user flips from Ancestor to Descendant view the transition first lingers over the person of focus, providing a point of reference. Then the old perspective fades out and the new perspective fades in. Flash/Flex is a rich visual presentation and affords the engineering effort a huge opportunity to rapidly create richly interactive websites.

4. Quick Engineering Deliveries and User Feedback

Our goal was a "Labs"-quality prototype in 6 weeks. The functionality and usability of the pedigree viewer product would also be heavily influenced by user feedback. This component would be integrated into future products. We launched and released the www.FamilySearchLabs.com site and Pedigree Viewer 3 weeks after the idea was conceived. Project iterations rolled out ranging from twice a week to once every 2 weeks, depending on the nature of the enhancements. Design and engineering occurred in parallel in a rapid-Agile environment. Our team consisted of 2 software engineers, 2 part-time human factor engineers and 1 product manager.

With such a rapid design and engineering cycle, we were able to test ideas in rapid succession. After an iteration of engineering and light-weight quality assurance testing, we would deploy to the website and within hours we would receive feedback from users regarding the site, the new features, and requests for enhancements. Some of our ideas were dumped after one pass in front of users. We had little invested. Some ideas forced re-factoring of the code. We did this only after we knew the core concept was successful, building on success after user validation.

5. Future

Overall the FamilySearchLabs Pedigree Viewer achieved the goals, proving:

1. The novel Pedigree Viewer visualization was extremely functional in conveying relationships and communicating pedigree information
2. A rich UI with high user interaction provides for quick response and rewarding experience with the application
3. Rapid iterations and user feedback was critical to advancing the functionality and usability aspects of the viewer
4. Our venture into the new Flex/Flash technology framework was rapid and proved the ability to engineer and modify the code base

There are a number of outstanding enhancements contributed within our organization and by the user community. Some include:

- See more details of a person, like affiliations and demographic associations, completeness of individual data, or reliability of source. UI Color coding and filters could be utilized to visualize such attributes
- Provide guides and rules such as generation, time and place associations of the individuals
- Leverage the Pedigree Viewer as a select and launching tool for other components that allow for extending the pedigree and enhancing individual information
- Provide a desktop client version