Icon Abacus and Ghost Icons

Eric A. Bier
Palo Alto Research Center, Inc.
3333 Coyote Hill Road
Palo Alto, CA 94304
+1 650-812-4439
bier@parc.com

Adam Perer
Human-Computer Interaction Lab
University of Maryland
College Park, MD 20742
+1 301-405-7445
adamp@cs.umd.edu

ABSTRACT
We present two techniques that make document collection visualizations more informative. Icon abacus uses the horizontal position of icon groups to communicate document attributes. Ghost icons show linked documents by adding temporary icons and by highlighting or dimming existing ones.

Categories and Subject Descriptors
H.3.7 [**Information Storage and Retrieval**]: Digital Libraries – *user issues*.

General Terms
Algorithms, Design, Human Factors.

Keywords
Visualization, metadata, icons, citations, computer-aided reading.

1. VISUALIZING METADATA AND LINKS
Visualizations of document collections can help people perform in-depth reading, an activity that involves reading many documents on a topic over a period of time. A visualization can help the reader find a good document to read next or re-find a previously-viewed document by making the user aware of relevant document attributes. For example, the user may wish to find documents with a given author, topic, rating or date or documents cited by or linked from a given document.

Collection visualizations often lay out document icons in two dimensions. Document attributes can be shown by icon color, shape, size, or position. Position is a particularly effective way to display data because the human eye accurately distinguishes many positions, and because it works for color-blind users. In addition, if icons are grouped spatially, users can visually scan the icons in a group rapidly, while ignoring other groups.

One way to encode attributes positionally is to use grids. However, grids waste a great deal of space in the common case that data is dense in some parts of the grid and sparse in others. We have developed two new document collection visualization techniques called *icon abacus* and *ghost icons* that use positional coding to communicate document attributes and relationships in a way that uses screen space efficiently.

Icon abacus is similar to a two-dimensional grid except that the boundaries between cells in a given row are not limited to straight lines. Cells from different columns are given different background colors to make the boundary between cells easier to see. For example, in Figure 1, the documents are sorted vertically into sections by date. The display also uses icon abacus to communicate a second attribute, such as whether or not a document has been read, by putting it in either a left-justified or right-justified span of icons. The left-justified icons have a dark background color while the others are on a white background. An icon abacus can save as much as a factor of three over grids and experimentation shows a typical reduction in screen space used of 50% - 89% for the five icon-per-line abacus shown here.

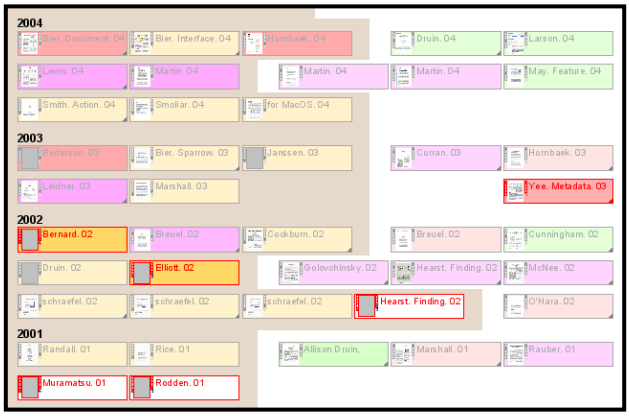

Figure 1. Visualizing a document collection with both icon abacus and ghost icons.

Ghost icons are a way to show all of the documents that are cited by a given document. Instead of providing a list of links to cited documents as is done in some on-line citation databases, the ghost icons approach adds a temporary icon for each cited document, sorted into the same spatial groups as existing icons, so that the attributes of the cited documents can be easily compared to those of existing documents. The temporary icons (drawn white) are called "ghosts" because they represent documents that are not yet fully part of the collection. Highlighting and dimming are used so four icon types can be distinguished: the selected icon, cited icons already in the collection, cited icons not present in the collection, and the rest of the icons. Animation is used during the transition into ghost icon mode, so it is easy for the user to see where the new icons are being added and where existing icons are being moved. As Figure 1 demonstrates, icon abacus and ghost icons can be used together so document metadata and citation relationships appear together in the same compact layout. Both are now in use in the Instant Bookplex reading environment [1].

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2. REFERENCES
[1] Eric Bier, Lance Good, Kris Popat, and Alan Newberger. A document corpus browser for in-depth reading. *Proceedings of the Joint Conference on Digital Libraries 2004*, pp. 87-96.

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