

Evaluating User Expectations for Widescreen Content Layout

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Abstract

Corporate large display usage is rapidly increasing due to lower costs and the promise of high worker productivity. In light of this, a formative evaluation of content layout and expansion in large browser windows was conducted to help inform an evolving large display design pattern. Ten corporate analysts provided opinions as they stretched a browser window on a prototype application. Left justification of content was preferred, and content should resize and flow as pages resize. They expected the page splitter to remain stationary, while content to the right of the splitter should resize and move in proportion to available page area. Tables should always show all columns, unless a horizontal scrollbar is present. Graphs and maps should resize with constant aspect ratio, with predefined minimum and maximum sizes that are based on intended tasks. Overall, a constraint-based liquid layout is recommended to accommodate many display sizes, without redesigning for each display.

Keywords

Usability, Widescreen Layout, Browser Window, User Expectations

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Introduction

Use of large displays in enterprise environments is dramatically increasing, due to declining hardware costs coupled with demonstrated potential for higher work productivity. Greater screen workspace means that larger browser windows can be opened, additional information can be displayed within one's immediate field of view without scrolling, and peripheral vision can be exploited. Investigators have found that office tasks routinely show productivity gains of 10%-25% when moving from current to widescreen displays (Colvin, Tobler, & Anderson, 2004; Czerwinski, et al., 2003; Pfeiffer Consulting, 2005; Raskino, 2005). Ethnographic studies have shown that large display benefits are due to improved work organization, less window obscuration, and less window switching. For desktop displays, these benefits can be expected for displays up to 4 feet wide by 2 feet high (when substantial head and body motion is required; Simmons, 2001).

Design Patterns and guidelines are needed to gracefully scale the design of existing (and future) enterprise applications to larger displays. Recent research on designing for larger displays has focused on operations, such as cursor location and control, scaling window sizes, and applying graphical algorithms to minimize the negative impact of display bezels (Robertson, et al., 2005; Mackinlay & Heer, 2004). However, there are still lingering questions on how page components should layout to take advantage of larger browser windows (Goldberg & Mochel, 2006). Usability ramifications emerge from placing page components so that users will be able to predict where to look and where to click, minimizing head and arm movements.

The objective of the present study was to determine users' preliminary expectations as to *how portlets and their contents should scale to larger windows on larger displays*. The study ascertained enterprise application users' expectations about widescreen page layout, portlet justification, portlet expansion, and component expansion within portlets. Both solicited and unsolicited comments were categorized, and then used as a basis for short summaries to guide portlet layout decisions on wideband displays.

A formative approach was used, emphasizing verbalized comments and surprises as participants resized and worked with a prototype browser-style application on a very wide display. Frequent users of enterprise software who had no prior exposure to large and/or multiple-monitor displays were recruited. Although participants had few opinions about widescreen page design at the start of the study, they had developed very strong opinions after two hours of working with the prototype. Results were abstracted from the majority opinions, and applied as general recommendations for further, targeted studies. Ultimately, these should generate design patterns and converging standards for a uniform large display user experience.

Methods

Participants

Ten analysts with 1-7 years experience in financial, human resources, and network management were recruited for this study. All had daily experience using enterprise business applications, and none had prior experience using widescreen (or multiple) displays. Examples of common reporting tools used by these participants include Business Objects, Oracle HRMS, McKesson FMS, Microsoft Excel and Access, Hyperion Brio, Oracle Discoverer, and Peoplesoft FMS. Each participant was individually tested, and each signed a confidential disclosure agreement and was paid for participating in the 2-hour study. Basic demographic information is provided in Table 1.

Apparatus and Prototype

The study was conducted in Oracle's Usability Labs, containing separate user and control rooms separated by a one-way mirror. The study was presented on a Panoramtech triple-head display (driven by a Dell computer with Matrox Parhelia 128 MB graphics card) that provided 3072 x 768 continuous desktop with three, 15-inch LCD panels separated by 3/8-inch metallic bezels. Desktop actions and participant video/audio were digitally recorded, and comments were logged for further analysis.

A prototype application, developed in Microsoft Visual Studio (<http://msdn.microsoft.com/vstudio/express/>) was developed to vary the number of portlets, portlet size, location, content, and expansion characteristics over many trials. A starting 600x400 window was presented on each trial, near the upper left edge of the triple-head display (Figure 1). Each portlet was defined by an orange title bar, with content that could

include a textbox, table, graph image, or map image. Resizing the application window resized and/or re-located each portlet according to predefined, programmed characteristics.

Table 1. Summary of Study Participants

<i>Gender</i>	<i>Job Title</i>	<i>Years on Job</i>	<i>Company Sector</i>	<i>Company #Emps</i>
F	Financial Analyst	1-3	Software	1001-5000
M	Sr. Financial Analyst	5-7	Health Care	1001-5000
F	HR Analyst	5-7	Entertainment Software	1001-5000
F	Financial Analyst	3-5	Financial Management	>5000
M	Financial Analyst	3-5	Healthcare	>5000
F	Financial Analyst	5-7	Education	1001-5000
F	Sr. Analyst	7+	Insurance	1001-5000
M	Consultant	3-5	IT Consulting	100-500
F	Financial Analyst	1-3	Education	1001-5000
F	Sr. Financial Analyst	5-7	Financial Management	>5000

Procedure

Each participant initially opened a 3072x768 (3-screen) browser window, viewing sample web pages, and their own company's site. They were instructed to verbalize their expectations and opinions, including likes, dislikes, and surprises. Most expressed surprise that site content could be left-justified, center-justified, or full-justified with flowing text. They also experienced several pages, whose content layout broke or did not fully utilize the available space. Participants next viewed and manipulated 24 test pages on the prototype, again verbalizing expectations and opinions. On each trial, they dragged the window to its maximum allowable (2000x768 pixels; 2-screen) size, while discussing typical tasks that could be completed on the page (Figure 2). After completing the 24 test pages, a brief interview ascertained general impressions, perceived usefulness of the widescreen display, and general likes and dislikes.

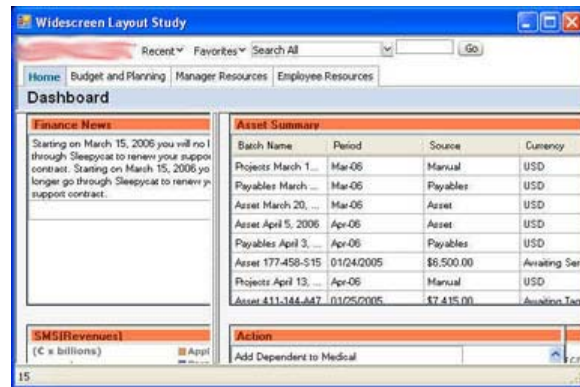


Figure 1. Example 600x400 starting window.

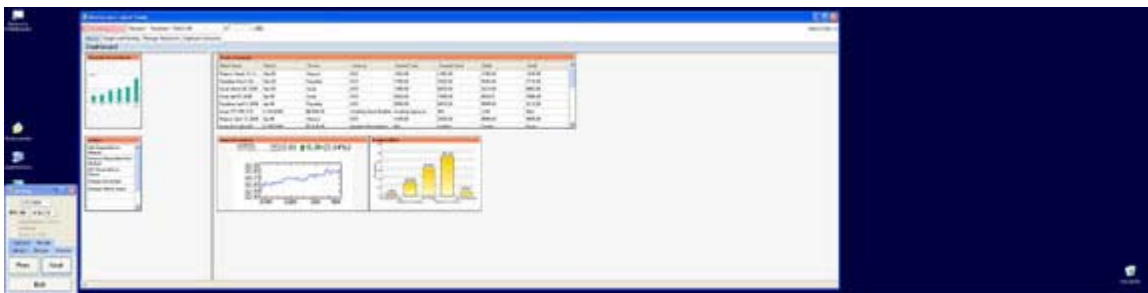


Figure 2. Example full-size (2000x768) maximized window, shown in context of the display desktop. Note that the participants also view two metallic, narrow bezels.

Design

The 24 trials that were viewed by each participant represented four different page layouts (Figure 3). The 24 test trials resulted from two replications of 12 combinations of portlet content, layout, and expansion. Each of these layouts included two portlets within the Regional area to the left of the vertical splitter, and three or four portlets within the Local Content area to the right of the splitter. Initial portlet sizes were small (200 px wide), medium (200-300 px), or large (600 px). Within a page, portlets were either of fixed size or

expanding, and they could independently be left or center-justified. Portlet content were resized either by maintaining a constant aspect ratio, or a constant size (clipping or exposing the right and bottom edges of an image). Tables were resized either by changing column widths while always showing all columns, or by maintaining fixed column widths. Additional table columns could also be exposed in expanding portlets.

RESULTS

Participant comments were collected, categorized by feature, then abstracted, as presented below. As a reminder, these are formative results based on

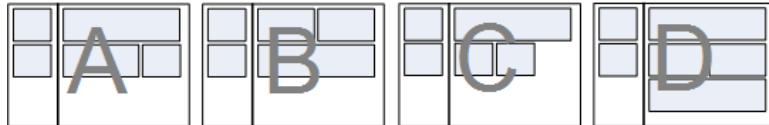


Figure 3. Four different portlet starting layouts.

comments and expectations, and so should be taken as preliminary, and dependent on follow-up studies.

Portlet Justification and Expansion

Groups of portlets within page frames were expected to remain left-justified as the page resized. This applied to both Regional and Local Content areas of the page, due to participants' desire to minimize white space within their work areas. Left-justification also made it easier to position large browser windows so that physical display bezels didn't obscure tables and portlets. Participants expected individual portlets to expand from their top-left corners as the window became larger. They also expected to see all portlets, though very small, on the starting (600x400) browser window. They stated that it would be desirable to know what portlets were present, even if too small for details to be read. Most were quite sensitive to the presence of white space that was sometimes present around portlets and window edges in this study. They wanted windows that were filled with information, whether the window was small or large. They frequently tried to minimize the white space, and voiced frustration when they could not.

- *As I make the screen bigger I would expect the portlets to get bigger...I want to see all the portlets on the page when I begin, views of all the objects and then see the expansion. (Participant 1)*
- *I think the portlets on the left hand side should be closer to the left edge...I would like to get rid of the white space on the left of the portlets in the local area. I would rather have portlets more on the left side. (P9)*
- *The left side is keeping some white space padding on the right side of the portlets that I am not sure I need...I prefer to have less empty space and have everything together. When the left hand portlets are center aligned, I feel like the white space is being wasted around the portlets. The white space bothers me. (P1)*
- *For whatever information I am looking for, I would like to maximize the information and reduce the white space around the portlets...It's difficult to eliminate extra white space from my view when things are centered...On the right side I want more information and less white space. (P3)*

Additional comments pertained to the expectation that portlets should flow to take best advantage of larger and wider browser windows. Expanding content areas should push other areas on the page, and vertically stacked areas could stack horizontally for widescreen displays. This "liquid layout" concept has been proposed by others (e.g., Tidwell, 2005), and should be the topic of further usability research.

- *When a portlet expands, the adjacent portlets should re-orient themselves around the expanded window...I should be able to line up everything horizontally. I want the objects that are at the bottom of the screen to be moving to the right of the existing portlets as I widen the screen. Bottom portlets should get pushed into the horizontal white space as we allow a portlet to grow, then space things horizontally and not let portlets cause vertical scroll. I would like to have portlets arranged horizontally rather than having to scroll vertically. That's the advantage of having wider displays. (P3)*

There was agreement that all types of portlets (tables, graphs, and maps) should have defined minimum and maximum sizes. These sizes should be based on users' tasks, such as reading text, locating states or countries, or comparing bar heights. Maximum sizes should also be limited by intended tasks, as well as by white space on pages.

- *I don't want portlets to get smaller than a particular size; they should have some readable size...I want portlets to start at a minimum size and then you are able to make it bigger, but not disproportionately. The portlet should know what the maximum size of the content is, then show some box around itself indicating that this is the maximum it can get. (P1)*

Splitter Movement

The prototype moved the splitter bar as a constant ratio of the overall window width. Participants usually agreed that the splitter bar should remain stationary as the window resizes. This is consistent with the general notion that left side contents include navigation elements, and other small information summaries.

- *I did not expect the splitter to move when I change the window size. (P5)*
- *When I expand the main window I want the left side to not change its size. I don't want the content on the left side to change when right side is changed...We manipulate the left side because we want more room to work with on the right side. The left side should not move when I want to see more on the right side. I want enough space on both sides to work with. (P8)*

When participants specifically dragged the splitter bar, they had somewhat different expectations from a page resize. They expected portlets to the left of the splitter to resize, but those to the right to move without resizing, eventually being clipped by the right-hand window edge. Double-clicking the splitter was expected to toggle its position from its current/minimum distance to its maximum distance. The maximum distance should be defined relative to the left-frame area maximum portlet sizes. In addition, participants frequently lined up the display bezels with the splitter bar, partitioning the page content between left-most and center displays.

- *I want to move the splitter myself and determine the space that I see...When I move it, it shouldn't expand or change anything on the right side...I should have splitters on the window to compartmentalize my work. I would like to create splitter bars and change different sections of the application independently. I should be able to compartmentalize tables on one side and charts on the other side. (P7)*

Table Resizing

If no horizontal scrollbar is present under a table, as was the case in this study, participants preferred that tables should render all available columns with minimum column widths in context to a task, rather than gradually exposing more columns as a window is resized. Tables with fixed column widths were expected to display a horizontal scrollbar when additional columns may be present, even if those columns are exposed upon portlet expansion. The horizontal scrollbar was perceived as an aid for knowing how many additional columns might be present.

- *I want to see more columns in the table as I expand the window, as opposed to having wider columns. (P3)*
- *The table should show all the different columns at once even if they are small in width; at least no information is cut off in this way. I think I like this better as you can see the same information regardless of the window size. (P10)*

Graph and Map Expansion

Minimum graph and map size should be defined by legibility, with respect to the requirements of a specific task. Overwhelming preference was expressed for both graphs and maps to maintain their aspect ratio on resizing, as opposed to being clipped. Some participants wanted more or different types of information to be revealed as graphs resized. They also expected the map component to have pan and zoom tools and capabilities.

- *I want maps and graphs to be undistorted. They are most meaningful in their proper aspect ratio. I would rather see less of an undistorted map than more of a distorted map. (P3)*
- *The graph maintaining its aspect ratio was good, as I can still see the preview and then play with the window size to read it. (P4)*
- *Revealing more info in graphs is better than making it bigger in size. I am trying to get more information from the graphs and not trying to make it bigger in size. (P6)*

CONCLUSIONS

The formative approach used here was successful in eliciting opinions, which in turn will be used to direct further large display usability studies. Issues such as portlet justification, layout and expansion, and their interaction with page and splitter resizing will provide valuable input for application design guidelines and patterns. This approach was especially valuable, because participants had no prior experience with these displays; opinions were formed during the study, following significant experience resizing a large browser-like window.

These participants generally wanted browser window objects to use all available space. They didn't want to see white space, and expected that elements expand as the available space expands. Left-hand justification of page elements, coupled with a fixed regional splitter upon page resize, were expected. They usually expected that graphical objects would maintain their aspect ratio, without clipping content. Tables could potentially expose and hide columns as they resize, but only if there is some indication of hidden versus observed columns.

Using all available large display horizontal browser area can be implemented in multiple ways. The most logically simple method is by creating multiple CSS documents, then switching these, depending on predefined display types. This method requires a resource intensive, separate UI design for each display, and would only work for predefined display sizes. A more general approach is the development of constraint-based liquid layout of elements and text. Constraints, written in Javascript or XML code, provide code-based heuristics for layout of page elements relative to each other, and to their parent containers. For example, a graph portlet could be designed to layout both above its caption, and to the right of an accompanying table. Page columns can be added and deleted as the page is resized, while both text and portlets flow among these. Prototypes testbeds are currently being developed to implement and evaluate these page behaviors.

The next step for this project will be to evaluate alternate examples of component flow (or liquid) layout within a prototype application. There are many factors to study to make sure non-static layout is highly usable and predictable by intended users. Completion time and other objective metrics could also be introduced for task-based scenarios on the large displays.

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References

- Colvin, J., Tobler, N., and Anderson, J.A. (2004). Productivity and Multi-Screen Computer Displays, Rocky Mountain Communication Review, 2(1): 31-53.
- Czerwinski, M., Smith, G., Regan, T., Meyers, B., Robertson, G., and Starkweather, G. (2003). Toward Characterizing the Productivity Benefits of Very Large Displays. Proc. INTERACT 2003, IOS Press, pp. 9-16.
- Goldberg, J., and Mochel, K. (2006), Developing Application Design Guidelines for Large and Multiple Displays. Proceedings of CHI 2006 Workshop on Information Visualization and Interaction Techniques for Collaboration across Multiple Displays, Montreal, Canada.
- Mackinlay, J.D., and Heer, J. (2004), Wideband Displays: Mitigating Multiple Monitor Seams. CHI 2004 Proceedings, pp. 1521-1524.
- Pfeiffer Consulting (2005), The 30-inch Apple Cinema HD Display. Productivity Benchmark, URL: http://www.pfeifferreport.com/Cin_Disp30_Bench_Rep.pdf.
- Raskino, M. (2005), Bigger and Better Display Will Boost Productivity at Last, Gartner Research Report G00126172, April 1, 2005.
- Robertson, G., Czerwinski, M., Baudisch, P., Meters, B., Robbins, D., Smith, G., and Tan, D. (2005), The Large-Display User Experience, IEEE Computer Graphics and Applications. July/August 2005, IEEE CG&A special issue on large displays, 25(4), 44-51.

Simmons, T. (2001), What's the Optimum Computer Display Size? *Ergonomics in Design*, Fall 2001, pp. 19-25.

Tidwell, J. (2005), *Designing Interfaces*. Sebastapol, CA: O'Reilly Publishing Co.

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