

Go big! Large screen displays and multiple displays for workstation applications



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Introduction

Businesses are always looking for ways to improve on their productivity, and many may be overlooking one surprisingly obvious bottleneck – the display we use to interface with the workstations that have become so critical to our jobs.

A significant number of research projects have clearly demonstrated that additional screen real estate, either in the form of multiple displays or in the form of larger displays (or both) improves productivity between 6 and 63%. We'll look more closely at these figures later.

We will examine just how display screen size and the use of multiple displays can affect productivity, taking a close look at how the ability to show more of a data set, application or applications, or a visualization set at full native resolution with less scrolling or tabbing improves your working efficiency.

We will then take a look at how large format and multiple display configurations can benefit the specific requirements of workstation users, and then we'll see what HP-specific design benefits are offered in our line of HP Performance LCD monitors. We'd like to make the case, not only for the use of large format and multiple displays for workstation users, but also for the specific and unique benefits of HP displays.

Finally, we'll examine some of the different configurations for various displays, and have a look at ways to select the size and number of displays in ways that optimize productivity and ROI.

Productivity gains

Our computer displays, with the right hardware and software, have largely taken over the roles once exclusive to our desktops, typewriters, diaries, filing cabinets, easels, light boxes, and artist stations. Yet, according to research by Microsoft, the average screen size is not much larger than a piece of US Letter stationery (8 inches x 11 inches)¹. How can one organize or create with optimal efficiency in such a small space?

The truth is, you can't. Microsoft researchers, while studying work efficiency patterns, discovered that one of the easiest ways to boost productivity up between 9% and 50% was to switch over to a multi-monitor configuration². In one paper, researcher Jonathan Grudin noted that the "overwhelming consensus" of Mechanical Computer Aided Design (MCAD) users was that they would never switch back to single monitor use, and this paper was written before larger format single monitors were available.³

Research firm, the Pfeiffer Group, went even further, claiming that efficiency gains of between 50-65% can be achieved when a user upgrades from a 17-inch or 19-inch monitor to a 30-inch high-resolution LCD. The Pfeiffer Group paper acknowledges that these gains can be seen in markets as diverse as digital imaging, video, design and publishing, but also in general productivity and office type tasks. The report also suggests that such large displays could lead to a return-on-investment of thousands of dollars a year⁴.

Researchers at the University of Utah conducted a study with 108 participants working on a series of three tasks: Text Editing, Spreadsheet Editing, and Presentation Editing on single, dual, and three monitors. Their performance was measured in several ways: time to start task, time to complete task,

¹ Microsoft Research News And Highlights – 'Two screens are better than one', 2005:
<http://research.microsoft.com/displayArticle.aspx?id=433>,

² Microsoft Research – 'The Large-Display User Experience': George Robertson, Mary Czerwinski, *et al*, 2005

³ Microsoft Research – 'Partitioning Digital Worlds: Focal and Peripheral Awareness in Multiple Monitor Use': Jonathan Grudin, 2002,
<http://research.microsoft.com/copyright/accept.asp?path=http://www.research.microsoft.com/research/coet/Multimonitor/CHI2001/paper.doc&pub=ACM>

⁴ The Pfeiffer Group – 'The 30-inch Apple Cinema HD Display Productivity Benchmark', Pfeiffer Consulting, 2005

number of errors, and a usability questionnaire. Efficiency improvements were measured at rates ranging between 6-33%⁵.

How can larger or more displays improve my efficiency?

Each of these different research projects have independently drawn similar conclusions, which can be summarized as:

The more physical screen real estate you have (i.e. the larger the display size) the more of your data and applications you can see at once.

This has a number of clear working benefits; the main one can be summarized visually. You can see the difference that scaling up in size can make for screen real-estate in Figure 1, which compares the display abilities of our HP Performance LCD family, from our 19-inch diagonal display (which is a typically standard size for LCDs in business) through to our 30-inch diagonal widescreen display. At the left of Figure 1 is a 17-inch HP L176v LCD, which is a typical business user size.

Figure 1. LCD size comparison

From left to right: 17-inch HP L176v; then HP Performance LCDs – 19-inch LP1965, 20-inch LP2065, 24-inch LP2465, 30-inch LP3065.



You will notice that the 30-inch display can natively display a much larger portion of the image than the 17-inch display. Clearly the larger the screen of your LCD and the more pixels it can display, the more data can be displayed at once. This has several advantages:

- You can show several different applications onscreen at once, either tiled in the desktop space on a single display, or one or more applications displayed across several displays. Imagine a spreadsheet with lots of columns, if you fit it in a single monitor you might not be able to read the text; span it across a wide aspect monitor or two or more monitors and you can work on the entire document.
 - Tiling applications across one or more displays will improve the accuracy of the transcription and comparison of data because you can do direct comparisons rather than tabbing between applications.
- You can have more menu and toolbars onscreen at once while still having a large working or viewport display. Some users will span an application across two or more monitors, and use one entirely for displaying toolbars. The less clicks required to access a tool translates to efficiency and ergonomic improvements.
- You can show more of an image, a document, a spreadsheet, a dataset, or a model at once without having to magnify your working area. HP's latest large screen LCD, our HP LP3065, offers 2560 x 1600 pixels of resolution which is the equivalent of 3.91 megapixels, i.e. you could display a 5 x 8 inch image at 300 dots per inch (dpi) on this display at full native resolution. This will save you money and time by reducing your reliance on printed material.

⁵ University of Utah – 'Productivity and Multi-Screen Computer Displays', 2004: tc.eserver.org/25325.html

Most applications and computer hardware are optimized for 100 dpi displays, but a printed document the equivalent of 300 dpi.

- You can test this for yourself by typing a line of text with a font size of 2 or 3. Print the test text out on an HP laser printer, then view the document in “print layout” (if you are using Microsoft Word) and set the viewing zoom at 100%. Then place your printed document next to the screen and increase the zoom level of your document until you can read the text. This should demonstrate that viewing a document in full detail on a computer monitor requires enlarging the text (with a corresponding loss of display real-estate to read more text at once) up to 3X of the original document size.
 - People compensate for the loss of pixel density by either printing their documents out or by zooming in and then panning around a document, which reduces efficiency by adding time to what was once an intuitive process. Until display hardware and applications are optimized for 300 dpi display, the best way to compensate for the difference in pixel density is to use the largest display possible with graphics card capable of achieving high resolutions.

So going large with multiple and/or bigger displays will allow you to see more of a document or dataset, and will allow you negotiate it intuitively and quickly (i.e. by eye). It increases your peripheral vision of a design or model in graphics applications; because you can see more of your model at a greater level of native detail, you can more easily get a holistic view of how the design is coming together. Experientially, it assists in both streamlining the design process and making good decisions without as many zooms and pans, as well as in the process of finding errors in the design.

How can larger displays improve my efficiency?

Much of what we have previously discussed regarding more display real-estate applies particularly to large displays. It's your choice whether you prefer a large monitor over several smaller ones; there are a number of factors to consider.

- A single large-aspect monitor has a smaller desktop footprint than two or more monitors, which may be an advantage in space constrained environments.
- A large-aspect monitor provides a single view space; multiple monitors are split by their bezels. It is typically a matter of preference.
- A large display provides more uninterrupted screen real estate for 'design peripheral vision', allowing a more holistic view of a single model.
- A large display requires less toggling or scrolling than two multiple monitors may require – you will have to move the mouse between each, or toggle between each.
- Applications such as NVIDIA nView Display Gridlines allow you to automatically tile a large screen into multiple sub-screens using frames, enabling a pseudo-multi-display functionality at a single mouse click.

How can multiple display improve my efficiency?

A multiple display configuration has a number of clear benefits:

- Multiple monitors with one desktop spanned across each will provide a much wider horizontal viewport, which can be useful.
 - By adding additional monitors, you can add screen real-estate for additional windows of your core application or for other core applications, reference documents and email that you would like displayed simultaneously
- You can typically achieve more screen area for less cost per pixel by purchasing two smaller monitors instead of one very large one.
- Applications like NVIDIA nView or ATI HYDRAVISOR will enable saved application configurations or one-click display switching across multiple displays.

Benefits by market

The HP Workstation customer is likely to have particular high-end requirements for data visualization and display. Some of the workstation-specific benefits of large and multiple displays are listed below.

Power Office

Being able to view more of your spreadsheet, document, image, or editing timeline has obvious benefits, which we have already reviewed. You can also tile your applications. With HP Performance LCDs, you are able to rotate your monitor 90 degrees which is particularly beneficial for long pages or sections of code.

MCAD

The ability to see an entire assembly is not only convenient, it speeds efficiency and accuracy in the engineering workflow⁶. The MCAD user now has more to see, and can detect design errors that might have slipped through in a smaller environment that relied on extensive panning and zooming to navigate through the model. An MCAD user can focus more on the design process with confidence, able to view larger models and drawings in their entirety. The MCAD user with a large-aspect monitor or multiple monitors will spend less time panning, zooming, maximizing and minimizing windows and menus, and switching between multiple applications.

Using the HP LP3065 30-inch monitor, you enable large 100 dpi windows, so an engineer can view 80% of a D-size drawing on a single monitor, compared to just 25% on a 21-inch Cathode Ray Tube (CRT) monitor.

Digital Content Creation

Like MCAD, the animator and artist will always benefit from being able to see more of their model while having multiple toolbars open to speed up accessing features of their chosen application, while still having space reserved for email, chat, productivity, or illustration, rendering, or photo manipulation applications.

Large monitors are extremely useful in video editing and effects. As High Definition is becoming a staple of the video editor, the ability that large-aspect monitors allow to view complete frames in the 1080i standard or even in 2K film resolution is invaluable. Multiple monitors are particularly useful when viewing long horizontal timelines. It enables the ability to zoom into the timeline for individual frame edits while still displaying a large length of time.

Oil & Gas

Seismic and reservoir analysis can cover huge physical distances in 3 dimensions, but fine detail can also be important when making reservoir management decisions. Therefore, multiple large-format monitor configurations is already the norm in the oil and gas market.

Public sector

The public sector market is very broad. Many of the same benefits seen for the MCAD and DCC market apply, as do the benefits of large area visualization in Oil and Gas, except in the public sector the task is more likely to be Geographic Information Systems-related or possibly in defense or

⁶ Microsoft Research – 'Partitioning Digital Worlds: Focal and Peripheral Awareness in Multiple Monitor Use': Jonathan Grudin, 2002, <http://research.microsoft.com/copyright/accept.asp?path=http://www.research.microsoft.com/research/coet/Multimonitor/CHI2001/paper.doc&pub=ACM>

scientific analysis. And basic productivity tasks are a staple of the office, so the same benefits apply as outlined at the beginning of this paper will apply.

Why HP monitors?

Figure 2 shows the HP Performance LCD family for HP Workstations, and just some of the possible configurations you can achieve.

Figure 2.

The HP LP2065 in vertical orientation and the LP3065 in standard orientation, great for applications with large menu and toolbar options that can go to the left monitor, leaving plenty of work area on the 30-inch.



4 HP LP2065s in horizontal orientation, ideal for displaying large chunks of data and multiple applications



4 HP LP1965 monitors in a horizontal configuration, ideal for multiple applications, including those that span two monitors



HP offers a number of specific benefits that are exclusive to HP workstation LCDs when compared to other tier one vendors:

- Carrying grip built into monitors
- HP Display LiteSaver allows you to schedule low-power sleep modes at the time of your choosing, such as the end of the workday. This helps prolong the life of your fluorescent backlight and reduces the possibility of image burn-in without the obtrusiveness of a screensaver.
- Adjustable height, tilt, rotate, and swivel options for convenience of positioning.
- Rubber cable management/concealment system.
- Quick release mount that is a VESA compliant and easy to use mounting solution, enabling you to reorient your display on a stand, mount, or all. Includes a 'sure lock' mechanism with a theft-detering security screw.
- Supports attachable audio speaker bar
- Our bezels are the narrowest in the industry, so that the interruption between screens in a multiple monitor configuration is slight, something reviewers of our products have recognized⁷.
- Every monitor we offer can be rotated or remounted in a vertical orientation
- No hassle support and warranties, plus factory audits help to ensure near-zero defects on shipped displays.

Our latest monitor, the HP LP3065, is leading the other tier one vendors in a number of other key features at the time of writing. These features are:

Contrast ratio: A high contrast ratio implies better color representation on a monitor. The greater the ratio, the more subtle the color details that can be displayed, and the better the monitor will display

⁷ See ExtremeTech's review in December 2006 of the HP LP3065: <http://www.extremetech.com/article2/0,1697,2077915,00.asp>

graphics under ambient light conditions. It is a measurement of the difference in light intensity between the brightest white and the darkest black.

The HP LP3065 wins with a 1000:1 ratio vs. the 700:1 contrast ratio for our closest tier-one rivals.

Response time: This measures the speed with which a monitor will display an image. If LCD has a slow response time, display pixels won't be able to keep up with fast moving graphics and visible artifacts, such as ghosting, will appear.

The HP LP3065 wins with a very fast 8ms response time vs. 11 ms for our closest tier-one rivals.

Color gamut: A subset of colors that can be accurately represented. Most typical LCD screens use fluorescent bulbs for backlights, and have a gamut much smaller than CRT screens.

HP's color gamut for the LP3065 is 92% of the NTSC standard color space, compared to 72% of NTSC for our closest tier one rivals.

The table below illustrates specific features of the HP Performance LCD line.

	HP LP1965 Flat Panel Monitor	HP LP2065 Flat Panel Monitor	HP LP2465 Flat Panel Monitor	HP LP3065 Flat Panel Monitor
Size (diagonal)	19 in (48 cm)	20.1 in (51 mm)	24 in (60.96 cm)	29.7 in (75.44 cm)
Brightness ⁱ	300 nits		500 nits	300 nits
Contrast ⁱ	1000:1	800:1	1000:1	
Response rate ⁱ	6 ms*	8 ms**	6 ms***	8 ms****
Viewing angle ⁱ	178 x 178 degrees			
Resolution	1280 x 1024	1600 x 1200	1920 x 1200	2560 x 1600
Pixel pitch ⁱ	.294 mm	.255 mm	.270 mm	.250 mm
Inputs	Dual DVI-I	Dual DVI-I	Dual DVI-I	Three dual link DVI
Warranty	3-3-3 includes backlight			
*6 ms gray to gray; 20 ms rise and fall. **8 ms gray to gray; 16 ms rise and fall. ***6 ms gray to gray; 13 ms rise and fall. ****8 ms gray to gray; 12 ms rise and fall.				

Conclusion

The trend in workstation is towards multiple processor cores, and even graphics cards. Large-aspect or multiple monitor configurations are the logical extension of this ability to multiprocess numerous applications or instances of an application at a time. In such a power-user environment, the display interface should not be the bottleneck.

HP offers extremely flexible, high performance monitors at very reasonable prices that will boost individual and company productivity.

To learn more about HP monitors, visit:

www.hp.com/go/monitors

To learn more about HP workstations, visit:

www.hp.com/go/workstations

†All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower

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