Working in the Office of "Real Soon Now"

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In our offices of "Real Soon Now" we use large-screen projection instead of conventional monitors. We've been using these systems for more than a year, and we'll never go back.

The "Office of Real Soon Now" is an ongoing experiment to see what it's like to use large-screen projection as our only computer display. We say "real soon now" to contrast our experiment with the "Office of the Future," a project[1,2] here at the University of North Carolina that's building a much more sophisticated, lab-based environment in which multiple projectors seamlessly blend to display on most of the office surfaces. Our systems aren't nearly that fancy. Our idea was to experiment with systems we could build and operate within days. "Next week" just didn't have the right ring. So we called our project the "Office of Real Soon Now."

We felt it was important to get more than demo experience with this new kind of working environment. It's one thing to demonstrate a system for a few minutes at a time; it's another thing entirely to use it all day every day for all the work you do. We have been using the systems described here for more than a year.

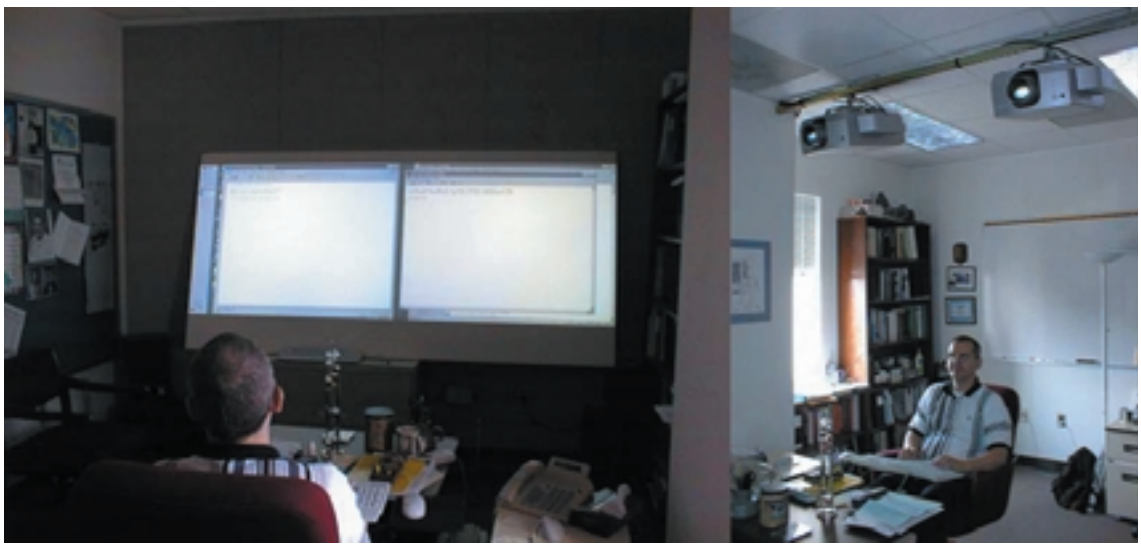
To get our systems working quickly, we decided to make them very simple and to accept the inherent flaws. As shown in Figures 1 and 2, we mounted the projectors overhead to display abutted images on a large, flat, display surface. We mechanically adjusted the position of the projectors to get the images approximately aligned. Greg sits about 2.4 meters from his screen, which is 1.8 meters wide, and Gary sits about 3 meters from his screen, which is 2.4 meters wide. The projectors each display 1024 by 768 pixels for a composite display of 2048 by 768 pixels.

Why would you want to do that?

These systems have improved our work environment in several ways.

Improved social and technical interaction

Eliminating that huge, CRT-based monitor really frees up desk space. In fact, it freed up so much space that we got rid of our desks. The monitor and its support



1 Gary's office seen from back and front.

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dominate the typical CRT-based office. Eliminating the desk opened up our offices and lets us work side-by-side with visitors rather than across a barrier.

We now routinely work with our students and colleagues by displaying the subject matter (typically a program, a graph, a paper, or an image) across the screen and pointing with the mouse, laser pointers, or our hands. When everyone can see the display clearly, everyone can participate productively in the process. We no longer have to crowd around a CRT to see what's happening.

To extend this capability, each office has two wireless keyboards and two simultaneously active mice. Either user can type or move the cursor—no more calling out a complicated URL or the command line of a program to a single typist. It's now common for our students to start a meeting by grabbing the spare keyboard and running a program or displaying a picture to demonstrate their latest progress.

Of course, you could get many of these benefits by scheduling meetings in a conference room with projection capability, but that requires planning for the interaction ahead of time. We find that having the system always and immediately available makes a huge improvement in our everyday work.

2 Greg's projectors.

Better ergonomics

Our eyes are much happier focused on a screen several meters away than they were when focused on a CRT at 1/2 meter. Health authorities now encourage computer users to rest their eyes by looking away from their CRT-based display as often as possible to rest their eyes. We find attending to a display at 2 to 3 meters much more restful to our eyes, and it eliminates the eyestrain we formerly experienced.

The displays are surprisingly clear and sharp. The geometry of our display setups is comparable to sitting 1 meter from a conventional 21-inch (53-cm) diagonal CRT monitor. We never sat that far from a monitor, yet the projected display seems much larger and clearer than our CRTs ever did.

The least expected and most appreciated advantage of our projector-based displays is the marked reduction in pain in our hands and bodies. We attribute this to our freedom to move around while using the system. A typical CRT monitor constrains the user's head to a small volume for proper viewing (especially when wearing thick bifocals). In contrast, the "sweet-spot" for the projected display covers most of the office. We can sit up straight, slouch, stand up, or walk around and still see the display clearly.

To further enhance our ability to change positions, we moved our keyboards to more flexible supports. Gary uses an articulated keyboard arm that instantly adjusts for use while sitting or standing. Greg uses a small, rolling, wooden table that adjusts for height and tilt.

Higher information content

The large, contiguous display area is great for everyday work. We can open multiple applications side by side and easily glance back and forth between them. This beats cycling through any window manager. In addition, we often spread large images, plots, and graphs across the wide projector wall to see both fine detail and the big picture simultaneously. When we really want an up-close view, we walk up to the screen. This provides a natural zoom capability that's much easier on the eyes than trying to focus on the CRT screen when it's only 5 centimeters away.

What problems did you have?

Of course, our systems have some drawback as well.

Heat, noise, brightness

Our projectors use 400-Watt lamps to produce 600 lumens at the screen. All that energy ends up as heat, and the fans needed to cool the lamps generate quite a bit of noise. When we first installed our systems, we made no provisions for eliminating the heat from our offices. Needless to say, nearly 1,200W of heating overwhelmed the air conditioning system in our offices. We got hot. We dealt with this by adding home-brew ducts to our projectors to carry the heat away from the office. You can see the silver ducts in Figure 2, which looks like something from the movie *Brazil*.

Our projectors aren't bright enough to maintain sufficient contrast with the room lights on. We never ran the room lights when we used CRTs, either, but many people do. Gary keeps one window open to see outside; Greg uses a shade of darkened transparent plastic because his office gets the morning sun.

Newer model projectors produce twice the light with half the power of ours. These and better models to come will eliminate both the heat and lighting issues.

Matching at the seam

A few pixels of alignment error and a marked color shift across the boundary between projectors makes the seam very noticeable. The projectors we use were not

designed for use with abutted images. The image from a single projector looks fine in isolation, but when compared side by side with another, it's obvious that the color varies significantly across the display. However, this seldom proves a problem in practice.

Privacy

You don't have much privacy when your computer screen is the size of a wall. This hasn't been a significant problem. Once or twice when we wanted to look at a spreadsheet with sensitive salaries or grades, we had to ask a guest to look the other way. Greg gets privacy using a third projector pointed at a smaller screen set into a bookcase to his right. Since his guest chair sits on his left, it's difficult for a guest to see this private display. A laptop or other small display offers another option for things that must remain private.

Cost

Many of our visitors have commented on the high cost of using projectors for computer displays. It's important to understand that CRT-based monitors are cheaper than projectors primarily because CRTs are produced in tremendous volumes. When the volume for projectors increases, there's no reason why the components of a projector (a light source, a small light modulator, and a lens) should cost more than the components of a CRT monitor (a giant bottle of vacuum with complex analog deflection electronics). In fact, with new micro displays they should be cheaper.

How did you do that?

Gary's system is Windows NT based, while Greg's is Macintosh based. We trick NT into driving multiple displays using a graphics card with multiple video outputs; NT thinks there's just one 2048 by 768 display. Such graphics cards are available from most graphics card vendors. The Macintosh OS has allowed multiple graphics cards for years; Greg uses three cards to drive his three projectors.

Our screens are made from a rigid foam board called GatorFoam. To eliminate keystone distortion, we had to tilt the boards slightly out from the wall (10 degrees for Gary's, 20 degrees for Greg's). The tilt looked strange for the first few days, then we didn't notice it any more. Avoid electronic keystone correction; it may work fine for your typical PowerPoint presentations, but it looks terrible for single-pixel fonts. Optical keystone correction, as in our projectors, works fine.

You can get more of the details on the construction of our systems from our Web pages.[3,4]

So, how do you like it?

Wow! It's so great we never want to go back to conventional displays. We feel better, and we get more work done. How can you beat that? Our students and collaborators like it and prefer to meet in our offices so that we can use the display.

We strongly recommend you try one of these systems before making up your mind that you prefer the conventional monitors you've used for years. Many of our visitors, at first skeptical, have left planning how to build their own office of "real soon now." We know of at least six other people who are currently using or planning to use projectors as the primary computer display. ■

References

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