

# Optimal Online Reading Guidelines

This document presents the primary factors to be considered in setting up a workstation that is both comfortable and effective for employees who spend a major portion of their day reading online. Although some mention is made of possible accommodation for employees whose vision is impaired, the primary focus is on users with relatively normal vision.

## Deciding What You Need

Major factors to consider in setting up an optimal online reading environment are:

- technology
- location and available workspace
- budget
- ergonomics

## Technology

The two basic types of computer display technology are the Cathode Ray Tube (CRT) and the Liquid Crystal Display (LCD), also known as a flat-panel display. CRT monitors offer multiple resolutions that produce sharp images, but are prone to screen flicker, which causes eye strain, especially during extended periods of online reading. LCD monitors offer more than one resolution, but only one provides a crisp and clear image. LCD monitors are not subject to screen flicker.

The LCD, with its bright screen, larger viewing area, and absence of screen flicker provides the optimal online reading experience.

A CRT that meets certain specifications (see Ergonomic Considerations) can also provide an acceptable viewing experience.

## Location and Workspace

Where the work will be performed and available workspace also influence the choice of equipment and setup of the workstation. A desktop PC is a logical choice for staff members who do most of their reading in the office; a laptop may be a better choice for faculty or staff members who frequently take work home.

## Budget

If your budget won't accommodate the more expensive LCD technology, buy a larger CRT rather than an inexpensive LCD.

## Ergonomic Considerations

Once you decide which type of monitor you can afford, focus on the ergonomics factor. Go to a computer store and try out each model you are considering to determine which provides both a clear, crisp image and lots of options for positioning the screen for comfortable viewing. The ability to adjust the height and tilt of the screen is as important to an optimal viewing experience as are the technical specifications of the monitor. If you decide to buy a CRT, it must have these two essential features.

- a high refresh rate, which reduces screen flicker
- a flat-panel screen to reduce reflective glare

## Features of the Recommended Technology

	<b>Recommended Monitor: LCD (Flat Panel) over CRT</b>	<b>Recommended Workstation: Desktop over Laptop</b>
<b>Characteristics</b>	Larger viewable area than CRT of comparable size  Brighter and more uniformly bright across the screen than CRT  "Native" resolution provides clear, sharp image	Greater capacity for expansion than laptop
<b>Location &amp; Workspace</b>	More compact "box" uses less of the work surface  Weighs less than CRT and is more easily transported	CPU can be placed beneath desk to save space on work surface
<b>Budget</b>	More expensive than CRT, but prices are coming down	Less expensive than laptop with comparable power
<b>Ergonomic Considerations</b>	Flicker-free screen causes less eye strain  More flexibility to adjust screen height, tilt, and, on some models, orientation  More energy efficient  LCD creates no electromagnetic radiation emissions	Larger keyboard is easier to use  Keyboard separate from monitor allows both to be correctly placed for user's comfort

## Recommended Monitor Setup

- Place monitor 25" - 30" from the viewer's eyes.
- Adjust monitor and chair height so the screen can be seen without tipping the head back or bending the neck.
- Tilt the monitor so the bottom of the screen is closer to the user than is the top.
- Adjust screen brightness and contrast to suit the lighting conditions of the work area.
- Use a movable monitor arm for more flexibility in adjusting screen viewing height and visual focal length.
- Arrange all equipment and tools so the user can work without repeated twisting, stretching, or bending.
- Use indirect lighting to reduce glare on the screen.



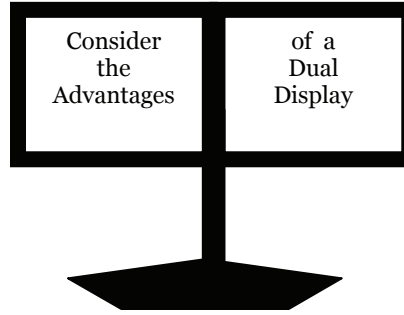
Contact Todd Baker or Carol John at 607-255-9344 or go to [www.ohr.cornell.edu](http://www.ohr.cornell.edu) for on-site assistance in creating ergonomically correct work stations.

## Options for the Visually Impaired

The technologies listed below represent only some of the options available to assist the visually impaired. Cornell's Workers' Compensation and Disability Services team (<http://www.ohr.cornell.edu/benefits/disabilityCase>) assists employees in finding appropriate solutions upon request.

- **Optical scanners** transfer information from a printed document into a computer or voice synthesizer.
- **Speech access systems** are software that enables a computer to read aloud from a stored document.
- **Braille displays** are devices on which a computer can "print" information in Braille.
- **Scanning and reading systems** use software to scan text from a printed document into a computer and read the text aloud. The information can be saved for later reading.
- **Screen enlargement programs** enlarge text on a computer screen to several times the original size.

## Dual Display



- allows easy access to multiple applications at the same time
- provides easy simultaneous viewing of multiple documents in the same application
- connected to a laptop, allows use of separate LCD and keyboard both positioned for safe and comfortable use

## Glossary

**Brightness** is the measurement of how light, or dark, the screen is. This is measured by candle power (candela).

**Cathode Ray Tube (CRT)** is the technology used in standard PC monitors.

**Dot pitch** is the spacing of pixels on the computer screen, expressed in millimeters. The average rating is .25mm. Low dot pitch ratings with high resolutions create sharper images.

**Electromagnetic radiation** is waves of energy created by magnetic fields resulting from electrically charged particles in motion.

**Ergonomics** is the study and practice of designing work spaces in which the user can operate efficiently and safely without physical stress.

**Flat-panel display** is a common way of referring to a Liquid Crystal Display (LCD) monitor. The LCD monitor has a flat screen as well as a much thinner (less deep) body than a CRT.

**Flat-panel screen** refers to a CRT that has a flat (rather than curved) viewing surface.

**Hertz** is the measurement of cycles per second, the number of times per second the computer monitor can scan the screen.

**Liquid Crystal Display (LCD)** is the technology used in laptop and stand-alone flat-panel monitors. This is not the same thing as a flat-screen monitor, which is a CRT.

**Native resolution** indicates the one resolution at which a LCD is designed to give the best image. Some LCDs offer multiple

resolutions, but those that are not "native" provide distorted or fuzzy images.

**Pixel** refers to picture elements, the basic unit from which images are created on a computer screen.

**Refresh rate** denotes the number of times per second that a CRT monitor redraws the display. This is expressed in hertz (Hz), and the faster the better. Too slow a refresh rate causes the image to flicker, which causes eye fatigue.

**Response time** is the measurement of the time, in milliseconds, that it takes the monitor to change the color of a pixel. CRT response times are slower than LCDs as CRT pixels are reset every time the monitor redraws the display. LCD pixels are not reset every time the screen is redrawn; each LCD pixel stays set (in the on or off position) until it needs to change.

**Resolution** refers to the sharpness and clarity of the text or graphic image, measured in pixels per inch. Higher resolutions allow more information to be displayed on the screen. The images will be sharp—but smaller than those created at lower resolutions.

**Viewing angle** is described by Mark Kyrnin, ("Understanding LCD Monitors" About.com) as "the arc of a semicircle whose center is perpendicular to the screen." An angle of 180 degrees would mean the image is clear and fully visible from any position in front of the screen; 120 degrees or higher is acceptable.

Recommended Technical Specifications			
	CRT	17"	19"
<b>Brightness</b>		250-350 cd/m <sup>2</sup>	250-350 cd/m <sup>2</sup>
<b>Resolution</b>		1024 x 768	1280 x 1024
<b>Refresh Rate</b>		75 Hz	85 Hz
<b>Dot pitch</b>		.26 mm or less	.26 mm or less
	LCD	17"	19"
<b>Brightness</b>		250-350cd/m <sup>2</sup>	250-400cd/m <sup>2</sup>
<b>Resolution</b>		1024 x 768	1280 x 1024
<b>Viewing Angle</b>		170/170 degrees	170/170 degrees
<b>Response Time</b>		25 ms is adequate	25 ms is adequate