

Nova users typically view the monitor at a 35 degree downward gaze angle from horizontal eye level. This angle, commonly known as the downward gaze angle, is the body's natural way of performing close tasks, such as reading.

Below is a short outline of the scientific studies and recommendations that support use of a downward gaze angle and lower monitor positions for computer work.

Standards and Guidelines

ISO 9241-5 - Ergonomic Requirements for Office Work with VDT's - Part 5: Workstation layout and postural requirements. Released 1998.

The International Organization for Standardization (ISO) released ISO 9241-5. The ISO standard requires that the entire viewing area of the screen be located between eye level and 60 degrees below eye level. The optimum position for the monitor, according to ISO, is within plus or minus 15 degrees of 35 degrees below horizontal eye level.

International Organization for Standardization: Geneva, Switzerland, www.iso.ch

BIFMA G1-2001, Ergonomics Guideline for VDT Furniture Used in Office Work Spaces (preliminary release)

The Business and Institutional Furniture Manufacturer's Association) has recently released a guideline that applies the principles of the ISO standard to the USA and Canada.

This is an invaluable tool for specifiers. The guideline provides the dimensions necessary to specify both seating and workstations. It echoes the ISO recommendation that the monitor be located between 20 and 50 degrees below horizontal eye level. The top of the screen should not be closer to the eyes than the bottom of the screen.

The BIFMA guideline includes an "Ultimate Test for Fit" for each of its recommendations. This is a way to ensure that the user is accommodated by the workstation, regardless of the dimensions of the individual components. A collection of all the Ultimate Tests for Fit is available from Nova Solutions, Inc. on request.

Contact: BIFMA International, 616-285-3963, www.bifma.org

Performance Studies

Two studies that compared performance at different monitor positions have found that a monitor at 35 degrees below eye level resulted in a 10% increase in performance when compared to placing the monitor at eye level:

Leoni, F. M., Molle, F. Scavino, G. Y Dickmann, A. (1994). Identification of the preferential gaze position through evaluation of visual fatigue in a selected group of VDU operators - A preliminary study *Documenta Ophthalmologica*. 87, 189-197

Sommerich, C.M., Joines, M.B., Psihogios, J.P., 1998. Effects of VDT Viewing on User Biomechanics, Comfort, and Preference. *Proceedings of the Human Factors Society 42nd Annual Meeting*, pp. 861-865.

Unfortunately, the authors of the second study mistakenly identified the 35 degree monitor condition as exceeding acceptable limits for muscle activity, when it fact it was well below them. An article in *Applied Ergonomics* which explains the mistake is available from Nova on request.

Neck Posture

An often voiced concern is that lower monitor positions will result in too much bending of the neck.

A study presented at the 2000 International Ergonomics Association/Human Factors and Ergonomics Society congress showed that viewing a monitor at 35 degrees below horizontal eye level resulted in postures that were very close to what is called "natural head posture." Monitors that were at eye level or slightly below eye level resulted in user's bending their necks back. Backward neck bending has been considered a risk factor of musculoskeletal disorders.

Ankrum, D. R. & Nemeth, K. J. (2000) Head and Neck Posture at Computer Workstations -What's Neutral? *Proceedings of the IEA/2000/HFES 2000 Congress*. pp. 565-568.

In addition, *Posture, Comfort and Monitor Placement*, published in *Ergonomics in Design*, shows that low monitor placement allows for a wider variety of acceptable neck postures than do high monitors.

Ankrum, D.R. & Nemeth, K.J., (1995). *Posture, Comfort, and Monitor Placement*, *Ergonomics in Design*. (April). pp. 7-9.

Both articles are available from Nova.

Monitor Height and Eye Strain

Lie I. & Fostervold, K. I. (1995). VDT-Work with Different Gaze Inclinations. *Work With Display Units '94*, eds. Grieco, A., Molteni, G., Occhipinti, E. and Piccoli, B., Amsterdam: Elsevier.

This study found that locating the monitor approximately 40 degrees below horizontal eye level reduced the increase in visual and postural symptoms compared to eye level.

Heart-rate Variability in Eye-level and Low Monitor Conditions

Ankrum, D.R. and Suzuki, K. (1997). Heart rate variability in eye-level and low monitor conditions. *Design of Computing Systems*, eds. G. Salvendy, M.J. Smith, R.J. Koubek. 21A, 571-574. Amsterdam: Elsevier

Mental strain reduces performance. This study found that a lower monitor position resulted in a lower Heart Rate Variability (HRV) reading than a monitor placed at eye-level. The HRV Index is a recognized method of evaluating mental strain.

Dry Eye Syndrome

Tsubota, K., Nakamori, K., 1993, *Dry Eyes and Video Display Terminals*. *New England Journal of Medicine*, 328, 8, 584.

Dry eyes are a common complaint among computer users. This study found that lower monitors would reduce the rate of tear evaporation when compared to eye level monitors.

Internet

www.office-ergo.com is a valuable internet resource for information on office ergonomics.

Other Studies

Numerous other studies support low monitor positions showing that a downward gaze improves accommodation and reduces the stress on the eye muscles that converge the eyes.