

Keyboard Placement

Generally, optimal placement of keyboards and other input devices should be determined by both the size and task of the user. Therefore, rather than using absolute metrics, this paper will discuss optimal placement in relation to the computer user.

Overall Concept: Placement of Computer Input Devices

Optimally, the user should be able to use the keyboard and mouse or other input devices with his/her arms close to the torso. In other words, upper arms should not have to extend very far forward to reach the keyboard or the mouse. In addition, the forearms should be approximately parallel to the floor when keying. There should be no more than a very slight reach up or down.

American National Standard Institute (ANSI) Guideline

The existing ANSI 100 guideline (1988) states that the angle between the upper arm and the forearm should be greater than 70 degrees and less than 135 degrees for keying. There is no specific guideline for using a mouse or other type of input device in the current standard. The preliminary draft of the 1996 version of the ANSI-HFES document reiterates this range of keyboard placement and adds the following:

- Shoulder angles between 10 degrees forward, backward or sideways unless the user's forearms are supported
- Wrist angle less than 5 degrees upward or downward from straight ahead
- Wrist angle less than 10 degrees to either side from neutral in all the ANSI reference postures.

Note that the 1996 version of the ANSI standard has not been finalized as is, therefore, subject to substantial change as of this date.

General Recommendations for Placement

The generally recommended angle between the forearm and the upper arm is 90 degrees or slightly less. This means that the forearms should be roughly parallel to



the floor when the fingers are resting on the home row of the keyboard. Thus, the optimal height for the keyboard is approximately seated elbow height. It is usually unsatisfactory for users to use the same support surface for the monitor and the keyboard. Separate, adjustable, stable support surfaces are recommended. Add-on adjustable support surfaces should be easy to move and to lock in place and have no sharp edges or noticeable wobble.

Overall Concept: Keyboard Slope

Keyboard slope is defined as the angle between the plane of the key top surfaces with the horizontal surface. Positive slope essentially means that the back of keyboard (i.e., the upper rows) are higher than the space bar, while negative slope is the opposite.

American National Standard Institute (ANSI) guideline

The existing ANSI 100 guideline (1988) states that the slope of the keyboard shall be between 0 and 25 degrees. The preliminary draft of the 1996 version of the ANSI-HFES document reiterates this position but adds the caveat that alternative keyboard designs can exceed the above range. **The emphasis in the draft of the revised standard is that keyboards in combination with their supporting surfaces shall permit users to adopt arm postures as discussed above and wrist postures that are straight.**

General Recommendations

There is general consensus among ergonomists and medical professionals that wrist extension and other bent wrist positions should be avoided. This is because the tendons that attach to the finger muscles pass through a relatively confined space in the wrist called the carpal tunnel. The tendons are encased in tendon sheaths and surrounded by a lubricating fluid. The median nerve that innervates most of the fingers also passes through the carpal tunnel. If the tendon sheaths become irritated, they may absorb fluids and swell, putting pressure upon the median nerve. This can cause feelings of tingling, numbness or pain.

The optimal posture for the wrist is, therefore, to keep the wrist straight -- free from upward or downward bends (extension and flexion) and sideways twists (ulnar and radial deviation). This is because when the wrist is not bent or twisted, the tendon sheaths have the most unobstructed passage through the carpal tunnel.





There are findings in the research literature that pressure inside the carpal tunnel is minimized when wrists are straight. In fact, the ANSI standard discusses data that show a connection between wrist extension and increased histological pressure in the carpal tunnel. Increased histological pressure, in turn, may be associated with the occurrence of carpal tunnel syndrome. Therefore, it is strongly recommended that wrist extension be avoided. Once again, the 1996 version of the ANSI-HFES 1000 document has recommended wrist postures as noted on page 1 of this paper.

Straight wrist positions can be achieved with both positive and negatively sloped keyboards provided that the degree of slope is not excessive. Currently, there is no comprehensive, published empirical work (done by impartial researchers) that indicates that one type of slope is beneficial over another. Users must be educated to keep their wrists straight (i.e., not bent) when keying.

Please note that there is no empirical literature that directly relates keyboard use to the occurrence of musculoskeletal disorders such as tendonitis or carpal tunnel syndrome. Importantly, however, there are empirical research studies that show relationships between musculoskeletal dis/comfort levels and assuming less than optimal postures. Therefore, user education on optimal working postures is essential.

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