1. The Evolution of the Keyboard

The basic design of today's computer keyboard, a set of keys grouped along a horizontal plane, was first introduced over 130 years ago as part of a heavy, desk-bound, mechanical typewriter.

When sitting at a desk, knowledge workers can achieve typing speeds of 50 to 100 words per minute or more using a keyboard. And faster typing means greater productivity. Many people, however, would like to use computers without having to sit at their desks to do so. Prior to the invention of the typewriter and touch typing in 1867, the average speed with which people could record their thoughts was approximately 10 words per minute using a quill pen. Today, computers come in all shapes and sizes and can be used, and are needed, in multiple environments. Yet, despite advances in the power and capabilities of portable computers, the speed of data entry on miniature keys or with a pen-like stylus reverts back to pre-1867 levels.

For modern-day computing, the keyboard is deficient in a number of important areas:

A. Inflexible - The keyboard was originally intended to be used only on a desk. It is awkward and uncomfortable to use a keyboard in situations such as leaning back away from your desk, sitting on a couch, recliner, bed or floor, sitting in a plane, train, bus or car. It is also difficult to use a portable computer while standing or walking around because fast data entry on a keyboard requires that it be supported by a flat surface. And if the keyboard is shrunk along with the computer, the keys become too small to allow touch typing or even fast hunting and pecking, thus greatly restricting a user's productivity.
B. Unhealthy - It is argued that extensive keyboard use can cause repetitive stress injuries such as carpal tunnel syndrome as well as back, neck and shoulder problems.

C. Inefficient - It is so difficult to learn how to touch type on a QWERTY keyboard that the majority of people who take touch typing courses revert to hunting and pecking. And even those who do touch type do so with a letter layout that was specifically designed to slow down typing so the first mechanical typewriter keys wouldn't jam.

![Figure 1 – QWERTY Typewriter](image)

The QWERTY keyboard has not been replaced because most alternatives, such as the Dvorak keyboard, do not offer enough benefits to convince people to switch. It is argued the Dvorak lets you type faster, but you still have to be seated at a desk to do so. The AlphaGrip has many benefits, a major one being that it allows users to type quickly and comfortably while away from a desk.

Additionally, once you grasp the AlphaGrip, your fingers naturally fall on all the buttons necessary to generate all the major characters. Thus, there is no "pecking" on an AlphaGrip - there is only touch typing.

The AlphaGrip, which looks and feels like a futuristic game controller, yet has all the functionality of keyboard, overcomes many of the deficiencies of the standard keyboard. It can benefit society in the areas of productivity and public health by enabling high speed data entry while away from a desk and by allowing users to position their hands and bodies more comfortably while typing.

**The keyboard has four defined zones,**

- **Main** Typing Area: Takes up the largest area of the keyboard, and includes the alphabet letters. It resembles a traditional typewriter.
- **Numeric** Keypad: Placed on the right part of the keyboard. Similar to a calculator keyboard.
- **Edition** keys: Located between the numeric keypad and the main typing area. It is very useful to move within texts and edit documents.
- **Function** Keys: Situated horizontally at the top of the keyboard. These keys are 'shortcuts' to perform specific tasks within different applications.
2. Ergonomic Keyboard and Mouse Use

It is easy to fall into bad postural habits when we use our keyboard or the pointing device (mouse). Adopting awkward postures to perform activities puts our body at risk for poor circulation, muscular fatigue and tendon or nerve irritation. By avoiding certain postures you can reduce your chances of developing these conditions. Read on for tips on how to avoid awkward postures.

**Keep A Neutral Position**

**NECK and EARS** should be positioned directly over the shoulders.  
**SHOULDERS** should be relaxed, with the elbows positioned at or near the body.  
**ELBOW** angles should be near 90 degrees, not straight.  
**WRIST** a straight imaginary line should run from the elbow to the wrist and to the back of the middle finger.  
**FINGERS** should be relaxed and should not stretch away from the hand to reach keys.

**Proper Positioning of Your Computer Workstation**

The proper position of the keyboard and mouse is essential in creating a comfortable workstation. Consideration of the following factors can help prevent musculoskeletal disorders such as carpal tunnel syndrome and tendonitis:

**HEIGHT and ORIENTATION**

**Potential Hazard:**

- Improper height and angle of the keyboard, mouse, or working surface can cause employees to bend their wrists or lift their arms for extended periods.

**Possible Solutions:**

- The work surface may need to be raised or lowered to keep the operator's arms in a comfortable position. This can be achieved by installing an adjustable
keyboard extender or tray (Figure 3), by providing an adjustable table/working surface, or by raising the chair and providing a footrest if needed.

**Figure 3 - Keyboard tray**

- Adjust the keyboard and/or chair height so the employee's elbows can hang comfortably at the side of the body, the shoulders are relaxed and the wrist is not bent up or down or to either side during keyboard use (Figure 3).
- The angle of the keyboard should also be considered when determining the preferred height. The preferred working position for most keyboard operators is with the forearms parallel to the floor and elbows at the sides; this allows the hands to move easily over the keyboard.

### PLACEMENT

**Potential Hazard:**

- A keyboard or mouse that is not directly in front of or close to the body (Figure 4) forces the employee to repeatedly reach during use.

**Figure 4 - Mouse placed too far from the body**
Possible Solutions:

- Make sure the keyboard is placed directly in front of the user.
- The mouse should be positioned at the operator's side with his or her arm close to the body (Figure 5). A straight line should be maintained between the hand and the forearm. The upper arm should not be elevated or extended while using the mouse. The employee should not have to reach to use the mouse.
- Consider using a mouse platform that rotates above the keyboard while maintaining about the same plane. This design (Figure 6) allows the mouse to be used above the 10-key pad, which gives the user a better wrist angle and reduces reach.

3. Why Redesign the Keyboard?

When typing, holding the hands and wrists in a neutral work posture where the hands are extended straight without significant bending at the wrist is thought to reduce the risk of musculoskeletal problems. Computer users sometimes use awkward or non-neutral work postures when working on the traditional keyboard. They rotate their forearms so that their palms are facing the keyboard (A), and they often bend their hands outward (B) and upward (C & D). Sometimes, workers also hold their elbows slightly away from their bodies (E) while keying, particularly when the keyboard surface is too high. Alternative keyboards can help keep wrists straight as shown on the following pages.
4. What’s Different About Alternative Keyboards?

Alternative keyboards use different designs to attempt to change the user’s posture. The following are some of the more common designs.

**Split keyboards**

Split keyboards are designed to straighten the wrist. This can be done in two ways: by increasing the distance between the right and left sides of the keyboard or by rotating each half of the keyboard so that each half is aligned with the forearm. Some alternative keyboards combine these two methods.

**Tented keyboards**
On tented keyboards, the two keyboard halves are tilted up like a tent. This feature is a variation of the split keyboard and reduces the rotation of the forearms.

![Figure 9 – Split and Tented Keyboard](image)

**Built-in wrist or palm rests**

Built-in wrist or palm rests help prevent bending the hands up by providing support that straightens the wrists. It should be noted that questions do remain about the usefulness of wrist or palm rests. For example, it is unclear whether they increase pressure on the wrists, relieve loads on shoulder and upper back muscles, or interfere with typing.

**Adjustable negative slope**

Keyboards with a negative slope also help prevent bending the hand too far up by allowing the user to raise the front edge of the keyboard, or to slope the keyboard backward, thus straightening the wrist.

**Key position**

Some alternative keyboard designs have attempted to “fit” the different lengths of the fingers by curving the rows of keys or by placing the keys in concave wells. This is believed to allow the fingers to work in a more relaxed posture (see illustrations on next page).

![Figure 10 – Straight Keyboard](image)
5. Do Alternative Keyboards Prevent Injuries?

Alternative keyboards have been shown to promote neutral wrist posture. Yet, available research does not provide conclusive evidence that alternative keyboards reduce the risk of discomfort or injury. Thus, further research is needed before specific keyboard features can be recommended with great confidence.

6. What if I Want to Use an Alternative Keyboard?

This is particularly important for users who rely on key visibility, such as “hunt and peck” typists. Also, check whether the job requires use of the numeric keypad and specialized keys, because some alternative keyboards eliminate or reconfigure these keys. Allow users to try a keyboard on a trial basis before buying it. It would seem reasonable to try the keyboard for at least one to two weeks, since studies show that this amount of time is necessary to adapt to alternative keyboards. Alternative keyboards are like other office equipment, furniture or accessories. Preferences will vary and one type will not “fit” everyone or every type of task. Allow users to try a number of different alternative keyboards before making decisions about which ones to buy. If a user wants to retain his or her conventional keyboard, respect that decision.

Expect frustration until users become familiar with the new keyboards. Frustration frequently results from diminished productivity as workers get used to new equipment. Involve a specialist in the decision-making process. This specialist should have both knowledge and experience in office ergonomics. If a computer user has discomfort or musculoskeletal symptoms, a health professional should also be involved in making the decision to purchase an alternative keyboard.

Integrate a new alternative keyboard into the work process carefully. Make sure that users are trained in the appropriate use of the product, since many alternative
keyboards can be used incorrectly. If the keyboard is adjustable, encourage users to change the adjustments gradually from the conventional (flat) configuration.

7. What Can Be Done to Prevent Musculoskeletal Injuries?

A keyboard is only one part of a computer workstation setup that may influence comfort. Other important factors include: workstation and chair adjustability; placement of equipment, accessories, and work materials; lighting; and the design and organization of work tasks.

Because computer work is highly repetitive and promotes static postures, it can cause discomfort over long periods of time. It is important to break up long sessions of keyboard work with frequent rest breaks or with other tasks that require movements different from those used to type or operate the mouse. Keep in mind that it is essential to examine the entire work environment to determine all possible causes of discomfort. In other words, it is unlikely that changing only one workplace element, such as a keyboard, will eliminate all discomfort and disorders. In addition, each workplace should have a comprehensive ergonomics program in place to protect all workers.

The following adjustments should be made to our workstation to increase our well being and help prevent the development of health problems (partially taken from recommendations by the Department of Health and Human Services CDC):

- Adjust your chair so your feet rest flat on the floor or add a footrest where needed. The chair back should have a lumbar support to support the natural inward curve of your lower back and don't stay in one static position for extended periods of time, alternate between sitting and standing.
- After you have adjusted your chair, with your arms comfortably at your side form a 90 degree angle with your upper arms.
- Adjust the keyboard height so that your shoulders can relax and your arms rest at sides. An articulating keyboard tray is often necessary to accommodate proper height and distance.
- Position the keyboard directly in front and close to you so you don't have to reach out excessively.
- Your forearms should be parallel to the floor (90° angle at elbow)
- The mouse should be placed adjacent to the keyboard and at the same height as the keyboard.
• The keyboard should be in a negative tilt position to keep your wrists straight while typing.
• Make sure, your articulating keyboard mechanism does not bump your knees under the worksurface.
• Avoid extended and elevated reaching for your keyboard or mouse. Always think about keeping the back of your wrist in neutral position.
• Do not rest your hand on the mouse when resting - rest your hands in your lap when not working.
• A padded wrist rest will help you to keep your wrist in a straight and neutral position while typing and keep your arms off the sharp edges of the work surface.
• Do not rest your wrists or hands on a palm or wrist rest when you are keyboarding. These rests are designed to provide support only during breaks.
• Press the keys gently and do not bank them or hold them down for long periods.
• Keep your shoulders, arms, hands and fingers relaxed.

8. Different Design of Keyboards
The Optimus Organic LED keyboard

The design featured on the studio's website received attention on the web when it was featured on Slashdot on 14 July 2005, and afterwards for a few weeks on other technology websites. Even though the pictures on its product page are computer graphics renderings, the designers stated that they intend for the keyboard to be a real product. The studio is currently looking for a manufacturer in China or Korea. According to the official
newsletter, the Art. Lebedev Studio expects to receive actual samples of the keyboard by the end of 2006. The keyboard is supposed to be in production next year, but the studio is planning on creating another model after the release of the Optimus mini three. The Optimus would allow for greater user interaction, by dynamically displaying the current function of the keys. For example, when the user presses the shift key, the pictures would change to upper-case versions. It would also make switching between different keyboard layouts (such as English and Cyrillic) rapid, and could make the switch to Dvorak easier for people who only have a QWERTY keyboard with no possibility of rearranging the keys. To demonstrate this concept, the computer renderings show example layouts for Quake III Arena and Adobe Photoshop.

The intended primary audience of the keyboard is typographers and translators; the secondary audience includes graphics professionals and gamers.

Figure 14 – The Optimus Organic LED keyboard

Sources:

- [http://www.ergoindemand.com/ergonomic-keyboarding.htm](http://www.ergoindemand.com/ergonomic-keyboarding.htm)
- [http://www.3dmultimedia.com/help/windows/intro_eng.htm](http://www.3dmultimedia.com/help/windows/intro_eng.htm)