Logitech: The Design of Keyboard Comfort
*A brief outlining the many ways in which Logitech
enhances keyboard comfort*

Logitech believes that people want and deserve comfort. Our approach to keyboard design begins with the science of ergonomics and includes continual testing of different comfort keyboard concepts. The result is strikingly attractive keyboards shaped to fit the curves of the human hand.

When designing comfort keyboards, Logitech takes into account people's familiarity with traditional keyboards and their inherent reluctance to try dramatically new and unfamiliar designs (e.g. a split keyboard). We then incorporate subtle but important ergonomic enhancements, including innovations related to the design and positioning of individual keys. Finally, we focus on providing built-in navigation controls to enable more efficient two-hand navigation, which minimizes our natural tendency to favor (and use) one hand more than the other.

In the following pages, we'll look more closely at a number of specific innovations, including:

1. Wave design
   o Wave key frame
   o Constant curve
   o Comfortable palm rest
   o Recessed Cap and Num Lock
   o Larger Space bar
   o Wave key frame
2. Zero Degree Tilt™
3. Negative Tilt
4. Key travel

1. The Comfort Wave Design
Wave key frame

Figure 1 Logitech® Comfort Wave 450

Fingers vary in length – for example, index fingers are longer than pinky fingers. To address this fundamental principle of hand shape, the signature element of Logitech's Comfort Wave Design, its gradual wave-shaped contour, cradles the fingers with a shape that supports the varied length of fingers.

Instead of the traditional, flat key frame layout (where the keys in each row are the same height) the wave-shaped contour sets every key at a unique, carefully calibrated height to assure maximum comfort. The left (Esc, Tab, Caps Lock, Shift, Ctrl), right (Backspace, Enter, Shift, Ctrl), and center (5, 6, 7; t, y, u; g, h, j; v, b, n) portions of the key

frame are set several millimeters higher – at a maximum variation of 4 mm – than other keys, resulting in a gentle, undulating wave-shaped contour.
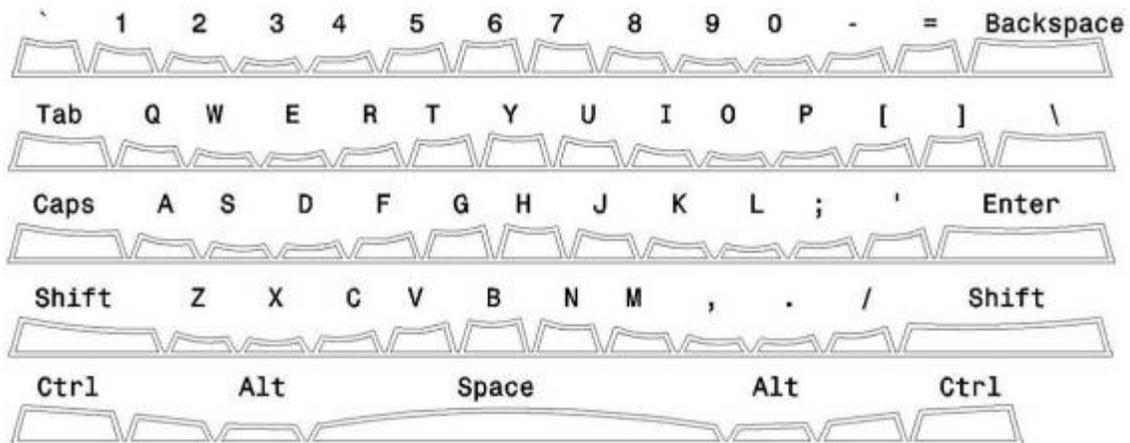

Figure 2 The Wave key frame. Note: Even though the keys vary in height, the key travel is the same.

By reducing the need to reach for certain keys – for example, with the Comfort Wave Design, keys commonly pressed by the pinkies are higher than keys pressed by the middle fingers – the amount of fingertip pressure (finger static load) required to press any one key is reduced, compared to a straight keyboard.

To determine the precise profile of the keyboard – an undulating wave shape – and the optimal height differential between the highest and lowest keys, Logitech conducted exhaustive research and built many prototypes.

Constant curve

The Wave keyboard's gently curving rows of keys, or constant curve, directly address the problem of wrist ulnar deviation (hand twisting), one source of discomfort. When we use a straight keyboard, we must turn our hands slightly away from each other, and in an unnatural position, to type on the straight keyboard layout. However, with the Wave keyboard's U-shaped constant curve (5 degrees at the maximum angle), the subtle arc supports the natural resting position of the hands. As a result, a high degree of comfort is achieved without dividing the keyboard into two sections, enabling comfort without requiring that people relearn how to type.

Consistently sized keys

With the Logitech Constant Curve, every key is the same distance from its neighbor and every alphanumeric key is the same width, the industry standard of 19.05 mm from center to center, which is different from other comfort keyboards. In some competing comfort keyboards, the middle keys in the bottom two rows (b, n, g, h) are significantly wider than neighboring keys. Focus-group testing conducted by Logitech revealed that people were disoriented by this arrangement and therefore reluctant to try using the

keyboard. Because Logitech's Wave design is not intimidating, more people are encouraged to try the new layout.

Comfortable palm rest

Many people instinctively rest their palms on their desks, or on a keyboard palm rest, between typing sessions. The recently released Logitech® Comfort Wave 450 keyboard provides a removable palm rest, which offers support and a high degree of comfort while adding a stylish design. In addition to greater convenience and a smaller footprint, this palm rest provides a more convenient place to rest the hands between typing sessions.

Recess on Caps Lock and Num Lock keys

Nearly everyone has accidentally pressed the Caps Lock key while typing. This is not only annoying, but it wastes valuable time. To alleviate this problem, for the Logitech Comfort Wave Design, Logitech added a special recess to the front edge of the key, designed to reduce accidental presses. This same refinement was also added to the Num Lock key.

Larger space bar and backspace keys

Because the Space Bar is the most frequently used key, on the Comfort Wave 450 keyboard, Logitech made it more than twice as large as the traditional space bar. The Backspace key has also been increased by 2 mm so that it is closer to the other alphanumeric keys.

2. Zero Degree Tilt
Introduced in 2001, Logitech's Zero Degree Tilt™ helps to increase comfort by allowing the wrist to remain in a more neutral position while typing.

Over the last decade, many studies have shown that a flat keyboard enhances comfort. The primary reason is simple geometry. With traditional keyboards, the rows of keys are set higher than the row in front, forcing people to angle their palms and fingers upward. A keyboard with a zero-degree tilt (or 0-degree incline) greatly reduces this wrist extension, and may reduce the risk of hand and forearm discomfort and musculoskeletal disorders.

3. Negative Tilt

In 2009, Logitech for Business introduced the Logitech® Comfort Wave 450 keyboard, with an innovative feature – negative tilt.

Negative tilt describes the angle one can experience on the Comfort Wave 450 by using the tilt legs to raise the palm rest above the plane of the keyboard. On the Logitech Comfort Wave 450, the tilt legs can create a 4- or an 8-degree downward angle.

Figure 3 Comfort Wave 450 keyboard with negative tilt

In a study commissioned by Logitech, participants confirmed that negative tilt helps create improved wrist postures with keying tasks in addition to providing reduced strain at the extensor and flexor muscles of the hands and forearms.

4. Key Travel

Optimized vertical travel

The ramifications of key-travel distance are especially noticeable on a notebook computer. To help make the notebook as slim as possible, notebook keys are not as tall as their desktop counterparts. The key-travel distance is usually less than the often-used standard of 3.6 mm to 4 mm – perhaps contributing to people's dissatisfaction with the notebook typing experience. Alternatively, with full-size keyboards that have large key-travel, people often feel as though their fingers are sinking into the keyboard.

In designing the Logitech Cordless Desktop Wave (the predecessor to the Comfort Wave 450 keyboard), engineers examined whether the wave contour, constant curve, and sloping key-top profiles necessitated an adjustment in vertical key-travel distance. Furthermore, since each key was to be a different height, individually tuned travel distance was considered. Through hands-on testing with three-dimensional keyboard prototypes, Logitech found that people preferred a 3.6 mm key travel throughout the entire keyboard, precisely in line with accepted norms.

Reduced downward force

As noted earlier, lowered height carries its own ergonomic benefits, but it also alters the key-travel distance. All Logitech keyboards, independent of their height or shape, are designed to match as closely as possible an optimal force/displacement curve.

The Comfort Wave Design goes further with its design, which keeps fingertips and keys close to each other without touching. Past research has shown that as the gap between

fingertip and key top grows people apply up to two-and-a-half times more force to operate keys, even though extra force is unnecessary. When keys and fingertips are closer, travel distance and downward force are reduced, lessening the likelihood of strain and improving typing accuracy.

References

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