

This pointer was inspired by the Optimus keyboard eventually to be offered by Art. Lebedev Studio (<http://www.artlebedev.com/everything/optimus/>). Although the design has been around a little more than a year now, it still isn't readily available anywhere and probably won't be until 2008. It also will cost over \$1400 from what I have read. But a keyboard that allows you to visually map each of the keys, you have to admit, is cool. Of course, you could do that same thing now with software and the use of visual overlays, but it still wouldn't be as cool. Imagine being able to not just change the mapping of the keyboard as interpreted by the computer, but also as actually displayed on the keyboard.

Thinking of the possible keyboard layouts, I was reminded that there are many alternative keyboards out there, but until I started to look, I didn't realize just how many there really were. Clearly, at least in English and most Eurocentric languages, the standard QWERTY keyboard layout originally patented by Christopher Sholes in 1868 is the most common, with additional keys added over time though. But within this layout of keys, the actual key angle and location can shift considerably. Then there are deviations from this layout to single hand keyboards and other alternative layouts such as alphanumeric and Dvorak. There are also extended European keyboards for instance that include umlaut keys in some languages and completely altered keys such as most Asian languages. One could even make the keyboard entirely virtual and map it to an on-screen display. As I played with the Nintendo Wii interface, I realized that text-messaging and the use of a numeric keypad for letter entry had moved beyond simply phone conversations as well. So in reality, we can think of alternatives as being in at least two classes: those that change the overall hand positioning and those that change the alphanumeric arrangement of keys.

Considering that the qwerty keyboard layout began appearing in Remington typewriters in 1873, it is amazing how much staying power it has had. Other layouts, such as the Dvorak layout dating to 1936, have not had the staying power or more importantly perhaps, the market share that the qwerty keyboard has had. Many reasons can be found for this fact, such as the early entry of qwerty, lack of investment in alternatives, and a reiterative system where teachers learn one method and then teach only that method among other possible reasons. History has shown that most people, me probably included, are not willing to learn an entirely new keyboard just for the sake of small increases in efficiency.

Why should we even worry about alternative designs though? Well, there are several reasons. First, the flat, straight, qwerty keyboard may not be medically the best thing out there. A study by Boone, Busby, Chance, Hill, and Pocasangre (2001) showed that splitting or angling the key design did not significantly affect comfort level, but it could reduce the risk of musculoskeletal disorders. Here we see the same thing as found in all studies. It is not that a different design will help, but that it may help. There does not appear to be anything conclusive in a well controlled study to show that a single design is right for anyone. It may still be an issue of preference and posture. Furthermore, there is no conclusive evidence on the ability of wrist or palm rests to

help, and they may even apply undue pressure to the wrists in order to relieve loads on the shoulder and/or back.

A second reason to consider alternative designs involves another purpose of the design. Not only is comfort important, but one also wants to input data as efficiently and quickly as possible. Letters should therefore be arranged in terms of letter frequency, letter adjacency probabilities, and the actual physiology of the hand. Alternatives such as the Dvorak layout came about in order to address these issues.

Two final reasons are simplicity and accessibility. An alphabetical keypad is quite easy to learn, and therefore simple for children to use while still learning the alphabet. One-handed keyboards allow for more accessibility options.

All that said, it would appear that the real choice in the end is to find the keyboard that works best for your given needs. Therefore, let's take a look at the options that are out there, and what they all offer. The list may appear larger than one might expect. I begin with the more typical designs and slowly move to more dramatic shifts in design. All of the keyboards in the first list are generally of the QWERTY layout in terms of placement of the keys, but they differ in orientation of the keys and the way in which the keys are accessed.

- The 'standard' QWERTY keyboard.
This design is the modern standard in English systems and typewriters. It was patented in 1868 by Christopher Sholes. It is called qwerty for the first 6 keys to appear in the top row from left to right. Two hands are used to type letters, with each finger responsible for at least 3 keys and the thumb using the space bar.
 - Advantage(s)
 - It seems to be what everyone learns.
 - Millions if not billions already know.
 - Disadvantage(s)
 - May not be the best for your wrists, although typing style plays a role as well.
 - Companies
 - Just about anywhere you look; you will find one of these keyboards. Wonder how far back it goes? Take a look at the thumbnail image to the right from an 1878 manual typewriter. [Original full-size image found at <http://computing-dictionary.thefreedictionary.com/QWERTY+keyboard> and copyright 2002 by the Computer Language Co., Inc.]
- 'Child size' or 'Mini' keyboards
Same as a standard keyboard, only smaller.
 - Advantage(s)
 - Standard keyboard layout.
 - Smaller for smaller hands
 - May be able to one-hand type



- Disadvantage(s)
 - Child may not properly map kinesthetic motions for shift to larger keyboard as hands grow.
- Companies (not an all inclusive list)
 - See a list of smaller keyboards at <http://www.aboutonehandtyping.com/littlefingers.html>
 - Adesso (<http://www.adesso.com/>)
- ‘Micro’ keyboards

Same as a standard keyboard, only really smaller.

 - Advantage(s)
 - Can be put on a phone or handheld device
 - Disadvantage(s)
 - Can’t really ‘type’ with them, but rather stylus point to each letter.
 - Companies (not an all inclusive list)
 - Several cell phones include micro keyboards
- ‘Large size’ keyboards

Same as a standard keyboard, only bigger.

 - Advantage(s)
 - Better for people with large hands.
 - Can help key recognition for young.
 - Disadvantage(s)
 - Takes up more space.
 - Companies
 - BigKeys Plus (<http://www.bigkeys.com/>) – This particular link is to keyboards that are standard size but with larger print on them.
 - Reizen – I couldn’t find a Web link to the company, but MaxiAids.com (http://www.reizenaid.com/store/prodView.asp?idstore=0&idproduct=6152&product=Reizen_E-Z-C_Oversized_Keyboard_-_White_Keys_with_Black_Print) has some images and more information.
- ‘Half-qwerty’ designs

These designs can be a full sized standard keyboard or a single hand keyboard (although single-handed designs are listed later) that utilize an additional key press to signify alternative characters. They appear like a standard keyboard otherwise.

 - Advantage(s)
 - Only requires one hand.
 - Allows blind to both type and use a Braille display simultaneously.
 - Disadvantage(s)
 - Cost
 - Slower input speed when using only one hand.
 - Companies (not an all inclusive list)
 - Matias Half-QWERTY (<http://half-qwerty.com/>) – Still functions as a regular keyboard; however, when the space key is continually depressed

rather than tapped, the keys for the given hand are switched using software alteration of keystroke.

- Maltron Executive Keyboard (<http://www.maltron.com/>)
- The 'ergonomic' or 'split' keyboard.
In order to create a more natural angle for the human anatomy, these keyboards have the keyboard angled in two sections.
 - Advantage(s)
 - May be better for your wrists, but may also require slightly better coordination of shoulder/wrist movements.
 - Disadvantage(s)
 - Y and 6 are often mapped to the left hand only.
 - The spacebar may not map as far across.
 - Larger than 'standard' keyboard.
 - Companies (not an all inclusive list)
 - Microsoft (<http://www.microsoft.com/hardware/mouseandkeyboard/default.mspx>)
 - Acer (http://www.acercomponents.com/PSC_Keyboards.htm)



- Darwin Keyboards (<http://www.darwinkeyboards.com>)
- TouchEasy from Ergo Sum (<http://www.ergo-sum.com/>)
- Cirque Wave Keyboard (<http://www.cirque.com>)
- Adesso, Inc. (<http://www.adessoinc.com/>)
- The BackCare Corp. (Chicago, IL)
- Adesso (<http://www.adesso.com/>)



- The 'adjustable-angle' or 'tented' keyboard
Similar to the ergonomic or split keyboard except that the keys are not only split but also at an angle, creating a tent-like appearance.
 - Advantage(s)
 - Can be customized to your wrist alignment.
 - Disadvantage(s)
 - Some keys have shifted position for some that like to use the right hand for 6 or B.
 - Durability can be an issue.
 - Companies (not an all inclusive list)
 - KeyOvation (<http://www.keyovation.com/>)



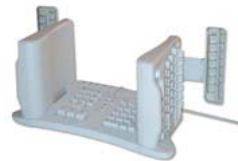
- Kinesis Corporation - Maxim (www.kinesis-ergo.com)



- Pace Adjustable Keyboard (<http://www.ids2.com/pace>) – The VG series offers completely adjustable angle both vertically and horizontally.
- ErgoLogi FlexPro (Fremont, CA)
- Goldtouch Technologies (<http://www.goldtouch.com>)

- The ‘vertical’ or ‘tented’ layout (note that I have split tented into two categories)
Here, the vertical angle is taken to the extreme.

- Advantage(s)
 - It looks cool.
 - Possibly more natural wrist position.
- Disadvantage(s)
 - More physical exertion may be required when typing for extended periods.
 - Hand movements needed to use specialty keys.
 - Takes up vertical space.
- Companies (not an all inclusive list)
 - SafeType (<http://www.safetype.com/how-it-works.htm>)



- The ‘negative-slope’ keyboard

Keyboard is angled away from wrists instead of towards the wrists. You could take any ‘standard’ keyboard and put a pad in the front of it, but it wouldn’t really be robust to movement. Keyboard trays and wrist guards are accessories that aid in creating a negative slope keyboard. Some keyboards have a flap on the bottom that enables backwards tilting to create a negative slope.

- Advantages
 - Prevent bending of wrists too far.
- Disadvantage(s)
 - Interference of actual keys, perhaps due to learning curve since fingers are bent to greater extent on bottom keys.
- Companies (not an all inclusive list)
 - I’m sure that there are probably some companies marketing keyboards that are specifically negative slope, but I couldn’t find them in a quick search. There are many keyboards that include tabs in the front to allow for negative slope inclination though.

- The ‘angled’ standard layout

- Advantage(s)
 - Still uses key arrangement most are familiar with.
 - Keys are individually angled rather than entire keyboard.
- Disadvantage(s)
 - Slight shift in some keys.

- Encourages, but does not force wrist realignment.
 - Companies (not an all inclusive list)
 - Kensington Comfort Type Slim Keyboard (<http://us.kensington.com/>)



- The ‘curved’ layout

Keys are aligned so that, for example, A and F would be closer to the wrist than S and D since these fingers are generally longer. In other words, the keyboard layout of letters looks like two small arches instead of a straight line across.

 - Advantage(s)
 - Possible reduction in finger movement and bending.
 - Disadvantage(s)
 - Hard to find
 - Companies (not an all inclusive list)
 - Maltron (<http://www.maltron.com/maltron-kbd-jtype.html>) – I don’t include an image at the right, because a thumbnail image doesn’t really capture the key difference.

- The ‘scooped’ keyboard

Each key has its own angle, creating a concave appearance to each hand aspect of the keyboard.

 - Advantage(s)
 - Reduced finger movement.
 - Possible reduction in keyboard use repetitive stress.
 - Disadvantage(s)
 - Bulky
 - Can be more expensive, but not much.
 - Slight learning curve
 - Companies (not an all inclusive list)
 - Kinesis (<http://www.kinesis-ergo.com/>)



- Maltron (<http://www.maltron.com/>)

- The ‘completely-split’ keyboard
 - Advantage(s)
 - Can be customized a lot to your wrist alignment and comfort needs.
 - Can still be used as a standard keyboard.
 - Disadvantage(s)
 - Key positions can shift in regards to one hand to the other but not within a given hand.
 - Durability may be an issue.

- Companies (not an all inclusive list)
 - Kinesis (<http://www.kinesis-ergo.com/>)
 - Apple (<http://www.apple.com>)
 - Workplace Designs Floating Arms Keyboard – Their Website is apparently no longer up, but the Floating Arms Keyboard is found in a lot of literature. They are located in Stillwater, MN.

- The ‘completely-split minimum-motion’ keyboard.

This is not really even a keyboard per se, but rather a keyboard emulator that maps to your finger movements within a hand device.

 - Advantage(s)
 - Can be customized a lot to your wrist alignment and comfort needs.
 - Can still be used as a standard qwerty keyboard.
 - Disadvantage(s)
 - Cost
 - Key positions can shift in regards to one hand to the other but not within a given hand.
 - Durability may be an issue.
 - Companies (not an all inclusive list)
 - DataHand (<http://www.datahand.com/>) –It still maps the keys using an ergonomic qwerty design on a completely split keyboard. It is also very expensive (~\$500).

- The ‘On Screen’ keyboard
 - Advantage(s)
 - Use mouse to enter information for accessibility issues.
 - No keyboard to worry about.
 - Since it is software driven, the keys can be mapped in any configuration, so this option appears both
 - Disadvantage(s)
 - Compatibility and ability to enter data into other software using concurrently running virtual keyboard.
 - Slower data entry through mouse movements.
 - Companies (not an all inclusive list)
 - Microsoft Windows (<http://www.microsoft.com>)
 - Innovation Management Group, Inc. (<http://www.imgpresents.com/>) – My-T-Soft AT Onscreen Keyboard
 - Prentke Romich Company (<http://store.prentrom.com/cgi-bin/store/WIV-3.html>) – WiViK On-Screen Keyboard
 - Canesta (<http://www.canesta.com/index.htm>)

- ‘Programmable’ keyboards
 - Advantage(s)
 - Can be customized, putting keys wherever you want them.
 - Disadvantage(s)
 - Programming time.



- Compatibility issues.
 - Cost
 - Companies (not an all inclusive list)
 - IntelliTools (<http://www.intellitools.com/>) – See IntelliKeys. Somewhat expensive at ~\$400. Lightweight and flexible membrane design, but may add durability issues for some.

 - Art.Levedev Studios (<http://www.artlebedev.com/everything/optimus/>) – Extremely cool, but equally expensive. Each key can be programmed separately with quick switching between settings.
 - Adesso (<http://www.adesso.com/>)
-
- ‘Flexible’ keyboards
 - Advantage(s)
 - Durability
 - Disadvantage(s)
 - Cost
 - Can move around
 - Companies (not an all inclusive list)
 - Adesso (<http://www.adesso.com/>) – They have one that is sealed to prevent bacteria buildup too.

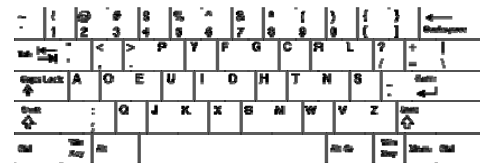


Although some of the designs above allow for alternative layouts, the keyboards shown below are designed not to use the QWERTY layout.

- The Dvorak Layout

This item represents the first deviation on this list from the qwerty key alignment, although some of the above examples could be programmed away from a qwerty design. There are many arguments as to why it was never fully adopted despite possibly being better than the qwerty design.

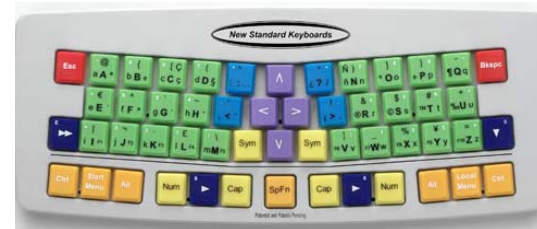
 - Advantage(s)
 - More comfortable design.
 - Less mistyping.
 - It is a provided alternative in all major operating systems including Windows, Macintosh, and Palm.
 - Speed. The fastest typist by Guinness Book of World Records in 1985 was Barbara Blackburn with 212 wpm.
 - Disadvantage(s)
 - No one seems to make them.
 - Making the switch.



- Companies (note an all inclusive list)
 - Fentek Industries, Inc. (<http://www.fentek-ind.com/dvorak.htm>)
- The 'alphanumeric' design

In this layout, the keys are simply arranged in alphabetical order. Included in this list would be the use of a 9 key entry system like text-messaging on a phone, since the keys are in alphanumeric order.

 - Advantage(s)
 - Very easy to learn.
 - Disadvantage(s)
 - Reduced data entry speed.
 - Problem with some key mappings in some software.
 - Companies (not an all inclusive list)
 - Handykey Corporation - The Twiddler (see one-handed designs below)
 - BigKeys (<http://www.bigkeys.com/>)
 - New Standard Keyboard (<http://www.newstandardkeyboards.com/Product.html>)



- The 'chordic' design

Chordic systems are also one-handed and also included in that list. The chorded keyboard allows users to enter characters by pressing several keys together. They almost always require additional training.

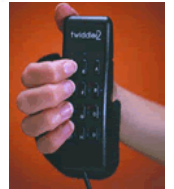
 - Advantage(s)
 - Possible accessibility advantages for those with limited mobility of hands.
 - One-handed.
 - Disadvantage(s)
 - Possible learning curve, although one company demonstrates 26.6 wpm in 7 hours of training.
 - More expensive for some.
 - Companies (not an all inclusive list)
 - MonoManus Keyboard
 - Bellaire Electronics – Cykey - see one-handed designs below.
 - Frogpad – see one-handed designs below.
 - GKOS – Global Keyboard Optimised for Small wireless devices (<http://gkos.com/>)



- The ‘one-handed’ keyboard
 - Advantage(s)
 - Keep one hand on the mouse.
 - Can be angled appropriately for given wrist.
 - Allows the blind to both type and view a Braille display simultaneously.
 - Disadvantage(s)
 - Learning curve.
 - Possible mistyping issues.
 - Companies (not an all inclusive list)
 - Frogpad (<http://www.frogpad.com>) – Uses an alternative key layout.



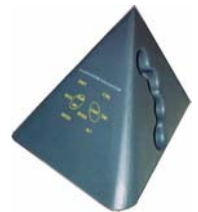
- Handykey Corporation (<http://www.handykey.com/>) – The Twiddler 2 uses an alphanumeric keypad



- Maltron (<http://www.maltron.com/>) – a bit bulky for a one-handed keyboard. The design issue seems more accessibility rather than usability here. They have both left and right handed models



- Pyramid Keyboard – Truly innovative, but I couldn’t find one for sale anywhere.



- Infogrip (<http://www.infogrip.com/>) – See the BAT keyboard.



- Bellaire Electronics – The CyKey (<http://www.bellaire.co.uk>)

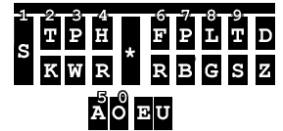


- DataEgg (<http://xaphoon.com/dataegg/>)



- ‘Stenotype’ layout

A shorthand specialized chording keypad used for shorthand, especially by trained court reporters or closed captioners. The output is in shorthand and cannot be read directly as text.



- Advantage(s)
 - Can be used at speeds in excess of 200 wpm.
- Disadvantage(s)
 - Training required.
- Companies (not an all inclusive list)
 - Advantage Software – Passport
 - Neutrino Group – Gemini
http://www.geminiwriter.com/index.php?option=com_frontpage&Itemid=1



- ProCAT – Stylus
http://www.geminiwriter.com/index.php?option=com_frontpage&Itemid=1



- Stenograph – Stentura fusion
<http://www.stenograph.com/productdetails.aspx?id=100001&subid=4640001&childid=&subchildid=&prodid=30073&nocall=1>



- Stenovations – Digitouch (Their Web site did not have any information on this product that I could find. I found a press release regarding a new version, but do not know anything more. See <http://www.stenovations.com/>)
- Word Technologies – Treal



- ‘Create-your-own’ keyboards – Basically, you can actually take any keyboard, open it up, and move the keys around on a board that you design yourself. This option is for the tinkerers out there.

- Advantage(s)
 - Put the keys wherever you want them.
- Disadvantage(s)
 - Requires a lot of work to construct
 - Learning Curve
- Examples (not an all inclusive list)
 - <http://www-users.cs.york.ac.uk/~ianb/broster.co.uk/keyboard.html>

- ‘Keyless’ keyboards
 - Advantage(s)
 - Accessibility
 - Simple to learn
 - Disadvantage(s)
 - Cost
 - Reduced input speed
 - Companies (not an all inclusive list)
 - orbiTouch (<http://www.keybowl.com/>)



- Other languages

The rest of this list has been somewhat English-centric. However, there are many keyboard layouts that are not limited to English. Arabic and Chinese keyboards are especially common. For more information on other keyboards, I found Wikipedia to be helpful. See http://en.wikipedia.org/wiki/Keyboard_layout.

Getting away from the use of one’s hands altogether are other options using adaptive technologies.

- ‘Voice’
 - Advantage(s)
 - Accessibility
 - Simple to use
 - Hands are free to do other things.
 - Disadvantage(s)
 - Time to ‘teach’ the device or program to ‘learn’ your voice patterns.
 - Increased error rate.
 - May have to slow down.
 - Background noise may interfere.
 - Cannot converse with others while inputting data.
 - Links
 - IBM ViaVoice (<http://www-306.ibm.com/software/voice/viavoice/>)
 - Dragon Naturally Speaking (<http://www.nuance.com/naturallyspeaking/>)
- ‘Head/Mouth Stick’ keyboard designs
 - Advantage(s)
 - Key placement to aid accessibility by limited mobility individuals or those using stick typing.
 - Disadvantage(s)
 - Speed is not the issue, accessibility is.
 - Links
 - Maltron (<http://www.maltron.com/>)
- ‘Eye Gaze’ Systems
 - Advantage(s)

- Usable for severe physical disabilities.
 - Disadvantage(s)
 - Cost
 - Speed
 - Links
 - LC Technologies, Inc. (<http://www.lctinc.com/2Products/Disability/Disabilitymain.htm>)
- ‘Touch Screen’
 - Advantage(s)
 - Can use a touch keyboard or use writing recognition.
 - Disadvantage(s)
 - Increased errors.
 - Cost
 - Touch-to-screen alignment issues possible
 - Links
 - Keytec, Inc. (<http://www.magictouch.com/>)

Additional Reading

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