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Alternative Keyboards: A User Survey

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This article describes the results of an alternative keyboard user survey that was sponsored by Interface Analysis Associates and performed as part of a Master's Thesis, as well as two follow on survey mailings. The 220 participants in the original survey study, and 204 additional participants through two follow on keyboard manufacturer mailings, represent users of a wide variety of alternative keyboard brands and types. A total of 424 alternative keyboard users from business, government, and educational settings participated in the survey. The questionnaire covered why alternative keyboards are acquired, setup and use patterns, benefits, and recommendations for improvement.

Alternative keyboards selected for this survey study vary from those very similar to the standard QWERTY design with only a horizontal split in the middle (e.g., generic split keyboards), to ones that have integrated palm rests and finger wells with multiple switches for each finger (e.g., DataHand). Table 1 provides a quick-reference for each of the commercially alternative keyboard designs and their category classifications being used for the purpose of this study.

Table 1. Selected Alternative Keyboard Design Configurations and Adjustability

Categories and keyboard names	Horizontal Opening angle	Vertical Inclination Angle	Adjustable
Fixed Split			
Adesso	Yes	Yes	No
Generic Split	Yes	No	No
Microsoft Natural	Yes	Yes	No
MiniErgo	Yes	Yes	No
MyKey	Yes	Yes	No
Sculpted			
Kinesis	Yes	No	No
Maltron	Yes	No	No
Adjustable Split			
Apple Adjustable	Yes	No	Yes
Comfort	Yes	Yes	Yes
ErgoLogic / FlexPro	Yes	Yes	Yes (Linked)
LexMark Select-Ease	Yes	Yes	Yes
Other			
DataHand	Yes	No	Yes

Fixed Split Keyboards maintain the standard key-spacing and size while introducing an opening angle and some vertical angling of the keys. The MiniErgo also has a detachable numeric keypad.

Sculpted Keyboards separate the left and right hand key fields at a fixed distance, without angling, and arrange the keys in sculpted, dished-out depressions.

Adjustable Split Keyboards can vary their horizontal and vertical split angles, with the exception of the Apple Adjustable which remains flat. These keyboards have detached numeric keypads except for the ErgoLogic/FlexPro keyboard whose angling mechanism also does not allow independent adjustments in the horizontal and vertical planes.

The DataHand is largely in a class of its own, being a hybrid somewhere between a standard and cording keyboard.

Generally speaking, Fixed Split Keyboards are more readily available on the commercial market while the Sculpted and Adjustable Split Keyboards are more drastic in their design changes and thus have a more selective market due to their higher cost. For more on alternative keyboards, visit the TIFAQ's Alternative Keyboard FAQ at <http://www.tifaq.com/keyboards>.)

Despite the variety of laboratory methods historically used to evaluate these keyboard configurations, this is the first published study examining how these keyboards are actually

being used by those who purchase them. This moves alternative keyboard research from the lab and queries real users in business, government and educational settings who have extended durations of exposure to these alternative designs. A primary issue is whether recommended keyboard configurations from literature are of benefit when applied to real-world products.

Survey Results

Study methods and partial findings have already been published (see references below). This paper provides an opportunity to present additional, previously unpublished information to the ergonomics community about the acquisition of these alternative keyboards and what their users think of them. Following in bullet format are some of the survey's findings and user comments. Note that N = Number of responses/answers.

People hear about alternative keyboards through the following means (in no particular order):

- Magazines / Catalogs
- Advertisements / Articles
- Saw in Store
- Internet Sources (FAQs/Groups)
- Co-Workers / Friends
- Medical / Ergonomics Specialists
- Resellers / Shows

Alternative keyboards were purchased for the following reasons (original 220 participants only).

- Existing Injury/Pain (65%)
- Avoid Potential Injury (40%)
- Recommended/Provided (25%)
- Adjustable Design (23%)
- Disability Accommodation (17%)
- State-of-the-Art / Looked Cool (9%)

The characteristics by which the keyboards were selected are given below: (original 220 participants only).

- Split/Separated Keys (67%)
- Adjustability (30%)
- Palm Resting Surface (30%)
- Cost (29%)
- Key Force/Feel (28%)
- Recommended (18%)
- Key Programmability (10%)

Other workstation changes reported when acquiring an alternative keyboard include: (original 220 participants only).

- Bought or Adjusted Chair (41%)
- Adjusted Monitor Height (26%)
- Different Pointing Device (26%)
- Keyboard Tray/Drawer (25%)
- Adjusted Work Surface Height (16%)
- Footrest (13%)
- New Work Surface (10%)
- Method Changes / Breaks (7%)

Microsoft Natural (N=109)



Worth more than a standard keyboard?

- Reduced pain and fatigue, increased comfort (N=28)
- Improved posture (N=10)
- More productive (N=5)
- Never go back to regular keyboard (N=2)
- Ability to maintain job (N=2)
- Ergonomic design (N=1)

Best attributes?

- Split, curved key layout (N=42)
- Improved posture (N=33)
- Reduced pain, increased comfort (N=16)
- Keyboard tilt adjustment (N=13)
- Key feel (not too mushy or clicky) (N=8)
- Built-in wristrest (N=8)

Worst attributes?

- Not adjustable enough (N=18)
- Key feel (hard touch, stiff) (N=15)
- Large keyboard size (N=14)
- Learning Time (N=7)
- The Windows keys are in bad locations (N=5)
- Attached keypad (never use, reach to use, increased mouse reach) (N=5)

Some user comments on why rejected (not purchased):

- "Overpriced junk"
- "Too large for hands"
- "Didn't seem as flexible"
- "Shoulder problem, need mouse closer"
- "Did not want the built-in numeric keypad"
- "Was driven crazy by the 6 being on wrong hand"

How improve?

- Make more adjustable (N=25)
- Better key design (light action with tactile and audible feedback option) (N=11)
- Built-in pointing device (N=9)
- Detachable numeric keypad (N=4)
- Make wristrest padded, adjustable (N=3)
- Eliminate or provide separate wristrest (N=3)

Kinesis Classic Contour (N=21)



Worth more than a standard keyboard?

- Reduced pain and increased comfort (N=9)

- More productive (N=3) Improved posture (N=2)
- Novel design, programmability (N=1)

Best attributes?

- Key layout, handwells (N=11)
- Programmability (N=9)
- Hand separation, improved posture (N=7)
- Footpedals (N=4)
- Light key force (N=3)
- Improved comfort (N=2)

Worst attributes?

- Not adjustable (N=6)
- Cursor and escape keys awkward to use (N=3)
- Difficult to change between Kinesis and standard keyboards (N=2)
- Thumb keys (amount of use & positioning) (N=2)
- Key feel (N=2)
- Having to re-learn (N=1)

Some user comments on why rejected (not purchased):

- "Too expensive"
- "Radical design"
- "Welled keys just didn't feel comfortable"
- "Thumb hurts, difficult to program"
- "Too many function keys accessed by R thumb"
- "Lack of: range of movement, height adjustment"

How improve?

- Separate the hand wells, make adjustable (N=7)
- Make a third pod for a numeric keypad (N=1)
- Change function keys to real keys (N=1)
- Adjustable key touch (N=1)
- Make feel of keys better (N=1)
- Allow more than two foot-switches (N=1)

Lexmark Select-Ease (N=24)



Worth more than a standard keyboard?

- Reduced pain and increased comfort (N=5)
- Adjustability / improved posture (N=4)
- More productive (N=1)
- I wouldn't consider using a standard keyboard again (N=1)
- This is the best cost vs. feature keyboard tested and used by myself (N=1)

Best attributes?

- Adjustability (angle & separation) (N=20)
- Reduced pain and increased comfort (N=4)
- Detached numeric keypad (N=4)
- Key tactility (N=3)
- Low profile (N=1)
- Improved posture (N=1)

Worst attributes?

- Noisy key clicks (N=5)
- Adjusting is not "stable", it tends to slip (N=2)
- Not adjustable front to back, for negative tilt (N=2)
- It should have a softer touch (N=1)
- Hard to figure out what ought to be adjusted where (N=1)
- I would prefer the keyboard sections to adjust closer to 90 degrees (tent) (N=1)

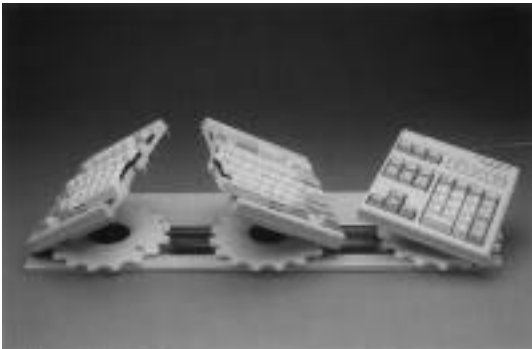
Some user comments on why rejected (not purchased):

- "Difficult to Adjust"
- "Relatively expensive"
- "Didn't seem as effective"
- "Not readily available, production was discontinued"

How improve?

- Remove click and decrease key actuation force (N=7)
- Increase height adjustability level (N=1)
- Make adjustment easier with better ball joint (N=1)
- Some sort of self tuning system; It is unclear how it ought to be configured (N=1)
- Don't provide the tenting feature - can't get forearm support with hands raised (N=1)
- Footpedals would be good (N=1)

Comfort Keyboard (N=28)



Worth more than a standard keyboard?

- Allows me to continue to do my work (N=7)
- Adjustability - Neutral position - Programmability (N=4)
- Lack of pain is difficult to put a price tag on (N=3)
- I value it beyond it's cost. I'd never go back to a flat keyboard (N=1)

Best attributes?

- Adjustability (N=18)
- Programmability (N=4)
- Ease of pain on hands (N=1)

Worst attributes?

- Key action hard/stiff (N=5)
- Software resets/freezes (N=4)
- Difficulty in adjusting / Wrench (N=3)
- Typing speed (N=1)
- The Price (N=1)

- Original wrist pads were cumbersome (N=1)

Some user comments on why rejected (not purchased):

- "Cost"
- "Too firm a touch"
- "Keypress hurt fingers"
- "Too large"
- "Couldn't find outlet"

How improve?

- Change key feel/more sensitive (N=3)
- Rearrange some keys (N=3)
- Easier adjustability (N=3)
- Less expensive (N=2)
- Add dust cover (N=1)
- Make it more reliable in terms of electronic parts (N=1)
- Lower the height, fix the key programmability (N=1)

Discussion

Overall survey results show that alternative keyboards are obtained primarily to alleviate an existing injury or to avoid being injured. There is more of a tendency to acquire one of the more readily available commercial keyboards (Adesso, Apple, Microsoft) for avoiding potential injury as compared to the more medically or injury accommodation-oriented keyboards (DataHand, Comfort, Lexmark, ErgoLogic, Kinesis, and Maltron). The Adjustable Split Keyboards were ranked as having been acquired as much for their adjustability as to the likely goal of addressing an existing injury or pain.

Consideration of other alternative keyboard products varied considerably between the different keyboards. A prime example is the Microsoft Natural keyboard which 2/3 of the time was purchased directly from a store or catalog without considering, or even knowing the existence of, other alternative keyboard options. The Apple Adjustable keyboard also showed this tendency, however, at the time there were very few options of alternative keyboards that were compatible with Apple computers. A similar comment would be valid for the Maltron keyboard being sold in the United Kingdom; there simply are not that many options being provided. Users of the Adesso keyboard made comparisons frequently, however those were frequently with other the commercially-oriented keyboards (Microsoft and Apple) because the more medically-oriented keyboards were considered too costly. The Adjustable Split and Sculpted keyboard users occasionally contemplated the commercial Fixed Split keyboards, but disliked the quality, lack of adjustability, and were not as comfortable. When users compared between the medically-oriented Adjustable Split and Sculpted keyboards they were concerned with cost, availability, ease of adjustment, and the ability to get used to the more unique designs.

Reported benefits of alternative keyboard use follow closely with earlier laboratory research. All alternative keyboards rated highly in the posture and comfort areas as compared to the standard keyboard. Ratings on adjustability were high for the Split

Adjustable keyboards and lower for the others. Productivity issues such as typing speed and accuracy, along with learning to use, generally did not show any major difference as compared to the standard keyboard. A couple of exceptions, however, would be the DataHand and Kinesis keyboards with more unique design solutions which results in increased learning curves and occasional problems when switching between alternative and standard keyboards. These ratings correspond well with earlier studies where initial productivity slows down and then increases towards original levels over time. Key feel is an important issue for many users, which is indicated by many of their comments and recommendations. The ErgoLogic, DataHand, and Kinesis keyboards rated the highest for improved key feel characteristics, while the other keyboards more closely match the key feel of the standard keyboard.

Overall, 81% of the users felt that their alternative keyboard was worth more than a standard keyboard. Reasons given for this ranged from it is worth my health, vitality, career, and lifestyle to improved posture, comfort, and reduced pain. Some even noted that split keyboards are plainly better and that they would never return to a standard keyboard again.

The users consider the best attributes of alternative keyboards to be the split or separated designs, improved posture, reduced pain and increased comfort, key feel, adjustability, key programmability, and a separate numeric keypad.

Comments on the worst attributes include: a spongy or stiff key feel, poor quality, lack of adjustability or hard to adjust, changes in the key layout due to the split or sculpted key designs, and learning time for the more unique keyboards.

Recommendations for improvement include increasing keyboard adjustability, better key design with a light action and tactile feedback, inclusion of an integrated pointing device (typically a touchpad or trackball), a detachable numeric keypad for positioning flexibility and allowing the mouse to move closer, varied suggestions of relocating specific keys, and reducing alternative keyboard costs.

To provide a broader perspective on the issues found and reported, the following conclusions relate not only to the information provided above, but to the study as a whole based on previous writings.

Conclusions

This study has provided insight into the primary factors involved in the selection process between the commercially available alternative keyboard designs. To some extent there appear to be two markets for alternative keyboards. One is the mass-marketed Fixed Split keyboards that users are finding and using for injury prevention and accommodation with rarely any insight into other available products. The second market is medically-related for the more costly Sculpted and Adjustable Angle keyboards. These keyboards are advertised in medical product catalogs and specialty shows focused on medical and ergonomics professionals. As such, these products to date have largely been hidden from potential users until after an injury has occurred.

The majority of adjustable keyboard users seem to prefer moderate adjustment angles while typing, which is consistent with previous research. Positive responses were obtained related to keying posture and comfort while using the alternative keyboards with no corresponding loss in keying accuracy and speed. Some learning curve issues exist for the more unique keyboard designs.

Over 80% of the users felt that their alternative keyboards are worth more than the standard keyboard previously used. Several users feel uncomfortable returning to standard keyboards and others state that they would not have been able to continue in their jobs, or would have undergone surgery, had it not been for the alternative keyboard being used. Users report improved posture and comfort, and reduced pain, from the split, sculpted and adjustable keyboard configurations investigated in this survey study. Of concern to users was the poor quality of some products, especially of the feel and action of the keyboard keys. Some personal preferences appear related to key feel as some prefer the "clicky" keys while others dislike the noise and prefer a quiet, smooth action. Much like the earlier-mentioned similarity to ergonomic chairs, many users are trying out the alternative keyboards and comparing cost to features and comfort. Each alternative keyboard has its benefits and drawbacks; however, users do appear to benefit from their use and in some cases could not work without them.

Survey responses from alternative keyboard users in business, government and educational settings have provided insight into the primary factors involved in the selection process, setup, use characteristics and perceived benefits between the commercially available alternative keyboard designs. Results from this study not only show that keyboard configurations and benefits as described in laboratory research have "real world" validity and benefit, but also provide information needed to focus user education, research and design efforts in the field. It must be emphasized, however, that keyboards are only part of the CTD epidemic and thus other aspects of the workplace (both products and practices) also need to be surveyed and observed as well, so we can better understand and address these problems in the office environment and elsewhere.

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