Keyboard design in the electronic era

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1 Introduction

'As technology advances it has tended to outstrip our appreciation of human needs in working situations, and lack of such knowledge has led to the design of machinery ill-fitted to human operation.' - (Grandjean[1]).

One piece of equipment which is universally recognised as being ill-fitted to human operation is the ubiquitous typewriter keyboard. The standard Sholes-designed keyboard with its qwerty letter layout, must be one of the very few pieces of equipment which has entirely resisted improvements, which could and should have been made to complement our advancing technological ability.

It has been said of the Sholes letter layout that it would probably have been chosen if the objective was to find the least efficient—in terms of learning time and speed achievable—and the most error producing character arrangement. This is not surprising when one considers that a team of people spent one year developing this layout so that it should provide the greatest inhibition to fast keying. This was no Machiavellian plot, but necessary because the mechanism of the early typewriters required slow operation.

As the qwerty layout and design have been retained in their entirety on electric and electronic keyboards which have faster keystroke capacity, it is not surprising that keying speed did not improve significantly when mechanical keyboards were replaced by electric and electronic equipment. The *Guinness Book of Records* reports these world speed records:

1918 on a Standard Underwood for one minute only 170 wpm (net)
1946 on an IBM Electric for one minute only 216 wpm (net)
An increase of 27.06%.

This increase is, however, only maintained on a one minute test as the records for one hour tests show:

1923 on a Standard Underwood for one hour 147 wpm (net)
1941 on an IBM Electric for one hour 149 wpm (net)
An increase of 1.36%.

Higher speeds could well have been expected as keying speeds for equipment increased from 11 kps for standard mechanical typewriters to 18 kps for electric and 35-50 kps for electronic. Restraints no longer exist in the mechanism of the hardware and must be looked for in other factors.

With greater use of computer aided technology, it becomes increasingly apparent that the cost of maintaining the standard qwerty keyboard design and layout is too great for developed societies to tolerate. The costs are both indirect and direct. Indirect costs arise from the ill-health suffered by the increasing number of people now using keyboards. Direct costs are in the acknowledged 'bottleneck' in keyboard input, whether in print production or in any form of typewriting or data-input, and in the length of training time required.

2 Indirect costs

Manufacturers of keyboards, and others, have claimed that the design of the keyboard is not important, as the human body can accustom itself to the required positions. Equally it has been claimed that although the human body can and does accustom itself to poor design, this is always done at a cost. The cost in terms of human suffering is dramatically evidenced by the research done by Ferguson and Duncan[2], by Osanai[3] and others before them.

Ferguson and Duncan have given a detailed diagnosis of the physical ill effects of the design of keyboards. Their investigations produced clinical evidence of finger, wrist and shoulder joints of keyboard operators with marked flexion, extension, abduction and deviation due to keying continuously on keys which force these joints into unnatural positions. Osanai gives evidence of pains in neck, shoulder, arms, hand and back, which seem to have been caused by repetitive quick motions of the hand and fingers as well as by the static muscular tension required to sustain working posture. He also isolated hardening of the muscles and tenderness.

Apart from such detailed clinical research studies, physiotherapists and osteopaths observe that keyboard operators provide them with a large occupational patient group.

Already millions of people all over the world use keyboards: typists in offices; students in schools, colleges and universities; in data preparation departments; airports; police offices and, of course, in newspapers and printing. They may produce characters on paper; paper or magnetic tape; disc;