Manufactured by PCD Limited of Farnborough, Hants, England, the PCD-Maltron keyboards all have the facility for being used with either the qwerty layout, or the Maltron Mark II layout. Either may be accessed at the touch of a key.

6 Letter layout

Siting characters on the keys is a complex matter, and to arrive at an optimum layout many variables require consideration: motion economy principles related to hand and finger movements; finger strength and flexibility; the human neuromuscular structure. All these factors are included, as well as language restraints, such as letter confusions which result in common spelling errors and then appear as common keying errors, and allowance for statistical frequency of letters, single and in combinations of di- and tri-graphs, especially those in the commonest words. For high speed keying, it is necessary to:

a
balance the load between the two hands—making some allowance for right hand dominance
b
balance the load between the fingers—allowing for individual finger capacity
c
reduce finger movements to a minimum—by placing the most commonly used letters directly under the ten digits
d
reduce difficult finger motions to a minimum—reduce hurdles and stretches and avoid use of the same finger twice in succession
e
allow for fastest finger movements to be used most frequently—provide for lateral as well as contra-lateral keying
f
avoid long sequences on one hand—balance lateral with contra-lateral keying.

For accurate keying and for ease of learning, letter layout should take account of cybernetic requirements related to language. Highest source of error in reading and in spelling is located in vowels and vowel graphemes. On the qwerty layout the highest source of error is on the vowels e and i. On the Linotype layout it is on the vowels a i o and Dvorak[9] himself detected that of 3 329 errors analysed for the 'Simplified' keyboard 1 631 involved the vowels. The five vowel keys accounted for 48.99% of the errors analysed. (Figures abstracted from chart on p 504) If vowels are strategically placed so that they do not appear on adjacent keys, nor on the same finger and same row of the two hands, neural confusion may be avoided. This would provide the best possibility for accurate keying.

The factors cited above apply equally to English and to the other languages using the Latin characters. The order of frequency of use of alpha characters in these languages do not differ greatly. French, Spanish and Italian keying will be aided by correct placing of vowels, and Dutch and German which often have three or more consonants together will also benefit.

The degree to which these requirements can be provided for in a letter layout may be judged from the accompanying tables for the Maltron Mark II layout.

All these calculations are based on letter frequencies in 1013232 words—a total of 5930220 keystrokes including spaces and most used punctuation (Kucera[10]). Calculations are also given for letters in the 100 commonest words, which occur 481200 times within the 1013232 words, a total of 1871000 keystrokes.

Statistics for Maltron Mark II letter layout with comparative figures for Sholes (qwerty) and Dvorak (DSK) keyboards are given in the Tables below.

Table 6 gives the percentage of letters keyed on the home row for all the words analysed in the Kucera Corpus (all language) and for all the letters in the 100 commonest words in the Corpus.

Table 7 gives figures for single finger keying twice in succession and a separate list for single finger hurdles. Hurdles occur when a finger is required to key across the home row, from top to bottom alpha character row or from bottom to top row. They are the slowest movements because of the distance between the keys.

Table 8 gives figures for index finger stretches inwards to the centre rows of keys. (qwerty letters are t g b for left index finger, and y h n for the right index finger.) These are the most uneven stretches on the Sholes design and with vowels are a high cause of error. On the PCD—Maltron design the stretches are even and smaller, as well as being considerably fewer in number.

Table 9 gives percentage figures for balance of keying to each hand. Two sets of figures are given. The first set is for letters and punctuation keyed by the eight fingers only. The second set is for letters, punctuation and the space bar keyed by all ten digits for PCD—Maltron and nine digits for Sholes and Dvorak which do not use the left thumb.

Table 10 gives the balance of keystrokes to the fingers and thumbs of each hand. The use of the left thumb on the PCD—Maltron reduces the load to other fingers. This factor is chiefly responsible for the reduction of single finger used twice in succession and hurdles on the PCD—Maltron.

Statistically the Matron Mark II layout makes good sense. Cybernetically related to language frequencies, its degree of fit is already apparent in the ease with which learners are able to locate letters of the alphabet and key alphabetical sentences.

7 Implementing the changeover

Of course it will not be necessary for all keyboard operators to change to both the new design and the new layout. There is no reason why it should be mandatory as was the change to drive on the right side of the road in Sweden, or the change to decimal currency. A change can be made to the new design only, and for many operators this may be of sufficient