Critically Discuss and Explain Human Factors in Design
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Throughout everyday life the needs of humans cause problems with the use of many items. The usability of items is now more important than ever for manufacturers, if an item is designed with poor usability then consumers will simply not purchase the item, giving the competition improved sales. In my opinion key areas for manufacturers to consider when designing products are human error versus design error, and the use of sensory feedback.

A simple idea of human errors versus design errors is evident in a component every computer user will use, the keyboard. The keyboard is one of the oldest input devices still used in computing today, and is quite possibly the most efficient for a great number of tasks. During the mid 19th century the development of typewriters was aimed heavily towards improving their reliability, during this time Christopher Sholes designed what is now commonly known as the 'QWERTY' keyboard. It took its name by simply using the first 6 keys on the top line of letters on the keyboard. The outcome of Sholes' QWERTY keyboard was that typists using it were slower typing, in comparison to keyboards such as the Dvorak keyboard. Booth(1989) believes that this was because 'the distance between the most frequently used keys is greater on the QWERTY keyboard than it is on the Dvorak keyboard.' This is a view somewhat shared by Dix et al(2004, p65-66) where it is stated that the most frequently used keys are placed on the middle row of the keyboard, also known as the home row, which means that 70% of keystrokes made are done with minimal stretching, and the fact that the Dvorak keyboard aims to alternate keystrokes between each hand.

With the layout of the Dvorak keyboard balancing the workload between the users two hands more evenly than the QWERTY keyboard, it starts to become clear why Booth believes the QWERTY layout is slow. However, it has become a major success globally and is the widespread keyboard of choice around the world. Booth makes reference to the opinion of Martin(1972) and Kroemer(1972) in which they attribute this to the fact that Dvorak keyboard users actually make less errors during typing, than their QWERTY counterparts. Comparing the two types of keyboards we can see that the QWERTY keyboard was extremely useful at the time of its conception, and confirms Booth's(1972, p6) theory that.

> 'A further compounding problem in design is that many designers pay more attention to the technical elegance of a system than they do the more practical consideration of is it usable?'

However the Dvorak keyboard is actually designed in a way which makes it appear that the design is not of the norm, in that they keys are set out in a way to make the more frequently used keys closer together, and spread the workload between the two hands more evenly. This means we can see how human and design errors relate to each other. Users of the Dvorak keyboard make less errors, due to its high usability, and user efficient design, but suffered from the design error which made typewriter keys jam. Whereas QWERTY users benefited from non jamming keys, but at a loss of speed and efficiency during typing. From this I agree with Booth's idea to a certain degree, in that some designs are based upon usability, and some not, however not to the extreme amounts that Booth appears to imply.

Following on from the design of the keyboard, there are many other factors users have control over, in regards to their computers. Emmons and Hirsch(1682) found that the ideal keyboard would have be one which sloped slightly towards the user, raising the far end up slightly, to make it more comfortable

for the user. It was also discovered that connecting the keyboard and Visual Display Unit should only be done by a single flexible lead, in order to allow the user to place the keyboard directly in front of them , whilst being able to be seated at a comfortable distance from the screen, to making viewing suitable. This approach is still seen today, and the majority, if not all computers, except laptops obviously, are now designed as a Central Processing Unit(CPU), connected by flexible cables to a monitor, with peripherals, such as keyboard, mouse and speakers also connected by flexible cable. This allows the user to utilise the space available to them in their room to the maximum potential, but still arrange the items in a way which is most comfortable for them. For example, some users may choose to 'hide' the CPU away, under a desk for instance, with the monitor on top of a desk, and then the keyboard and mouse within easy reach of their seated position. Studies into the best way to be seated and use a computer have influenced this design heavily. Figure 1 outlines the ideal typing position a user should undertake.

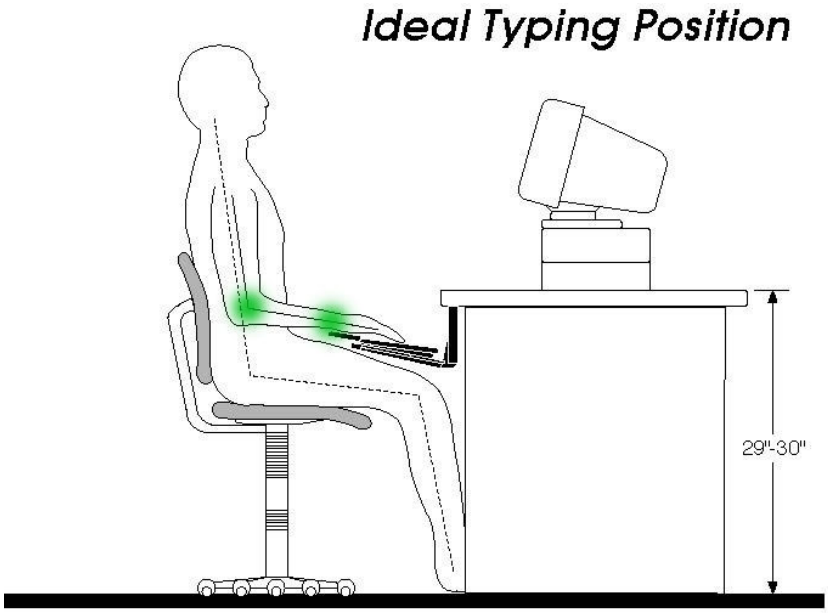

Figure 1 – Ideal Typing Position

As can be seen in Figure 1, this is contradictory to Emmons and Hirsch (1982) theory, that the keyboard should slope gently towards the user. Cornell University's Cornell Human Factors and Ergonomics Research Group (CHFERG) explain on their Ideal Typing Posture web page that typing with a keyboard sloped towards the user causes muscle fatigue after prolonged usage, because

> 'it is difficult to maintain the wrist is in a neutral posture, because the forearms sag as they tire and this puts the wrists into greater wrist extension. Also, most users have to work with their elbows flexed, which can compress the median and ulnar nerves at the elbow and restrict blood flow to the hands. Working with the forearms sloping up increase muscle loads in the upper arms, shoulders, and neck '

This is where laptops pose a problem. For all the positives they bring to the computing world, such as

being small and portable, so easy to use in numerous places where desktop computers simply aren't, they bring possible health problems to the user. As stated by the American Academy of Orthopaedic Surgeons due to the laptops not having a monitor and keyboard in different places users must make a compromise. They must choose whether to place the laptop in a position where their wrists are in a neutral position, therefore having to bend their neck or head. Otherwise they could position it so that it is ideal for looking at, but the wrists suffer from being in poor posture, related to the keyboard. Neither of these is ideal, as eventually after prolonged use the user will likely suffer from injury. This is probably the single greatest flaw of the design of the laptop. In my opinion, the best solution is to, where possible, use an external USB keyboard, connected to the laptop, so both the screen and a keyboard can be positioned in the most ideal places possible, in an attempt to avoid gaining a serious injury.

The use of sound in conjunction with key presses can provide excellent feedback for the user, if used in the correct manner. For example, Dix et al (2004, p92) raises an excellent point about the use of doorbells.

> 'If we press it and hear nothing, we are left undecided. Should we press it again, in case we did not do it right the first time, or did it ring but we did not hear it?'

This, as stated, leaves the user with a problem. Do they do nothing and wait for a response, in case press worked, and the sound was simply not heard by them, for a number of reasons, such as background noise, or the speaker being out of earshot of the user. Or, do they press the button again, in case the press wasn't recognised by the unit and the sound was not emitted by the speaker, therefore not making anyone aware of their presence at the door.

Sound is nowadays used for feedback in a whole range of items, digital cameras for example use a shutter sound, designed to sound like the clicking noise non digital cameras emit when a picture is taken. This shutter sound acts as a notice to the user that the button press was registered by the camera, and that a photograph has been taken. Mobile phones are another example. Most, if not now all phones, have the option to have a tone sounded when the user presses a key. The noise makes the user aware that a key was pressed, and the ability to have different tones assigned to different keys means that the phone can also feedback to the user which button in particular was pressed.

The idea of sound being used to alert people is evident in the motor industry as well. The most obvious example of this being the horn on a vehicle. A button is pressed and a loud 'honk' noise is emitted from a device, usually situated in the engine bay. The horn is used primarily for letting other road users know that your vehicle is in the immediate vicinity, maybe because another road user failed to see you and so committed an unsafe manoeuvre. Car indicators usually also incorporate sound, and light into their design. When the indicator is used, a flashing light is present on the dashboard of the car. Normally 2 identical lights are situated on the dashboard, sometimes in arrow shapes, one pointing left, and one right, but not always, and they light up when the indicators are used in the respective directions. Not only this, but a 'ticking' noise is also heard. This acts to remind the driver of the vehicle that the indicators are in use, in case they don't automatically cancel, of the driver forgets to cancel them. The most likely time for the driver to forgot their indicators are on is when the lights on the dashboard fail, and so by having a secondary reminder, in the format of a sound, it can help to stop the indicators causing confusion to other road users.

A third of the traditional five senses humans use is also included within the design of many items, touch. The majority of keyboards utilise a raised dot, or line, on keys on the home row. In some cases these raised pieces are on the two keys the index fingers use, F and J. They are present to serve as a way in which touch typists, those who can type without looking at the keyboard, can recognise where there fingers are placed on the keyboard. This idea is not limited to just keyboards however, more and more devices are starting to use the idea. A great number of telephones posses a raised dot or line on the 5 key, as it is one of the 2 most central keys on the pad, along with 8.

The video game series Guitar Hero, published by Activision (and RedOctane, prior to its purchase by Activision), has begun to place a small raised line on the yellow fret button of the controller used to play the game. The game is played by pressing and holding one of five coloured fret buttons, on the guitar controller, whilst strumming with the bar, as the coloured notes appear on the screen. The game is played with your left hand pressing the 5 coloured buttons representing the frets, and the right hand strumming. The buttons appear on the controller in the following order: Green, Red, Yellow, Blue Orange. As you can see, the yellow button is the middle of the 5. A human hand comprises of 5 digits, and with the way one most hold the controller, 4 digits are only available to button press with. The inclusion of a raised area on the middle yellow button allows users to easily and quickly recognise which buttons their fingers are pressing, and allows them to locate all 5 buttons whilst they traverse the 5 buttons.

Even Mobile Phones are now beginning to utilise touch feedback. A number of more advanced Mobile Phones which uses touch screens are now implementing small vibrations to provide feedback to the user. One such phone is the LG KU990 'Viewty'. The Viewty uses a touch screen across the whole of the front of the phone, bar a small area at the bottom where 3 conventional buttons are located. Icons and menus are displayed on the touch screen and the user must touch the screen where the icon or menu item is displayed to access it, instead of the conventional button pressing. This is where the Viewty uses touch feedback to help the user. If the press on the screen is recognised by the phone it subtly vibrates to confirm the press was recognised. This helps users who otherwise may possibly be temporarily worried that something had gone wrong, and is in my opinion an excellent and efficient way of helping the user.

Overall the influence of human needs in design is recognisable in an absolute mass of products readily available on today's market, and in my opinion the advances that have been made because of these needs has turned the products into items which are much more useful, and massively increased their usability. There are of course exceptions, such as the QWERTY keyboard. In a day and age where the problems which it served to counter are not evident any more, it primarily is only still in use because of the lack of willingness by users to change what they are used to, and move back to what was a more efficient and user friendly item, in the Dvorak keyboard. If products, and ultimately manufacturers are to succeed in the future then I feel they must develop the idea of sensory feedback in devices, and use it to enhance the users experience of their products.

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