Human Centering:
An Approach to Designing Controls & Displays

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As the world population continues to expand, so too does the market for consumer products and services. The 1990 U. S. Census projects a 50% increase in the American population by 2050. As birth rates and immigration moderate, the population increase will be due primarily to aging. Additional projections by the 1990 U.S. Census indicate that between 2015 and 2030, the population over the age of 65 will increase by more than 26 million people while the population of children will only increase by just over 7 million during the same time period. This aging population is living independently and remaining healthy for longer periods of their lives. They also control the largest percentage of discretionary income in America. For all of these reasons, human centered design is becoming less of a courtesy to the consumer and more of a necessity for product success in the marketplace.

By definition, human centered design "is based on the premise that design is meaningful only when the focus of design activity and design outcome accommodate the largest possible number of people inclusive of their diversity." Although the aging population is remaining healthy, independent and physically capable for much of their lives, the progression of aging ultimately brings with it the onset of functional limitations. These limitations can manifest themselves as moderate to severe reductions in sensory, cognitive or motor capability. It is imperative that designers recognize that proper identification of the user combined with planning to accommodate the user over the span of a lifetime will yield products that are human centered.

Information that is presented to the user through visual or auditory stimuli can be classified as a display. Controls are those devices that allow a user to interact with or input information into a system. Used in combination, displays and controls appeal to visual, auditory and tactile senses. They allow users to interact with and respond to a product or system through presentation and analysis of information that may be quantitative, qualitative, static, dynamic or representational. (Asfour et al. p. 259.)

"Displays and controls are essential in our everyday living." (Asfour et al. p. 257.) Indeed, they are inexorably woven into all facets of life from illuminating a room, to bathing, to accessing information and communicating with others. "As technology takes on added significance in our lives, the design of displays and controls will become a critical component of the effectiveness with which we perform our daily work." (Asfour et al. p. 257.) Human centered displays and controls should follow basic tenets of ergonomics and encourage population stereotypes thereby reducing operator errors, and increasing user speed and learning efficiencies. Application of human centered design makes displays and controls more accessible and at times, may even be considered as implementation of assistive technology.

Population stereotypes relate to consistent and predictable direction of movement cause and effect relationships anticipated by the user. In other words, a user would expect that sliding or pushing a control upward or to the right would turn a device on, increase volume or speed, initiate a forward direction or raise the level of a known quantity. Conversely, sliding or pushing a control down or to the left should turn the device off, slow it down, put it in reverse or lower the level of a known quantity. Displays provide the necessary feedback to confirm to the user that the action is occurring and is having the desired effect. A critical aspect of accessible design (and thus human centered design) is the consideration of multi-cultural and multi-lingual aspects of developing a product or system. (INCLUDE, No. 1, p. 1.) Population stereotypes are one way that designers can overcome cultural and language barriers in the design of a product's controls and displays. The Telecommunications Industry Association, in conjunction with the Electronics Industry Foundation publishes "A Resource Guide for Accessible Design of Consumer Electronics." This is an extensive set of guidelines for designing controls and displays that consider and define a broad range of population stereotypes.

Implementation of size and shape coding of controls allow a user to discriminate a control by touch alone. (Asfour et al. p. 270.) This is critical to visually impaired users. Additionally, incorporation of tactile displays such as mechanical vibration or electric impulses will appeal to those users who are visually impaired and/or hearing impaired. (Asfour et al. p. 269.) Inclusion of these design details adds a level of information redundancy for the user who is neither visually nor hearing impaired. These design details are considered assistive technology and thus increase the overall population capable of using the system as well as the long-term accessibility of the system.

Since 1878, the QWERTY keyboard has been in production and has become the de facto standard for ten finger touch-typing. It was not specifically designed for ten finger touch typing nor was it designed with ergonomics, human centering, or ease of use in mind. In the 1940s, the first extensive studies of keyboards were conducted and in comparison to over 250 keyboard designs, the QWERTY fared among the worst. Among its many physical problems, it is biased toward the left hand and requires extensive movement between rows of keys. (Baber, p. 29.) And yet the layout of the QWERTY persists. There are as many reasons to keep the QWERTY as there are to abandon the design layout. One of its attributes is speed. In spite of its problems, the QWERTY remains one of the fastest keyboard arrangements with touch-typists routinely able to achieve speeds of 60 – 90 words per minute. This speed is considered near optimal. (Baber, p. 30.)

Perhaps the reason that the QWERTY is so successful in spite of its apparent ambivalence toward users is its (accidental) embodiment of several key tenets of sound ergonomics with regard to the design of displays and controls. For instance, the keys are designed to provide quality feedback through the tactile experience of depressing them. When depressed, they offer resistance and return easily to the neutral position. The keys travel a precise and consistent distance when depressed. They offer an auditory display by clicking when depressed. And they provide visual displays in two ways: the act of physically depressing a key can be seen with the eye and the corresponding change in output on a screen or other medium can be witnessed in real time. There is a direct visual cause and effect relationship.

The variety of ways in which the standard QWERTY keyboard appeals to the different human senses is exactly what makes this keyboard an accessible human centered device in spite of it shortcomings. As users develop functional limitations due to aging, disease or trauma, the QWERTYs built-in feedback redundancies are often able to compensate for the user's loss of sensory modality. A visually impaired user is still able to experience the tactile controls and auditory display of the keyboard. A hearing impaired user engages the visual displays and tactile controls of the device. Loss of sensitivity to touch is compensated for by use of visual and auditory displays. Although the QWERTY is considered a device for ten finger touch typing, it is accessible to individuals using fewer fingers, mouth sticks or other assistive devices and it continues to provide redundant displays and controls to the user regardless of the method of interaction with the keys. Redundancy of feedback makes the QWERTY a good example of a device that is usable by the widest range of the population inclusive of their diversity and over the span of their lifetimes.

In stark contrast, membrane switch keypads embody all of the tenets of poor ergonomics and consistently prove difficult to use by the broadest range of the population even when they conform to the QWERTY arrangement of keys. Membrane switch keypads offer little or no tactile feedback. When the switches are domed and actually depress physically, the key resistance and travel distance are negligible and users suffering from loss of tactile sensation or those requiring assistive technology may not be aware that they have engaged the keypad. Auditory displays may be missing or of inappropriate intensity or frequency. Persons with visual impairments may not even be able to locate actual button placement on the keypad of a membrane switch. Visual displays are often the only way to confirm proper engagement of a membrane switch keypad. This is the embodiment of inappropriate design and disregard for the user population.

Designers must learn to embrace ideals of inclusiveness. They must educate themselves about users and their physical and cognitive abilities. Human centered design often adds no additional cost to the production of a product and can increase market share by appealing to those with a variety of functional limitations. As the population ages and lives longer, it will become increasingly more important to recognize age onset functional limitations and to anticipate them in the design process. In order for the healthy, aging population to continue living independently, they will require human centered products that allow them to remain functional and productive in their environments and daily living activities. The discretionary purchasing power of this market segment commands designers and manufacturers to be attentive to their needs.

References

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