Ergonomics and the Aging Workforce in Singapore

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Ergonomics and Aging

All developing countries are faced with aging populations. These challenges are dealt with by politics, economics, sociology, rhetoric and sometimes by hiding the problems behind closed doors. The ergonomics approach complements and depends on these approaches in that it aspires to use objective analysis of human capabilities and limitations and apply these findings to the design of the physical, informational, operational, social, contextual, technological and esthetic aspects of work.

The outcome of any work situation may be a compromise among effectiveness, efficiency, health and safety and stakeholder satisfaction. The stakeholder may be the individual concerned, a customer, a manager or a government representative and these may have different expectations. For example an operator on a production line or in a busy food court must achieve acceptable quality, but the operator must also keep up with the speed of line. If this line speed is too high then the operator may become fatigued, be prone to having accidents or may suffer from cumulative stress. Another problem is that people vary in their characteristics and vulnerabilities.

A traditional view of ergonomics sprung from a simplistic view of anthropometry in that designs were recommended to accommodate 95% of the population on single or multiple spatial dimensions. This philosophy meets with two shortcomings. First when multiple dimensions, including physical, informational, contextual and esthetic are involved, simple ideas of statistical accommodation are complex and usually meaningless. The second challenge to this ergonomics accommodation dogma comes from an offshoot of the ergonomics profession – universal design. The philosophy of this movement is to accommodate everyone concerned, including the elderly and the disabled. The practicality of these concepts is where politics, economics and avoidance come into play. For example, should all computer systems be cognitively accessible to all people? If not then how far should the designer or system manager go to provide human aided automation? One example is the LTA implementation of longer pedestrian crossing times on demand. How could the massive challenge of overhead pedestrian bridges be dealt with?

Ergonomics Analysis

Ergonomics is based on the basic sciences of anatomy, physiology, psychology, sociology, engineering and operations management, with due regard to statistics to address the variability inherent in all these domains. It is generally understood that aging is an important contributor to this variability. The challenge for ergonomics is to measure this variability in populations, cohorts and individuals, and apply appropriate design and accommodation principles. From the physical viewpoint older people generally deteriorate in strength, flexibility, stamina, sensory processes and motor skills. This deterioration is generally linear throughout middle age at about 1% to 5% per year, but accelerates in old age (beyond 60 or 70). Again there is considerable individual variability due to genetic or habitual activities. Sensory capabilities such as vision and hearing also deteriorate, although some degree of personal adaptation is common in the form of spectacles and hearing aids. But more could be done to make information more accessible to those with deteriorating vision and hearing. Contextual interventions of lighting increase and noise reduction can offset this sensory deterioration. Information processing capability also deteriorates, but performance may benefit from strategies based on experience. For example, older people, may “buy time” to search for the best responses. Unfortunately, however, older people may be less flexible in dealing with complexity and uncertainty, resort to habitual responses and disregard possibly relevant information. For example they may say “I’ve always done it this way.” This lack of flexibility is also evident in operational, social and affective contexts in that older people may seek familiar less challenging pathways.

Ergonomics and Design for Aging in Singapore

The general principle of ergonomics in design for aging is to reduce the demands by providing more time, lower forces and greater amplification and discriminability of sensory sources; there should also be less noise, distraction and a reduction of informational complexity. There should be fewer expectations for productivity. From the first principles point of view, accommodation of a large proportion of the population by adjustability in design will facilitate acceptable behavior and performance.

A distinction is often made between white collar and blue collar workers; in reality this is a continuum as “information workers” may face challenges of too little physical activity and may be susceptible to fatigue due to prolonged static work. Examples include the metabolic illnesses prevalent in white collar workers who spend most of their days tied to a computer. On the other hand blue collar workers, often limited by strength and stamina capabilities, may also exhibit cognitive failure in safety critical contexts. Examples include driving and manual materials handling. Both white and blue collar workers are subject to physical environment challenges, such as thermal, acoustic and visual stress; they also may be subject to similar operational and social stresses. In Singapore the thermal environment load is an ever-present hazard for many workers.

One way of addressing these challenges from the political viewpoint is the principle of “seniority” widely used by trade unions in the United States and Europe. This allows individuals with earlier employment dates (but not necessarily greater age) to have a choice of less physically or cognitively demanding jobs. Although seniority is not a direct correlate of age it may be used as a surrogate if age *per se* is deemed to be an unacceptable way of dealing with job choice. An imperfect, general observation is that that age and expertise are correlated. However, as with physical factors, age may be a weak surrogate for expertise, which is dependent on specific experience. Nonetheless, the operational principle of allowing greater choice based on age is preferable to the stereotypical external assignment of more menial task demands. Furthermore, where physical capabilities may be compromised by age, experience may be captured as a mentoring function. These socio-technical principles of human centered design have been shown to enhance both work satisfaction and productivity. Examples in the Singapore context include the opportunity for self paced work, flexible work schedules and part time opportunities.

Summary

In summary, the key to the accommodation of human variability and the predictable deterioration due to aging is through adjustability in design and operations, and choice in physical, informational, contextual and esthetic aspects of work. A “big picture ergonomics” or socio-technical systems approach must be complemented by micro-ergonomics attention to workplaces, equipment, tools, operations and environments.