Gerontechnology--Beyond Ergonomics and Universal Design

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J.L. Fozard, Gerontechnology--Beyond ergonomics and universal design. Gerontechnology 2002;1(3): 137-139 . The increasing rate of aging of the world population is paralleled by an increasingly rapid change in the technological environment that supports activities related to family, work, education and leisure. The analysis of person-environment interactions is, accordingly, ever more dynamic. One implication is that applications of ergonomics and universal design related to products and environments that compensate for age-associated limitations in physical and cognitive functioning will become more complex and probably shorter-lived. Moreover, because some age-associated functional limitations may be delayed or prevented, gerontechnology should now emphasize technology developments that support lifestyle and environmental interventions that alter the usual course of aging.

Keywords: aging, prevention of functional limitations, universal design, ergonomics

In their editorial for the second issue of this journal[1], Charness, Czaja, Fisk and Rogers posed the question. "Why gerontechnology?" Part of the answer was that age related declines in physical and cognitive functioning require environmental compensations, a point also made by Bouma in the editorial for the premier edition of this journal[2]. Bouma, recognizing the wide range of variability among the abilities and interests of older persons, further stressed the need for developing adaptive technological products and environments that compensate for reduced functioning of older persons. The processes needed to develop, disperse and distribute compensatory technology for older persons are by no means trivial. To carry them out successfully, the multidisciplinary approach represented by gerontechnology is appropriate[3].

But gerontechnology has other uses. One is using technology to prevent or alter the course of aging; another is to use smart technology to enhance the opportunities for new activities related to education, self-expression, social contacts, work and recreation that may occur in later life[4]. It is these uses that define how the conceptual roots of gerontechnology reach beyond the fundamental principles of gerontology, the scientific study of aging, and beyond those of ergonomics and design.

Results of generations of gerontological research document the variability of individual aging. More importantly aging is to some extent modifiable by a variety of interventions--environmental, medical and lifestyle. At the same time the boundaries between the design of products and environments that support special populations and those that improve functioning for the broad general population are being continuously redefined by new knowledge about aging and specific disabilities. Considered together, these developments require us to adopt a

dynamic view of changing person-environment interactions in our definition of gerontechnology. The essentials of this dynamic view can be represented in the embellishment of the traditional diagram of the man-machine interaction, depicted in Figure 1.

The familiar person-machine interaction diagrammed in the central circle of Figure 1 pictorially represents the core concept of ergonomics and user-centered design, according to which people (top half of figure) and their environment (lower half of figure) should be considered as a system. Optimal system functioning can be achieved by proper assignment of function to person and machine, by adapting the devices used to present information and those used to control or otherwise interact with the machine, and/or by training or selecting the person using the system.

The time dimension of Figure 1 indicates that

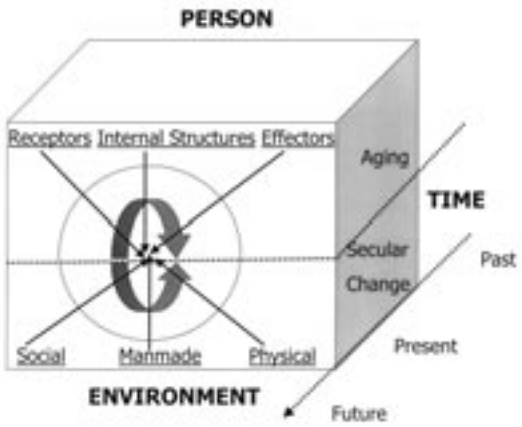

Figure 1. Diagram illustrating how the dynamics of human-environment interfaces (curved arrows) change over time (arrow tracks). The major components of the human side of the interface (upper half of figure) all change in varying degrees as an individual ages. At the same time, secular changes occur continuously in the social, built and physical components of the environment (lower half of figure).

the changes occurring in people as they age and the secular changes in the environment that occur over time complicate the person-environment dynamic. The complex human systems involved in the person-environment interactions include the physiological processes underlying the perception of information; the structural changes in internal cardiovascular, nervous, endocrine systems that support behavior and the nervous and muscular systems required to interact with the device. With aging, important changes occur in all of these systems. Some age-related declines can be compensated for with environmental and task modification; others may be prevented or delayed by lifestyle or medical interventions.
Changes over time in the environment can differentially affect the aging of persons of different age cohorts. The social component of the work environment changes with respect to the age distributions of workers, production methods and supervisor expectations. Secular changes in the physical environment may affect commuting, the use of remote working stations and the degree of urbanization of a neighborhood known since childhood. Above all, the products and or built environment associated used in many tasks change. The menu-driven control devices of today are quite different from the electromechanical devices that performed similar functions several years ago[5]. The proliferation of sophisticated technology is growing at an increasing rate. As indicated by Bouma[2], the growing sophistication of self-adapting machines has the potential for altering the environment or device to the idiosyncratic needs and preferences of the human user to a degree never before experienced.

In conclusion, the analysis of specific man-machine systems or person-environment interactions varies both with secular changes in the environment and the course of aging. The experience of a person encountering a computer for the first time in old age will be very different from that of the child who encounters the computer as a toy, and the

aging experiences of both will be very different as well. Accordingly, gerontechnology significantly expands the philosophy of human factors engineering and consumer oriented product design because the interaction between individual aging and secular changes in the environment over time is not static[6]. Optimistically, we can expect our rapidly advancing knowledge about aging to make it possible to use technology to systematically alter the course of aging as well as to compensate for some of its problems. Current developments in technology allow for an ever-increasing adaptation of machines to the idiosyncratic needs and purposes of persons of different ages. Gerontechnology provides the foundation for our optimism.

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Erratum Gerontechnology 1(2) Editorial

In the Editorial 'Why Gerontechnology' by N. Charness, S. Czaja, A.D. Fisk and W. Rogers that appeared in Issue 1(2), an omission was discovered on page 87. To the listing of Scientific Advisory Members should be added: Hans-Werner Wahl, Germany.