GERONTECHNOLOGY

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as seen from a technological perspective

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An approach to “Aging and Technology” as seen from a technological perspective.

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ABSTRACT.

The paper describes a conceptual framework that was set up for an international scientific debate on “Gerontechnology”, a term coined by the author in 1988. The conclusions from the first international conference on gerontechnology (August 1991, Eindhoven, the Netherlands) are presented. The conditions under which a supra-national scientific and industrial collaboration could take place are discussed. Finally an example is given of a recently begun project on technology and aging in the south of the Netherlands.

FRAMEWORK

We have to accept that performances of people with regard to different tasks change with age. We also have to realize that our living and working environment is not adapting automatically to our changing needs and wishes. This might be especially true for the technological products and services that become available on the market. Therefore more dedicated attention is required for possible mismatches between the living and working environment, the one dominated by the functional capacities and capabilities of consumers, their needs, wishes and behavior, and the other by technology.

Gerontechnology is the representative domain for these activities dealing with the interaction between the elderly and their technical environment. Until now the main research effort on aging has been delivered by scientists and professionals in the field of geriatrics and gerontology. These researchers are facing the problems of the mental and physical health status of growing numbers of elderly with an ever increasing life expectancy.

Health is the major factor that determines whether a person can live a comfortable life and maintain an acceptable level of independence. However, many other factors contribute to the well-being and adequate functioning of an
Gerontechnology aims at the combination of, among others, technological and ergonomical factors that determine the quality of life and the capability of the elderly to remain independent. The objective of the gerontechnology program is the optimization of the functional environment of the elderly and the possible contribution of technology to this, given the reality of socio-cultural and economical constraints and opportunities. Gerontechnology will make use of the ongoing research on aging processes as a reference for the definition of technological approaches to sustain functional independence and well-being.

The framework of the gerontechnology program will consist of:

* The realization of a reference base, built upon more comprehensive insight in normal aging processes and the description of these processes with appropriate parameters
* Collection of qualitative and quantitative information regarding normal aging at the level of daily human functioning
* Collection of information with respect to the influence of environmental factors and of technical products, processes and systems on older consumers
* Development of operational user characteristics and standards in relation to the (technical) environment, i.e. human factors for the elderly
* Generation of design criteria and specifications for the total of technical products, processes and systems that can or will be present in the daily life of the elderly
* Initialization of projects, evaluation studies and processes of optimization and implementation.

Three main domains and their subsequent intermediaries will be involved in the program, i.e. the consumer market, the industrial branches and the relevant academic research disciplines.
CONSENSUS ON GERONTECHNOLOGY

It is obvious that older consumers, especially, will remain independent and active in society on the premise that living and working environments are created and provided that support them in their activities of daily life. In order to achieve this it is necessary that products and services become available that have been proven to meet functional criteria for older users. The conference on gerontechnology and the preceding survey made clear, that, until now, only scarce information has been gathered in a systematic way on the capabilities limitations, activities and wishes of older consumers. It has also become clear that new products only very rarely have been evaluated in the actual user environment. The producers as well as the distributors of products and services are in need of more practical information and knowledge on consumer groups. Some problems are apparent here:

- Producers are not (yet) aware of their lack of knowledge
- They do not know where the knowledge is available
- The available knowledge is difficult to apply
- They do not know which knowledge is relevant for them.

This implies that a close collaboration program needs to be organized between producers and distributors as one party and a network of knowledge centers as the other. Research centers will have to form the nodes of this network, especially because of the assumed lack of insight in certain basic or fundamental processes of aging. A technological research center will necessarily have to be one of the nodes in this network. Its position will be that of a linking pin between industrial product development and public services (the market) and the socio-economic and medical research.

In summary: The elderly do need technical products and services for their activities of daily life. However, the providers do not know which products and services are desired or appropriate. The market of the elderly is still judged as unattractive and many elderly do not know which products are available or how they can get access to them. Therefore, more consumer research, especially earlier product evaluation, needs to be carried out. On top of that, a consumer information system has to be established in another form as the actual information systems. Aspects, such as user friendliness, comfort, safety, efficiency and efficacy should be ranked as high if not higher than price, maintenance costs, technical performance of products, etc.

GENERAL CONCLUSIONS

Individual differences increase with age. There is no uniformity in older age groups with regard to the physical, cognitive or financial resources or constraints. One generalization might be valid, that is, that elderly might need a little extra time to complete their activities of daily life. Problems might arise
The keynote presentations during the gerontechnology conference revealed that there exists an enormous amount of data on isolated, simple cognitive or physical functions, such as for example changes in visual acuity with age. However, when complex tasks need to be performed, it is not sufficient to just add up and combine the simple human functions. Among the elderly in particular, the interdependency of all functions becomes critically important. Environmental factors (social, cultural, physical) will also determine whether a complex activity can be completed successfully.

The research, development and design of user friendly (transparent) living and working environments demand a systems approach; an approach by which the elderly are studied in their actual environment. This should have a high priority. From a socio-economical point of view one must conclude that the majority of elderly (90%) do live independently and that the family structure plays a crucial role. In Europe, as compared to the USA, there is little micro- and macro-economical data available about elderly, their consumer behavior, or their discretionary income nor about cross-national differences. In this respect, Europe is very inhomogenous. Therefore it will not be easy to carry out the necessary cross-cultural studies.

In general the elderly are not 'technofobic' (afraid of technology) although much depends on the way they are confronted with an innovative technology or gadget for the first time. Technical products and services can make daily life comfortable. The perception, information processing and mobility of elderly can, in most situations, be improved, or at least maintained, by adequate products as such, or by various types of cognitive and physical exercises (body and mind jogging), that are instrumentalized with facilitating technical products. Which
technology and how and where it should be applied in the near future has to be investigated.

Technical and ergonomical standardization are of utmost importance. This can be illustrated by the possible support of the human memory, if and when the living environment and the activities that take place there, are designed in a structured, systematic, logical and consequent way.

Appropriate consumer information about new technological developments and the products resulting thereof have to be disseminated among the future users. At the same time it is necessary to carry out product evaluations in situ as soon as products get on the market. These product evaluations will have value only if they are done in the immediate environment of the consumer. As mentioned before, the most important aspects for evaluation are: comfort, safety, user friendliness and efficiency. Test beds have to be developed that are applicable to the user environment as well as test batteries in laboratory set-ups.

In conclusion here one must keep in mind that products designed with maximal user friendliness for the elderly, will prove to be very suitable for all consumers.

DISCUSSION

There are some conditions that have to be fulfilled in order to make some progress in the field of gerontechnology. These conditions are given here as statements with the main objective of starting a discussion.

1. The necessity of a scientific network.
Gerontechnology, an area of pure and applied scientific research as well as industrial development, is an integration of parts of current research and development activities in the fields of gerontology, human factors and industrial design. As such, this domain must be defined in relation to these fields.

2. The role of a catalyst or intermediary.
Intradisciplinary exchange of information is a tedious job, even for experts who focus on specialized areas within one discipline. Interdisciplinary collaboration, as the integration of insights from different disciplines, is even more difficult, albeit necessary, when dealing with complex societal matters, such as elderly and their (technology driven) living environment. Special emphasis must be put on the role of a catalyst as an integrator of research and development processes that can lead to optimal solutions for the living and working environment of the elderly.

3. The driving forces behind science and industry.
The goals of industry and science are often at odds. The aim of industry and trade is to provide products with a certain margin of profit. However the objectives of scientific research are to gain more fundamental insight.
For industry this implies that technologies and market characteristics must be integrated, sometimes in tailored, but mostly in mass products. For scientific research the opposite approach is necessary. Due to the complexity of problems, the division of research objects into smaller portions, in order to enable the design of suitable experiments, further enabling the meeting of the criteria for reproducability, is often unavoidable.

Research organizations survive by publications, where industries survive only by profit. This ambiguity is one explanation for the gap between the two. A gap that can only be bridged by governmental support. The precompetitive research -multidisciplinary in nature- that is needed is not valued highly by scientific researchers and is often too expensive for small and medium enterprises. There is a great need for the translation of results of fundamental research into functional specifications for product design. Especially the small and medium enterprises with their great flexibility and the resulting innovative power there of, could profit and thus serve the market better. Administrations should therefore feel themselves responsible for the creation of semi-permanent infrastructures for this type of precompetitive research.

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**Fig. 3: Parties involved in gerontechnology**
4. The pace of human adaptation versus technological changes in society. Although the level of income and education of the elderly is increasing constantly, this increase is not, and never will be, sufficient to keep pace with the rapid advancement of technology that will impact the future daily life of all. This implies that the consumer who is not interacting on a day to day basis with mainstream innovations will, sooner or later, disengage from society.

5. The need for international and interdisciplinary collaboration. A collaborative research program should be designed (concerted) that yields findings that generalize beyond the particular environment or task in which elderly are examined. As a result of this program a theory or conceptual model of the relevant person-environment interaction will be beneficiary for future applications. Then there is a need to design basic studies in order to evaluate, specify or extend this theory. Appropriate methodologies can be derived from human factors research (not exclusively) such as: task analysis, critical incident analysis, accident analysis and experimental simulation of task components.

6. We do not know much about the older consumer. The highest priority in gerontechnology should be given to the collection of distributional data, since there is a lack of basic information regarding the needs, wishes and problems of elderly with regard to their interaction with new or existing technologies. The elaboration of these data could reveal the need for more fundamental insight (research), as well as the specifications for new products to be developed. A thus generated knowledge base permits the optimization of environments, tasks and equipment for older people and the identification of interventions designed to improve functioning and to enhance the quality of life.

7. The information gap. Due to socio-economic, psychological and physiological changes that come with aging, there exists a continuous need for re-adaptation of the living environment. Most people (including elderly and their immediate environment of care professionals) are not aware of the numerous options that are available to them in the form of products and services. Provided that product information is made accessible to consumers, most individuals will be capable of re-creating a functional environment with a good quality of life.

SENSE MAKES SENSE

Very recently a project was begun in the Netherlands in the province of Limburg, town Sittard. The aim of the project is to provide a tailored product and service environment for elderly citizens in such a way that they can remain in
their own houses in spite of the, mainly health, problems that they have to cope with. This project, called SENSE (SENior SErvice), will run for 2 1/2 years with a budget of 7 Million Dutch guilders (over 3 MECU). Half of this budget is provided by industry, mostly small and medium sized enterprises. The rest is supplied by local, national and European funds.

The introduction of a variety of technical products in the home situation is not an isolated activity. Therefore a new organizational structure has been set up, both on a management level and on an operational level. The adjustments and co-

![Diagram](image)

**Fig. 4: Relation scheme SENSE-projekt**

operation between all parties involved are regulated by contracts. In total 150 elderly, 45 companies and 15 care institutions or organizations participate in the project, which will last until December 1993. Strong emphasis is put on the evaluation of the project, especially the cost-benefit and cost-effectiveness analysis of the different products and services that will be introduced.

Four groups of technologies along with their respective industries can be distinguished within the project:
- medical technology (home health care and care)
- telematics (information and telecommunication)
- housing (mainly adaptations)
- consumer technology (products that support activities of daily life)

The goal of the project is to build up experience that can contribute to: technology transfer, knowhow about the use of technology by the elderly, the role of technology in sustaining independence and autonomy, the organization of
technology transfer to specific target groups, development of user characteristics, development of design criteria and specifications and the development of follow-up projects. In other words, Sense is applied gerontechnology in close interaction with the elderly.

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Note: This paper is not yet in a format that can be published. References have to be added.
After presentation of the various ongoing projects in different countries in Europe, the discussion as focussed on the development of the COST-action "Ageing and Technology". Two aspects were discussed:

- form of future actions
- contents of the program.

Apart from the formal decisions and steps that have to be undertaken under a COST-protocol, it was suggested that this workshop should be followed by more thematic workshops in order to create consensus on the future program.

It became obvious that there are a number of disciplines and organizations that have to be involved in a program on technology and ageing. Many of these disciplines differ in their methodology and approach towards problem solving. A common language ("esperanto" for care-professionals and technologists) does not yet exist.

Step 1:
Organize a workshop in which the concepts of autonomy and/or independence are clarified. When the framework for the concept of autonomy is set up, it can be used as a starting point for the description of the demands and criteria that should be met for a basis infrastructure that can support independent living. This basic infrastructure should consist of provisions aimed at:

- appropriate housing
- mobility
- communication

It also became apparent that in most care and welfare experiments no systematical analysis is carried out with regard to technological threats and opportunities. At least three topics should be addressed in a coming workshop.
Step 2:
Topic 1: Technology; does it help or does it hinder active participation of elderly in society: An in depth analysis of products in the actual user environment should be made (criteria: good, bad, useful, useless etc.).
Societal processes in general are dominated by technology. Therefore it is also necessary to analyze to what extent for example communication technology and transport technology cause disengagement of elderly (questions: which technology in which situations, why).

Topic 2: Why do people retire? It is not clear yet what the motives are for (early) retirement. It should be unraveled what the respective influences are from: economical perspectives, technological changes, social/cultural aspects, health status.

Topic 3: Age, gender and technology. Special emphasis should be put on older women, who never participated as employees in whatever paid jobs. This group has never had strong interaction with technological changes and as such they are at much higher risk of disengagement. At the same time they form the biggest group among the elderly.

Consensus: The group agreed that the care-triangle of Leppo and the framework graph (age, performance, comfort and independency threshold) of Graafmans could be put together and serve as a starting point for future collaboration.

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