TIDE proposal gerontechnology

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TIDE proposal

Gerontechnology

J.A.M. Graafmans

21 November 1991
QUESTIONNAIRE TIDE

PART A: MARKET SITUATION AND R&D PRIORITIES

Introduction

The response with regard to market situation and R&D priorities concerns the field of Gerontechnology, i.e. the study of the integration of technological advancements with the knowledge of age-related changes in daily functioning of (disabled) elderly. The goal of this study is the optimization of the living and working environment of (disabled) elderly. Aging processes and the consequences thereof for daily functioning in a technological environment are the topics of research activities. Primarily gerontechnology aims at the integration of fundamental insights resulting from this research and is directed to preventive health care in order to keep the elderly autonomous and independent as long as possible in an appropriate environment. Research products should in the first place be specifications for the design of over the counter products and should not be restricted to medical technology products only. Apart from the research activities as such, strong emphasis has to be put on the diffusion of knowledge to possible areas of applications. Also more insight is required into the real market needs (distributional data). The specific areas that, among others, have to be addressed are:

- mobility and transport technology
- communication and information technology
- housing and living environment-home health care technology

Consumers of the integrated results of scientific research are:

- industries (SME's and multinationals)
- care organizations (welfare, health care and unions of the elderly)
- clients (elderly and disabled individuals)

Consumers of market information are: industries, administrations, research institutions and home care organizations.

1. The current market situation in gerontechnology

A. Gerontechnology at a national level

In the Netherlands one out of four citizens is 50+ and one out of eight is 65+. In 2020 this will respectively be 40,5 and 18,6%(Eurostat). In the age group 55-64 only 35,4% of the Dutch men are employed which is the lowest in the world(OECD, Activity statistics, Paris 1989). In contrast to that the expectation of life at birth (1989) is the highest in Europe (73.7 years). 90 % of the dutch elderly live independent and in this group (65+) 84% of the men and 80% of the women feel themselves healthy (CBS,NL). 17% of the families has a discretionary income that is not higher than 5% above the accepted social minimum.

Statistical records reveal that the elderly are the biggest consumers of health care and rehabilitation. The 65+ age group(13%) cause 39% of the hospital expenditure, 44%
of the outlays of district nurses and 61% of those for home help services (Ouderen in tel, 1990). No data are available about the number of elderly who are not yet patients but very prone to that situation, if no interventions are undertaken. It is beyond discussion that an enormous amount of elderly still live independent but are confronted with multi facetal problems related to health, income, welfare, situation and task demands, etc. There is a noticeable trend that elderly buy more over the counter health products.

In the Netherlands a grant program is currently running under the name NESTOR. Main emphasis in this program is on medical and psycho-social problems related to aging. No attention at all is paid to technological issues. The development of home health care in the Netherlands is supported on an additional basis with approximately 2 Million ECU yearly. The subsidized projects are aimed at innovation of care organizations or at the introduction of existing technologies/products in the home situation (shift from hospital based to home based care and cure). Product innovation projects are not subsidized by this program. In August 1991 the First International Conference on Technology and Aging was organized by the EUT Center for Biomedical and Health care Technology. This illustrates the efforts of the Eindhoven University to achieve the status of center of excellence in the field of Gerontechnology. A textbook on gerontechnology is under preparation and will be issued in spring 1992. A copy of the conference program is attached.

The Dutch Ministry of Welfare, Health care and Culture, Department Policies for the Ageing supports the Eindhoven University of Technology in this strive and is willing to provide an initial grant for a period of four years.

B. Gerontechnology at a European level

In Europe 31.3% is 50+ and 14.4% is 65+. In 2020 these percentages will be respectively 42.2 and 20.0. Life expectancy at birth is 72.8 for men and 79.2 for women (born in 1989). There is a persistence of poverty and low incomes and therefore social exclusion, especially among older women. Deprived housing conditions are experienced by some older people in all EC countries. Employment rates for men (55-64 years) are 43.7% (France), 54.5% (Germany), 60.5% (UK) and 51.9% (average EC) (Source: OECD 1989). Trends are:
- lowering of both activity and employment rates of older workers
- emergence of new possibilities for a rapprochement between employers, unions and the state.

Close to 10% of the elderly in Europe require long term care or other regular support from other people. However, there is a lack of community care services and a boom in private residential and nursing homes. There is a lack of integration between health and social services and of special facilities for long term care. There is a lack of coordination in community care services and a need for more flexible and user responsive services. (Social and economic policies and older people, EC, June 1991). More detailed data on a European level are lacking. Moreover, the differences in status of welfare and health care and culture in the various countries make the market overview complex.

Within the European Community a number of programs are active, that have elderly, among many others, as a target group ( Helios, AIM, Biomed, RACE, Drive, Euronut, etc.).
Apart from these programs Directorate General V launched the action program for the older European citizen in September 1991. Another action is COST A 5: Ageing and technology, mainly an initiative of Health care and Welfare Departments of national governments of the EFTA countries. None of these programs is explicitly studying the interaction of elderly with their technological living and working environment.

C. Gerontechnology at a global level

Statistics on elderly in the western world do not differ much. However, the employment rate of men (55-64 years) in Japan (78.6%) and North-America (63.7%) are much higher than in the EC. A recent analysis in 'USA today' showed that if circumstances do not change, the American citizens will not be able to pay for their extra (on top of medicare and medicaid) health care expenditures. Only recently the National Institute on Aging (USA) announced a grant program for Human Factors Research on older people. The objectives of this program are to seek applications that relate the skills, capacities and functioning of older adults to the activities in which they engage and the environments that they encounter (NIA, 1989).

2. The relative position of the European Gerontechnology Industry as compared to America and Japan

As compared to the American situation the European industrial attention for this area can be characterized as poorly developed. Some reasons for this underdevelopment can be given. First of all the American consumer market for self care products has always been easier accessible than the European market, mainly because of uniform regulations and standardization. Secondly, the American approach of trial and error showed to be very successful in this particular market segment. And last but not least, the older American consumer is organized and as such the grey power has a strong impact on the market.

Japan can be characterized as a gadget market. Japanese consumers are eager to try new innovative products and this is not only the case in electronics. Therefore the Japanese industry has a very well developed field test laboratory especially for the early tests of new products.

Opportunities for European industries can be created by:
- Integration of the fundamental knowledge that is available in many research institutes. The scientific basis in Europe seems to be still stronger than in Japan or the USA. Fundamental research tends to be more fragmented into smaller specializations. Integration of this knowledge requires separate and extra attention.
- Diffusion of integrated knowledge. Due to cultural differences between knowledge centers and industries, a big time lag often exists between the creation and utilization of knowledge. Rehabilitation technology as well as Gerontechnology are not restricted to a single industrial branch nor to a monodisciplinary scientific sector. If knowledge extension in Europe is organized and the cultural and socio-economical differences are taken into account, European industries will become strong competitors with Japan and the USA.
3. Effect of the Single Market on the Gerontechnology market place

The effects of the Single Market will be different for rehabilitation technology and gerontechnology. Products and services in rehabilitation technology mainly are developed in a medical environment and provided through a health care or social security system. Between the member states of the EC there are still substantial differences in these care systems. Therefore, to this respect the Single Market will follow the processes of integration of these care systems.

The Gerontechnology market will develop more easily because here we are dealing with over the counter consumer products, that do not require registration. In general one might assume that the public market of health and comfort products will develop faster than the medical market.

4. Impact of European standards

Through standardization of products and services that are related to the health and comfort of elderly a lot of criteria can be met: quality assurance, efficacy, efficiency and safety, price/performance ratio, liability, user friendliness, maintenance and service.

A very important consequence of standardization will be the availability of data for assessment studies on product performance. This can be of great importance for Europe as a whole because of the information that will be generated by controllable cross cultural studies. The pluriformity of Europe is both a drawback and an opportunity in the competition with Japan and the USA.

5. Priority areas for European standards

The number of medical technical products in the health care consumer market will increase continuously. The standards that were and are developed for professional users will not be adequate for non-professional consumers. For this reason high priority should be given to a set of standards for these products with strong emphasis on quality, liability, safety and ergonomics.

6. Priority areas for R&D in Gerontechnology

Within a framework of technological research and development priority should be given to encounter the problems that arise from changes in the musculo skeletal system (motor skills). Mobility problems will initiate a chain reaction that in the end will lead to total dependence on supportive systems (technological and care systems). The decrease in mobility also demands for an increase in support in communication. Telematics can provide compensation for loss in mobility when solutions in mobility support systems are not sufficient anymore.

Perception and cognition processes also change with age. A better understanding of these processes on a functional level (perceptual skills) is needed. High priority should be given to research in perception and technology with a strong emphasis on man machine environment interaction(user interfaces).
7. Non-technical barriers in the Single Market

The highest barrier is formed by the differences in the health and social care systems across Europe. There is a strong relation with the socio-cultural and economical differences of individuals within and between member states which can act as a barrier, that has to be considered and taken care of in an appropriate way. The technical illiteracy of professionals in health care and welfare can become manifest as a barrier for natural development. On the other hand one should not expect much insight in care aspects from technologists neither in research nor in industry.(Heijnen, 1991).

Another barrier is the lack of knowledge about the real day to day problems of elderly and disabled persons. The common market research instruments of industry and trade are not adequate to reveal these problems. This market is broader and more complex than their usual object areas. A lot can be improved if early evaluations of innovative products or systems were created (test beds), that can serve optimization of final products. In general there is a lack of communication or diffusion of knowledge between industry and care organizations. Finally we should be aware of the fact that a lot of new coming technologies will create user problems. The most vulnerable group will again be the elderly of today or tomorrow. It is not unlikely that often the high price of a new technology at the introduction phase, already in the beginning causes a gap between the older user and the innovation. The design of a programme of activities demands for balanced attention for all the aspects mentioned.
PART B: RESEARCH & DEVELOPMENT ISSUES, SCOPE AND TASKS

1. Title and area of work

Title: GERONTECHNOLOGY
Framework for the proposed program.
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 individual.

Area of work: INTERACTION OF ELDERLY AND THEIR TECHNICAL ENVIRONMENT

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 core activities in the gerontechnology program will be:
* 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.

Areas of technological activities: **HUMAN FACTORS RESEARCH**
As far as older consumers are concerned, their quality of life is partly dependent on the tasks and demands that (new) technological environments pose to them. The environment shows itself with controls and displays. The consumer shows him/herself with characteristic functional motor, perceptual and cognitive skills which in the case of the aging consumer are not constant and very diverse.

With regard to perceptual and cognitive functional capacities, a theoretical model for communication will be set up incorporating physical functions such as vision, hearing and speech. This model will be validated in experimental set-ups, and after validation it will be applied as a test bed for the field trials of various communication products. Where ever appropriate higher cognitive (like memory and attention) and neurophysiological functions will be incorporated in the model.

Modelling of the total musculo skeletal system will be done by methods derived from multi body mechanics and dynamics, robotics and cybernetics. The models will be validated by motion and force analysis, deformation studies and parameter estimates of biological materials. The models will be refined and optimized by adding qualitative and quantitative information from support systems such as ventilation, circulation and nutrition. The objective is the design of an experimental set-up that will produce characteristic information on physical skills of elderly (manipulation, control, endurance, balance, etc.).

Both activities mentioned will provide instruments and methods for functional assessment studies. Spin offs will be criteria and specifications for learning and training as well as technical specifications for interface and product design.

Integration and application of the results of these core activities will take place in the build environment. The house can be considered as the place were most activities of the elderly will take place. In our approach the house is not restricted to the home. The living environment in homes for the elderly and nursing residences will also be taken into account.

2. Rationale for inclusion in TIDE

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 (August 1991) and the proceeding 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.

The rationale for inclusion in TIDE emerges from the magnitude and the complexity of the problems that will arise with the aging of the European population. A collaboration program on a large scale is needed in which technological issues are encountered in relation to socio-economic, cultural and health aspects. Expertise from various fields has to be connected and integrated on a pre-normative and pre-competitive level.

3. Issues to be addressed

There are some conditions that have to be fulfilled in order to make progress in the field of gerontechnology. These conditions are given here as statements.

*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.

*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.

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.

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.

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.

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.

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.

4. Scope of the proposed action

The objectives of the gerontechnology program are:

a. The realization of a reference base, containing qualitative and quantitative information on functional capacities related to aging.

b. The translation of this information into user characteristics, design criteria and technical specifications.

c. The operationalization and implementation of a. and b. in projects in collaboration with industries and care organizations.

The technological products of the gerontechnology program are instrumentalized methods to carry out functional assessment studies in elderly populations. The focus of the study will be on normal aging processes, but wherever relevant age-related disabilities will be incorporated. The instrumentalized methods will enable the quantification of human skills in relation to the requirements that the environment poses to the individual. Instruments will be developed that can measure:

- perceptual skills (vision, hearing, reading, touch)
- cognitive skills (memory, attention)
- motor skills (locomotion, manipulation, balance, endurance)

Spin-off products will be technology-supported methods for teaching and training of (disabled) elderly in order to restore and support social participation and continuous independence at a comfortable level.

The domain of application will be the built environment and it's immediate surroundings.

See also paragraph 1.

5. Identification of R&D tasks proposed

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 when new activities have to be carried out in new, strange environments.

The keynote presentations during the gerontechnology conference in Eindhoven (1991) 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 inhomogeneous. 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 we keep in mind that products designed with maximal user friendliness for the elderly, will prove to be very suitable for all consumers including the disabled.

R&D tasks are also outlined in paragraph 1

6. Non R&D tasks required in this area

Networking
Taking the target area of gerontechnology into consideration, it is obvious that no single expertise center has all the necessary knowledge, skills and resources for the programme. Several networks have to be formed and interconnected. As a result of the Gerontechnology conference in Eindhoven (August 1991) a start is made with a scientific network in which all relevant disciplines are present. In this multidisciplinary network Eindhoven University forms the technological node. Secondly a beginning was made with an industrial network. During the conference, several Europe based multinationals recognized the importance of developing the field of gerontechnology. Care organizations, including the governments that finance them, form the third
forum, that elaborates on technology and aging in an international debate. Eindhoven University is an active participant in this forum (COST A5: Ageing and Technology). A missing link until now is the network of consumer organizations in Europe. National and international (FIAPA, Eurolink Age, Eurag) unions of elderly do exist, but until now they do not profile themselves as consumer organizations.

Knowledge integration
Integration of knowledge from various fundamental research disciplines, aimed at an operational goal, is not an automatic process. This process requires an active role of integrators or intermediaries. The continuous effort that has to be put into integration is often underestimated.

Knowledge diffusion
When integrated knowledge becomes available, there is no guarantee that it appears in a suitable or applicable form for industry. This is especially the case for Small and Medium sized Enterprises. Therefore the knowledge diffusion in itself between the parties involved (research, industry and health care and welfare) is an indispensable link in the chain.

Construction of interactive Knowledge and Information Systems (KIS)
In the very near future a number of new interactive media will appear on the market. The interactivity opens possibilities to present customized information to the individual (older) consumer. If these systems are made accessible for elderly, they will be able to solve the majority of their day to day problems. The problem area then is not only restricted to the technical environment. Health, financial, legal, educational and other issues that are important in day to day life can become manageable.
PART C: OUTLINE PROPOSAL, SKILLS AND EXPERIENCE

Outline Proposal

The Eindhoven University of Technology organized the First International Conference on Gerontechnology in August 1991. The field of gerontechnology has been defined as the study of integration of technological advancements with the knowledge of age-related changes in daily functioning of the (disabled) elderly. The goal is the optimization of the living and working environment of (disabled) elderly.

The university would like to extend its research efforts in the fields of mobility and transport technology, communication and information technology, housing and living environment and home health care technology. Priority is to be given to prevent and to encounter the problems that arise from age-related changes in the musculo skeletal system.

Prevention can be established by keeping the elderly as long as possible mobile and encourage this with adequate exercises for their musculo skeletal system. More insight in the aging processes of the skeletal system is therefore necessary. If mobility problems have arisen, they will eventually lead to a total dependence on supportive technological and care systems. The development of instrumentalized methods for the functional assessment of motor skills and subsequently the technical specifications for the supportive systems will be subject of R & D efforts at the Eindhoven University of Technology.

The decrease in mobility also necessitates an increased need for support in communication. Telematics can provide compensation for loss in mobility when solutions in mobility support systems are not sufficient, not available or not feasible. A better understanding of perceptive and cognitive processes is needed. Therefore, also high priority will be given to research in perception and technology with a strong emphasis on man - machine - environment interaction (user interfaces).

The following methodological approach is set up:
- 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.
R&D groups of the Eindhoven University seek collaboration with other groups, fundamental as well as applied in fields related to aging and technology on the topics:
- perceptive and cognitive skills
- motor skills
- build environment
- vegetative functions

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Skills and experience:

Perceptual information processing in interaction with hardware and software. This research is concerned with sensory and cognitive information processing by humans interacting with flexible information systems (General Supervisor: Prof. Dr. H. Bouma).

Subgroups:
- Hearing and speech (supervisors: Prof. Dr. A.J.M. Houtsma, Prof. Dr. R. Collier)
- Vision and reading (supervisor: Prof. Dr. Ir. J.A.J. Roufs)
- Cognition and communication (supervisor: Prof. Dr. D.G. Bouwhuis)
- Information ergonomics (supervisor: Prof. Dr. Ir. F.L. van Nes)
- Communication aids (supervisor: H.E.M. Melotte)

Medical electrical engineering.
This research group particularly focusses on communication-, information- and control theories; a.o. instrumentation for the disabled (speech synthesis, speech recognition, environmental control, signal analysis and signal processing) is developed (General Supervisor: Prof. Dr. Ir. J.E.W. Beneken).

Biomechanics.
This fundamental research is directed to biomechanical systems. Advanced computational and experimental mechanics are applied to gain more insight in human systems, such as joints and muscle-joint interactions (General Supervisor: Prof. Dr. Ir. J.D. Janssen).

Architecture and environmental technology.
The research group of Prof. Dr. Ir M. Bax and the interdepartmental research institute Interface (Director: Dr. Ir. A. van Wagenberg) have a longstanding
cooperation in the domain of the development and design of user friendly living environments. Recently they specialized in environments where home care of elderly or disabled is anticipated.