Housing older users: selecting ingredients, negotiating gerontechnology (H.O.U.S.I.N.G.)
Westra, J.

Published in:
International Conference on Technology for Independent Living in Life Cycle Homes, 8-9 June 1994, Lillehammer, Norway

Published: 01/01/1994

Document Version
Accepted manuscript including changes made at the peer-review stage

Please check the document version of this publication:

- A submitted manuscript is the author's version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

Citation for published version (APA):
H.O.U.S.I.N.G. 
housing older users: selecting ingredients, negotiating gerontechnology
Jan Westra

Up to 40% of the stock will be occupied by the elderly in the Netherlands by the year 2010. Mainly this developing market will be represented by an existing volume. Newly built housing will only bring a minor contribution to the demand. This scenario takes into account the move of the building industry to develop technical strategies to renovate and certainly to upgrade the past and the actual production. There will be a move to dress the built product with ‘comfortable features’. On one hand this means a substantial upgrading of the stock, on the other hand it raises the issue of the current production. Well designed balanced housing will accommodate several groups of users over a long period of time. Housing that is created along the narrow guidelines of rules and performances set by the professionals will handicap the user that differs from the default user.

Basics
The regular building industry in Europe, because of the tradition in housing, has investigated the possibilities to enlarge production by rationalization. It meant that concrete and brick technologies were explored. It evolved into sophisticated poured-in-place structures as well as in prefabricated concrete panels, gypsumblocks, modular bricks etc. But, it always could be referred to as building, and certainly not to an industrialized way of producing. This comment is one of the basic arguments of the initial work of Habraken (Habraken, 1961, 1970).
The argument is clearly outlined and manifested in the division of the two spheres: individual (= industrialized production: choice as a virtue to the user) and community (= building: the collective materialized support). Unfortunately too often the theory is explained in terms of support (concrete structure) and infill (wall partition system with accessories). The shrinking of the production and the growth of the stock in many western countries might very well have contributed to the effect that the approach has not been very successful in the building industry. Yet, it was first of all meant to be an attempt to regain the deleted user in the decisive process of generating housing. It has been only very recent that the building-industry has discovered the potential value, but for other reasons. Recently due to new interests in flexible and adaptable housing different strategies have been developed along similar lines for new projects and for refurbishments. Certainly in the field of gerontechnology the support infill approach might be of importance because the approach prevents the stigmatized development of specific housing for labeled users.
Building

Building itself, the activity is about changing: the change in form, position and state of material. A trilogy performed at building sites from the beginning. Different to each context, similar in pattern, with each separate activity to gradually evolve in a defined craft. The success of the supporting industries and the building products catalogues demonstrate the shift from craft to work but also from make to fit to fit to make. In general professionals do not interfere with the production of the building product.

It is taken for granted.

Building can be an awkward process. Building is about the change of place, shape and state of material. This has been a trial over and over; related more or less to the ways and means of the local context. People in Europe as in many other parts of the world are housed in rather square rooms, connected or rather divided by corridors. Most rooms are built to suit specific functions. Regulations and bylaws have promoted this way of arranging and subsequently the mode of living. Architects are urged to design housing by the number and by the numbers. The result is screened by surface, volume, rooms, construction, ventilation, insulation. The harnessed situation leaves little room for alternatives that tickle the default setting. The approach seems to be so fixed and immortalized that the user's attitude can hardly be expressed in 'being' terms, but has to be referred to in 'having' terms.

It sometimes seems that ends and means have been interchanged. Industrialization and automation promise to free man from the drudgery of repetitive unconscious tasks. It can turn out a large number of products, control quality, and may raise the level of the performance of the product. (Herbert, 1984). It should however be the means towards an end and not the end itself. The mode of production will play an essential part in the way we will cope with new rapidly emerging housing demands that are caused by shifts in the structure of the population due to aging, immigration and refuge.

The search for industrialization, consequently automatization in building is the indigenous habit of architects and administrators. There seems to be the immanent quest for the production that will overcome the given disadvantages of the traditional building method. Yet one has to consider the virtual performance of the building technique in many and certainly widespread implications. History shows that only in times of great needs, caused by the nature- and man provoked disasters, the basic shelter emerges, formatted to the extremes of performance and production. Wars and earthquakes therefore have a tremendous impact on building and its production modes, whereas in peaceful times the urge vanishes into paper innovations. Gerontechnology might have an impact on housing. It could lead to a more conscious planning in which housing and environment are to perform for users in general, but can also be adapted to the needs of specific demands: disabled and elderly in particular.
Trends
The 90's are characterized by less volume but more variation. The profile of the market has been diversified due to a new demand. Our way of life is focussed by 'horizontal orientation'. The world in all its aspects has been introduced into the living room. The tradition vertical layers of the society have been dissolved by a variety of attractions; pluriform and impersonal activities are introduced by the technological progress. More free time, homework, it means a need for facilities besides the usual living, dining, bedrooms, kitchen and so on. In some scenarios the house of the near future will become a homebase for work, learning and teaching as well as leisure time. A vast part of the housing stock will not accommodate for these changes easily. Also in particular reference to the homes for senior citizens and the elderly it will mean that only by adaption at great cost the housing stock can be turned into a better living environment.
It will mean
1. freeing the dwelling from its traditional obstacles such as partitions and infrastructure
2. providing appliances that will keep track with the development of telematics, informatics, economics in environment and energy
3. taking advantage of new techniques and materials in order to be able to innovate the building mode.

One of the main issues in the western world has been the question of and the quest for an open or closed system. Open systems have been promoted by those who have pointed to the incapability of the traditional building process to cope with sophisticated production. Referring to the industries that produced consumer goods in an industrialized way, many have argued that the open system would enable the production industry to apply modern technologies. Through modular coordination and the separation of the collective and the individual issues initiatives for industrialized building have emerged in the 30's, 50's, 60's and 80's.
Since building products to a large extent, still derive from the original traditional building materials and products, the strive for diversity and variation was powered by coordination and rationalization mainly. If building products were to be produced with reference to preset rules concerning the ultimate position and size, the building mode would not only benefit in organizing the grand product, it would imply that the underlying coordination would accommodate participation.
A potential conflict is about to enter the production of the built environment. Until now, the prefabricated components have largely been incorporated into or combined with building parts produced on the site. This has made it possible to use components of various origins in one and the same building, without too much difficulty and waste of materials. Moreover, their dimensi-
ons could be set independently of each other and, if required, according to special wishes of clients, designers or building contractors. Closed production systems demonstrate an independent strategy the product and the production. The virtual possibility of synergic solutions where one and one equals three can only derive from integral research and development.

All efforts have in common the goal to diminish the amount of construction time on site. The foundation and the infrastructure on the site are critical obstacles in the evolution of the industrialized building system. Manufacturers in other fields hardly have to worry about the context of their products: in general the commodities are provided. It is not necessary to create a kitchen in order to sell a refrigerator. Cars that leave the dealer find themselves launched on streets that have been provided by the government.

Strives
At all times and in all cases when research enters the building mode manufacturing costs are a key element of concern. It used to be important to look at labor costs in the first place to cut the manufacturing costs. But in recent times the limit of the laborcosts seems to have reached the ultimate level. Since the waste in material and time are drawn to a stop through the potential influence of Continuous Flow Manufacturing and Just In Time procedures one would come to the conclusion that every step in the process adds value to the product: and that is what production is all about. But it only can be done when
- each individual recognizes the responsibility for eliminating waste
- the objective underlies the continuous improvement rather than the one-time process
- the production unit may equal one
- the machine set-up time may equal zero
- uncertainties in machine downtime, off-standard parts, vendor quality specifications are eliminated by identification and correction
- lines or cells are product oriented in focussed factories set ups.

Prefabrication - the shift from the site to the plant - provoked intriguing ways of building. Traditional materials were traded in for modern more integrated building products and elements in order to cope with future markets. This strive is connected with the emerge of a more systematic, methodical and comprehensive development process. Concurrent engineering or simultaneous engineering is a process in which the approach to product development integrates product and process design.
The objectives of CED (Concurrent Engineering Design) are to:
- design products that the market demands
- design quality into all products and processes
- design products and processes which are as simple and as flexible as possible
- design products which can be efficiently fabricated, assembled and tested
- design products with a minimum lead time between initiation of product development and manufacturing start-up.

Big Industry, including non-building multi internationals have stated to solve our problems in their and our benefit. Operation Breakthrough (USA 68), Housing 55 (Japan 80), Maison 85 (France 85) are amongst smaller attempts pronounced examples. The key-objective of those programs was to demonstrate the extent of the potential of the (building) industry. In Japan big industry claimed 10% of the production in customized prefabricated homes. The production and distribution of houses is in no way comparable to the production of so called consumer goods. Yet the efforts that were put into industrialization and rationalization of the building mode have caused step-by-step alterations in common building practice. Whereas the production of industrialized consumer goods is largely monopolized by specialized investment, the built product often remains a reflection of intrinsic values rooted in society. It therefore is hindered as well as protected regarding its performance, cost and status.

Regarding the improvement of the building mode there has been a notable shift from one side to the other. The early search for an improvement on the performance of the product and the process largely as a result of design efforts, had become a major topic in the building industry. It resulted in a general interest in prefabrication, modular coordination, open vs. closed building systems, but it led also to uninspired architecture and unbuilt environment. Unfortunately the inspiration of the pioneers who were questioning both purpose and performance was lost in the massive strive for large scale productions. When major discussions among professionals started to mystify the issue of the quest for industrialization it became clear that only the trivial arguments that inhibited the process were consistant:
1. Public Attitude (lack of mastercraftsmanship);
2. Organization in the building industry (lack of evaluation the performance);
3. Trade unions (protection of the tradition);
4. Managerial Procedures (by the rules of the company);
5. Labour supply (the arguement for changing the building mode);
6. Marketing opportunities (pull instead of push);
7. Building and Zoning codes (restrictictions and constraints that prevent experiments to be initiated);
8. Governmental Policies (strive for strategy);
9. Research policies of Governmental agencies, Industry and University.
Users, Components and Interfaces

The theme 'human having versus human being' is inherent to a way of living, housing and building. The words themselves -housing, living, building- are synonymous in some languages especially in the rural and older tongues, stressing the relation between functions and activities that have grown apart ever since man has tried to solve housing in strategy and technology. Yet modern society has stressed the possession of the house and the status that applies to the spent capital. Housing is no longer equal to living or being but has become equal to capital and having. Housing is advertised, promoted, and rated in square meters, front doors, hallways, color of tiles, but there seldom is any information about the way activities can accommodated, the way of living, in short: nothing about the 'being'.

Housing because of its fundamental roots and immediate social necessity, can not be analyzed as if it were furniture of peanut butter. The easy comparison that is frequently made to consumer goods seems to be only focussed on the product as an independent artifact, not as an imbedded residence with cultural and social aspects.

There is no ministry of refrigerators in my country. There is however a ministry of housing. Government does not govern the industrial production of consumer products, but it does have the ultimate influence on education, medical care, defense and certainly on housing. Disregarding the status of housing simply implies pleading for utopia or revolution. It is interesting that officials, professors and ministers still manage to entertain an audience in outlining the view that housing is comparable to the production of aircrafts, cars or recreation vehicles and therefore should be produced along lines. Including prototypes, a basemodel, the special, the adapted version, the yuppytype, the grannytype etcetera. There is a widely shared belief that when housing will be connected firmly to industrialization most of our problems will disappear. The arguments in favor of industrialization have hardly changed over several decades. The issue has fled the academic architectural circles and has found strongholds in several layers and areas of society.

The message is often extremely simple: more for less.

Since people are housed instead of having housed themselves participation has compensated the lack of influence. Complicated rules and patterns have been introduced by professionals to control the process. The basics are there. The participant is guided through the multiple choice test. The range is limited. You can have the wall here or there, but you cannot have no wall. Certainly the procedure will not call for a choice on the building material or the building mode. But in many cases the urge for participation is of course deriving from the idea to open a new market for the common product, so the limits are well defined by contractor and developer. The approach to create participation has to a large extent been based on the assumption that the
collective and individual decisions will have to be separated. The level of influence is related to the level of the operation: room, house, neighborhood. The ultimate 'freedom to build' (Turner, 1967) (or not to build) is not at stake; it is the mere sharing of opinion on a precooked set of possibilities or on a systematic collection of alterations.

Because participation called for diversity before and during the use of the accommodation, building systems (eg. building with related programmed parts) were introduced, that had been specially designed for 'flexibility'. These building systems were to be assigned to schools and industrial buildings mainly. The emphasis was put on the organization of a diversity of buildings on similar or identical elements. The production of those elements therefore could be independent of the construction of the buildings. The product building and the building product in one organization. Participation and user control have had a rebate effect on the production and construction industry. In the 60's when user control in well developed countries stood for support/infill, the construction industry was still booming to cope with the permanent and almost immanent housing shortage. In the 70's quantity was overruled by quality, demonstrated in the performance of the product: insulation, variation, traditional finish along with scattered experiments in participation. In the 80's new waves of larger housing schemes-decorated to match the architectural magazines- were added to the stock.

Components that traditionally belong to the application of the dwelling deserve a thorough evaluation before they are put on the list of automation, computerization or liquidation. Sometimes one gets the impression that the market is guided by wishful thinking instead of by thorough research and reflection on the issue.

Consequently the user is labeled to a predestined category of users. Labeled sometimes seems to be more important than disabled, certainly in academic circles in which the normal day life is regarded as a scene that can be researched, that can be influenced and almost as objective can be manipulated. The labeled user will be taken into custody by the scientific approaches that will eventually even the disparities. The current elderly user has been analyzed, or stigmatized to the insecure, clumsy, inadequate performer on the scene of the sophisticated tools that have been developed for living. They don't know how to handle the video, how to use the telefax or how to program the home security system. It seems that one of the aims of the increased efforts in the field of the housing for the elderly is deriving from that elite point of view: to create an understandable environment that will guide the user regarding the installed applications thanks to -amongst other features- the improvement of the users interface.
User and Intelligence

The growing Intelligence of machines would cause the technological purification of the body. The body will become less resistant and will have to be protected against the danger from outside. The artificial purification of the built environment will compensate for the failing innerbody immunity systems. The reason they fail is due to a irreversible, often seen as a progressive dismantling of the body and the spirit from their responding initiative and resistance in order to substitute for technical artifacts. Relieved from the health resistance systems, man would be very sensitive to science and technology, as man would be vulnerable to psychology and its therapies when no longer passion would rule the relations and freed from disease and inabilities man would be extremely involved with and depending on medical science.

With respect to the above analysis by Jean Baudrillard (1993) one could add: Liberated from environmental hindrances and obstructions the elderly person might get extremely sensitive to adapted housing.

The professional interest concerning the elderly and housing is reflected in a widespread urge for research by housing corporations and affiliated institutions. Growing older used to be a common accepted matter, today it seems to be one of the new discoveries in the market. Gradually we have been trained to realize that the older person is a very special person. Vulnerable, clumsy, unintelligent, slow and therefore in need for a different set of living tools that are gladly provided by science and industry. It is understandable, but maybe not very logical that the creation of intelligent appliances in the house -the domotics- have been appointed and will be applied to the living environment of the elderly user. Domotics belong to a vast group of electrical, mechanical and electronical equipment that will eventually automate several functions of the 'computerized home'.
Automatization

In general there are three levels that can be recognized in the process of home automatization:

1. Telematics
New Media will infiltrate the house and its environment to contact outside sources for a comfortable improvement of 'household functions'. They stand for appliances, systems, management and for different sorts of information.
In short the Home Interactive Telematics.

2. Homematics
House related equipment components will be automated. First they will function as programmed stand alone components, the next stage includes a central device that will link and control the functions into an integrated house system or housebrain.
In short the Automated Dwelling.

3. Archimatics
The living environment is generated within a complex of house components that are manipulated according to the desired or provoked instructions by the central device. It means that the environment will be shaped and equipped as if it were in fact a living machine.
In short the Generated Living Environment (Price, 1972).
The performance of automated dwellings with 'intelligent' equipment can be captured with three C's: Comfort, Control and Communication.

1. Comfort
   The quest for a safer, more friendly, comforting home related to the use of appliances and equipment derives from the inept homematics that have been introduced and of the traditional clumsy handling of building parts and components. Tripping over thresholds, finding your way in the dark hallway, undesired air movement, unnecessary heat loss, the hinder and nuisance of the common product ought to be over.

   This means a more sophisticated tool to register, alarm, coordinate, report and anticipate on the performance of house related functions.

2. Control
   The dwelling will be protected against undesired intruding, consumption will be registered and regulated, building components will be inspected for failure or maintenance etc.

   This means a more sophisticated tool to protect, warn, alarm, care and act for the user to prevent a negative situation.

3. Communication
   The home as center of the universe. Connected to the major and minor providers of audiovisual information the user can get informed and served regarding data, commercial messages, education, care etc.

   This means a more sophisticated tool to communicate in and out for information and service.
User and Issue

Long time ago man sat around the fire, in the open air, cave or tent. Smoke disappeared through a hole in the top. The shaft that became the first infrastructural element in the building allowed for different use of the built product. The infrastructural equipment that followed allowed for a better weather related use of the building. A comfortable climate became one of the modern virtues of the technological progress, thanks to a system of mechanical elements that became a standard part of the building. Still the main functions were very much related to the pattern of the infrastructure.

A next step recognizes the systematic pattern that will free the building from the predestined functions and spaces. Unifying an architectural unit and equipment may lead to a refined manipulation of the configuration. This condensed view of the relation between space, room and infrastructure intends to press one issue which is of importance to building and users in general but more specific to the strategy that could be of importance to labeled (disabled and elderly) users.

Since people are housed instead of having housed themselves participation procedures have soothened the lack of user influence. Complicated rules and patterns have been introduced by professionals to control the process. The principle of the divider between the collective and the individual has set the parameters of the housing process. The basics are available. Support and infill, modular coordination, open building systems they are meant to finally push the user into the category of the consumers. This consumer formerly known as the participant is guided through the multiple choice test. The range used to be limited. You can have the wall here or there, but you cannot have no wall. Recent examples however demonstrate a more sophisticated approach in which the building technology promotes an upgrading of the faciltary features in the built product. For instance the often misunderstood meaning of flexibility has shifted from the field of the planning into the field of the infrastructure. The performance of the product is related to the flexibility, to the quality of the infrastructure. It means that the basic building mode has not been changed in concept, but it does mean that the development of the outfit has reached new levels. It is interesting to note that in most cases the development has been focussed on the separation between the sphere of the construction and the sphere of the consumer oriented elements. It seems that in building industry the efforts for integration that emerged in periods with large demands and low labour capacity have been abandoned.
STEW

Building systems that are truly innovative have never really caught on in the Netherlands. An important reason for this is that such systems usually require a large-scale approach and considerable investments in new production processes. The STEW research demonstrates that innovative building systems are possible, that are based on existing techniques and products.

STEW is an abbreviation that translates into 'steel and housing'. It also refers to the British and Irish dish, which contains a mixture of ingredients. At the University of Eindhoven an obvious concept of building and living has emerged from these early attempts. The initial quest was posed by a contractors firm that seeks expansion for future markets. A simple question that has been asked over and over again: how can we approach the European market with an intelligent product that incorporates an inventive view on new building materials, but will still respect the outcome of the public interest in housing in terms of performance and status. Learning from previous attempts including the classic inventory by A.F. Bemis and recent attempts to overcome the constraints of the productions of houses we have developed STEW.

The major objectives:
- create a product with potential for users
- create a product that will easily accommodate different programs
- create a product that will adapt to change respecting the environment
- eliminate clumsy techniques by using selected choice materials
- reduce the building time by at least 50%
- aim for maximal spans in the main construction in order to accommodate different functions during the lifecycle of the building - complex
- establish an intelligent generic core, regardless of the program, regardless of the region or nation;
- distinct separation between the units may lead to new concepts in infrastructural performance in vertical shafts that create individual infill and protection.
- the product should be able to compete on the market of traditional or standardized products, but also on the market of high performance products that claim better insulation, carefree endurance of building materials, sophisticated construction etcetera.
The most recent concept includes the introduction of vertical shafts between the dwellings thus resulting in concentrating infrastructural and constructive zones that will contribute to the thermal as well to the acoustical independance of the ‘detached terraced’ houses. The scheme is at the very first stage of research.

In short the project is focusing on steel framed constructions that allow for fast and flexible initiatives. The main module will measure 7.2x7.2m thus allowing for unhindered initial and future floor plans. The main construction will be doubled between the units and therefore creating a high acoustical insulation and allowing a fully equipped infrastructure in vertical shafts. The project follows the strategy of the Center for Industrialized Housing of the University of Oregon focusing first on the improvement of human resources instead of on technology, equipment and systems.

STEW will organize itself from local firms in the first stage. It will not move along obvious paths. It is based on the premise that there is enough intelligence and enough know-how within the existing building industry to start the project. It is just a matter of convincing that the performance related to the cost of the product will succeed the everlasting scepticism towards the new approach.

Construction
The construction of houses in accordance with the STEW concept is made up of steel portals. The full height of the second floor is used as a basis for the construction height. This means one only needs to have a very light frame. Moreover, the ground floor is completely free for the transport of materials during building. The longitudinal stability is taken care of by introducing stability partitions in the outer wall. The foundation necessary is minimal. In principle it is made up of four peers. These peers are connected by pre-fab concrete beams in the outer wall surface which support the floor elements and the outer wall itself. The usual foundation sections beneath the separating walls are not implemented. For that matter, the floor at ground level can also be carried out locally as a floor cast in sand. Inner walls and floors are made from pre-fab concrete elements. The floors above ground level span the portals and are completed on the top surface. The outer walls are set against the edges of the floors and mounted onto battens. Parts and their finish can be supplied on demand. Adaptations can be made later on too. Because of the building principle involved, it is not necessary to work with a fixed modular size; the size can vary per project. As various series of sizes can be worked with and because the system is suitable for different allotments, parts can be manufactured for stock independent of demand.
Building factory
A specific feature of the construction system chosen is that it is possible to make a row of houses fully glazed and to add the separating walls later on, because they do not function as supports. The whole row of houses stays completely accessible from the sides for the movement of materials and for small cranes, scaffolds, and even cars. In this way a kind of building factory can be made on location, where each house is completed in a dry environment with modern means. After this, the separating walls can be placed in the houses. In such a case the row of houses is completed from one side to the other, or working from the middle outwards. Another technical peculiarity in production is that all parties who normally work under mixed circumstances are separated, so that they can carry out their work independently of each other. The STEW concept views the roof building as a self-supporting construction. This can take various shapes, while the load is transferred to the portals.

Super cavity
An important innovation used in the STEW concept is the very broad and walkable cavity between houses. In the first place it serves as a place for wiring, pipes and installations. Due to the width, these are easy to access and even large pipes can cross each other. In addition, the installation can be mounted completely independently and alterations can be made easily later on if necessary. The broad cavity also means that a high level of sound-proofing can be attained between houses. With this a difficult aspect of steel house is solved pretty easily. The consequence of a broad cavity is that houses become broader too and this requires alterations to allotments. Furthermore, the problem of management of the walkable cavity has to be solved - you can just see your neighbour tapping into your electricity. For the moment this can be solved by allocating each cavity to one single other adjoining house.

Inner walls and additions
The separating walls in the house are made up of panels and strips from different series of sizes. The sizes are determined on the basis of a zoned grid using the allotment, the type of house and the demand on the market. Also, strips are included in this for wall sockets, power points, switches, etc. The construction of the house with steel portals makes it possible to attach accessories to the outer wall strips without difficulty. Thus, porches and extensions can be made without foundations, because they can be attached to the steel portals. All sorts of balconies are possible too.
Ready to build
Despite all the new aspects mentioned, STEW does not work with special techniques or parts, everything can be bought or ordered on the existing market ready for use. It is possible to build a house using this concept right away. There are no financial hindrances either. The concept was costed for a number of variants. The result was that STEW houses will definitely not be more expensive than traditional houses and will offer a higher level of achievement. A STEW house has advantages from an environmental perspective too. The construction is lighter and uses less material, reuse and adaptation are easy, after demolition the parts can be stored separately.

To whom it concerns
The development of house related equipment and appliances has been and will be a matter of push and pull. In that respect I would first of all recommend that we would be urged to design decent housing for all kinds of users in such a way that future reuse will be incorporated in the built product. In that sense would I hope that the category of grandma’s and grandpa’s could be considered to belong first of all to the regular users, before they feel the unavoidable need to profit from the technical features that have been specifically created for their circumstances.
Wouldn’t it be nice to call them BOBA’s (Being Old But Active) before they are condemned to become part of the GANG (Grand Age Needing Gerontotechnology).


