

A Systemic Approach Applied to the Design of a Strolling Corridor for Elderly Persons with Alzheimer's-type Dementia

B. Tondu and N. Bardou

Abstract—Elderly persons with Alzheimer disease exhibiting cognitive and behavioural disorders are generally placed in institution where they are often unoccupied and can show different syndromes of agitation. As an alternative to general inactivity or to physical or chemical restraint we study the possibility to take a positive advantage of the strolling symptom often associated to elderly persons with Alzheimer's-type dementia. This paper aims to propose an original project of a strolling corridor based on a sensory stimulation of the elderly patient. The application of the general system theory is used to establish a patient's 'affective map' whose technical translation into sensory stimuli all along the corridor could help the elderly person with dementia for reminder of personal memories as for limiting the memory decline process.

I. INTRODUCTION

MOST of advanced societies are moving towards aged societies – in the case of Japan the term of “super-aged society” is sometimes used to emphasize the fact that people whose ages are at least 65 is estimated to 30% in 2020 [1]. The increasing of degenerative diseases of central nervous system is an unavoidable consequence of societies ageing. Dramatically the prevalence of Alzheimer's disease is estimated to 25% for people of 85+ [2]. Although only 10-15% of patients with Alzheimer exhibit cognitive and behavioral disorders needing their institutionalization [3], the population ageing makes necessary to adapt nursing homes to elderly people with dementia. The problem is all the more acute that several studies have highlighted the inadequacy of nursing homes which in general are not considered conducive to meet the multidimensional needs of older people [4]-[6]. In the case of elderly people with dementia physical and cognitive impairments dramatically enlarge the difficulties of the caregivers and the risk of neglect or ill-treatment. It is so clear that new assistance approaches are necessary to improve the quality of life of those particularly frail old persons as to make easier the caregivers working conditions. In this framework we propose to study the possible relevance of new architectural structures specifically dedicated to elderly persons with dementia under the form of a strolling corridor with an integrated sensory stimulation. The paper is organized as follows : in section two we analyze some problems relative to the integration of patients with dementia in actual nursing

homes. Because it often appears that residents with dementia share their free time between inactivity and agitation we try to show in section three how to take advantage of the propensity of these patients to stroll; in organizing their wandering along a sensory stimulation corridor, we hope so to favor a remembrance of personal memories, both soothing and therapeutic. General system theory is used to specify the functional structure of the corridor.

II. ELDERLY PEOPLE WITH DEMENTIA : BETWEEN INACTIVITY AND AGITATION

Nursing homes is sometimes defined as a “total institution” [7] in the sense that work, leisure time as privacy time, care, etc... are organized under one roof and one authority. As underlined in their recent public health's work, G.Lang and his colleagues remind that “the institution reacts by often resorting to standardization and de-individualization to manage such a complex situation, and the reactions are often withdrawal, psychic regression and refusal” [8] (page 111). This de-individualization of elderly people in nursing home can be a consequence of their need for assistance leading to paternalistic interventions and, in fact, to an autonomy loss for the nursing home residents. The question of the autonomy is now well known and delineated in long term care since seminal Collopy's essays [9]-[10]. One important Collopy's idea concerns the complex ethical conflict between self-determination of old persons and the nursing staff decisions: this conflict is all the more subtle that the concept of autonomy as a condition of self-governance or self-determination is not univocal as highlighted by Beauchamp & Childress [11]. However if actual thought about long-term care favours the improvement of quality of life of lucid older people, the problem is much more difficult in the case of elderly people with dementia. Several authors have noticed the evident link between cognitive and physical impairments and low social interaction in nursing home residents [12], [13]. So, even in the case of residents still able of independent function, and in consequence autonomous in some way, they can be in fact unoccupied throughout the day. As noticed by Kolanowski and Litaker, “boredom and inactivity are pervasive in nursing homes because residents [with cognitive impairment] lack the internal resources needed to initiate social interaction” [14] (page 13).

Furthermore, in the case of elderly persons with dementia distinct syndromes of agitation have been identified with nursing homes residents since important essays by J.Cohen-Mansfield at the end of 80' [15], [16]. For these people agitation is manifested in a wide variety of verbal and physical behaviours that clearly deviate from

Manuscript received April 30, 2008.

B. Tondu and N. Bardou are with the University of Toulouse, France, Institut National de Sciences Appliquées, LATTIS (Laboratoire Toulousain des Technologies de l'Ingénierie des Systèmes), Campus de Rangueil, 31077 Toulouse, France (e-mail: bertrand-tondu@club-internet.fr).

social norms : irrelevant vocalizations, verbal aggressive behaviour, screaming, cursing, handling things curiously as strange motor behaviours including strolling, unpredictable movements, etc... Recent studies have clearly highlighted the impact of dementia on distress in family and professional caregivers (for example in [17]). Although, at our knowledge, no general study has been developed to determine a possible relationship between inactivity, boredom and agitation, it clearly appears from crossing of several studies that nursing home residents with dementia combine frequently :

- low social interaction ,
- inactivity and boredom ,
- agitation including wandering.

The recent development of assistance technologies for old people does not really take into account this social dereliction of elderly people with dementia. The notion of ‘assisted living facilities’ gather different alternative solutions to the nursing home : board and care homes, personal care home, group home, close care, etc... [5]. The term of “smart home” is often used to describe this intelligent environment thought of having many highly interactive and embedded devices and able to control these devices automatically in order to meet the daily life and care needs of older or disabled people [18], [19]. Home automation is still however a non-completely solved problem essentially due to the fact that unlike humans devices do not have the inherent understanding of the environmental conditions and have difficulties to determine the right actions to be selected under which situations. Due to these major difficulties in giving enough intelligence to automated houses, actual smart homes for older people are essentially devoted to the monitoring of residents and to protect them from accidents but also to lighten the burden of caregivers. The examples reported by the designers of the Japanese “Mimamori-care system” [20]-[21] for persons with dementia illustrate the possibilities of these computer-assisted monitoring systems: to accurately track residents movements and thanks to this control to detect inappropriate behaviors like to enter by mistake in a wrong room, to sleep on the corridor or to excessively wander between the restroom and the private room [21]. But little is said about daily life of residents. The question of people with dementia occupation is also little considered in recent Meegahawatte’s studies [22] : as in previous approach, the concept of “smart home” is based on the use of sensors to monitor the residents’ behavior. Since 2005, a complete smart home system has been installed in a sheltered house in Deptford in London. The goal of smart house is to act in a similar manner to a live-in career providing care for 24 h a day without tire or frustration. Technology is also devoted to the help for daily activities but as emphasized by the authors, “the variability and unpredictability of user-behavior caused problems and again required the collection of a large amount of real-life data to derive effective algorithms” [22] (page 162).

Two points emerge from this brief analysis :

1. The truly difficult problem of integration of elderly people with dementia in nursing home. At the best, they are calm but unoccupied, at the

worst, their agitation is so troublesome for other residents as for caregivers that chemical or physical contention means are to be used. It is interesting to note that recent experiences of sharing rooms with dementia patients have highlighted the ‘stroke’ suffered by lucid elderly persons due to this neighborhood [23];

2. Technological means, associating a large range of sensors and computer-controlled devices, used in new assistance approaches can help for tracking residents or for preventing dangerous behaviors but they actually appear not to be able to lead residents with dementia to activities or to prevent their agitation.

Our project of sensory stimulation strolling corridor also uses computer-controlled electronic devices put in a complementary approach to prevention and watching in order to stimulate personal remembrance in a little supervised activity.

III. PROJECT OF A SENSORY STIMULATION STROLLING CORRIDOR

The use of corridors especially devoted to elderly people with dementia is not new (see, for, example, the case of *Brindley Manor Federation of Nursing Homes* which integrates in some of its nursing homes, as in Brentwood Manor, corridors ‘designed for strolling with rest areas along the way, where life size murals have been painted detecting streetscapes and agricultural scenes from bygone days’ [24]). They offer a special place where agitated residents can wander without disturbing other residents. Strolling corridors can however present two disadvantages:

1. Straight-line corridors with dead ends can generate anxiety and finally increase patient’s agitation; in consequence circular corridors are preferable ;
2. Circular corridors can however be questionable if the resident uses them like a kind of ‘speed ring’; the physical fatigue resulting is obviously a source of appeasement but is ethically questionable.

In the proposed project we will keep the idea of a circular corridor but in associating it to a sensory stimulation we hope to ‘channel’ the resident’s agitation.

Before developing our own idea of the strolling corridor, let us mention the existence of gardens for elderly people with dementia. This idea has been particularly well specified by some German actual landscape gardeners [25], [26]. Isabelle Woysch’s “gerontogärten” [27] whose Fig.1 illustrates a recent development are particularly remarkable. As it can be remarked, the garden is divided into ‘rooms’ : ‘Raum der Kinheit’ (room of the childhood), ‘Raum der Jugend’ (room of the youth), ‘Raum des Erwachsenen-alters’ (room of the adult age) ‘Raum des Alters’ (room of the old age), gettable by a ‘Übergang in eine andere Welt’ (passage towards an other world). The garden tempts one to go for a walk in a kind of ‘garden-apartment’ whose ‘rooms’ can be well identified by the elderly person with dementia thanks to their geometrical shape, their vegetation and their furniture. The symbolic

designation known by the caregivers and assumed to be understandable by the elderly person can be considered as some invitation to remind memories in correspondence with each ‘room’ of the garden. It is clear that this garden-based therapy uses a natural inclination to thought when we walk in a garden. In comparison, an interior corridor has not a natural ability to favor thought and remembrance of personal memories but we think that it is possible by means of an artificial sensory stimulation to give to it a similar power. This is to specify this process that we think it is relevant to use the general system theory.

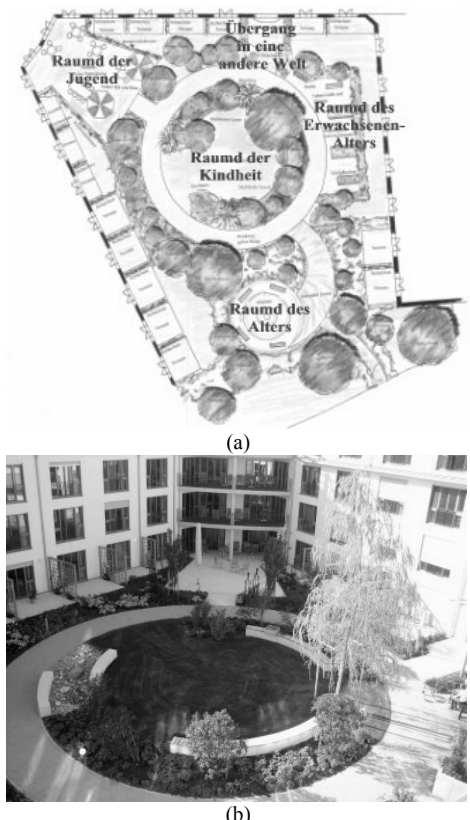


Fig. 1. I.Woysch’s “gerontogarten” example in München (Kuratorium Wohnen im Alter), (a) General structure of the garden divided into ‘rooms’ dedicated to the different life ages, (b) Photograph of the ‘childhood room’ (from [25]).

A. Systemic approach applied to elderly people with dementia

The hallmark of dementia is a severe memory loss and the inability to learn new tasks. It seems that anxiety and agitation – which is an other hallmark of dementia – are correlated to cognitive impairment. There is no mean actually for restoring the apparently lost memories as cognitive functions. It can however be hoped to limit the memory impairment by stimulating patient’s remembrance. This would be the main cognitive function of our corridor project.

We propose to base the functional structure of the corridor on systems theory. General system theory has been formulated by L. von Bertalanffy [28] : according to him, a system is a set of elements interacting among them by means of given relationships, as illustrated in Fig.2.

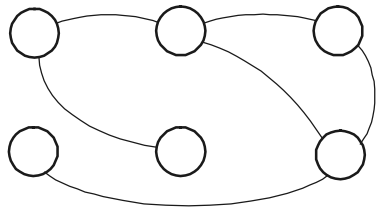


Fig. 2. Definition of a system as a set of elements (circles) interconnected by relationships (curved lines).

This general definition can be applied to technical systems as to social systems. Palo Alto’s sociological school has notably emphasized the great interest to apply the systemic approach to the understanding of pathological family relationships [29]. According to Jackson’s work, the family is a system interconnecting its members whose stability – or homeostasis – depends on peculiar ‘relation rules’ [30]. We will not attempt to rigorously integrate our study in the framework of Palo Alto’s communication theory. We will however borrow to this thinking movement the notion of communication link between familiar members. If we consider in Fig.2. that the elements of the system are familiar persons communicating between them the privileged communication mode is naturally the oral communication mode. In the case of elderly persons with dementia, this usual communication mode is unfortunately not very or not available due to the cognitive impairment of the person. At the opposite, we can assume that other communication modes are still possible through one of the sensory modes : sight, hearing, smell and touch (we will not consider the taste due to practical difficulties to use it). Furthermore, we will distinguish two situations peculiar to people suffering of Alzheimer’s disease : the visual recognition of a given familiar element and its non-recognition. In the first case, the relationship between the older person and the familiar element will be represented by a full line, as illustrated in Fig. 3.a, whereas we will represent the second situation by a dotted line, as illustrated in Fig. 3.b.

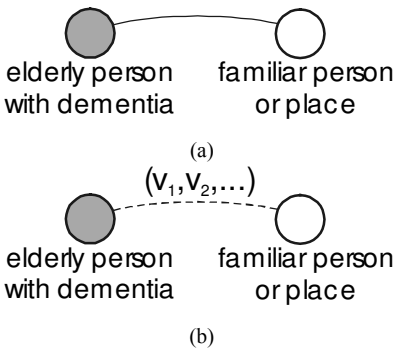


Fig. 3. Definition of the relationship between an elderly person with dementia and familiar persons or places, (a) Case of a possible visual recognition of the familiar element by the elderly person expressed by a full line, (b) Case of non-visual recognition of the familiar element (dotted line) but possible remembrance through other sensory channels (V_1, V_2, \dots) ordered from the most significant to the less.

In both cases, we propose to distinguish the elderly person with dementia from the other system elements by filling his(her) corresponding circle representation in gray.

Furthermore, we assume that when the visual recognition has disappeared the person is still able to access to deep memories of the familiar elements by means of other sensory stimuli (hearing, smell and/or touch) that we eventually could order from the most significant to the less one (see Fig. 3.b). As we will discuss it in next paragraph, we think to be able to obtain these pieces of information from the patient's family.

In this way it seems to us possible to elaborate a kind of "affective map" for each nursing home's resident in the form of a sagittal diagram in which the elderly person is the central element jointed to a set of familiar elements in close affective relation with the resident. Links are also considered between family members and familiar places, as illustrated in Fig. 4 example.

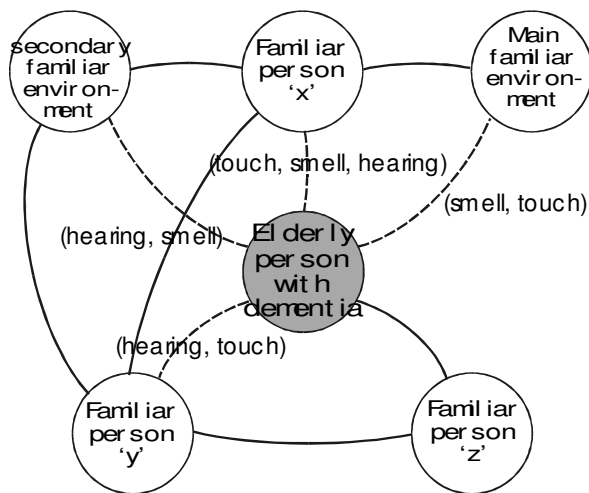


Fig. 4. Example of a systemic diagram of the relationships of an elderly person with dementia with his(her) familiar persons and places (see text).

This sagittal representation synthesizes the familiar relationships of the old person but it also leads to highlight 'major' familiar components which are the ones linked to the greatest number of other elements; in stimulating the memory of this particular element it can be hoped that his(her) 'social network' could amplify the remembrance effect.

B. Technical project

The resulting 'map' is however purely abstract. In order to make it practical the originality of our approach consists in expressing the link between two nodes by a set of sensory stimuli. For example, the privileged link between the old person and a place could be expressed by particular images or particular sounds attached to it as by associated scents. In consequence, the general situation of Fig. 3. can be technically specified for each considered stimulus by a double-arrow relationship between the old person and the sensory stimulus, as illustrated in Fig. 5: the arrow from the person with dementia to the stimulus assumes that the elderly person is attentive to it and the opposite arrow supposes that the stimulus affects the person in such a way it could participate with other sensory stimuli to create a remembrance of the familiar element. The term of

'remembrance' is used here in a large understanding. In the case of familiar persons or places still visually recognizable by the old person (case 'a' of Fig. 3), the photo or picture will be used in association with complementary sensory stimuli to make more stable its memory or to remind some eventually lost memory links between the visually recognizable element and associated non-recognizable elements. In the case of a no longer visually recognizable familiar element (case 'b' of Fig. 3), the sensory stimuli associated to it will be considered first to call to mind the lost visual trail but photos or pictures of the familiar person or place will be also integrated into the remembrance process.

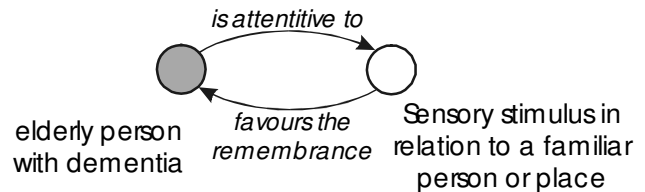


Fig. 5. Technical relationship between the elderly person and a given sensory stimulus highlighting the expected feedback between the individual person or place and the stimulus for a remembrance of the familiar element suggested by the sensory stimulus.

The efficiency of the sensory strolling corridor is so based on the sensory feedback process between the elderly people with dementia and a set of sensory stimulations (as it is expressed in double-arrow Fig. 4 generic scheme). By this process, it is hoped to appease the elderly person by 'immersing' him in a sensory space favorable to the remembrance, even punctually, of personal memories but also, by means of the memory working that such a 'walk in his(her) past' induces to limit the individual memory decline process.

The achievement of the sensory strolling corridor does not put any big technical problems. It is easy, technically spoken, to integrate in the wall of the corridor the mechanical and electronic components necessary to the sensory stimulation : scents and sounds emitters, touch panels, computer screens. Moreover, simple presence detectors can be used to trigger the sensory stimuli when the walker is in their proximity and it can be assumed that the time during which the stimulus is active be adjustable in function of the stimulus type as in function of the person.

As said in previous paragraph, interaction modes will be adapted to each individual patient by the intermediate of a user-interface programmed by a caregiver. As emphasized in recent Japanese researches about 'group homes' gathering caregivers and people with dementia [21], it must be assumed that caregivers are inexperienced with computers. In consequence, we plan to design touch-screen type monitors with a few buttons for programming and tracking the wandering in the corridor. Fig. 6 gives an example for an intuitive programming of the 'affective map'. In this example, the link specification between the elderly person and the familiar element is made from a selective choice in an internal data base of pictures, scents

or sounds. The elaboration of this internal data base does not seem difficult to do : first it could benefit from the existence of actual scents and sounds specialized libraries used for example in children pedagogical toys or in interactive museums; secondly, the integration of new emotional elements proposed by the family could be easily made, in particular in the case of numerical pictures or numerical pieces of music. This numerical approach has is however bounded in the case of the touch panels for which no computer-like equivalent are existing.

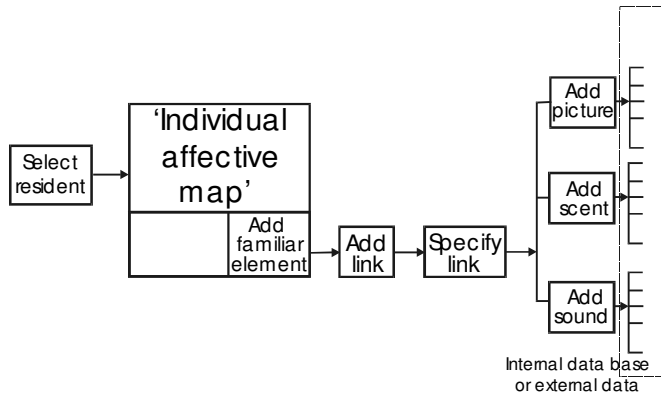


Fig. 6. Possible approach for an intuitive programming of a new 'familiar element' into the 'affective map' of an individual patient.

It is finally interesting to note that the sagittal-type representation of the 'affective map' seems to make easy its transposition into an intuitive programming.

Fig. 7 gives a schematic view of this actual project of stimulation sensory strolling corridor. An important practical question remains : how to organize the presentation of sensory stimuli all along the corridor ? It can be first assumed to impose a wandering way for the

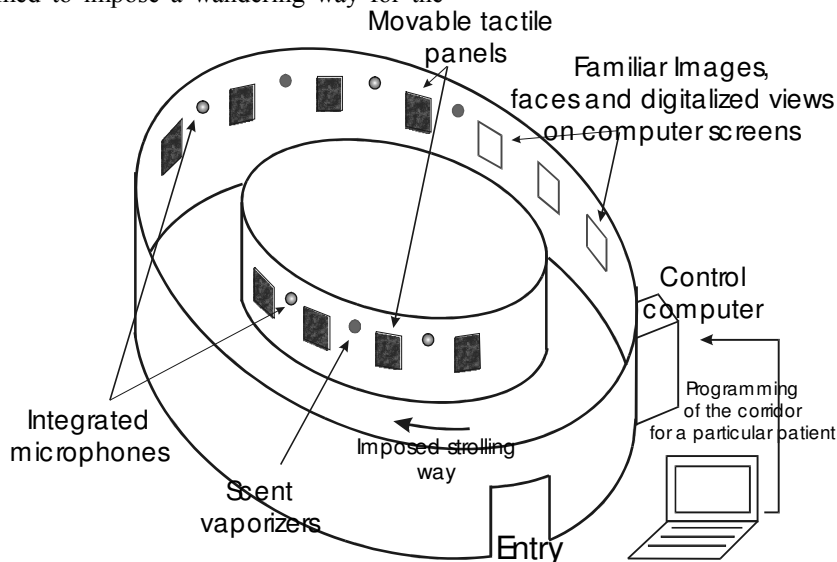


Fig.7. General scheme of the sensory stimulation strolling corridor : the organization of the sensory stimulations on the corridor's walls can depend on the elderly person personality and on his(her) dementia state; for example, on the proposed scheme it is supposed that the patient is no more able to recognize familiar faces and, for this reason, it has been chosen to gather together visual familiar elements after a first sensory stimulation step of associated scents and sounds.

IV. CONCLUSION AND FUTURE WORK

The institutionalization of elderly people with dementia

first run, at least. Secondly, two possibilities can be considered for the stimuli organization :

1. *The stimuli are successively presented according to their nature* ; it can be so defined inside the corridor a 'smell area', a 'hearing area', a 'touch area' and a 'visual area' whose order could be chosen in accordance with what is known about the sensitive nature of the patient, from the less sensible stimulus to the most one, for example;

2. *The stimuli are associated to a person or to a place* ; it can be so defined inside the corridor successive 'memory areas' combining several stimulation types to evoke a person or a place (for example, scents, sounds and pictures are combined in a same evocation).

Preliminary experiments will be necessary to determine the relevance of one or the other approach or to get both to take into account the diversity of residents personal situations.

Lastly, let us try to consider the role of the caregivers. When the corridor has been programmed, the wandering of the patient must be relatively free, go and return are permitted as to make several runs. The caregiver would however intervene if apparently the sensory stimuli generate anxiety or seem to amplify the agitation or if the patient appears to be unconcerned. Finally, let us emphasize that such a systemic approach can favor a bringing together of the institution with patient's family through the evocation of the elderly person memories.

is a particularly difficult problem due to the conjunction of physical and cognitive impairments. Out of care time, they are often unoccupied or they exhibit typical agitated

behaviors which are a great problem for caregivers as other residents. Chemical or physical restraint cannot be then a long-term solution. Although the causes of agitation for elderly people with dementia are not perfectly known nor easily associable with patient personality, it has been remarked that wandering can both appear as a symptom and a natural pain alleviation. Our project of sensory stimulation strolling corridor aims to take advantage of this defense strategy. We assume indeed that a strolling corridor can be associated to a memory stimulation process that we propose to base on a computer-controlled sensory stimulation. Appeasement and remembrance are the positive requested effects of gardens for elderly people characterized by their symbolic structure. In comparison, considered sensory stimulation strolling corridor could be viewed as a complementary approach to these symbolic gardens. The originality of our approach consists however in deriving the sensory structure from a kind of 'affective map' elaborated as a sagittal diagram linking the elderly person to familiar people or places by means of visual, smell, hearing or touch stimuli.

Future work will look for showing the practical relevance of this systemic approach applied to elderly persons with dementia. We plan it in two steps :

1. To present the project to nursing homes caregivers as to patient's family and to pick up their reactions;
2. To find a nursing home candidate for experimenting inside one of its actual corridors a first set of technical devices for sensory stimulation.

This first 'real world' experiment must permit us to determine the true possibilities of this both systemic and architectural approach for an improvement of daily-life elderly residents with dementia.

ACKNOWLEDGMENT

We would like to thank Dr. Katrin Grüber, Institutsleiterin, from the *IMEW (Institut Mensch, Ethik und Wissenschaft)* in Berlin for having let us know the German concept of "Gerontogärten" and its actual application to nursing homes for elderly people with dementia.

REFERENCES

- [1] The Japanese Ministry of Health, Labor and Welfare. White paper on aging society, 2005.
- [2] K. Alloul, L. Sauriol, W. Kennedy, C. Laurier, G. Tessier, S. Novosel and A. Contandriopoulos, "Alzheimer's disease : a review of the disease, its epidemiology and economic impact", *Archives of Gerontology and Geriatrics*, vol. 27, pp. 189-221, 1998.
- [3] H. Agüero-Torres, E. von Strauss, M. Viitanen, B. Winblad and L. Fratiglioni, "Institutionalization in the elderly: The role of chronic diseases and dementia. Cross-sectional and longitudinal data from a population-based study", *Journal of Clinical Epidemiology*, vol. 54, pp. 795-801, 2001.
- [4] C.L. Johnson and L.A. Grant, *The nursing home in American society*. The Johns Hopkins University Press, Baltimore, 1985.
- [5] B. Schwarz and R. Brent (Eds.), *Aging, Autonomy and Architecture: Advances in Assisted Living*. The Johns Hopkins University Press, Baltimore, 1999.
- [6] R.A. Cane, "Long-term care and a good quality of life: bringing them closer together," *Gerontologist*, vol. 41, n°3, pp. 293-304, 2001.
- [7] E. Goffman, *Asylums. Essays on the social situation of mental patients and other inmates*. Doubleday Anchor, New York, 1961.
- [8] G. Lang, B. Löger and A. Amann, "Well-being in the nursing home – a methodological approach towards the quality of life," *Journal of Public Health*, vol. 15, pp. 109-120, 2007.
- [9] B.J. Collopy, "Autonomy in long-term care: some crucial distinctions," *The Gerontologist*, vol. 28, pp. 10-17, 1988.
- [10] B.J. Collopy, "Ethical dimensions in long-term care," *Generations*, vol. 14, pp. 9-12, 1990.
- [11] T.L. Beauchamp and J.E. Childress, *Principles of biomedical ethics*. 4th edition, Oxford University Press, New York, 1994.
- [12] H.E. Resnick, B.E. Fries and L.M. Verbrugge, "Windows to their world: the effect of sensory impairments on social engagement and activity time in nursing home residents," *Journal of Gerontology. Series B. Psychological Sciences and Social Sciences*, vol. 52, n°3, pp. 135-144, 1997.
- [13] Y. Chen, M. Ryden, K. Feldt and K. Savik, "The relationship between social interaction and characteristics of aggressive, cognitively impaired nursing home residents," *American Journal of Alzheimer's Disease and Other Dementias*, vol. 15, n°1, pp. 10-17, 2001.
- [14] A. Kolanowski and M. Litaker, "Social interaction, premorbid personality and agitation in nursing home residents with dementia," *Archives of Psychiatric Nursing*, vol. 20, n°1, pp. 12–20, 2006.
- [15] J. Cohen-Mansfield, M.S. Marx and A.S. Rosenthal, "A description of agitation in a nursing home," *The Journal of Gerontology: Medical Sciences*, vol. 44, n°3, pp. 77–84, 1989.
- [16] J. Cohen-Mansfield, M.S. Marx and A.S. Rosenthal, "Dementia and agitation in nursing home residents: how are they related?," *Psychology and Aging*, vol. 5, n°1, pp. 3–8, 1990.
- [17] C. Farran, E. Hagerty, L. Tatarowicz and E. Scorza, "Dementia care receiver needs and the impact on caregivers," *Clinical Nursing Research*, vol. 2, pp. 86-97, 1993.
- [18] J.C. Augusto and C.D. Nugent editors, *Designing Smart Homes*. Springer Verlag, Berlin, 2006.
- [19] D.H. Stefanov, Z. Bien and W.-C. Bang, "The smart house for older persons and persons with physical disabilities: structure, technology arrangements, and perspectives," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 12, n°2, pp. 228-250, 2004.
- [20] H. Kanai, T. Nakada, G. Tsuruma and S. Kunifuji, "An aware-environment enhanced group home : AwareRium," *ICHIT 2006*, LNAI 4413, M.S Szczuka et al. (Eds.), LNAI 4413, Springer Verlag, Berlin, pp. 425-436, 2007.
- [21] H. Kanai, K. Nakagawa, T. Sugihara, H. Koshiba, R. Takatsuka, N. Kato and S. Kunifuji, "Development of a mimamori-care system for persons with dementia based on the real world-oriented approach," *KES 2007/ WIRN 2007*, Part II, B.Apolloni et al. (Eds.), LNAI 4693, Springer Verlag, Berlin, pp. 1261-1268, 2007.
- [22] D.H. Stefanov, R. Orpwood, C. Gibbs, T. Adlam, R. Faulkner and D. Meegahawatte, "The design of smart homes for people with dementia – user-interface aspects," *Univ Access Inf Soc*, vol. 4, pp.156-164, 2005.
- [23] J. Oh, "Stroke patients' experiences of sharing rooms with dementia patients in a nursing home", *International Journal of Nursing studies*, vol. 43, pp. 839-849, 2006.
- [24] Brindley Manor Federation of Nursing Homes, Brindley Manor, Letterkenny road, Convoy, County Donegal, Ireland, web site www.brindleymanor.ie.
- [25] Landschaftsarchitektbüro Isabelle Woysch, Gerontogärten, web site www.gartenwelten-woysch.de.
- [26] Landschaftsarchitekten Wankner & Fischer Eching, web site www.wankner-und-fischer.de.
- [27] I. Woysch, *Demenz-Die Reise in eine andere Wirklichkeit, Gerontogarten-Freiraum für eine andere Welt*, Zusammenfassung der Diplomarbeit, on-line available on prof. I.Woysch web site.
- [28] L. von Bertalanffy, *General System Theory*. New York, 1969.
- [29] P. Watzlawick, J. Helmick Beavin, D.D. Jackson, *Pragmatics of Human Communication. A Study of International Patterns, Pathologies, and Paradoxes*. Norton, New-York, 1967.
- [30] D.D. Jackson, "The question of family homeostasis", *Psychiatric Quarterly Supplement*, vol. 31, pp. 79-90, 1957.