

Evaluation of the effects induced by environmental characteristics on the behavioural models of people affected by dementia.

Design oriented towards the therapeutic significance of spaces.

Alessandra Cucurnia*, Gianluca Darvo**

key words: design, evaluation, quality, Alzheimer's, usability, environmental well-being

Abstract

The paper describes a model for evaluating the quality of spaces used to accommodate individuals affected by dementia.

Of the various problems generated by this pathology, behavioural disorders represent the most critical issue both in terms of the patients' quality of life and in relation to the work load brought upon family members and personnel who provide assistance.

Studies conducted at international level highlight the

extent of the direct effects on people's well-being produced by environmental and spatial features, giving them a genuine "therapeutic" value in supporting the difficulties connected to the deficits and counteracting behavioural disorders.

Carefully examining the correlation established between the characteristics of architecture for dementia sufferers and the perceptual-sensory component of patients is essential to assess whether, and to what

extent, it is possible to help improve people's quality of life and make the spaces more restorative.

Through a joint analysis of sector-based literature and outcomes deriving from Post Occupancy Evaluations, a relational matrix can be defined concerning the implications of spatial aspects on specific domains recognized as significant, such as behavioural, cognitive and functional characteristics, social skills, well-being, orientation and care outcomes.

A critical reading of the systematized data allows us to identify factors with respect to which the international scientific community has reached substantial convergence and those around which there is conflict, and to understand the dynamics underlying the relationships between people and the built environment, select them and place them in a hierarchy based on their degree of interference with well-being and the quality of life.

Through an integrated approach of expertise from multi-disciplinary areas, both in order to develop the methodology and with regard to the contamination and transfer of knowledge, the aforementioned considerations – brought together in an operational tool that converts the information from the matrix into closed and specific questions, attributes a score to the answers and provides the user with operational suggestions – can support the decision-making processes associated with the programming and design of effective solutions in the conception of space that can adapt to the residual capacities and is capable of establishing adequate interactions with the environment, also in situations where there is reduced awareness.

The tool could also assist operators in the managerial phase with verifying the degree of “spatial congruity” of the existing structures.

1. INTRODUCTION

In the design of residential and day facilities to accommodate individuals affected by dementia who very often have no awareness of themselves or the physical and social environment surrounding them, the characteristics of the specific requirements play a role of primary importance.

The main objective designers must set themselves is to provide adequate safety and comfort conditions, support independence and ensure suitable places¹ capable of countering the advance of behavioural disorders, conserving the remaining functional capacities and facilitating spatial and temporal orientation².

The environmental aspects assume a fundamental “therapeutic” value. In each stage of the disease, in fact, the spatial characteristics can offset the disability linked to the cognitive deficit or, on the contrary, emphasize it³.

In relation to the degree to which the disease has taken

hold⁴, the structural characteristics together with the human component of the spaces combine to achieve the best functional level in terms of the appropriateness of care⁵ and the maximization of well-being.

Much scientific evidence⁶ reveals how safety, usability and spatial-temporal orientation, environmental well-being, familiarity with the space, comfort and sensory stimulation, flexibility, and work and occupational well-being represent requirement-based prerogatives critical to the design.

The technical translation of these latter into requirements allows us to define the characteristics connoting the spaces and to develop efficient design recommendations.

2. METHODOLOGICAL APPROACH

The evaluation and hierarchization of the impact of the spatial characteristics on the well-being of people affected by dementia encourage the orientation of design choices towards coherent interventions.

¹ Department of Health and Human Services, State Government of Victoria, Australia, www.health.vic.gov.au/dementia/.

² Regione Emilia-Romagna, Direzione Generale Sanità e Politiche Sociali, Progetto Regionale Demenze, DGR 2581/99, 2001, *L'ambiente: strumento terapeutico. Criteri per la progettazione e l'adattamento degli ambienti collettivi e domestici per una migliore qualità della vita dei soggetti affetti da demenza*;

CESTER A., DE VREESE L.P., MINELLI P.P., NIZZARDO G.F., SORDINA R., *Spazio & Ambiente*, Vega Edizioni, 2000.

³ GOLLIN D., BASSO D., MICLWRATH J., GABELLI C. *La gestione integrata clinico-ambientale: lo spazio come risorsa terapeutica*, Giornale di Gerontologia, 52, Pisa, 2004 (URL: <http://www.sigg.it/public/doc/GIORNALEART/436.pdf?r=0,5523816>);

STABILINI F., *Design e spazio terapeutico*, FinMark Bologna, 2006.

⁴ GUAITA A., JONES M., *Il progetto Gentlecare*, Giornale di Gerontologia, XLVIII, Pisa, 2000.

⁵ FABRIZIO R., CARAFELLI A., ROLFINI M., *Centri Diurni specializzati nell'assistenza alla persona con demenza: esperienze e materiali nell'ambito del Progetto Ministeriale “Qualificazione di centri diurni e di strutture residenziali e di azioni di sostegno ai familiari”*, Assessorato Politiche per la Salute, Regione Emilia-Romagna, 2006.

⁶ JUDD S., MARSHALL M., PHIPPEN P., *Design for Dementia*, Journal of Dementia Care, Awker Publications, London 1998;

COLOMBO M., VITALI S., *The Home environment Modification Program in the Care of demented elderly. Some examples*, Archives of Gerontology and Geriatrics, suppl. 6, 1998.

With the aim of achieving the greatest correspondence between users' expectations and raising the qualitative levels of the facilities, the definition of the operational tool to support decision-making processes in the phases of planning, designing and evaluating architecture for sufferers of Alzheimer's disease is subject to a mandatory preliminary phase of the systemic surveying of the set of problems with the aim of exploring some fundamental issues:

- the pathology in terms of its distinctive features, dimensions, evolutionary trends, pharmacological and psycho-social treatments, critical issues and progress in the clinical and care approaches;
- the accommodation facilities, reference legislation, the most important examples at international level and the main innovations;
- scientific research on the relationships between the environment and people with particular reference to typological, dimensional, technological and environmental aspects;
- the guidelines, good practices, methodologies and tools for evaluating the built space, and neuropsychological points of view.

The representation of the state-of-the-art is a very important factor. Isolating the set of problems, understanding the results achieved, the considerations that emerged, and the convergence and divergence points are all actions that allow us to adjust the positioning and identify the significant focuses as well as the limits and specify the areas that must be investigated further.

In such an inspection, in order to confer the coherent value of operational pragmatism on the outcomes, with a view to knowledge sharing, contamination and transfer, the use of an integrated approach involving expertise and tools from various disciplinary areas is essential.

The complexity of the topic requires the stresses generated by the environment that can be associated with behavioural models to be clearly highlighted and structured in order to make both the environmental determinants and the actual extent of their influence legible.

Focusing on the behavioural aspects deemed to be critical factors by the most qualified experts enables us to construct a spectrum of the most critical and frequent situations and represents the cognitive analytical assumption essential for understanding which elements create difficulties, how they should be tackled from the perspective of interpersonal interaction and how in each situation the space can provide a contribution in terms of therapeutic significance, all elements that must be considered prior to the identification of design behaviours aimed at facilitating the co-existence of the various presences within the facilities and their translation into operational outcomes.

The main objective is managing to specify indications that can be translated into questions identifiable in the design

solutions that allow us to see how they correlate with certain effects on the patient and to express an opinion.

For the purpose of the correct application of the evaluation process, it is a prerequisite that the approach implemented takes into account the map of the most complex cases and their codification into homogeneous groups, reconstituted by the competent operators. Highlighting this aspect allows the designer to understand how the space can provide a contribution in terms of therapeutic value and infer the configurations most consistent with managing all the potentially coexistent categorizations, without generalizing.

If the space is to have a therapeutic value, in the first instance it is necessary to know the diagnosis, that is, in this case, the specific nature of the behaviours automatically assumed by an individual in relation to specific contexts. In this action the most qualified representatives are the personnel who provide care in that, as they are able to support the process of identifying which aspects can be treated with the help of the environment, they are able to point out the usefulness of the spatial solutions.

The questions to be addressed cannot be schematized in a strict and rigid way as they are contingent upon an overall indeterminacy which characterizes the profile of individuals, who are all different to each other. Undoubtedly there are some constants, the state of anxiety, for instance, is a component that occurs widely in a fairly large population, as does reactivity, but there are many other manifestations.

The interdependence between the function of the space and an individual's reactivity therefore represents the fundamental component giving rise to all the ingredients that can be adopted in terms of solutions to be tested; the reference context should be validated through indirect studies associated with direct field surveys.

An analysis of the authorization regulatory framework and the study of scientific literature allows us to develop a system of the minimum structural requirements necessary and to come up with a functional programme of the spaces. Through scientific evidence which relates the satisfaction of requirements to the physical characteristics of the spaces it is also possible to compile a relationship matrix concerning the space/person relationship analogously with some domains recognized as relevant in terms of well-being by the international community, highlighting the factors with respect to which substantial convergence has been achieved, those where conflict still exists and those relating to aspects subject to further in-depth examination.

Some shortcomings detected in literature can be bridged with the support of a multidisciplinary team that integrates expertise in the technological and architectural sector with knowledge of the medical and care area⁷ contributing to the definition of the

⁷ psychologist, neuropsychologist, educator/therapist.

characteristics of the environmental settings and the survey tools to be used for in-the-field verifications.

The weighing of the solutions, identified in relation to the degree of satisfaction with the overall well-being of the categories of users, allows us to hierarchize the factors contained in the matrix and to identify the most critical aspects with respect to the perceived level of quality of the space.

This information represents the knowledge basis for constructing the operational tool to support the design, analysis and evaluation of the facilities used to accommodate people affected by dementia including the cultural scientific references of the requests, the specific recommendations and the indicators to assess the level of satisfaction.

3. THE SPECIFICITY OF THE PATHOLOGY

When we talk about dementia we are referring to a set of degenerative chronic pathologies that lead, with different degrees of severity, to cognitive deficits, behavioural disorders, functional damage and the consequent loss of independence and self-sufficiency, having a decisive effect on the capacity for social interaction and the performance of daily and work activities.

In relation to the ways in which the symptoms are expressed, different forms can be distinguished, the most common of which is Alzheimer's disease which represents around 50-75% of the total cases.

From a clinical point of view it involves the widespread destruction of neurons which prevents the transmission of impulses resulting in the gradual atrophy of the brain. The initial manifestations are difficult to discern. Memory disorder is undoubtedly the predominant symptom which is gradually associated with other cognitive decay and functional deficit processes, resulting in states of anxiety, depression, delusions, hallucinations, irritability, aggression, apathy and aberrant and repetitive behaviours undermining the possibility for the individuals affected to conduct an independent life.

Although the manifestation of symptoms is extremely variable from individual to individual, the disease can be broken down into four phases with a successive degree of importance (Bianchetti *et al.*, 2003).

The first, mild, is characterized by the emergence of topographical disorientation associated with modest short-term memory loss, difficulty in managing complex problems as well as states of anxiety and depression.

In the second, moderate, the disorientation extends to the spatial and temporal sphere, the loss of memory is accentuated and there is a clear disturbance to language, with symptoms of insomnia, loss of appetite and the inability to perform personal pursuits independently.

The third, serious, involves difficulty in recognizing faces or familiar places and language is compromised to a significant degree up to the total loss of it, with

stereotypical manifestations such as fidgeting, wandering, persistent vocalization and agitation. In this phase the remaining functional capacities are minimal and self-sufficiency is almost inexistent.

In the last phase, severe, although some studies have detected the conservation of some perceptive and emotional functions, the person is generally bedridden, requires artificial feeding and is almost completely incapable of communicating.

The behavioural disorder⁸, connected with stress, functional damage, cognitive deficit (Pearson *et al.*, 1989) and an increase in inappropriate demand for institutionalization (Steele, 1990), is the most decisive in terms of the worsening quality of life, for both patients and their caregivers (Gonzales *et al.*, 2000).

Symptomatic clusters identify 4 types of disturbance (Finkel, Burns, 2000):

- thinking and perception which induce delusions, hallucinations and misidentification;
- the affective sphere, which results in depression, anxiety, irritability and emotional lability;
- conduct interfering with sleep and nutrition;
- specific behaviours, which cause a tendency to wander and to exhibit agitation, aggression, persistent vocalization, incongruous fidgeting, perseverations, indifference, apathy and disinhibition.

Generally, the disorders concern the initial and middle phases of the disease with a clear attenuation in the advanced stages where neurological deterioration predominates.

The onset of these dysfunctions sends the whole system underlying the accommodation facilities into crisis, representing the main factor of concern.

4. REQUIREMENT-BASED PROFILES AND CHARACTERISTICS OF THE SPACES

As already maintained, research in the international sphere recognizes that the environmental and spatial characteristics have an appreciable influence on the behaviours displayed by individuals affected by dementia.

Examining the perceptive and sensory aspects that most identify the specific categories of users and the cultural scientific references that associate the physical attributes of the space with the satisfaction of requirements allows us to outline the characteristic requirement-based profiles as devices to specify the implications in terms of the spatial requirements⁹ to be associated with the

⁸ Behavioral and Psychological Symptoms of Dementia, BPSD.

⁹ CESTER A., DEL NORD R., FABBO A., BRACALI I., CEI M., MASETTI G., MONTESI M., "Requisiti strutturali", in *Linee di indirizzo per i centri diurni Alzheimer*, 4° convegno nazionale sui centri diurni Alzheimer, Pistoia, 31 maggio – 1 giugno, 2013.

architecture of reference and to support the process of defining the design recommendations.

Safety

The progressive cognitive and sensory deterioration, aggravated by reduced visual capacity and psycho-motor retardation, along with the tendency to escape and aimless wandering, in addition to generating an increase in the workload of the personnel, has a negative influence on the person's ability to perceive possible situations of danger.

The elimination of physical dangers may guard against probable causes of accidents, while restricted access to uncontrolled outside areas helps to prevent against the risk of escape.

Faced with the tendency to fidget and wander, or risks linked to attempts to escape and the consequent access to potentially dangerous areas, solutions that hide and reduce the number of accesses, together with an environment controlled by hidden video cameras, represent effective security measures that are not excessively invasive.

Spatial and temporal usability and orientation

The gradual loss of memory and capacity to judge repress the perception of the depth of space and the recognition of objects while the motor deficits and the tendency to wander aimlessly determine the inability to adequately use the space, generating feelings of anxiety and aggression in the person.

Physical and perceptive impediments may limit the use of the spaces and objects, as may interior and exterior surfaces that have different levels¹⁰, while clear recognition of the functions of spaces, furniture and equipment, together with appropriate implicit and explicit signage, may facilitate orientation.

The colour component and the use of contrasts between objects and the context and between spatial elements helps to reinforce the perception reducing disorientation and supporting independence.

Some studies¹¹ have shown that ordered and appropriately configured places free of distracting elements and equipped with adequate signage lead to an improvement in the independent performance of daily

activities, in addition to representing a valid support for orientation purposes¹².

Interior and exterior paths fitted with handrails and aids for mobilization¹³, enclosed within themselves as circuits, enable free ambulation in safe conditions and, at the same time, ensure that the personnel have visual control; moreover, when integrated through the inclusion of points of interest and stopping areas they can create multi-sensory stimulation in the patient¹⁴.

Environmental well-being

The sensory perceptions of the environment in terms of visual, audio, tactile and olfactory stimuli affect mood and behaviour. Scientific literature reports that they can produce positive or negative effects on the performance of daily activities, well-being, skills, social interaction, spatial and temporal orientation and the state of health⁵.

Good lighting conditions, with diffused rather than dazzling light, that optimize visual contrast and are commensurate with the type of activities they support, and a comfortable interior temperature that can be adjusted and proportioned with respect to the functions and set up of devices that emit scents to favour olfactory stimulation and evoke a domestic atmosphere, can have a positive influence.

Background humming noises are responsible for states of confusion and penalize communication¹⁶; adequately soundproofed rooms and resting areas not adjacent to those that represent sources of noise counteract the onset of wandering and aggression.

Familiarity with the space, comfort and sensory stimulation

Factors that make an environment pleasant and stimulating can be linked to actions aimed at conceiving

¹⁰ DEL NORD R., *Architettura per l'Alzheimer*, volumi I e II, Edizioni Regione Toscana, Firenze, 2002;

CANNARA A., BRIZIOLI C., BRIZIOLI E., *Progettare l'ambiente per l'Alzheimer*, Franco Angeli, Milano, 2004.

¹¹ MARQUARDT G., BUETER K., MOTZEK T., *Impact of the design of the built environment on people with dementia: An evidence based review*, Health Environments Research & Design Journal, First Published October 1, 2014.

¹² MARQUARDT G., *Wayfinding for people with dementia: a review of the role of architectural design*, HERD, Vol. 4, Num. 2, 2011 (URL: http://alzheimer-architecture.nl/wp-content/uploads/2012/10/Wayfinding-for-People-With-Dementia_HS.pdf).

¹³ DGR Emilia Romagna del 20-4-2009 n.514, *Primo provvedimento della Giunta Regionale attuativo dell' art. 23 della L.R. 4/08 in materia di accreditamento dei servizi socio-sanitari*, allegato DF; MOROSINI P., PIERGENTILI P., *Accreditamento volontario di eccellenza. Manuale e questionario di accreditamento volontario tra pari per strutture residenziali per anziani non autosufficienti*, Vega Edizioni, 2005.

¹⁴ HODGES L., BRIDGE C., CHAUDHARY K., *Dementia Design Guidelines: Home and Community Care Capital Works Program*, University of Sydney, 2006.

¹⁵ FLEMING R., CROOKES P. A., SUM S., *A review of the empirical literature on the design of physical environments for people with dementia*, University of Wollongong Australia, 2008 (URL: http://ro.uow.edu.au/cgi/viewcontent.cgi?article=3923&context=hb_papers).

¹⁶ STABILINI (2006), *op. cit.*

of non-institutional spaces that can be personalized and are capable of provoking stimuli¹⁷.

Sensory enhancement through sensory stimulation processes curbs the tendency to wander¹⁸ and to display agitation and defeatist behaviour, whereas, on the contrary, over stimulation may generate the opposite effects¹⁹.

Personalized spaces with familiar furnishings that are not institutional and that are familiar in terms of both appearance and size, together with devices that can be regulated for environmental and sensory stimulation, solicit greater involvement in activities, encouraging informal social interaction and increasing well-being²⁰.

The outdoor space, set up with natural characteristics²¹, is another appreciable component of therapeutic value. Contact with natural elements in fact helps to keep the person more linked to their own identity in a place familiar to the memory²², and encourages physical activity leading to conservation of the remaining functional capacities and inducing valuable sensory stimulation that can reduce psychological stress and at times the characteristic tendency towards wandering.

Flexibility

Over the course of the disease a change occurs in the expression of the requirements of patients and the people who care for them which leads to the need to ensure the spaces have an adequate adaptation capacity²³ based on the type of activity, duration of their

stay and organizational model. Completely different configurations exist generating dynamically variable cases that inevitably influence the use of the space, which in turn must be appropriately sized and set up so that people with different degrees of disability and interaction capacity levels can live side by side.

In this context flexibility assumes three main characteristics:

- *flexibility of the space* which allows for adaptation based on the activities provided for and the number of users involved;
- *flexibility of use and reconfiguration of the furnishings* in relation to the different degrees of disability and interaction with the space;
- *flexibility in the organization* of the facilities, with reference to the variable nature of some factors such as the degree of disability, short and long-term turnover and occupation time.

Work-related and occupational well-being

Considering the high workload and psychological load, the occupational well-being of the personnel²⁴ who operate inside the facilities that accommodate people affected by dementia produce decisive effects on the composure of the guests²⁵.

The composition of the users, captured at different moments, leads to a change in the activities programming model and to an assessment, from time to time, of the initiatives aimed at achieving the therapeutic objectives.

The presence of work spaces for exclusive use set up for specific managerial functions and the equipping of rooms for the performance of care and treatment activities, suitably adapted in terms of size and characteristics, along with an appropriate layout that ensures adequate direct visual control of the routes and the areas where guests stay, help to optimize the management of the operators' tasks²⁶.

5. THE OPERATIONAL NATURE OF THE SUPPORT TOOL

The operational tool proposed, which refers to the process of selecting, systematizing and hierarchising the environmental characteristics on the basis of their degree of interference with the well-being of the individuals

¹⁷ MARQUARDT, BUETER, MOTZEK (2014), *op. cit.*

¹⁸ COHEN-MANSFIELD J., PARPURA-GILL A., *Bathing: A framework for intervention focusing on psychosocial, architectural and human factors considerations*, Archives of Gerontology and Geriatrics, Sep-Oct, 2007.

¹⁹ VITALI S., GUAITA A., *Il significato dell'ambiente protesico nella cura della persona con demenza in fase severa*, Dementia Update, n. 7, 2000.

²⁰ MARQUARDT G., JOHNSTON D., BLACK B.S., MORRISON A., ROSENBLATT A., LYKETSOS C.G., SAMUS Q.M., *Association of the spatial layout of the home and ADL abilities among older adults with dementia*, Am J Alzheimers Dis Other Demen, feb, 2011.

CESTER A., GUMIRATO G., *I percorsi della contenzione dal caos al metodo*, Vega Edizioni, 1997

²¹ DEL NORD (2002), *op. cit.*

VALLA P., *Alzheimer: architetture e giardini come strumento terapeutico*, Guerini e Associati Editore, Milano, 2002.

²² DETWEILER M.B., MURPHY P.F., KIM K.Y., MYERS L.C., ASHAI A., *Scheduled medications and falls in dementia patients utilizing a wander garden*, Am J Alzheimers Dis Other Demen, Aug-Sep, 2009;

MURPHY P.F., MIYAZAKI Y., DETWEILER M.B., KIM K.Y., *Longitudinal analysis of differential effects on agitation of a therapeutic wander garden for dementia patients based on ambulation ability*, Dementia, 9, 2010.

²³ HODGES L., BRIDGE C., CHAUDHARY K., (2006), *op. cit.*

²⁴ Burn-out: symptom of work stress which arises with greater frequency in professions that involve high relational implications, such as between a patient affected by dementia and the caregiver taking care of them.

²⁵ CALKINS, M. P., *Environments for late-stage dementia*, Alzheimer's disease Quarterly, 6, 2005.

²⁶ HODGES L., BRIDGE C., CHAUDHARY K., (2006), *op. cit.*

previously described, converts the matrix information into the form of closed and specific questions and attributes a score to the answers representing a support in both the prefiguration of effective solutions and in the evaluation of the degree of coherence of the existing structures.

The considerable number of variables involved makes the formulation of opinions particularly complex, not only with regard to the evaluation process but also the designer's decisions.

At the outset, the functional areas making up the facilities must be identified and the spatial characteristics assigned a score in relation to their congruence with the satisfaction of the requirements expressed by the different categories of users and then, taking into account the different cases and constraints that guide the solutions, an opinion on their merits must be formed.

The overall score does not derive from a simple addition but it must necessarily reflect the consistency that each aspect assumes. There are many decisive factors but not all have the same significance. The ranking of the environmental characteristics by importance, a fundamental element in attributing their weight, must be defined by the personnel who represent those most qualified to express an opinion in this sense. The criteria on the basis of which the latter may differentiate, in terms of weight, the characteristics of a space may vary.

One is the qualitative level as a function of the degree of incidence on the overall congruity of the facility. Another is the quantitative incidence of the different spatial solutions, expressed in relation to the numerical quantity or in terms of the extent of the surfaces where in the specific scope of investigation the solution is considered in relation to the effects that it can procure on patients in terms of well-being and on personnel in relation to performance. Another component is represented by the type of user concerned in each type of space. All the categories can be jointly present, or just some of them. This discriminant may be calculated as a multiplication coefficient which, in units where there is greater crowding, acquires a constant factor that must reflect all expressed requirements, while in others it will assume lower values proportional to the number of user categories concerned.

For the purposes of assessing the impact, the hierarchization of the relevant aspects from a neuropsychological point of view is essential to produce a reliable weighting; an incorrect formulation of the opinion would generate negative resonances precisely on the most significant aspects.

The items contemplated in the model are organized by levels of problems, on the scale of the complex, in relation to the overall configuration of the property, with reference to the characteristics of the individual spaces even including some environmental and technological factors. The inputs can be implemented progressively

through the inclusion of new information derived from the in-depth examination of additional items and environmental domains on the basis of the findings, or as a result of the outcomes correlated to subsequent scientific research.

Field investigations have highlighted that the values attributable to the recommendations can be different: a certain requirement may be highly influential while another may be almost irrelevant. The importance of the recommendations therefore depends on the degree to which the factor is considered significant.

In order to confirm the value of the different parameters in terms of advantageousness, the scores are identified through in-the-field surveys associated with analytical processes to understand the operators' points of view.

The values change depending on the recommendations: for some recommendations a certain aspect is much more important, which as a consequence must assume a greater specific weight.

As it is a multidimensional matrix in which each parameter is intertwined with the others, a simple mediation of the values expressed is not effective enough to produce reliable results; it is therefore also necessary to perform a weighting in relation to the weight that each user category assumes with respect to a specific recommendation.

Once the weights have been identified and the order of importance specified, the next step concerns the formulation of an opinion. Based on the degree of satisfaction with the design solution, the tool provides the corresponding scale of values. The verification is applied proceeding by functional areas, matching the evaluation with each individual aspect considered. This establishes close correlation between the space, the recommendation and the degree of satisfaction that can be detected.

If the recommendation is well specified in descriptive terms, the opinion option can occur automatically.

In the evaluation process the problem lies in deciding where to apply the verification procedure: on which and how many units. There are two main situations that may be created.

The first, simpler one, is when all the spatial units that refer to each functional use are the same, that is they present the same degree of satisfaction in relation to each corresponding requirement. In this case it is sufficient to choose a unit by typology and apply the verification exclusively to those that exemplify the maximum representativeness in that the opinion expressed for one is also valid for all the others with the same use.

The second situation is when the spatial units, with the same use, are different. In this circumstance selecting a single unit by type of space significantly reduces the representativeness. An alternative simplification could be evaluating the worst situation, selected on the basis of its response to the priority requirements, or the

most representative based on its numerical incidence, going on to read all the recommendations for just that one. Another hypothesis could be assuming as a selection criterion the numerical incidence of each typology and going on to verify just the one with the greatest weight. In any case it would be preferable for control to be performed with a propensity towards the quantitative criterion in the context of the most representative units, or for it to be referred to the specific weight that each space category has on the design due to the numerical incidence or in terms of surface area.

The representativeness of the sample to be taken as a reference depends on the cases and, as a result, it is the main indicator to be followed.

When the types of spaces relating to an identical functional use are the same, one is unit is more representative and the opinion expressed about it is objectively indisputable, whereas when the representativeness of the single samples is reduced mediation becomes necessary. Mediation can take into account the percentage of cases in which opinions were expressed.

The reliability of the weighting process lies in the skill of the operator, despite the complexity of the procedure, to correctly read the range of cases and relate it to the importance of the recommendations, while the difficulty lies in defining the number of samples to be selected. One support mechanism in the process of selecting representative samples could be the application of the "sight" estimates procedure through which the valuator personally judges the percentage of cases to which to attribute different values in order to then classify all types of spaces present in the project based on the judgement category.

The indicators on the basis of which to codify the incidence of the levels vary from case to case. To arrive at the summary opinion for each spatial unit, represented on a numerical basis and influenced by the percentage incidence of the types of cases present, it is necessary to adhere to the levels corresponding to each recommendation.

Each opinion level is associated with a number which returns summary results. Mediation between the individual opinions expressed on the samples selected, which must be carried out beforehand, represents the value that allows the operator to identify the degree of satisfaction.

The verifier is responsible for distributing, on the basis of the opinion levels identified, the percentages of the values given to the spaces, that is to rank each spatial unit by satisfaction category and, through interpretation, to formulate the final evaluation.

The main aim of the model is to optimize the spaces for the purposes of the well-being of individuals affected by dementia, and therefore the recommendations must be

acquired before undertaking the design work in order to guide the choice of the solutions and achieve results coherent with the maximum levels of the indicators. In this sense, the purpose of the tool is to accompany the design path.

For the purposes of applying the verification, which represents the next step, solutions that have taken on board the indications and configured the design accordingly are clearly favoured.

The tool permits a quantitative evaluation of the existing interventions and at the same time provides operational indications for the design associating the choices with reward mechanisms that recognize the degree of coherence of the facilities with respect to the scientifically tested indicators provided.

The potential users are therefore all operators involved in the process of creating architecture for Alzheimer's sufferers. The decision-makers involved in governing the programme of interventions and defining the conditions to be prescribed in the drafting of invitations to tender, designers who assess the alternative solutions, guide the choices and make self-assessments of the outcomes, those in charge of performing the design verification procedures, and the valutors who attest the coherence of the existing facilities.

6. CONCLUSIONS

From an optimal perspective, the model applied to some case studies deemed significant could be more sophisticated, transferred to a computer and implemented through subroutines capable of automatically carrying out the mediation process for the single opinions, allowing users to express partial evaluations and obtain the summary result directly from the system.

This would make it possible to go from the most simplified option, in which a verifier analyses the case, summarizes the result and expresses an opinion, to an analytical-reconstructive alternative which allows us to formulate traceable and transparent partial opinions, consolidating the significance of the considerations expressed and increasing their incisiveness.

The privileged beneficiaries, as the main users of the tool, are the organizations and subjects involved for various reasons in the process of creating architecture for Alzheimer's sufferers.

It can be used by designers and researchers specialized in the sector, as well as the organizations²⁷ involved in the programming and reorganization of the network of facilities for dementia sufferers with particular reference

²⁷ Higher Institute of Health, Ministry of Health, Regions, Local Authorities.

to integration of the minimum requirements for operating authorization and the preparation of recommendation documents.

The outcomes of the application can also benefit guests

of Alzheimer's Day Centres, testing an innovative model of using the space, as well as care providers in verifying the real impacts on psychological, work-related and occupational well-being.

* **Alessandra Cucurnia**, Architect, PhD in Architecture Technology; University Researcher in the ICAR/12 Disciplinary Scientific Sector, Professor of Project Management and Technology, Bachelor of Science from the School of Architecture, Florence University.

e-mail: alessandra.cucurnia@unifi.it

** **Gianluca Darvo**, Architect, he attends the PhD in Architecture, program curriculum in Architecture Technologies, Department of Architecture, Florence University.

e-mail: gianluca.darvo@unifi.it

References

BIANCHETTI A., PIROTTI P., SILVANO L., FABRIZIO R., "Non so cosa avrei fatto oggi senza di te" Manuale per i familiari delle persone affette da demenza, Regione Emilia Romagna, progetto ministeriale demenze, II edizione, Aprile 2003.

BOWIE P., MOUNTAIN G., *The relationship between patient behaviour and environmental quality for the dementing*, International Journal of Geriatric Psychiatry, vol. 12, issue n. 7, July 1997, pp. 718-723.

BROOKER D., LA FONTAINE J., EVANS S., BRAY J., SAAD K., *Public health guidance to facilitate timely diagnosis of dementia: Alzheimer's COoperative Valuation in Europe recommendations*, International Journal of Geriatric Psychiatry, vol. 29, issue n. 7, July 2014, pp. 682-693.

COHEN-MANSFIELD J., WERNER P., MARX M.S., *The spatial distribution of agitation in agitated nursing home residents*, Environment and Behavior, First Published May 1, 1990, pp.408-419.

COHEN-MANSFIELD J., WERNER P., *Environmental influences on agitation: an integrative summary of an observational study*, American Journal of Alzheimer's Disease and Other Dementias, First Published January 1, 1995, pp. 32-39.

COHEN-MANSFIELD J., WERNER P., *The effects of an enhanced environment on nursing home residents who pace*, The Gerontologist, vol. 38, issue n. 2, 1998, pp. 199-208.

DAY K., CARREON D., STUMP C., *The therapeutic design of environments for people with dementia: A review of the empirical research*, The Gerontologist, vol. 40, issue n. 4, 2000, pp. 397-416.

DEPARTMENT OF HEALTH, *Health Building Note 08-02 - Dementia-friendly Health and Social Care Environments. Improving the environment of care for people with dementia*, March 2015 (scaricabile dal sito internet: https://artshealth-network.ca/ahnc/hbn_08-02.pdf).

EU HEALTH PROGRAMME 2008-2013, *Alzheimer COoperative Valuation in Europe (ALCOVE)*, Joint Action N° 20102201, Executive Agency for Health and Consumers.

FERRANTE T., *Valutare la qualità percepita: uno studio pilota per gli hospice. Evaluation of perceived quality: Hospice: a pilot study*, Franco Angeli, Milano, 2013.

FINKEL S.I., BURNS A., *Behavioural and psychological signs and symptoms of dementia (BPSD): a clinical and research update*, Internationale Psychogeriatrics Journal, n. 12, Suppl. 1, 2000, pp. 9-14.

FLEMING R., CROOKES P.A., SUM S., *A review of the empirical literature on the design of physical environments for people with dementia*, University of Wollongong Australia, Research Online, 2008 (scaricabile dal sito internet: <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=3923&context=hbspapers>).

FORBES D., BLAKE C.M., THIESSEN E.J., PEACOCK S., HAWRANIK P., *Light therapy for improving cognition, activities of daily living, sleep, challenging behaviour, and psychiatric disturbances in dementia*.

Cochrane Library, 2014 (scaricabile dal sito internet: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003946.pub4/pdf>).

FORNARA F., BONAIUTO M. BONNES, M., *Soddisfazione ambientale e qualità affettive percepite in relazione al grado di umanizzazione fisico-spaziale delle strutture ospedaliere*, Rassegna di Psicologia, n. 24, 2007, pp. 33-56.

GONZÁLEZ H.M., HAAN M.N., HINTON L., *Acculturation and the prevalence of depression in older Mexican Americans: baseline results of the Sacramento Area Latino Study on Aging*, Journal of the American Geriatrics Society, n. 49, 2001, pp. 948-953.

LOW L.F., DRAPER B., BRODATY H., *The relationship between self-destructive behaviour and nursing home environment*, Aging and Mental Health, vol. 8, issue n. 1, 2004, pp. 29-33.

MARQUARDT, G., BUETER, K., MOTZEK, T., *Impact of the design of the built environment on people with dementia: An evidence based review*, Health Environments Research & Design Journal, vol. 8, issue n.1, 2014, pp. 127-157.

NELSON J., *The influence of environmental factors in incidents of disruptive behavior*, Journal of Gerontological Nursing, vol. 21, issue n. 5, 1995, pp. 19-24.

PEARSON J.L., TERI L., REIFLER B.V., RASKIND M.A., *Functional status and cognitive impairment in Alzheimer's patients with*

[

and without depression, *Journal of the American Geriatrics Society*, n. 37, 1989, pp. 7-21.

PHIRI, M., *Design Tools for Evidence-Based Healthcare Design*, Publisher Routledge, 2015.

PRINCE M., COMAS-HERRERA A., KNAPP M., GUERCHET M., KARAGIANNIDOU M., *World Alzheimer Report 2016. Improving healthcare for people living with dementia, coverage, Quality and costs now and in the future*, *Alzheimer's Disease International (ADI)*, September 2016.

SHEPLEY M., BRYANT C., FROHMAN, B., *Using a post-occupancy study to validate a building prototype: An evaluation of a new women's medical center*, *Journal of Interior Design*, vol. 21, 1995, pp. 19-40.

SHERMAN S.A., VARNI J.W., ULRICH R.S., MALCARNE V.L., *Post occupancy evaluation of healing gardens in a pediatric cancer center*, *Landscape and Urban Planning*, vol. 73, 2005, pp. 167-183.

STEELE S., *The content of our character: A new vision of race in America*, St. Martin's Press, New York, 1990.

STEVENSON F., HUMPHRIS M., *Post occupancy evaluation of the Dundee Maggie Centre*, Ecological Design Group, School of Architecture University of Dundee, Bute Medical School, University of St. Andrews and the Maggie's Centres, Final Report for Sust., March 2007 (scaricabile dal sito internet: https://www.ads.org.uk/wp-content/uploads/4560_new-maggiacentre1.pdf).

WORLD HEALTH ORGANIZATION, *The ICD-10 Classifications of mental and behavioural disorders: clinical descriptions and*

diagnostic guidelines, 2015 (scaricabile dal sito internet: <http://www.who.int/classifications/icd/en/bluebook.pdf>).

ZEISEL J., SILVERSTEIN N.M., HYDE J., LEVKOFF S., LAWTON M.P., HOLMES W., *Environmental correlates to behavioural Health Outcomes in Alzheimer's Special Care Units*, *The Gerontologist*, vol. 43, issue n. 5, 2003, pp. 697-711.

Riferimenti internet

Alzheimer Disease International (ADI), www.alz.co.uk
Associazione Italiana Malattia di Alzheimer (A.I.M.A.), www.alzheimer-aima.it

Dementia Services Development Centre, <http://dementia.stir.ac.uk>

Department of Health, State Government of Victoria, Australia, www.health.vic.gov.au/dementia

Design Council, www.designcouncil.org.uk

Istituto Superiore di Sanità, www.iss.it

Ministero della Salute, www.salute.gov.it

NHS England, www.england.nhs.uk

Portale dell'epidemiologia per la sanità pubblica (EpiCentro), www.epicentro.iss.it

Royal Institute of British Architects (RIBA), www.architecture.com

The Center for Health Design, www.healthdesign.org

The King's Fund, www.kingsfund.org.uk

UIA Public Health Group, www.uia-phg.org

World Health Organization (WHO), www.who.int