Design & Health IV

Future Trends in Healthcare Design

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Foreword

This book contains a unique selection of papers based on presentations during the 4th World Congress on Design & Health (WCDH2005), sponsored by the International Academy for Design and Health. The Congress was organized in the city of Frankfurt, Germany on July 6-10, 2005. Authors, coming from all parts of the world represented varied yet related scientific and architectural fields. All papers submitted were of scientific importance and demonstrated the results of evidence based design. To ensure the quality of the conference, all submitted abstracts were reviewed anonymously by the Scientific Committee for relevance and content suitability within the framework of Design & Health.

Many of the papers presented in this book are case studies which strongly support the link between Design & Health. Good design is an essential component of healthcare; it forms the context and environments by which healthcare activities affect healing processes. Furthermore, the design and quality of health care has great impact on staff health and wellbeing.

The success of our 4th World Congress on Design & Health (WCDH2005) in Frankfurt would not have been possible without the collaboration of its participants whose thoughtful, carefully researched, innovative and creative contributions are presented in this book.

We appreciate the efforts of all of the Congress's participating authors whose shared experiences contribute to the field of Design & Health. The International Academy for Design & Health is very grateful for the generous support of all of its colleagues who have taken part in the long planning process for the 4th World Congress. I would like to thank Professor Lueder Clausdorff and Mr. Hartmut Wernich for the practical arrangements in organizing the Congress in Frankfurt.

The layout and design of this book has been prepared by guest researcher and architect Anna Sillitti at the Research Center for Design & Health in Stockholm. I am grateful for her professionalism and her interest in working on this book.

I deeply appreciate the careful review of the entire book by my colleagues and friends, Derek Parker FAIA, Director of Anshen + Allen Architects, San Francisco and Elliot Paul Rothman AIA, Director of Anshen + Allen + Rothman, Boston.

International Academy for Design & Health
Alan Dilani Ph.D.
Professor

Stockholm, July 2006

Introduction
Design and Health

Chair: Leuder F. Clausdorff (Germany)

Psychosocially Supportive Design-
As a Theory and Model to Promote Health

Alan Dilani

Alan Dilani, Ph.D.

Dr.Dilani is the founder and Director of the International Academy for Design and Health (IADH). He has been engaged worlwide in several universities in the field of Design and Health developing "Psychosocially Supportive Design Programs", both in Medical and Design Institutions. He holds a Ph.D. in Health Facility Design from the Royal Institute of Technology, Stockholm and a Master of Architecture in Environmental Design from the Polytechnic of Turin, Italy. His research at the Karolinska Institutet, Medical University, based on a multidisciplinary approach, leads to the new definition of design. That not only fosters functional efficiency, but also improves health processes. He is the author of numerous articles and books in the field of Design and Health including: "Design and Care in Hospital Planning" and editor of the book "Design and Health - The Therapeutic Benefits of Design". Professor Dilani is the Head of the Research Center for Design and Health in Stockholm.

Introduction

This paper provides a critical view of the challenges facing the field of health care design. The persistence of institutional and narrow functionally oriented approaches in which high priority is given to functional efficiency has largely neglected environmental qualities that could be considered psychosocially supportive. Modern disease concepts are no longer narrowly pathogenic; rather disease is seen as multifaceted, oriented to systems, with a variety of psychosocial factors in which the quality of physical environment has great impact.

Psychosocially Supportive Design, as theory and a model, presents a possible paradigm for health promulgation by design within the physical environment, generally and in particular within healthcare facilities. The Psychosocially Supportive Design approach is offered as a useful theory and framework to guide healthcare designers and planners who consider how the physical environment impacts wellness factors in order to promote health. The main issue here is to emphasize that the qualities of the physical environment require both functional efficiency and psychosocially supportive design, aimed at enhancing and creating conditions for health processes to evolve.

In order to define the characteristic of psychosocially supportive design, we need a clearer understanding of health definitions and to determine the distinguishing connection between the physical environment and health promotion.

Health and Wellbeing

In the 1930's it was discovered that something in the mind could lead to somatic diseases, revealing that some diseases are psychosomatic and that exposure to the surroundings, as positive distraction, has great impact on human health (Antonovsky, A. 1996). Human distress is highly affected by an integrated organism that has psychological, social and somatic aspects. Health promotion, as a conceptual platform for health, has been developed by the World Health Organization (WHO); it's vision states: "Health is a state of optimal physical, mental and social well-being, and not only the absence of disease." WHO has emphasized a range of recommendations for people to engage in practices and behaviors which promote health promotive, all leading to a decrease in human suffering and an increase in human happiness. The consequences will be crucial for disease prevention. WHO contends that successful promotion of health would have a major economic impact, because it would decrease the need for disease care expenditures and consequently allow people to be more economically productive, reducing absenteeism, and increasing work efficiency.

The concept of health promotion as championed by WHO is very attractive. The organization advances original ideas about how health promotion should be developed and implemented in broader fields. Unfortunately the economical consequences with respect to cost saving of health promotion have not been well documented. Presumably, people who are healthy are people who will live longer and might well have secure more years of economic dependency.

According to Aaron Antonovsky, the best arguments for health promotion lie in value rather than in market oriented terms. He cites the paragon of museums in which no one challenges that the museum experience pays off in cash.

Health promoters have not confronted the question of life style and the creation of appropriate social conditions that promote health. As a target for health promotion policy, “lifestyle” refers, for some, to the consciously chosen personal behavior of individuals as it may relate to health. Another interpretation of “lifestyle” is a composite expression of the social and cultural circumstances which condition and constrain personal behavior (McKinlay, J.B. 1993).

Environmental solutions that affect urban space and access to urban structure of the city have great impact on lifestyle and human behaviors.

Figure 1 *Providing wellness factors by designing place that stimulate social wellbeing (Sunderby Hospital Sweden)*

The quality of urban space can support health promotion by providing wellness factors that stimulate social and mental wellbeing. There is a lack of empirical knowledge about the effect of more appropriate physical environments on health promotion, despite the fact that world scientists continue to emphasize the environmental quality of disease prevention.

It is because there are good theories, a world of empirical knowledge, sophisticated techniques and methodologies, and of course most important evidence that many problems can be understood and managed. If the same efforts were used to address the causes of health and toward developing empirical knowledge with evidence, we could develop the concept of health promotion much further in a broader field. According to the WHO European Regional Office, "Health promotion is the process of enabling people to increase control over, and to improve, their health." "Health Promotion" is often understood as disease prevention in the community that encourages individual measures to help people develop lifestyles that maintain and enhance the state of well-being.

The concept of lifestyles as it appears in the literature is well documented. It includes a list of risk factors such as smoking, other substance abuse, over and under nutrition, drinking and driving, unsafe sex and exposure to injuries. The focus remains on the realm of disease prevention. However, lifestyle is somewhat broader-banded, because it identifies risk factors that are often precursors to a variety of diseases. The physical environment provides a context for lifestyle and thereby affects our behavioral and, in consequence, our health condition.

Salutogenic orientation as a basis for health promotion mandates both research and action towards developing psychosocially supportive design as context for a healthy lifestyle and positive distractions. Design factors such as wellness that actively promotes health, rather than only seeks to prevent risk factors aimed at preventing injuries, should be developed.

The salutogenic perspective which was developed by Aaron Antonovsky's concern for health promotion factors emphasizes wellness factors rather than risk factors. Antonovsky founded the concept of "salutogenes." He describes health as a continuum and an incessant process in which the extremes are health and disease. The factor that determines where on the continuum a person finds himself is a question of high or low sense of coherence.

The stimuli bombarding one from inner and outer environments were perceived as information that affects our behaviors. This stimuli and thought led to the emergence of the sense of coherence (SOC).

In the following text, I will describe my observations regarding the salutogena principles in a health promotion approach for the physical environment. My point of departure includes the factors which, in various ways, affect the sense of coherence in the physical environment that may stimulate our behavior in a positive way. According to Antonovsky, the decisive factors driving the sense of coherence are comprehensibility, manageability and meaning.

The strength of every one's sense of coherence is a significant factor in facilitating the recognition of health promotion and confronting the stressor. Persons with a strong sense of coherence will believe that a challenge are understandable (comprehensibility), believes that resources to cope are available (manageability) and finally wish to be motivated to cope (meaningfulness).

 

Figure 2 *Designing for the senses and place for social interaction. (Rikshospital, Oslo- Norway)*

Design that stimulates healthy behavior

Within the context of psychosocially supportive design, its implementation supports the coherence that stimulates and engages persons, both mentally and socially. The basic function of psychosocially supportive design is to start a mental process that, by attracting a person's attention, may eliminate or, at least, reduce anxiety, bringing about positive psychological changes. Design from a salutogenetic perspective defines, not only the causes of stress, but introduces wellness factors that strengthen health processes. Psychosocially supportive design should challenge our mind in order to create pleasure, stimulation, creativity, satisfaction, enjoyment and admiration (Dilani, A. 2001).

My hypothesis, based on the sense of coherence, is that there is a decisive link between psychosocially supportive design that creates healthy environments which then promote healthy behavioral responses that result from this creative health process. In this case, we need powerful, comprehensive and systematic theoretical guidelines for research and implementation of psychosocially supportive design.

Within this point of view, I do not wish to dismiss those whose concern for design addresses the prevention of risk factors in which the efforts are limited to functional factors rather than issues essential to design. These issues address functionality and our senses, both providing positive stimulation.

We need more longitudinal studies regarding the evidence to support such a hypothesis and to measure the salutogenic model approach in designing our daily environments. These studies could demonstrate the efficacy of such an approach in design toward producing significant health related change outcomes. We need to structure a program based on an intellectually systematic organizing framework that answers questions about how to define wellness factors in the design process, supporting our behavior to strengthen the sense of comprehensibility, manageability and meaningfulness.

There is an important relationship between a sense of coherence and the characteristics of the physical environment that strengthen people's emotional wellbeing. What movements in the daily life of a person, acting within the physical environment, could activate his/her emotion and strengthen his or her collective experience? Do the characteristics of a designed environment affect our behavior and thereby our emotional state? These characteristics will lead us to the science of psychoneuroimmunological effects of the environment on the immune system and neuroscience, and to research about how the brain perceives design qualities related to the central nervous system in relation to the effect of exposure from the surroundings.

During my past fifteen years of research, I focused on the effects of design on health and wellbeing, finding a more profound understanding of the problem through the theoretical approach of the Salutogenic model for creating a healthy environment. Assuming the need for social support, a core problem of elderly persons living alone who are socially isolated, it is through the physical environment we could provide more access to social support. For example, we could build a central setting that facilitates part of a social structure for the community or, close to other settings, we could facilitate social interaction. Within the local community, it would be desirable to provide places where elderly persons could easily socialize- by attraction and stimuli from other activities such as at a children's school close to elderly, as in the following photo in the next page (Norling, I. 2001).

With the aging of the population and the increase in the incidence of neurodegenerative diseases, the medical costs of Alzheimer's disease will increase steadily in the coming decades. It would be useful to know exactly how much care will cost, who will pay for it, and to what extent it is likely to grow. However, the specific medico-social costs of Alzheimer's disease are difficult to distinguish from other costs because of physical dependence and multiple disorders that may affect elderly people generally. Currently, it is almost impossible to obtain reliable financial data. Through the physical environment, there are possibilities to reduce social costs, anxiety levels, and depression accompanied by the consumption of drugs (Zeisel, J. 2005).

The quality and character of the built environment has a profound influence on our health. During the last thirty years, architecture and design have been influenced by our industrial society. Public buildings like airports and hospitals were designed to function like factories. In hospitals, clinical practice formerly focused on treating illness while neglecting the psychological, social and spiritual needs of patients. Entering one of today's older hospitals, you may find that signs that are difficult to interpret and the corridors, with people rushing about, appear endless. It makes you feel lost and anxious. If you weren't ill before, you certainly might be after waiting for hours in a crowded, stuffy, featureless waiting room (Dilani, A. 2000). Contrast that with the welcoming environment of some of the best of the new hospitals where you may encounter water features, an orchestra playing pleasant music, natural daylight, and works of art. Such an environment stimulates our senses, soothes our nerves and makes the whole hospital experience comprehensible, manageable and meaningful.

The Importance of Design for our Senses

Aesthetic enjoyment through wellbeing- of the eyes, the ears, touch taste or smell- is a fundamental human need. Like other abilities, the senses need stimulation and practice to thrive. Sounds, for example, contribute to enlarging and reducing an architectural experience. Rooms and materials reflect sound in various ways. There are pleasant sounds and unpleasant sounds. Designers and architects sometimes spend a great deal of effort on the sound of environments, independent of their designing concert houses and theaters. One goal is to reduce or filter unwanted sound; another is to highlight beautiful and serene sounds such as rippling water and clicking sounds, informing us that a box or a door is closed. To find the right sound for a product has become an increasingly more important job for designers. If the sensory appeal is heightened with a pleasing handle, pleasurably tactile and smelling materials etc., it will increase people's inclination to make the most of these environmental qualities. Personal insight is awakened, reflecting well on the value of a good environment. Medical research has shown how these sensory qualities stimulate patient recovery; the environment has a great positive influence on elderly patients, in particular.

Care and maintenance is often neglected in public environments; a worn and unattractive environment contributes to a sense of hopelessness and recklessness. Lack of administrative and caretaker sensibility becomes a vicious circle. A scrubby environment lowers the inclination to care for this environment, thus increasing wear and tear and littering. A beautiful environment increases the will to keep up maintenance. Durable materials which age in a beautiful way contributes, therefore, to long-lasting aesthetics and a more sustainable society.

By design I also mean form and architecture; that the built environment consists of components which together make up the architectural whole. Size and variation affect aesthetic and physical qualities toward the final architectural result. The same argues for colors, wallpaper, lamps and rugs, furnishing the building, floor and wall materials, interior products, bathroom and kitchen equipment, use of materials

Figure 3 *Elderly and school setting integrated within the social structure of the city.*

such as ceramic design, textile design, interior design and industrial design, all skills of the design professions. Products for the outside environment, such as bus stop booths, public telephones, signs and other typographical items, materials for groundcover etc., all have a shape which someone needs to make a decision about. If all of these factors do not function well or do not have the qualities which correlate to the need for a suitable purpose, good architecture will not be achieved. Details and the whole are interdependent. It is not unusual that furniture which the furniture designer developed and tiles and washbasin which the ceramicist designed, specifically for a particular interior, turned out so well that they thereafter were produced on a big scale for a larger market.

Research and action

Despite the fact that the human being spends more than ninety-percent (90 %) of his/her time in man-made indoor environments, the existing knowledge of how these environments affect human health is still insufficient (Evans G. W. 2003). Earlier research in environmental psychology has shown that architectural parameters such as stimulation (intensity, variety, complexity, mystery, novelty, noise, light, odor, color, crowding, visual exposure, proximity to circulation, adjacencies), coherence (legibility, organization, thematic structure, predictability, landmark, signage, pathway configuration, distinctiveness, floor plan complexity, circulation alignment, exterior vistas), affordances (ambiguity, sudden perceptual changes, perceptual cue conflict, feedback), control (crowding, boundaries, climatic & light controls, spatial hierarchy, territoriality, symbolism, flexibility, responsiveness, privacy, depth, interconnectedness, functional distances, focal point, sociofugal furniture arrangement), and restoration (minimal distraction, stimulus, shelter, fascination, solitude) are closely linked to the perception of positive and negative stress.

Figure 4 *Music performance in the main entrance of hospital Chelsea and Westminster, London*

The question is: Can the positive architectural characteristics required to reduce stress, as mentioned previously, be concretized and implemented in current workplaces and the overall built environment, thus strengthening the sense of coherence and its consequent promotion of health? We need to go one step further in order to pursue this concept that links health promotion and design- that is, how to reduce stress through architectural design.

It is of critical importance that the field of design, as the creator of the physical context for health promotion, lacks a theoretical approach. As a basic foundation, the salutogenic approach should be considered to be the crucial point of departure in an attempt to develop a theoretical approach for psychosocially supportive design. It should be developed further as common ground for a design theory to promote health.

This theory has been proposed as a direction and focus, allowing the field to commit to its concern about all aspects of the human encounter in relation to the physical environment. The theory suggests that we not only design for stress reduction, but focus on salutary rather than risk factors. Designers and planners should always focus on stimulating and rejuvenating the entire person's mind and body, rather than only addressing risk and prevention factors. As one methodology, the sense of coherence linked to this design approach is a respectable way to apply health promotion by design. I have discussed a comprehensive source and guide for research and action. I believe that the salutogenic approach in design provides a common objective and is a particularly appropriate model for psychosocially supportive design.

Conclusion

The salutogenic approach, as a link and model to a design approach for health promotion, provides a basic theoretical framework for Psychosocially Supportive Design. It provides a model and theory to promote health by design. There is a need to systematically investigate and conduct more empirical studies that verify this model. It is a model that posits that health outcomes are not only linked to stress reducing factors but are linked to environmental qualities that could measure the positive effects of health outcomes. Furthermore, this effort requires informed leadership to guide the organization through the salutary approach process.

The issue of psychosocially supportive design is not only the task for designers; it requires that the entire organization should understand the meaning of salutary organization. Designers could support the effort by quantifying the benefit of such an approach. The organization should measure the sense of coherence; the staff should comprehend it and act on it. We believe that the staff resources to cope are available (manageability), waiting to be motivated (meaningfulness). Design qualities that could be included as wellness factors should be identified follow: access to nature; art; colors; sound of music and nature; lighting; access to pets; use of culture; familiarity; creating landmarks and references in buildings; aesthetics; harmonious and cheerful color; social interaction and neighborhoods; spatial composition and articulation; provision of inviting spaces for social support, all of which seek to engage mentally with positive stimulation that could strengthen people's sense of coherence. This approach emphasizes both psychological and social components that are crucial for health outcomes.

In this nascent stage of scholarship about design and health promotion, the most pressing need is for a better understanding of the psychological and social components that could potentially link a sense of coherence to quality of wellness factors within the designed environment. Psychologically Supportive Design provides the theory, knowledge and models for advancing healthcare design.

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New Dimensions for Future Healthcare Facilities

Romano Del Nord

Romano Del Nord, Professor

Prof. Romano Del Nord is deputy rector for the University of Florence, Italy and Professor at the Faculty of Architecture. He is chairman of the Scientific Committee of the 3th World Congress on Design and Health. He serves as Director of The Interuniversity Research Center (TESIS), a research and teaching program of healthcare facilities. The Center conducts research on "wayfinding humanization, space pathologies" and the impact of new technology on the planning of healthcare facilities. He is also engaged as a consultant for the Ministry of Public Health developing regulations and guidelines for hospital design. He serves as an "expert" for the Ministry of Public Works and for the Ministry of Education. He owns the architecture firm "CSPE Architects" in Florence, designing various types of healthcare facilities.

One of the ambitious goals of our "Academy" (Design and Health) is to enrich the debate on health policies with contributions which are the fruit of scientific and planning research, in order to support the development of new visions, through which, actions of health protection and promotion can be governed.

The questions most insistently asked nowadays are: what "space" will health treatment have, and what should we understand by "care" or "assistance", in a future scenario characterised by a renewed dimension of the concept of health? As things stand, over 40% of the social/health expenditure borne by governments is absorbed by hospital structures. The main factors cutting into this expenditure and determining the very nature of the hospital today are directly connected to phenomena such as the growing use of techno-medicines, biotechnologies and e-health, the unstoppable increase in health service consumerism, and the effects induced by longer life expectancy.

The progressive and necessary disappearance of the boundaries between the various medical/surgical specializations aimed at making treatment less fragmented, the growth of new "medical practices" connected to the introduction of gene therapies, selective chemotherapies, immunotherapy, stem cells, the most recent radiotherapy techniques, and the ever-growing weight of chronic pathologies and rehabilitation activities are all factors that make it essential to rethink not only the idea of "Hospital", but also the idea of the whole infrastructural system within which said "Hospital" is situated.

If we are to ask ourselves what form the system of health-care will take in future and which criteria should direct future choices, we must also bear in mind the current, urgent demand for the improvement of the human condition. This requires deep, intrinsically philosophical and humanistic, reflection. In fact, medicine itself, more and more frequently, now feels the need to consult the disciplines of philosophy and social sciences in order to orientate its future development or to correct wrong directions already taken. Health care is becoming, more and more, the "taking care" of human beings according to the peculiarities of their nature and way of life.

Figure 1 *What space for care and assistance?*

This interpretation of the "vision" which must inspire the future reformation of the health system poses two types of questions from the operational point of view: what can the future locus of treatment be, and what requirements must be considered in its (re)conception so that it can be the true expression of a renewed conception of treatment? The object of the research in the sector of health infrastructuring thus reaches further and further beyond traditional "healthcare facilities," and embraces all the living environments which generate or increase the risk factors threatening our state of health and well-being, and which have the potential to damage them to the point of provoking discomfort and disease. (The places of well-being are not only those of health treatment!)

"Care" means considering individuals and their life-environment. Since this environment is the scenario of the variables which influence their health, it should be seen as the main operational area for the wide-ranging modernisation of health strategies. The life environment is so becoming the locus of care. "Caring" for people is increasingly taking-on the meaning of integrating good physical/physiological functioning with psychological, social, moral, and religious components. If we accept the importance of the close interdependence of psyche and body (a sort of "holy alliance"), greater emphasis must inevitably be placed on studies and research on "stress," because this factor is posited to be at the origin of several of the most serious, widespread, and costly pathologies, and also because it is correlated to the environmental conditions in which it is generated (and which we plan!). Ippocrate (Hippocates) wrote, "Iatros philosophos isotheos: the doctor who becomes a philosopher is equal to a God".

Psycho-immunological studies have shown a link between the experience of stress and changes in the immune system, consisting of modification of the efficacy of said system and in some cases a reduction of its capacity for defence against both- outside infective agents, and tumour growth. The proven link between stress, mental disorders and diseases, whose huge increase over the last few years, is one of the most significant features of the new pattern of distribution of pathologies in the population of the developed countries, immediately makes us aware of how widespread the effects of this phenomenon are.

"Stress" is treated in scientific research as a psychological and medical concept. The studies concerned with the modelling of the phenomenon are in agreement that it derives from problematic interactions between a person and the environment in which he/she lives and operates. According to this concordant vision of the origin of the phenomenon, it is impossible not to consider the environment in its physical/spatial dimension as a fundamental locus in the generation of conditions and factors of risk which can stimulate "stress responses."

Thus "stress" is authoritatively proposed in the literature as a heuristic tool for scientifically investigating the relationship between the physical environment and people's condition of health or ill-health. Hence the concept and phenomenon of "stress" may also be considered as a possible criterion for the correct planning of the care locus, since this is a place of proven stress generation. In the words of Saegert, "Those responsible for conceiving the future built spaces of life must aim at minimising the stress-inducing qualities of the environment and maximising its stress-reducing qualities."

Research has moreover revealed that some conditions and factors related to the architectural dimension of the built environment may influence human health, altering the "stress" levels of the people living or working in them.

The Hospital is certainly an emblematic type of built environment for an investigation of this kind. "Stress" and "hospital" are closely connected through the two fundamental events of illness and hospitalization, so much so that they can cause illness-induced distress plus hospital-induced distress.

Figure 2 *The hospital building as an occupational stresstor.*

Hospital buildings, as they are conceived today, on the basis of operational approaches which do not address the potential negative impact of its architectural features on health and well-being, have clearly shown that they possess certain stress-inducing qualities which are able to seriously threaten the psychophysical balance of its users.

Also, the Hospital building is highly significant in relation to the problem of occupational stress. The medical staff, and more importantly the paramedical staff are considered to be in occupational categories which are strongly exposed to the effects of stress on health. We should also mention the effect on patients' state of health through the increase in clinical errors and an impoverishment in clinical/nursing performances related to occupational stress.

The image of the "hospital environment" as an architectural expression, almost exclusively emphasising efficiency, has led to the common perception of the hospital as a stressful place. It is "incomprehensible," "alien," "intimidating." Familiarity with its physical arrangement, its scale, the symbolic meaning transferred are planning areas requiring application of a conception of the built environment which controls psycho-emotional stress conditions.

A recent research-report published in England, significantly entitled "The role of hospital design in the recruitment, retention and performance of NHS nurses in England (2004)" revealed that 86% of the nursing chiefs surveyed claimed that "…the design of the hospital building is a means for improving the performance and morale of the staff." From this derive the positive consequences in terms of more applications to work there, and greater ability to retain the labour force. On the basis of the results of this research, the CABE (Commission for Architecture and Built Environment), the body from whom it was commissioned, has formally urged the English government to "…..place the quality of the architecture at the top of the agenda for the implementation of the vast building programme of social/health structures now in progress."

In the more general context of Hospital structures, the specific context of the Children's Hospital is an exemplary case of the problem of health care as prevention at the onset of states of stress which can impair the patient's health outcomes (i.e. not only considering the clinical outcomes alone.) In the specific case of this type of hospital, the concept of "environmental vulnerability" finds a concrete expression in the stress-inducing potential of the physical/spatial environment. The paediatric hospital may thus become a "paradigmatic physical place" in order to focus the process of conception of spaces for health care.

Children are more exposed to the negative aspects of the built environment and more dependent on the features of the social/physical environment because of the role this plays in their correct, healthy development. At the same time because of this dependence, the positive impact in health-giving terms, which could be pursued by planning the built environment with this in mind, makes further, scientific research on this topic, especially interesting and important.

Taking care of children as patients, means taking care of their whole experience of hospitalisation, placing special emphasis on the emotional and psycho-social dimensions which form the particular character of their response. The control of emotional distress, in which the main manifestations are fear and anxiety, is the principal aim of the project through which interaction between children and hospital, is generated.

The importance of the physical environment in the overall economy of children's experience of hospitalisation is demonstrated by research and by the emphasis given to it in the declarations of the main organization and institutes.

Figure 3 *Children hospital as an exemplary case*

The CFHI declares its aim of "developing a system of care that will focus on the physical, psychological and emotional well-being of children attending health-care facilities, particularly as inpatients." The same document states in standard 2, which most directly addresses the physical dimension of the hospital, that "...the environment in the health-care facility should be secure, safe, scrupulously clean, and child- and family-centred, avoiding the inducement of fear and anxiety in the child..." The concept of "paediatric patient" cannot be confined within a unified description however wide and generalised this may be.

The extreme variability in the level of physical/psychological, psycho-emotional, cognitive and cultural maturity that is linked to the various stages of development within the paediatric age, requires that the physical environment be able to modulate and adapt itself to support the varying specific connotations of the environmental vulnerability of this evolving human being.

Let us consider the differing abilities of the baby/child to manipulate, and control the environment according to his/her level of physical development related to height, physical strength or motor coordination. The different levels of maturity of a child's psycho-cognitive development correspond to different skills in understanding and using the physical context. For architects professionally addressing this particular planning who ratinalise the many dimensions of the revised concept of care, the working-out of suitable architectural solutions is a unique opportunity for modernising the stress-reducing potential of the built environment. My personal experience of planning the new Meyer Children's Hospital in Florence re-proposed modernisation of an operational vision for planning control of those psycho-sensorial, social and practical environmental conditions that greatly and significantly contribute to the formation of the hospitalisation experience, adding to or removing their negative effect on the children's and also the parents' lurking fears.

Figure 4 *New "Meyer" Children's Hospital in Florence (Italy)*

Essentially, the concept of a child-friendly environment may be expressed as the capacity of the hospital environment to represent, as far as possible, a logical continuity of the baby's/child's life experience.

The physical and social environment of the hospital must present traces of a "continuity," despite the necessary "change" that the illness produces. It must speak to the child's developing sensory perceptions, imagination, cognitive and cultural structures. Continuity of life experience also means continuity of the emotional, psychological, sensory and social stimuli which constitute the fundamental input for the child's very growth, and prevention of involutional manifestations in the behaviour of the hospitalised child. The entrance to the hospital structure is a highly important symbolic and spatial locus. It is the psycho-emotional imprimatur through the first impression it generates and it materially marks the event of passage into the hospital. Fears and anxieties can be confirmed by the first impact with the building. Nature, with its stress-reducing restorative value that lies at the root of our human evolutionary history, communicates familiarity, security, tranquillity, as well as cultural and aesthetic mediation.

Green spaces can speak to children's imagination, taking-on animal shapes which draw their attention away from the contingent experience and attenuate their fears and anxiety. Green spaces are the favourite places for play, freedom, and contact with animals. If children can maintain a continuity of relationship with this type of space, they have a bridge to their own healthy life which can continue its course despite its momentary restriction to the perimeter of the hospital building.

The hospital must be permeable to the child's network of relations, offering spaces and facilitties which support the continuity of his/her social life and of the development of his/her sociality. The parents, for whom for the smallest children constitute the whole "social universe," must be able to stay beside the child during the day and even more during the night when fears and anxieties are amplified by fear of the dark. The child's building-up of the fundamental relationship of trust and reassurance with his parents, in parallel the development of the parental role, must not be interrupted by the design of the hospital.

From birth, tactile perception is the vehicle of the social relationship between the newborn baby and the mother, and it is through the latter that the level of attachment between them is established. Creating spaces inside the hospital for breast-feeding means creating the principal locus where this primitive vital bond is formed. Whereas for an adult a chair is for sitting on, for the child's imagination not yet tamed by too many cultural rules a chair may be an object for climbing on or a horse for riding. Sitting and waiting is for a child, at the very least, a boring activity, and certainly an occasion for keeping his/her mind fixed on the fact of being in hospital. Thus the seating design may influence the waiting experience, adapting to children's cognitive/behavioural particularities and offering them an opportunity for positive distraction.

Since the hospital is a place of many prohibitions ("don't touch that", "don't go near this") and limitations, it in itself supports a context which inhibits and suspends children's experiential autonomy, mainly expressed through tactile and motor interaction with the environment.

Figure 5 *Emotional and psycho-social dimentions*

Figure 6 *The access to the building*

Guaranteeing children the continuity of this type of environmental experience means offering them fundamental opportunities of normal activity and perception.

The control of children's psycho-emotional perception of the environment and the fear and stress linked to illness also depends on what children see and what is hidden from them or masked in some way. The perception of objects is not neutral but linked to the emotional conditions in which it occurs. As such it may give rise to phenomena of perceptive deformation which further increase the stressed response towards what is seen. Several planning strategies might be pursued in order to interrupt this perceptive short circuit. They include strategies explaining to the child what the strange machines he has seen or are about to be used actually are and are actually used for; hiding the machines which are not useful or are no longer useful; occupying his line of vision with pleasurable objects which speak to and encourage his healthy side

It seems to me appropriate, now, to conclude in this sense by recalling the words of Frank Lloyd Wright in an interview: "Hospital patients should never be imbued with any idea that they are sick…. health should be constantly before their eyes."

Healthy Workplace Design

Chair: John Wells-Thorpe

Workplace Design and Health Performance

Elisabet Schell

Elisabet Schell, RPT, MSc, PhD

Elisabet Schell, is registered physiotherapist from University of Lund 1969. She has MSc degree in physiotherapy at Karolinska Institutet, Stockholm. As RPT she is specialised in orthopaedics, rheumatology, rehabilitation and occupational & environmental health. She wrote a book "Neck and Back pain; to prevent, palliate and cure" in 1998 with co-writer Karin Lorenz. She has been engaged for Television and Radio programs as "backpain-specialist". Elisabet Schell is also professional ergonomist since 1994. She has been working in Occupational Health at the Swedish Broadcasting Company more than 20 years on prevention and rehabilitation, health promotion in general, and related teaching. Several projects on working environmental interventions and workrelated rehabilitation interventions have been performed by her and her colleagues. The results have been applied on local, national and international levels. In addition to her work she is now a part-time PhD student at the Karolinska Institute in Stockholm.

Introduction

Sick leave caused by musculoskeletal disorders (MSDs) is staying high. and sick-leave caused by mental stress and depression has been increasing during the latest decade in Sweden according to the National Social Insurance Board, 2004. When introducing an office ergonomic intervention program Amick BC 3rd et al 2003, showed that musculoskeletal symptoms could be reduced. According to Juul-Kristensen B et al 2004, risk factors for developing shoulder, elbow and back symptoms among computer users could be reduced by interventions such as work pauses, reduction of glare or reflection and screen height.

An early ergonomic work place intervention for employees with MSDs-related absenteeism was evaluated by Arnetz B et al 2003. The intervention group claimed less costs as compared to the reference group.

Psychological factors at work and in private life as risk factors for low back pain are analyzed by Hoogendoorn WE et al 2000. The impact of decision latitude, psychological load and social support at work on musculoskeletal symptoms was described by Johansson JA and Rubenowitz S 1994.

In their review on work organization and leadership, Karasek L and Theorell T 1990, point out "feeling of belonging to the work society" as an essential factor for health. Schnall et al 2000, and Theorell T 2000 show further importance of work organizational factors.

In a Swedish population study, differences between genders and professions were found concerning the influence of work-related physical and psychosocial factors on seeking care for neck or shoulder disorders according to Thornquist EW et al 2001. After a long period of studies about physical factors such as loading and noise, as well as hierarchical status in work organisations, the research focus extends to study the design of work environments at large.

The impact of design and architecture on occupational and patients health was studied by Dilani A *2000 and 2001*. However, the impact of ergonomic laboratory research on practical design of work environments is still poorly understood as pointed out by Dekker S and Nyce J 2004. To capture background data for future study designs, it is important to analyze employees´ opinions on this issue.

Aim

As a part of a larger study on occupational and individual health of employees at the Swedish Broadcasting Company for Television (SBCT), and with orchestra musicians at the Swedish Broadcasting Company for Radio (SBCR-O), questions on ergonomics and aesthetics were included. The aim was to analyze in a cross-sectional study, in order to determine if the self reported need for ergonomic improvements and lack of aesthetic environment were associated with socio-economic status, health status, occurrence of musculoskeletal symptoms, stress and depression, life-style, professional position, and work environment.

Methods

Study persons

All employees at SBCT in Sweden and SBCR-O in Stockholm who had been employed 12 or more months and were not on long term (> 6 months) leave due to studies, childbirth, working abroad, or sickness were included and asked to answer a questionnaire. Age, professional position according to the company's coding system, and total sick-leave during the year before the study as reported in the company files were recorded.

Questionnaires

The questionnaires were distributed by company mail. (The return envelope was included). The questions on ergonomics and aesthetics were: 1. Do you consider that your workplace ergonomics need to be improved? 2. Do you consider that your workplace aesthetics need to be improved? The answer alternatives were: yes, definitely; yes, in high degree; yes, in some degree; and no, not at all:

The following groups of variables with pre-validated questions were included: 1. Socio-economics; 2. Health and disease; 3. Professional position; 3.Work environment; and 5. Life style. The occurrence of pain in neck, shoulder, back and other musculoskeletal organs, work stress, depression, and sick-leave were particularly considered.

Variables included in the questionnaires concerning the time period of last 12 months:

- Satisfaction with general life conditions (VAS scale)
- Education level
- Sleeping disturbances
- Intensity of pain (VAS scale) in neck, shoulder, upper and low back, and other musculoskeletal organs
- Frequency of treatment for neck, shoulder, upper back or low back
- Frequency of treatment for stress or depression
- Worry about own recent health
- Sick-leave due to neck, shoulder, upper back or lower back disorders
- Sick-leave due to stress or depression
- Subjectively stated relationship between pain, workload and stress for each of pain locations above
- Occurrence of work related negative stress
- Occurrence of work related problems in general
- Noise at work
- Influence on work (VAS scale)
- Dissatisfaction with work circumstances (VAS scale)
- Frequency of physical training
- Smoking and alcohol intake
- Working hours per week
- Working hours with VDU (Video Display Unit)
- Working hours with VDU in leisure time

Some of the questions are equal to those used by Statistics Sweden (Living Conditions Survey 2003, and Report no 95) in their repeated population studies, or those used in SNQ (Standardised Nordic Questionnaire), Kourinka I et al 1987.

A 4-week test-retest reliability analysis of the other questions in the current study was performed. Thirty-two (32) out of randomly selected 40 persons (80%) participated. All questions showed significant correlation with mean p-value 0.001 (<0.001-0.007) and correlation coefficient mean 0.76 (1.00-0.47) by Spearman´s non-parametric test.

Statistical methods
Spearman´s correlation, Pearson´s correlation, univariat analysis of variance, one-way anova, chi-square and logistic regression analyses were used.

Results

2641 fulfilled the inclusion criteria, and 1961 answered, mean 74 (86-70 % in subgroups). The mean age was 48 years (21–67). 43% were females and 67% males. There were no differences in participation between Stockholm, where the headquarters are located, and the rest of the country. Between participants and drop-outs there were no statistically significant differences in age, gender, and education.

The distribution of the answer alternatives on “need for ergonomic improvements” was as follows: yes, definitely 16%; yes, in high degree 18%; yes, in some degree 49%; no, not at all 17%. There was a difference between genders (p=0.034). Males found the need more often than females, 85 and 81 %, respectively.

The distribution of the answer alternatives on “need for aesthetic improvements” was as follows: yes, definitely 27%; yes, in high degree 19%; yes, in some degree 36%; no, not at all 17%. There was no statistical difference between genders (p=0.083), but 83 % of males found the need and 79 % of the females.
Education levels and work demands is described in Table 1-2.

Table 1. *Education levels.*

	n	%
Compulsory school (9 yrs)	94	4,8
Gymnasium or professional education (12 yrs)	391	19,9
More specific professional education	338	17,2
College/University BA (16 yrs)	614	31,3
University MSc	139	7,2
Missing information	385	19,6
Total	1961	100

Table 2. *Subjective work demand*

	n	%
Psychologically demanding	1404	71,6
Physically demanding	90	4,6
Both psychologically and physically demanding	425	21,6
Missing information	41	2,2
Total	1961	100

There were positive statistically significant correlations between:
- Working hours per week with VDU and neck and shoulder pain (p=0.003, p=0.004 respectively).
- Subjectively stated relations between shoulder pain and stress (p=0.008), shoulder pain and work load (p=0.001) as well as neck pain and work load (p=0.002).
- Total working hours per week and pain related to workload for neck, shoulder, upper back and low back (p=0.001, p=0.001, p=0.004, p=0.015 respectively).
- Working hours with VDU per week and pain related to work load for neck, shoulder and low back (p=0.002, p=0.001, p=0.006 respectively).

There were no statistically significant correlations between working hours per week and any musculoskeletal pain; working hours and pain related to stress; VDU work at leisure time and pain; VDU work at leisure time and pain related to workload and to stress.

Socioeconomy

There were statistically significant differences between the expressed “need for ergonomic improvements” and age, gender, and general life circumstances. Male gender (p=0.034), lower age (<46 yrs) (p<0.001) and satisfaction with life circumstances were associated with higher reported need for improvements (p=0.001). Whereas higher education did not show significant correlation (p=0.063). “Need for aesthetic improvements” was significantly correlated only to age (p<0.001). Younger persons (< 47 yrs) expressed more than older ones “need for aesthetic improvements” (p<0.001). Higher education level showed a similar tendency (p=0.059), whereas gender and satisfaction with general life circumstances did not show significant correlation.

Health and disease

According to the company’s sick leave register, 53 % (37 % females and 63 % males) had no sick leave (p<0.001). 54 % of females and 42 % of males had 1-183 days sick leave. Older persons, had statistically significant less sick leave than younger (p=0.016).The mean satisfaction on general life conditions was 7 on a 0-10 scale. There were statistically significant positive correlations between “need for ergonomic improvements” and all tested variables: the occurrence of musculoskeletal pain (neck, shoulder, upper and low back and other musculoskeletal organs) (p<0.001); pain intensity (p<0.001); subjectively stated connection of pain (neck, shoulder, upper back, low back and other musculoskeletal organs) to stress (p<0.001); subjectively stated connection of pain (neck, shoulder, upper back, low back and other musculoskeletal organs) to work load (p<0.001); treatment frequency for musculoskeletal pain (neck, shoulder and back), (p<0.001) and for stress or depression (p<0.001); sleeping disturbances (p<0.001); worry about own health (p=0.004); self reported sick-leave due to neck, shoulder or back pain (p=0.015) and to stress or depression (p=0.021).

“Need for ergonomic improvements” was strongly correlated to occurrence of pain: p<0.001 for each of pain locations. It was most obvious for shoulder and neck pain. For those who reported a definite need for ergonomic improvements, the mean estimated pain on a VAS-scale was 5.2/10 for shoulder and 4.6/10 for neck pain. For those who reported no need for ergonomic improvements, the means were 2.3 and 2.6 respectively. The distribution of the total sum (0-50) of the reported musculoskeletal pain (neck, shoulder, upper back, low back and other musculoskeletal organs) in relation to the stated “need for ergonomic improvements” was as follows: yes, definitely 21.1; yes, in high degree 17.7; yes, in some degree 13.5; no, not at all 10.4.

There were statistically significant positive correlations between “need for aesthetic improvements” and the following variables: the occurrence of musculoskeletal pain (neck, shoulder, upper back, low back and other musculoskeletal organs p<0.001-0.028); pain intensity (p<0.001-0.028); treatment frequency for musculoskeletal pain (neck, shoulder, upper and low back p=0.039); sick-leave due to neck, shoulder, upper or low back pain (p=0.036).

“Need for aesthetic improvements” was correlated to the occurrence of pain, p<0.001- p=0.40 for each of pain locations. It was most obvious for shoulder and neck and upper back. For those who reported a definite need for aesthetic improvements, the mean estimated pain on a VAS-scale was 4.3/10 for shoulder, 3.6/10 for neck and 2.9/10 for upper back pain. For those who reported no need for aesthetic improvements, the means were 3.4, 3.0 and 2.0 respectively.

The distribution of the total sum (0-50) of the reported musculoskeletal pain (neck, shoulder, back and other musculoskeletal organs) in relation to the stated "need for aesthetic improvements" was as follows: yes, definitely 16.7; yes, in high degree 15.0; yes, in some degree 14.7; no, not at all 13.1. There were no statistically significant correlations between "need for aesthetic improvements" and the following variables: treatment frequency for stress or depression; sleeping disturbances; worry about own health; and sick leave due to stress or depression.

Professional position

There were statistically significant differences between "need for ergonomic improvements" and the groups of professional position ($p<0.001$). Under Table 3, those who reported the highest "need for ergonomic improvements" were photographers, reporters and program leaders, sound/light/picture technicians, and studio and work room professionals. Those who mostly reported no need at all were high chiefs and IT staff. There were statistically significant differences between "need for aesthetic improvements" and the groups in professional positions ($p<0.001$). In Table 3, those who reported the highest "need for aesthetic improvements" were: musicians, reporters and program leaders, sound/light/picture technicians, studio and work room professionals, and persons working directly with productions. Those who mostly reported no need at all were high chiefs and IT staff. See Table 3, below:

Profession group according to code	*n*	*% of total*	*Ergo yes 1 %*	*Ergo yes 2 %*	*Ergo some %*	*Ergo no %*	*Aest yes 1 %*	*Aest yes 2 %*	*Aest some %*	*Aest no %*
1.Administration	320	16,3	12,9	13,2	49,4	24,5	18,2	15,3	39,5	27,1
2. Persons with high chief position	85	4,3	6,0	7,2	41,0	45,8	12,0	12,0	41,0	34,9
3. Chiefs reporting to (2)	70	3,6	10,0	18,6	52,9	18,6	18,6	22,9	40,0	18,6
4. Studio- and work room professionals (e.g. masks, wig-makers, carpenters, painters, costume-makers, tailors and assistants)	77	3,9	16,9	22,5	54,9	5,6	30,6	11,1	36,1	22,2
5. Picture/sound/light technicians	190	9,7	19,7	24,2	49,5	9,7	31,9	21,6	33,5	13,0
6. Photographers	144	7,3	22,6	24,8	43,8	8,8	24,2	15,9	31,8	28,0
7. Persons working directly with productions	373	19,0	18,1	17,9	47	17,0	30,0	20,9	31,7	17,4
8.Reporters, program leaders and editorial workers	507	25,8	19,2	20,4	49,8	10,7	32,7	20,7	33,9	12,6
9. IT staff	35	1,8	11,4	5,7	45,7	37,1	14,3	14,3	42,9	28,6
10. Research and development technicians	79	4,0	5,1	12,7	51,9	30,4	10,3	19,2	51,3	19,2
11.Symphony orchestra	75	3,8	15,1	9,6	63	12,3	40,0	29,3	29,3	1,3
Missing information	6	0,3	0	0	100	0	16,7	66,7	16,7	0

Table 3: *Number and % of participants in different professional groups. Distribution of answer alternatives in % for "Need for ergonomic improvements" (n=1917) and "need for aesthetic improvements" (n=1905) in professional groups. Ergo=ergonomic; Aest=aesthetic. Yes, definitely=yes1; Yes, in high degree=Yes 2; Yes, in some degree=some; No, not at all=no.*

Work environment

There were positive correlations between "need for ergonomic improvements" and occurrence of disturbing noise ($p<0.001$); stress ($p<0.001$); problems within work ($p<0.001$); low influence on own work ($p=0.006$); dissatisfaction with the work circumstances and general problems in work ($p<0.001$); subjectively stated connection of musculoskeletal pain to stress and (neck, shoulder, upper back, low back and other musculoskeletal organs) ($p<0.001$ - 0.003); subjectively stated connection of pain (neck, shoulder, upper back, low back and other musculoskeletal organs) to work load ($p<0.001$).

There were no statistically significant correlations between "need for ergonomic improvements" and physical or psychological work demands or both physical and psychological demands.

There were positive correlations between "need for aesthetic improvements" and occurrence of disturbing noise ($p=0.035$); stress ($p<0.001$); problems within work ($p<0.001$) dissatisfaction with the work circumstances ($p=0.003$); musculoskeletal pain related to work load and to stress ($p<0.001$-0.003).

There were no statistically significant correlations between "need for aesthetic improvements" and physical or psychological work demands or both physical and psychological demands, low influence on the work, and general problems in work.

Life style

There were no statistically significant correlations between "need for ergonomic improvements" and high intensity of physical training (>30 min at least tree times per week), smoking or alcohol intake whereas those who were physically active (>30 min 2 times or less than two times a week) stated a higher need of ergonomic improvements ($p=0.001$). Those with high intensity of physical training (>30 min at least three times per week) had a high need of aesthetic improvements ($p=0.001$). So did daily smokers ($p=0.010$).

Logistic regression analyses

In logistic regression analyses concerning age, gender, education level, stress in work, problems in work, sleeping disturbances, smoking and leisure time training (> 30 min at least three times per week) the following correlations were found:

"The need of ergonomic improvements" was positively correlated to lower age, work stress, sleeping disturbances and problems in work ($p<0.001$-0.002), whereas gender, education level, training and smoking were not. "The need of aesthetic improvements" was positively correlated to lower age, work stress, problems in work, training and smoking ($p<0.001$-0.023), whereas gender, education, sleeping disturbances were not.

Discussion

The results in the current study pointed out correlations between the stated need for ergonomic improvements in working life in all the included areas such as: socio-economic and health status, occurrence of musculoskeletal symptoms, stress and depression, professional position, work environment, and life style. Many of the results in the present cross-sectional study were expected. They confirm earlier results about the complexity of work related health concerning musculoskeletal disorders, work load, work stress, influence on own work, and psychosocial factors (rehabilitation outcome included) by Karasek R and Theorell T (Ed) 1990, Johansson JÅ 1995, Basmaijan J.(Ed) 1995, Linton SJ 2000, Hoogendoorn WE et al 2000, Feyer et al 2000, Hansson T and Westerholm P (Ed) 2001, Jensen I et al 2001, Evans O et al 2002, , Arnetz B et al 2003, Nachemsson et al report no 145/1 "Neck and Back pain" 2000 and Alexanderson K et al report no 167 "Sickleave" 2003 (www.sbu.se).

The present study analyzes the “need of ergonomic and aesthetic improvements” in a large working population from varying geographic areas and with many professions and working positions, namely: 1. Administration; 2. Persons with high chief position; 3. Chiefs reporting to no 2; 4. Studio- and work room professionals (e.g. masks, wigmakers, carpenters, painters, costume-makers, tailors and assistants); 5. Picture/sound/light technicians; 6. Photographers; 7. Persons working directly with productions; 8.Reporters, program leaders and editorial workers; 9. IT staff; 10. Research and development technicians; 11. Symphony orchestra members.

The fact that the ”need of aesthetic improvements” mostly were correlated to the same variables as the “need of ergonomic improvements” puts the focus on the importance of the work place design in general. These findings correspond well to the descriptions and discussions by Dilani A 2001 and 2002 where he points out the importance of well performed hospital workplaces and care room´s design for workers health and recovering patients. The current study indicates that these conclusions are also valid for other workplaces. Possible cost benefits, including such as less sick leave and higher work effectiveness, could be achieved by ergonomically and aestheticicall well designed and well performing work places in addition supported by to wimproved work organization.

Conclusion

A cross-sectional study on eleven different professional groups at radio and television companies (1961 persons) showed a significant correlation between stated needs of both ergonomic and aesthetic improvements in relation to the following factors: socio-economic and health status; professional position; work environment; and life style ($p<0.001$-0.034). There were more and stronger correlations for ergonomics and health variables than for aesthetics. The need for aesthetic improvements (definitely and in high degree) was 46%; and of ergonomics 34%; no need at all was 21% and 17 % respectively. High chiefs and IT-staff were those who had the lowest needs.

The correlations of aesthetic and ergonomic needs to lower age, higher education level, work stress, problems in work were mostly the same. I logistic regression analyses proved that the results stayed significant for both aesthetic and ergonomic needs.

The fact that the ”need of aesthetic improvements” mostly was correlated to the same variables as the ”need of ergonomic improvements” places the focus on the importance of work place design in general.

These results may indicate that benefits, such as less sick leave and higher work effectiveness, can be achieved through ergonomically and aesthetically well designed work places combined with well designed work performance strategies and procedures.

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Healthy Workplace Design for Healthcare Staff

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Jeanette Paul is Head of the School of Design at the University of Dundee, Scotland. She is a registered architect who practiced in Scotland for several years prior to her appointment in lecturing and research. Her research has focussed on workplace environment in the UK and its effect on users, and she has published collaboratively on this subject. The School of Design in Dundee has a research focus on healthcare design. Jeannette Paul's current research is a collaborative project with the School of Nursing ond Midwifery, funded by NHS Estate in UK. Het particular interest in this field is the effect of the workplace environment on staff wellbeing.

Abstract

The National Health Service in the UK has been dealing with massive change; changing technologies, change in working methods, and change in stakeholder expectations. Consequently, staffs are under increasing pressure to adapt to these changes. The NHS has focussed on patient-centred care (DoH 2000). It is argued that, while this is obviously an important driver, there has not been adequate attention directed towards staff wellbeing. The healthcare environment is one which can be enormously stressful for both patients and staff. As such, the environment must be designed to alleviate that stress. To enhance productivity and to redress the recent trend in high absenteeism, poor retention of staff and difficulties with recruitment, the NHS must address staff morale and satisfaction. Healthcare workers need to be accorded dignity and respect through provision of a decent workplace environment.

The paper describes a nationwide study of the design of maternity facilities in the UK. The research seeks to establish to what extent environment affects the performance and satisfaction of maternity unit staff and how this impacts on patient wellbeing. The hypothesis is that there is a strong correlation between staff and patient satisfaction levels.

The methodological approach is derived from Environmental psychology and post-occupancy evaluation. The paper describes the quantitative and qualitative methodology used and the initial results which have been obtained.

The preliminary findings indicate staff dissatisfaction with their work environment. Privacy, security, provision of spaces for respite, and lack of visual contact with exterior space are the prime issues of concern. The paper makes suggestions for built spaces which designers and the procurers of new maternity units need to consider.

Key words: Healthcare workers, interior design, work environment

Introduction

The National Health Service in the United Kingdom has focussed on patient-centred care (DoH 2000). Although this is an important driver, it could be argued that there has been insufficient attention directed towards staff well-being. The hypothesis of this research is that there is a strong correlation between staff and patient satisfaction levels. The importance of 'quality of care received' rates consistently highly in all patient satisfaction and patient experience surveys (Reeves, R. Coulter, A; et al 2001, Press Ganey, 2003), therefore the relationship of the patient with the caregiver is obviously of vital importance. Staff morale and satisfaction with their work environment will impact on the care provided. Consequently, the needs of healthcare staff must be acknowledged and catered for in the design of healthcare facilities.

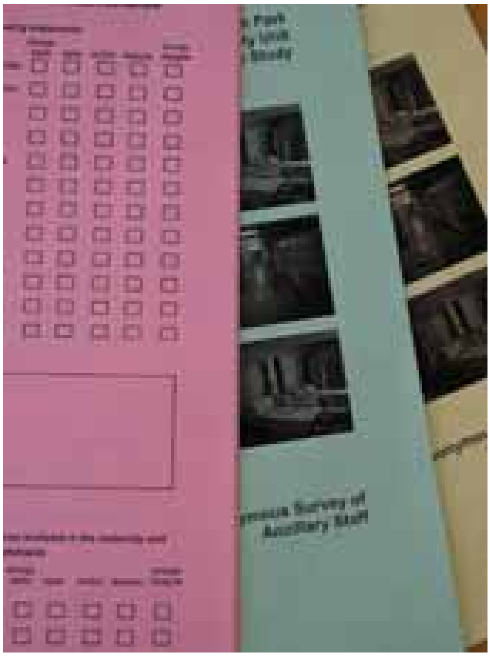
This research study explores the effect of interior environment on the users of maternity units in the U.K. To date, very little research has been conducted into the wellbeing of healthcare staff with specific relation to workplace environment, although a recent study by PricewaterhouseCoopers (2004) was one of the first in the UK that focussed on the role of design of the environment on the retention, recruitment and performance of NHS nurses. This study concluded that the design of hospitals impacted on nurses' performance more than retention and recruitment. In the UK, figures indicate that there is difficulty in retaining and recruiting midwives, and in July 2004, 76% of maternity units across the UK were reporting a staffing shortage (Royal College of Midwives 2004). Factors which were cited as attributing to retention and recruitment difficulties were stress and heavy workloads.

This paper discusses an ongoing study which aims to determine the environmental factors that are of particular importance to healthcare staff in the unique setting of maternity units. It seeks to identify various factors related to the design which impact on the psychological and physiological health and wellbeing of staff and patients through the examination of existing and accepted design models in maternity units. This evidence based research will be used to inform future design models for maternity units.

Methodology

The research is investigating seven maternity units throughout the United Kingdom. The sample was selected to give an evenly distributed geographical spread and variation in population, covering both large conurbations and small towns providing maternity care for rural areas. The sample also includes the spectrum of different organisational structures within maternity care: Midwife-led units, Obstetric units, Labour/ Delivery/Recovery and Post-partum units.

A multi-method approach was adopted, which relies on a combination of quantitative and qualitative methods to confirm the validity of the results. Self-completion questionnaires were issued to all healthcare staff (midwives, healthcare assistants, doctors, cleaners/ domestic staff and porters).



The questionnaire was presented using a five-point Lickert scale and staff was asked to respond to questions requesting an evaluative assessment of variables of the architectural environment including ergonomic factors, layout, size and relationships of spaces, temperature, heating, ventilation, lighting, etc. Questions were also asked about psychological perceptions of environmental variables such as privacy, security and personal space and other work process factors including organizational structure and inter-personal relationships within the workplace. The Perceived Stress Scale (Cohen et al. 1983) was used in conjunction with the staff questionnaire to ascertain whether there were any extraordinary life circumstances which might be influencing their satisfaction with the job.

The postal questionnaires were substantiated with focus groups that sought to explore some of the most important issues raised in the responses to the questionnaires and to obtain further qualitative data. Face-to-face structured interviews were carried out with individual healthcare managers, facilities managers, and when possible, the domestic services managers. In addition to obtaining further information, this investigative process allowed comparison of perception across different working groups.

The healthcare work environment was also assessed using the NHS Estates Achieving Excellence Design Evaluation Toolkit (AEDET). This Toolkit seeks to assess the quality of various attributes of healthcare buildings under three categories: Functionality, Impact and Build Standard with ten subcategories that include Access, Citizen Satisfaction, Internal Environment, Performance and Construction.

It was considered important in this research that the functionality of the maternity units should be analysed from a user perspective, because has been demonstrated that architects' and designers' evaluations of quality in buildings differ significantly from those of lay people (Gifford, Hine et al 2002). The AEDET was therefore adapted to a more ethnographical approach whereby the questions and categories were re-ordered to facilitate the researchers in performing a walkthrough analysis of a typical staff journey and the different user experiences encountered on this journey. This walk-through analysis supplemented the information obtained from the questionnaires, interviews and focus groups, providing an integrated evaluation assessment.

Although the research is investigating the effect of the design of maternity units on all users, this paper will focus specifically on the results related to midwifery staff.

Preliminary findings

Because the research is ongoing and will not

Situation of unit	Type of unit	Birth rate annum
Large teaching hospital in a major city	Consultant Unit	5500
General hospital serving a series of small towns and a rural population	Consultant Unit	1920
Birth center forming part of a community hospital in a major city	Midwife Led Unit	420
Maternity unit within a women and children's hospital in large city	Consultant Unit	4900
Birth Center attached to outpatients' hospital in suburb of large city	Midwife Led Unit	500

Table 1 *Maternity unit sample*

be completed until April 2006, the preliminary findings discussed here pertain to only five of the maternity units being investigated. The units which are included in the findings to date are categorised as follows: Maternity staff often have different shift patterns and working practices compared to other ward based staff. It has been determined through the focus groups and interviews that many midwives choose to work "long shifts" of twelve hours at a time. In addition to giving them more days away from the unit, this shift pattern also allows them a longer period in which to supervise a mother throughout labour and delivery. However, the implications of this are that staff are exposed to a potentially stressful environment for longer periods of time.

In the questionnaire, staff was asked to indicate any aspects of the interior environment which they felt might contribute to personal health problems. They were also given the opportunity to explain their response in the open comment box after the question. The response to this question indicated the following:

Aspects of the interior environment which staff perceived might contribute to personal health problems	Percentage perceiving a problem %
Noise levels	16.3
Lighting	42.5
Air quality	53.5
Access to rest areas	36.1
IT or telecommunication equipment	12.8
Suitability of clinical equipment	15.7
Suitability of office furniture	21.0
Other	14.0

Table 2 *Staff response to personal health problems attributable to environment*

The relationship between job satisfaction and perceived health problems was investigated using Spearman's rho. There was a negative correlation between the two variables showing an association between low satisfaction ratings and reported health problems. It can be seen from Table 2 that the factors which were the cause of greatest concern were air quality followed by lighting and access to rest areas.

i) Air quality

The quality of air was found to be a significant problem for many midwives and was rated higher than the other factors in terms of causing personal health problems.

57.9% of staff either disagreed or strongly disagreed that the temperature in the ward was comfortable and, in response to further questions, 43.4% did not believe that the air in the rooms was fresh. It was commonly considered that spaces were overly warm, particularly in staff rooms and offices which often did not have windows. In conjunction with the high temperatures, some complained of high humidity in rooms occupied by a large number of people, but the majority of complaints referred to the air being excessively dry, resulting in dry skin, eyes and throat. A regular comment was that staff had little control over the air quality and temperature. Many spaces suffered from having no windows and those that did often could be opened no more than 75-100mm owing to security precautions. Some staff expressed concern that the high temperatures combined with the lack of ventilation created an environment where ailments such as the common cold flourished. Comments included:

"Unable to control air quality, must be done by maintenance personnel, no control switch."

"Working a 12 hour shift with the heat and lighting often gives me headaches, particularly if I have been too busy to drink enough."

		Job Satisfaction	Health
Job Satisfaction	Correlation co-efficient Sig. (2-tailed) N	1.000 . 164	-.153 .050 164
Health	Correlation co-efficient Sig. (2-tailed) N	1.153 .050 164	1.000 . 171

Table 3 *Correlation between job satisfaction and health*

ii) Lighting

Lighting was the second highest source of dissatisfaction in terms of factors contributing to health problems. In a further question asking specifically about natural daylight and artificial light, 29% of staff either disagreed or strongly disagreed that the amount of natural light (i.e. daylight) was adequate. Some described this as "depressing" while artificial lighting was reported as causing headaches.

Comments included:

"Poor and unnatural lighting can make reading or clinical work more difficult."

"No direct light is depressing."

"Due to poor light in office, get headaches when using p.c."

Staff commented that they felt happier working in the wards which had large windows as opposed to those with small windows or without windows and, if possible, enjoyed views, preferably of natural scenes. (This is verified in research carried out by Kaplan (1987 cited Hildebrand 1999, p.1) and Ulrich (1983). Midwives complained that while the labour rooms and wards often had good natural daylight, staff offices suffered from lack of windows and natural ventilation.

iii) Access to rest areas

This research has evidenced that it is rare to find a maternity unit that provides satisfactory spaces for staff respite on the ward. This is stressful for staff and psychological stress can potentially lead to health problems. Staff was asked whether access to rest areas contributed to personal health problems. 28% indicated this to be the case. The results show that this factor was third highest in potentially contributing to midwives' health problems. In a further section asking for an assessment of staff facilities, 93.5% indicated that the quality of staff rest areas was important to them, but 70% either strongly disagreed or disagreed that the facilities aided rest and relaxation.

"There is nowhere to go in the maternity unit to eat that is nearby but not on the ward. I am continually disturbed on my break by queries from other staff. I usually end up going outside."
"Need area to rest, to get away from work environment."
"On antenatal ward, the break area is little more than a cupboard with no windows."

iv) Noise

In addition to the question asking for factors impacting on personal health, 43% either strongly agreed or agreed that noise levels were a problem on the ward. The research has determined that there are a number of irritating sounds which can affect concentration levels. Within the units surveyed, the noises which were perceived as causing a nuisance were:

- Telephones ringing
- Printers and computer equipment
- Noise from the buzzer on the secure door entry system
- Noise created by cleaning and kitchen staff
- Noise from lifts

Although midwives commented on the fact that birthing mothers in labour often generate substantial noise, this type of noise was not raised as a problem in the questionnaires. As the Nurses Station is also the area commonly used by staff to complete clinical records, there is a danger that concentration levels are affected. The consequent need to adapt their behaviour to this noisy work environment is stressful. This is supported by research carried out by Topf and Dillon (1988) and reported by Ulrich and Zimring (2004) which states that "nurses often have to complete charting and fill medication orders in crowded noisy makeshift areas which can lead to errors and increase staff burnout."

v) IT equipment

This was the factor which was perceived as being least likely to cause health problems, with only 8.5% citing this as problematic.

> "My eyesight is not fantastic and I am sure the more time I spend on the computer the worse it gets."

Judging by the comments from staff in the open comments box, the problems were less to do with the IT equipment itself and more often related to where the equipment was positioned. For example, staff complained of lack of space to access the IT equipment (see paragraph vii below).

vi) Clinical equipment

There were comments regarding heavy clinical equipment having to be moved by staff contributing to health problems. It was observed also by some staff that they often had to walk a long distance along corridors to access clinical equipment. A further complaint was that "not finding clinical equipment is stressful." Through interviews and on-site evaluation, it was established that storage is generally a problem, more particularly for large items. As a result, equipment is left lying around in corridors or corners of rooms, thus rendering it difficult for staff to locate.

vii) Office Furniture
Some midwives indicated dissatisfaction with what they termed "non ergonomic furniture."
It was also noted that the desk area at the nurses' stations were "very cramped." In one unit, the amount of space available for midwives to write up their clinical records was approximately one metre in length and was shared by up to five midwives.

viii) Other
Other factors identified by staff as contributing to health problems included the weight and size of beds and other furniture especially in the delivery rooms.

ix) Further comments
In addition to the health problems highlighted above, the research has revealed that staff have concerns regarding their personal safety and security which creates another stressor in their work environment. Staff has to deal with aggressive birth mothers and their partners and frequently drug users. There was concern that although access was restricted by the entry buzzer system, as the access doors were often located at a distance from the actual Nurses Station, unauthorised people could enter behind those gaining permitted access. The rooms used as offices were constantly criticised as being of an unsatisfactory standard. Offices were undersized for the number of people required to use them and did not account for the increased amount of administrative work required of staff.

The offices had inadequate ventilation and often no natural light. Overcrowding is recognized as a stressor (Farshchi & Fischer p 61) as is the need for the body to adapt to inadequate thermal and lighting conditions.

Recommendations for designers and procurers of new maternity units

From the research findings to date, a number of issues have been revealed which designers and procurers may consider in the design of new maternity units or refurbishment of existing units.

Nurses Stations
An in-depth analysis of staff working patterns within maternity units is necessary to identify the purpose and location of the nurses station. Traditionally the nurses station was a central desk overlooking a large ward where staff observed patients and wrote up patient notes. With the move towards smaller 2 and 4 bed wards and single rooms, the nurses' station is now located in the corridor and serves a different function,

with computer terminals, printers, telephones and fax machines. Midwives now spend a large proportion of their time at the nurses station occupied with administrative duties, writing up notes and entering data into a computer. Consideration must be given as to whether the nurses station is the best location for such duties. In the USA, the Health Insurance Portability and Accountability Act (HIPAA) has produced guidance about protection of patient confidentiality which will prevent the storage of patient notes in open files at desks on corridors. As similar moves towards data protection are in place in Europe, it is time to consider the design and layout of the nurses' station.

It has been observed in this research that nurses' stations can also be the source of a great deal of noise. Not only does this affect staff concentration but it was also commented by birthing mothers that they found the noise a problem when they were trying to sleep. Provision of a suitable office/records room and a central handover room where medical staff can meet and discuss care strategies in privacy would address some of the issues pertaining to nurses' stations.

The control of patient entry systems by staff situated at the central nurses' station must also be reconsidered as this is a frequent source of distraction for staff and another source of noise and disturbance for those patients whose rooms are nearby. Where possible, maternity units should consider a dedicated security staff member who will deal with visitor access needs at a separate point from the nurses' station.

Respite and refreshment areas

One of the most important findings of the study so far is the need for staff privacy. Privacy is defined as the ability to control interpersonal behaviours and access to and exposure of the self (Archea 1977). Maternity care requires staff to work together as a community and many work long shifts, attending women throughout the length of labour. Places of respite where staff can escape from the demands of patients, intercom and telephones are vital to allow staff time to recuperate. According to Westin, emotional release is the "safety valve" function afforded by privacy and he states that "without the aid of such a release…most people would experience serious emotional pressure (Westin 1967)." Some maternity units provided access to a centralised restaurant facility in the hospital. However, staff complained that where no specific area for staff was identified, staff found themselves taking refreshments beside the partners or family of the woman whom s/he was attending and thus never found respite from the job.

In larger hospitals, the restaurant facilities are often too far removed for staff on restricted lunch breaks. In all of the units which have been evaluated so far, nursing managers have adapted spaces designed for other functions to provide "on the ward" break rooms for staff. Most of these are inadequately situated and under-sized. Procurers and designers of new maternity units must consider staff facilities as equal in importance to patient facilities and make provision within the budget for suitable spaces with quality furniture and fittings to ensure that staff feel valued.

Clinical environment

Besides the provision of staff offices/ workspaces suited to the increased number of administrative duties, staff are also concerned about the following factors which hinder their ability to perform clinical duties:

- Natural light was identified as of importance as visual contact with exterior space particularly fot maternity staff working long shifts.
- Staff would prefer to have some localized control of heating and ventilation. This is a difficult problem to resolve because different individuals will have individual preferences for ambient temperature and air movement. To compound this difficulty, energy saving controls will impact on a fully controllable system. However, where possible, opening windows should be provided it fitted with security stops.
- More storage is needed, particularly for large items of equipment.

Conclusions

In the UK, the recruitment and retention of midwives is an issue of concern. There are numerous variables which may impact on this such as working practices, pay scales, shift patterns etc. However, the workplace environment can have a significant impact on staff satisfaction and performance. Considered design can eliminate or reduce the environmental stressors which may significantly contribute to reducing the dissatisfaction levels in staff consequently improving performance and staff retention. This is supported by a comprehensive analysis of a large number of research studies which were carried out in the United States by the Robert Wood Johnson Foundation and the Center for Healthcare Design. It indicated that the healthcare environment not only has an effect on patient health but also appreciably affects staff effectiveness, health,and satisfaction (Ulrich & Zimring 2004). This research has identified that, with reference to midwifery staff, there is an association between low staff satisfaction ratings and reported health problems related to interior environment.

Designers and procurers of new healthcare buildings need to address staff needs. In the NHS, staffing accounts for 60-80% of the total costs for new Private Finance Initiative (PFI) healthcare facilities. According to Sir Stuart Lipton, "...for every £1 spent on construction, £5 is likely to be spent on maintenance and £200 on staffing costs (Lipton 2002)." This supports the argument that attending to the needs of staff in healthcare facilities must be placed higher on the agenda.

There needs to be innovation in the way design is perceived, commissioned, and executed; and to do that a clear understanding of users needs is required through evidence based research. This research has indicated that a new analysis of staff work patterns to consider the suitability of existing and newly conceived ward layouts, office accommodation, and rest facilities is required. This would lead to the development of new design solutions which truly could be termed as evidence based design.

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Healthy Environments and PPP Impact in the UK

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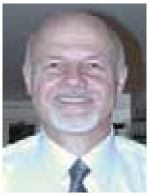
Delivering Healthy Environments via PFI
Kenneth Schwarz

Healthcare Design Development in UK
Susan Francis

Evaluation of PFI Built James Cook University Hospital
Geoffrey Purves

Delivering healthy environments via Private Finance Initiative (PFI)

Kenneth Shwarz



Kenneth Schwarz,

Kenneth Schwarz is Senior Partner of Anshen+Allen San Francisco and Director of its subsidiary, Anshen Dyer London. He holds a Masters Degree in Architecture from Massachusetts Institute of Technology and has devoted the bulk of his 25-year career to the planning and design of healthcare facilities. In 1992 his team won an international competition for the design of Norfolk & Norwich Hospital. This subsequently became the largest hospital in England developed under the Government's Private Finance Initiative, and a forerunner of other significant PFI projects in which Mr Schwarz had a key role. In parallel with project-focused work Mr Schwarz has pursued research aimed at achieving a sound balance of humanist values and clinical efficiency in healthcare facilities – a constant theme in his design projects, teaching activities, publications and talks.

Can good environments for the delivery of healthcare be successfully achieved under the Private Finance Initiative (PFI)?

PFI has been touted for bringing private sector expertise and capital to the development of healthcare facilities, effecting the transfer of risk to the private sector, and achieving a better balance between capital costs and long-term running costs. PFI has become the principal method by which major healthcare facilities are procured in Great Britain and is viewed with increasing interest elsewhere.

Critics, however, charge that the pressurised commercial culture at the heart of PFI leads to sacrifices in quality, innovation, flexibility and the broader contributions to the community of which such projects should be capable.

To address this debate, this paper draws lessons from the experience of Anshen Dyer Architects' decade-long involvement in the planning and design of PFI healthcare projects. In particular the paper offers examples from four aspects of hospital design that are essential to creating successful healthcare projects: - physical integration with the surrounding community; a lively, coherent campus; optimal building blocks, adjacencies, and flows for clinical efficiency; and a physical environments that promote healing.

The examples, all from recent PFI healthcare projects, offer evidence which indicates that, under the right circumstances, hospitals developed under PFI can achieve these aims as well as hospitals developed by other methods.

Integrating the Hospital with Its Community: Newcastle, Royal Victoria Infirmary

A hundred years ago, the Royal Victoria Infirmary was developed in Newcastle, near to the centre of town, next to the University and the city's major park. But the hospital was fenced.
The project comes at a time when the city itself is changing. With the decline of the coal industry, Newcastle has been regenerating itself as a

service-oriented city, often relying on architecture to help raise its profile. The city is already well known for its built form, from the seven landmark bridges that span the River Tyne to the famed classical buildings of Grey Street. Recent redevelopment efforts have included the £240 GBP million transformation of Grainger Town, the historic heart of the city centre, into a high-quality mixed-use urban quarter, restoring dozens of historic buildings. In addition, more than £250 GBP million is being invested along the river front to create one of the largest cultural and leisure destinations in Europe. As part of this regeneration, the redevelopment of the Royal Victoria Infirmary will connect the hospital to a vibrant city centre and further add cohesion to the urban fabric.

The hospital's new master plan includes 70,000m2 of new clinical space for tertiary emergency and elective services, and a new children's hospital - along with measures to better integrate the campus with the surrounding community.

The potentially overwhelming physical scale of the new hospital building is reduced by disaggregating it into its natural components – wards and outpatient facilities, diagnostic and treatment block, children's hospital, clinical offices and restored historic buildings for non-clinical uses. Further, each element is designed as a bespoke block of distinctive shape and material - for instance, the round copper-clad children's hospital. These blocks are joined to ensure clinical functionality.

Figure 1 *Red lines indicate major hospital circulation routes. Left-hand vertical line represents external mall. Righ-hand vertical line represent internal gallery*

Major circulation routes are introduced through the campus - outside in the form of a mall that enables free passage north to south for the convenience of the University community and the general public - and inside in the form of a long skylit gallery envisioned as the new heart of the hospital, providing reception points, catering and retail outlets and clear passage for patients and staff throughout. The glazed end of the gallery offers views of the University iconic Armstrong Tower, thereby symbolically reinforcing the connection between hospital and University.

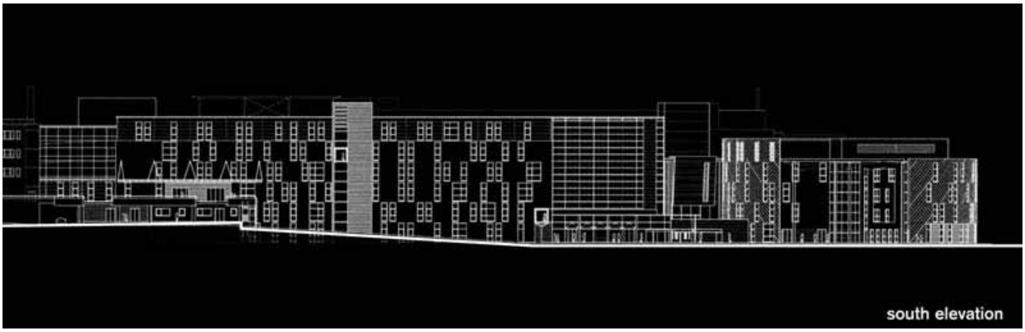


Figure 2 *The facade of the hospital form the edge of the external mall, variety of shapes diminish the scale of whole. Children's Hospital at far right.*

Figure 3 *View of the main entrance with distinctive copperclad drum of Children's Hospital to the right.*

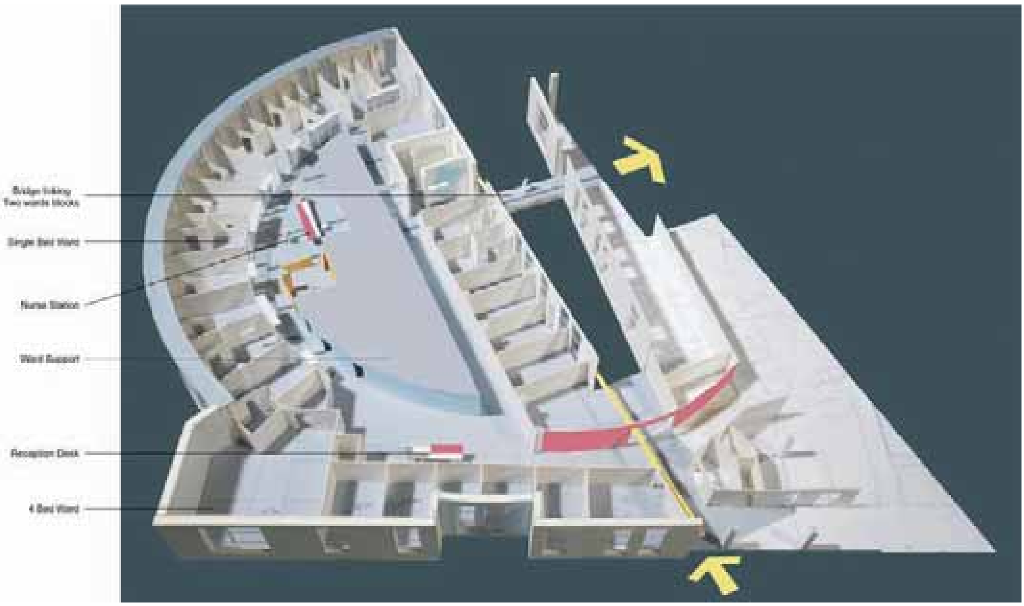


Figure 4 *The shape of the Children's Hospital derives from the circular ward which is designed to better separate differing patient groups and impart informality.*

Not long ago, in a speech marking the start of construction, the Chairman of the hospital Trust, Sir Miles Irving, predicted that "although this facility is being built for treating patients, it will have a much wider impact - that is its contribution to the regeneration of the northeast of England". This statement goes far to emphasise the signal importance that this and other major hospital projects have for their communities – socially, economically, in terms of civic pride and quality of healthcare. It also emphasises the importance of integrating the hospital with its community, operationally and physically.

Planning a Lively, Coherent Campus Manchester Joint Hospitals Project

Over time, healthcare campuses often lose their original coherence, as new buildings are added or old ones modified without an overall plan guiding development. Gradually it becomes harder for visitors to find their way. Open space gets filled in. Fewer and fewer landmarks provide guidance. Posting maps and directional signs can only do so much when the physical layout has become too complex. Most importantly, clinical effectiveness is diminished.

An example of this is the major healthcare campus in the university district of Manchester, less than a mile from the city's downtown. Built over a century ago, the campus includes the Manchester Royal Infirmary and four specialist hospitals. A variety of factors have conspired to blur the original plan over the years and make navigation through the site difficult: infill development to replace buildings destroyed by bombing during World War II, additions and alterations to meet changing clinical requirements, and piece-

Figure 5 *MRI Campus, 2003*

meal redevelopment. The spaces between the patient ward blocks have been filled in. It is no longer possible to walk across the campus except through a maze of corridors, with little exterior space to provide a sense of orientation. The campus needs other upgrades as well. Few of the facilities are configured and equipped for modern healthcare delivery. And because each of the hospitals had originally been established separately and operated independently, there is much duplication of spaces and services. The recent consolidation of all these hospitals under the administration of one hospital Trust, enables the rebuilding of the campus for improved clinical functionality, and in the process, to take advantage of the economies of sharing specialist services and to improve the quality of the campus environment.

The Manchester Joint Hospitals Project creates a unified campus. The key was to insert a major green space and landscaped boulevard, creating a new centre for the campus. The second largest open public space in Manchester, this green space not only provides respite, it also serves as an orienting device for navigation through the complex. Vehicles have a clear path through the campus, with car parks at either end.

The boulevard serves as the nexus for pedestrian paths and provides access to public transportation. The 150,000m2 of phased development includes new facilities for six distinct hospitals. Four of these—Manchester Royal Infirmary, Royal Eye Hospital, St. Mary’s Women’s Hospital, and Manchester Children’s Hospitals (relocated here from outlying sites) - are placed

Figure 6 *The new boulevard and complex of six hospitals, four of witch are under one roof, Children’s Hospital to the right.*

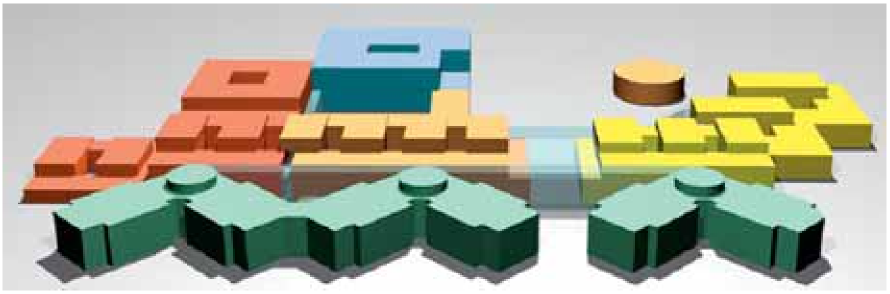


Figure 7 *Generic model of principal building blocks of hospital: wards, diagnostic and treatement, outpatient/office, specialist intitute (blue).*

under a single unifying roof. To allow each hospital its identity, each has its own individual entrance, skylit reception hall, outpatient, and ward facilities.

Figure 8 *From the terrace of the new cafe on the boulevard; the creche, education centre and staff residences in restored historic buildings beyond.*

However, they are connected to a shared diagnostic and treatment block with imaging rooms, surgical theatres, and key diagnostic and treatment services. The Children's Hospital located on the corner of the facility, features a playful curving façade random-height windows and roof top play area to give it a child-friendly identity. The other two hospitals on campus, the Rehabilitation and Mental Health Hospitals, are located in new freestanding buildings.

The campus retains a number of historic buildings, restoring the best of the Edwardian Baroque structures along one side of the new boulevard to create a nucleus of nonclinical support facilities, including administrative offices, staff residences, education centre, library, café, and crèche. Historic buildings along the traditional front of the hospital, Oxford Road, have been preserved, while new infill buildings such as the crèche and part of the graduate education centre afford this complex new relevance and vitality. There are also plans to develop some of the older buildings into residential flats, which will further enhance the liveliness of this part of the campus.

Optimizing Buildings, Adjacencies, and Flows: Norfolk & Norwich University Hospital

The massive flow of design work that has resulted from PFI programme in Great Britain has provided a unique opportunity for the study of hospitals as a building type. This is particularly true of hospitals in the 50,000m2 - 100,000(+) m2 range, of low to medium height, as these constitute the majority of major new hospitals being developed.

From Anshen Dyer's studies a generic model has emerged that derives from the key functional elements of the hospital:- inpatient wards, heavily-serviced diagnostic and treatment areas and outpatient/administrative areas. Each of these has unique characteristics that are best satisfied in a bespoke facility of optimum configuration, structural spacing, balance of natural and assisted light and ventilation, etc - all of which can contribute to maximising functionality and sustainability and minimising costs.

The generic model enables the practical use of such building blocks by joining them for clinical effectiveness. Related clinical services extend seamlessly between them. For instance a cardiology service may occupy space in the wards block, which is located adjacent to the cath labs in the diagnostic and treatment block which, in turn, is adjacent to cardiac outpatient clinics in its bespoke block. This "matrix" pattern of organisation achieves what might be considered to be the best of both worlds - the benefits of functionality-driven, efficient bespoke building blocks, together with integrated clinical departments that cross seamlessly between them.
The new Norfolk and Norwich University Hospital offers an example of the application of the matrix approach. This 950-bed facility is one of the largest hospitals completed under PFI. The plan reflects trends toward greater reliance on ambulatory care and multidisciplinary working, as well as the need for greater efficiencies and flexibility for future changes.

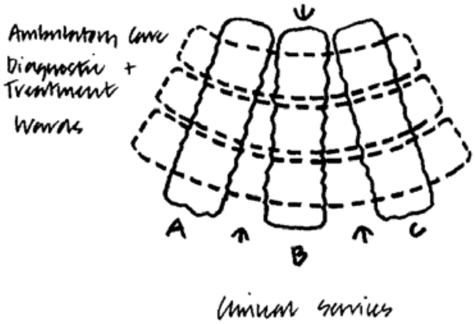


Figure 9 *Application of matrix pattern of organisation for Norfolk and Norwich Hospital.*

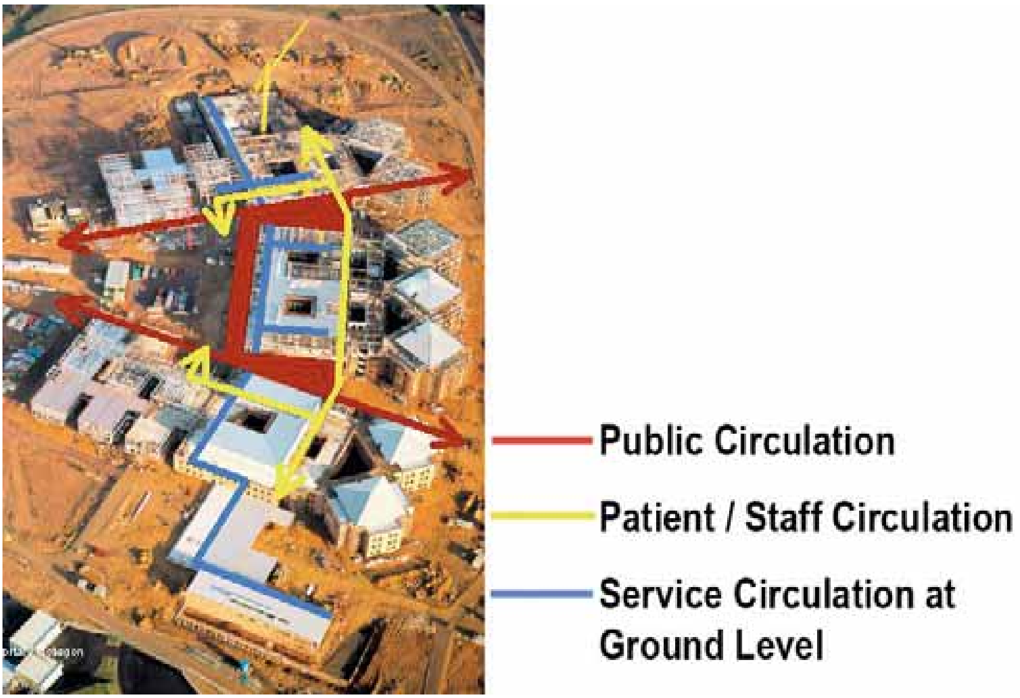


Figure 10 *Composite diagram of circulation routes shows separate flows for public, patients and staff, and service traffic.*

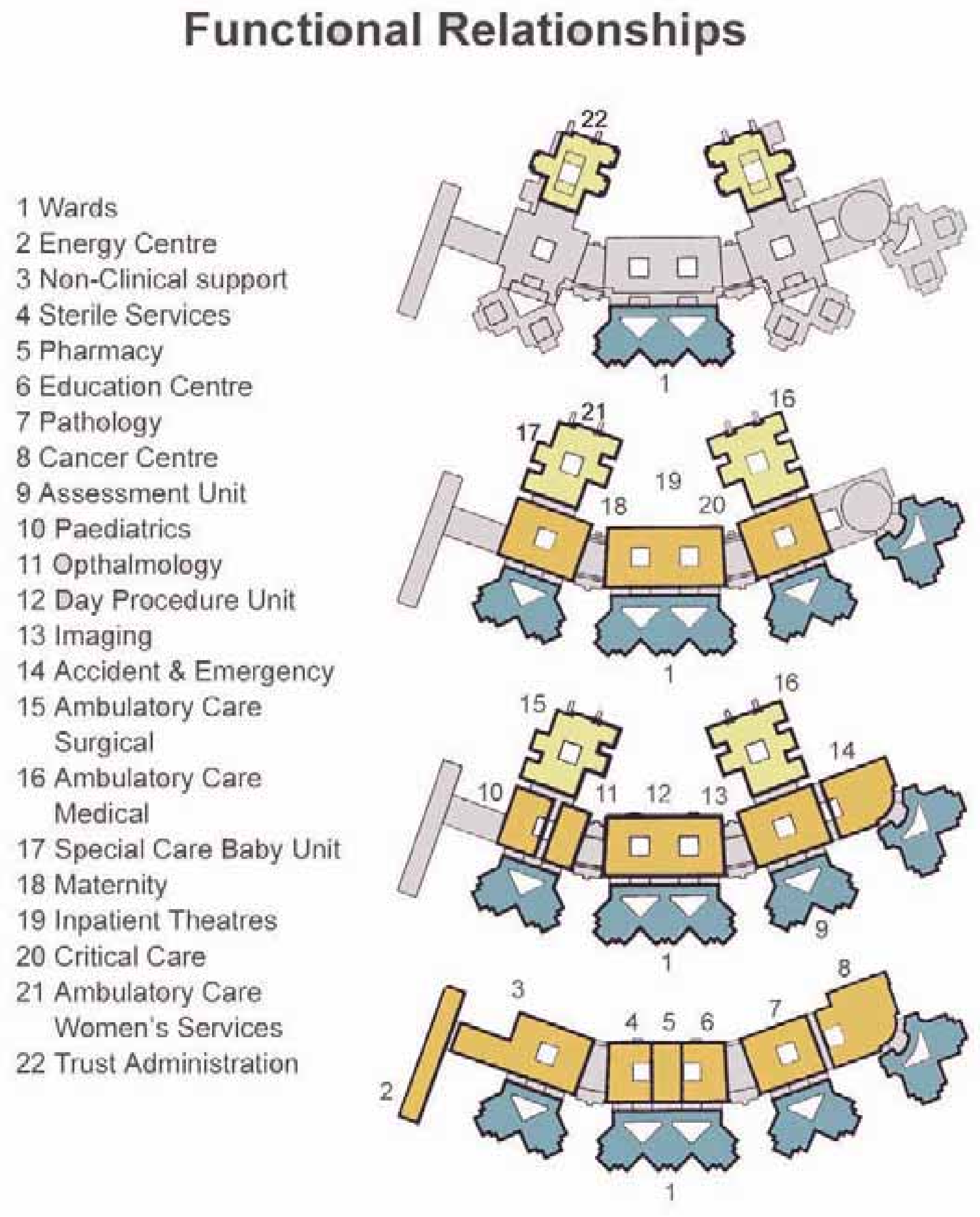


Figure 11 *Functional relationships based on matrix pattern for Norfolk and Norwich.*

Figure 12 *The finger plan surrounding landscaped courtyards enables good light and views to all patient areas.*

Services are arranged in the above described, three zones. The highly serviced clinical diagnostic and treatment zone, configured as adaptable loft-space, was constructed of concrete to enhance vibration and acoustic performance and to improve the flexibility of mounting heavy equipment in theatre and radiology departments. Diamond-shaped ward blocks, that maximise perimeter and ensure efficient staff movements are located immediately adjacent to one side of the central block; modular outpatient clinic buildings are located on the other side. Both are of steel frame construction which delivers the required performance most economically. As described above, clinical specialities cross all three zones.

This pattern can only work effectively when combined with a network of circulation that provides discrete paths for the movement of public, clinical and service traffic. At Norfolk and Norwich the public can enter from either of the long sides of the building and pass through the hospital via atrium lobby spaces, which serve as reception points. Hospital streets for patients and staff join all clinical areas. As these streets cross the public space they do so on bridges that protect patient privacy. At the lowest level a dedicated service consider system joins the materials management centre to dedicated service lifts that bring goods close to their point of use on all floors. Each of these flows is kept separate from the others. Although the concept for the hospital is very disciplined, the resulting building has a less rigid, softer, more user-friendly appearance.

Natural light and landscaping are necessary for patient areas anywhere in a hospital, but perhaps no more so than in radiation therapy areas, where bunkers, placed within the building's podium, can create an oppressive feeling – in this case mitigated by south-facing courtyards cut into the podium base. Above the podium, wards are arranged around these south-facing courtyards. The hospital is conducting special fundraising to assure that these courtyards are generously landscaped.

In buildings taller than three stories, enclosed courtyards may bring in daylight, but they tend to resemble light wells, too narrow to alleviate a sense of enclosure. The open-ended south facing finger plan of the wards at St. James's ensure that all patients have not only access to natural light, but also long views beyond the hospital's boundaries.

Outpatient services on the ground and first levels also benefit from these courtyards which enable views, framed by windows to the outside as well as to the gallery and café inside.

A glazed gallery runs the full length of the building. Serving as an internal public street, this gallery provides a generous daylit passage that gives access to all clinical areas and contains cafés and retail space for patients and staff.

Figure 13 *The New Oncology Wing is zoned vertically, with ward and outpatient areas over a podium housing radiation therapy chambers.*

Creating Healing Environments
St James's University Hospital, Leeds

The term 'healing environment' has come to mean all aspects of hospital design that directly contribute to patient comfort, wellbeing, and safety. Natural light, views, landscaping, colour, artwork, and well-designed patient rooms all play a role.

The New Oncology Wing at St. James's University Hospital in Leeds offers a catalogue of examples of these devices. It will be the largest cancer research hospital in Europe, with 66,500m2 of research, teaching, and patient facilities. The facility features 12 Linac chambers, large outpatient and daycare suites, a significant imaging department, theatres, critical care, 300 patient beds, laboratories and support spaces.

Research demonstrates that providing patients with single-occupancy rooms produces several benefits:- it minimises patient transfers, which lowers the possibility of medical errors and patient falls; it diminishes stress and noise for the occupant, which can result in shorter patient stays; and it decreases the rate of hospital-based infection transmission. The National Health Service is interested in increasing the proportion of single rooms for upcoming projects to at least 50 percent and beyond. However, interest in increasing the percentage of single rooms has not yet been matched by increases in funding for them. As a result, much study has been oriented toward achieving more single-occupancy rooms at little or no extra cost. Some studies suggest that the efficiencies gained by all-single ward units can justify reductions in numbers of patient rooms and support areas to offset the inherently higher cost of single rooms. It seems inevitable that hospitals in Great Britain will eventually match the high proportion of single rooms found in French and American hospitals. St. James' represents the high end of what is typical for new NHS hospitals, with about half of all beds located in single-occupancy rooms; the other half are in four-person rooms.

Figure 14 *Thoughtful detailing and use of colour enhances patient bedroom.*

Other ways to enrich patient environments can be less expensive. Thoughtful use of finishes, lighting, colour, themes, signage, and art can all make the environment more pleasant while adding little or no extra cost. Repetitive design elements contribute to an institutional feel; introducing variety tends to make patients and visitors alike feel more comfortable. St. James' features four colour schemes, each with complementary sub-colours groupings, arranged so that they all work well together. The colours also relate to the themes, directional signs, and art for each zone, economically unifying the environment whilst giving the building texture and a sense of variety.

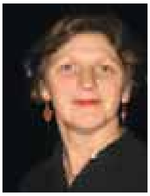
Conclusion

This paper indicates how issues that affect the creation of healthy environments were addressed in several recent hospital projects. We believe that these examples indicate that the PFI development regime did not diminish their ability to address the above issues. Rather the success and weaknesses of these projects were determined by those factors that affect any project: the adequacy of budget and brief, and the aspirations and technical competence of those who participate in both public and private sectors.

Figure 15 *Thoughtful interior design mitigates claustrophobic nature of radiation therapy chambers.*

Healthcare Design Developement in UK

Susan Francis



Susan Francis BA, AA, Dip MA

Susan Francis is architectural advisor to the Future Healthcare Network at the NHS Confederation and The Centre for Healthcare Architecture and Designat NHS Estates. FHN facilitates a learning network for some 80 Trusts engaged in major capital developments for both hospital and primary care services. Susan co - chairs the Design Review Panels and has led the evaluation of the DRP process and AEDET toolkit. Susan is engaged in several joint initiatives with CABE, The King's Fund and the National Patient Safety Agency. Supported by CHAD and the Modernization Agency, FHN has developed a program entitled 'Optimizing Design' exploring the relationship between service redesign and physical design for future healthcare buildings. Trained as an architect, Susan has published research, books and articles and contributed to UK and International conferences on healthcare design for over 15 years.

Abstract

The UK Government has embarked upon the largest healthcare building programme for a generation, aiming to build over 100 new hospitals by 2010. So far, about one third have been completed, some 60 or so are being developed. At the same time more investment is being made in primary and community care to extend diagnostic and treatment services to more local centres. What can we expect? And how much are we doing to ensure that the designs are good quality?

A recent survey (CABE 2004)[1] showed design does matter to nurses, and has most influence on their workplace performance, followed by recruitment and then retention. The extent to which the link between performance and capital expenditure has yet to be quantified, but an initiative to scope the case for investing in good design (FHN scoping study 2003)[2] for health through expert panels, suggests three main principles:

• Design can help reduce operating costs of the building itself and the service by creating more efficient working patterns, improving staff turnover, recruitment and retention.
• Design can affect patient health outcomes. The wider community can also benefit from the contribution of schemes to regenerate the local economy and social conditions.
• Design is a contributory factor in healthcare quality and patient safety.
The need for a more sophisticated valuation system that recognises the benefits of social and environmental factors as well as economic factors needs now to be addressed.

The latest thinking about service redesign (reorganising services to provide a greater focus on patient flows) is being linked to physical design in home, community and hospital settings through a series of seminars called "Optimising Design"[3], organised by FHN with support from NHS Estates and the NHS Modernisation Agency.

Topics have so far included changes to care outside hospitals, the impact of networks of care and patient pathways, and changes inside hospitals. The workshops have explored changes to the organisation of care and its impact on the design of the physical environment. The sharing of good practice and innovative solutions between clients and designers has been at the heart of the project.

The extent to which these workplace issues are being addressed in the current programme of projects can be understood through the Design Quality[4] Review Programme. Major capital projects over £25m undergo design review and over 50 schemes have been reviewed and a further is being planned. The initiative aims to ensure that good design is embedded within the NHS healthcare building programme. A panel, consisting of architects, engineers, project managers etc, reviews the proposed scheme designs and makes recommendations to the trusts. The Design Review Panel has identified key issues arising from the reviews. Together with the findings of an independent research evaluation of the process, a framework of 12 design principles is being developed that identify significant indicators of good design. This paper will focus on three of these issues, illustrated by a selection of current projects in development namely,

• Health and the city : the building in its context
• Quality of the internal spaces: staff and patient environment
• Future proofing the design

The case for investing in good design

The NHS is in the middle of the biggest capital programme of investment in environments for healthcare across the whole spectrum of settings from hospital to home. An ambitious programme of planning and development is underway with the potential to realise not only significant improvements in the modernisation of care and the quality of the physical environment but also to support a more efficient system that can deliver better health outcomes for patients, benefits for the trusts who will manage and staff the buildings, and for the consortia who will operate and run the facilities.

It is often assumed that good desgn is costly and that investing in design is superfluous. However, the UK Treasury has made it clear that value for money must be measured over the lifetime of a building and that design is essential to achieving value for money. [5] The case for investing in good design for health, devised by the Future Healthcare Network (FHN Briefing 3) through expert panels is based on three main principles:

• Design can help reduce operating costs of the building itself and the service by creating more efficient working patterns, improving staff recruitment and retention
• Design can affect patient health outcomes. Patients benefit and costs are reduced through, for example, shortening patient lengths of stay and use of analgesics. The wider community can also benefit from the contribution of schemes to regenerate the local economy and social conditions.
• Design is a contributory factor in healthcare quality and patient safety

The evidence base

A growing evidence base is emerging to demonstrate the impact of the environment on staff performance, improvement to patient health outcomes, and effect on staff and patient safety. Many research, governmental and campaigning organisations are now supporting research and development projects on this topic in the UK.[6] The potential to translate the American experience from 'Fable Hospital' and Pebble Projects initiatives at the Center for Health Design Studies is being explored .[7] Studies that focus on cost benefit analysis of design covering aspects such as regeneration, sustainable development and visual and performing arts, are beginning to emerge. The need to integrate these issues into guidance for capital projects is now timely and imperative.

The notion that the capital cost of the building is overtaken by revenue costs in little over two years is an argument that has been rehearsed for over 20 years in the health sector. Now, construction economists [8] are refining the ratio of capital costs to maintenance of infrastructure costs to the cost of the service or business (originally understood as the 1 : 5: 200 ratio) to show just how small the capital cost is relative to the revenue costs (let alone the design fee !) ; and to highlight how the potential design can positively affect the productivity and running costs of the service.

The impact of the environment on patient safety is also a major concern, including healthcare acquired infection, medical errors, patient falls, medication errors, staff fatigue, and crime and vandalism. The project teams that develop programming briefs generally operate under great pressure and at short notice. They are obliged to explain the way design impacts on the previously mentioned factors, synthesizing both into a coherent and practical evidence-based brief.
Key design considerations are being developed by government in relation to these medical factor and will include, for example, air quality, arrangement of single/ multiple bedrooms, location of hand-washing facilities, lighting levels, flooring materials, standard layouts for clinical procedures and staff workspace.

A more sophisticated valuation system that recognises the benefits of social/medical environmental, and economic factors is urgently required to advance an integrated methodology.

Optimising design

The organisation of healthcare and the context in which it is taking place are undergoing rapid changes: there is a drive to better integrate health with social care, housing, education and employment. This drive, in turn, raises clear links with issues of sustainable communities and the impact of the public health agenda on the design of the environment.

Figure 1 *BECaD View North*

For the health sector itself there are also many changes in the application of technology: demographic population profiles becoming significantly older in many developed countries,; increased consumer expectations of patients, developments in medical procedures; and changes in epidemiology and the labour force.

In the UK, we are also undergoing policy changes in delivery of care: to offer greater choice, diversity, and contestability with new financial flow mechanisms aimed to make the money follow the patient. All this makes planning care services for the future uncertain.

The impact on the buildings is profound, with a need to be able to plan beyond the individual project and to see it as part of a system of care and infrastructure. New activity clusters and even building types are emerging alongside the need for design that address outlook and observation, privacy and sharing, convenience and efficiency, well-being and intensive care, independence and support; and finally there is the potential to unpick the hospital as we know it.

Through a series of developmental seminars, organised by the FHN, with support from Department of Health Estates and Facilities (formerly NHS Estates) and the NHS Institute for Innovation and Improvement (formerly the NHS Modernisation Agency), the programme brought together key policy makers, project directors, clinicians and design professionals to explore the content of these changes – for example, care improvement, integrated planning, use of technology – and also how they will shape future buildings.

The aim of this presentation has been to stimulate discussion and debate about the links between service redesign and physical design and demonstrate practical examples of projects where new ideas are being developed. It is expected this information will increase knowledge amongst project teams in the health service, engaged in major projects and the design teams and consortia who are generating the design proposals.

Optimising design has highlighted topics that are undergoing rapidly changing new thinking and demonstrates the impact on design of recent projects in development and use. Its focus has been on three settings: care outside hospitals, networks of care across the NHS, and care inside hospitals. Topics include care at home and intermediate care; maternity, children and diagnostic networks; and scheduled and inpatient care. This pilot project will be extended to cover further issues in the next year.

People now expect a more personalised health service which is tailored to individual needs, and one which respects their dignity and privacy.
With the new emphasis on customer service, the improvements in the quality of the healthcare experience for staff, visitors and patients are crucial – by fostering local pride and, importantly, reducing length of stay and staff turnover. Matching these aspirations in buildings that are uplifting and comfortable represents a successful solution.

The availability of more sophisticated IT-enhanced, miniature, cheap and automated equipment, linked through broadband to remote experts, is allowing more care to be provided outside hospitals. Patients and carers are becoming experts and can be empowered to look after themselves. It is now possible through design and technology to maintain monitoring and living skills at home. Ensuring that houses are built with sufficient space and infrastructure to support care at home is vital.

The public has for years been requesting the provision of more care in more numerous locations, particularly for people with long-term conditions, older people and those with young families. Patient pathways for community-wide services integrate health and social care across

Figure 2 *Waiting area at The Arches Center*

all settings from home to hospital. Some services, particularly those for children and older people, integrate health with other services to support wellness not just illness. These services can be further enabled by investment in IT connectivity, allowing organisations to coordinate their activities around individuals and move information rather than people.

Integrating patient pathways across health, social care and voluntary sector will also help to deliver seamless care. The creation of local centres for childrens' services enable professionals from different disciplines to work together to deliver care from one place. Networks of maternity services are able to distinguish between women who require consultant assisted births and those that can be supported by midwife care. Centres for more natural births are now available with a less clinical ambience to support and celebrate this important life event.

Investment in more diagnostic services and elective capacity is enabling earlier diagnosis and greater access to treatment with the aim of improving health outcomes, particularly for cancer. This flexibility offers the potential to maximise flows through buildings and reduce waiting times. This investment, if handled well, will also help reduce medical errors and infection rates, thereby improving patient safety. Teamwork and multidisciplinary working teams are very important for the diagnosis and treatment of patients with complex or several diseases. Creating space that supports team working may help to achieve better health outcomes.

Improvements in care processes have the potential to increase healthcare productivity, partly by standardising care processes for common conditions through protocols that maximise patient flows. However, we still need to develop strategies for maximising productivity through design, which may allow staffing levels to be reduced over time. Better design is needed to maximise efficient flows for patient and staff journeys between activities. There should be a reduced need for waiting and wayfinding should be easy. Design can assist by standardising room sizes to suit these protocols.

Space needs to be thought of as a common resource to avoid individual ownership. This means, for example, rethinking office space in terms of activities such as group work, and quiet work, meetings rather than as individual offices. Diagnostics and treatment involves developing planning templates that minimise variation in terms of organizational flows and reducing the design differentials to create standard clusters to suit the flows. IT supported networks can help to reduce reliance on physical adjacencies and enable more efficient use of staff time, simultaneous reading and reporting from different locations. Design can help to reduce medical incidents, medical errors and infections by supporting teamwork and discouraging interruption.

Perhaps the most important challenge facing health services is the sheer speed with which key components need to be replaced–eg IT systems after three years, medical equipment after five years, models of care in ten to fifteen years, with buildings lasting for 30- 60 years. It is clear that flexibility for the future is vital.

Changing buildings can be a catalyst for organisational change: projects may stimulate 'disruptive innovation' to change habits of behaviour, question traditional departmental clusters and conventional layouts.

Design Quality

A programme of Design Reviews for major capital projects over £25m has been developed over the past 18 months. The initiative, which was mandated by the former Secretary of State for Health in England, is intended to ensure that good design is embedded within NHS healthcare building programme. Managed by the Design Centre at the DH, the reviews take place at two stages in the project development: at the beginning when the Trust is developing a PSC (Public Sector Comparator) and later at ITN (Invitation To Negotiate) when two (or more) bidders' proposals are being developed.

A panel, consisting of architects, engineers, project managers etc. meets the Trust at the site to review the proposed designs. The panel offers constructive criticism and recommendations to the trust. Further developments are underway to extend the review to community and primary care projects. The potential for developing a Strategic Planning Review is also being considered : this would assess the service content within a strategic area framework commenting on the organization of care the content as a well as the location of the building.

Achieving Excellence in Design : measuring design quality

A systematic approach to design appraisal has been developed with the aid of a toolkit based on Vitruvian principles of good design: 'commodity, firmness and delight' that translate into modern language as functionality, build quality and impact.[9] Excellent design requires all three of these elements to work together and none can be ignored.

The health service has developed its own version called AEDET, (Achieving Excellence Design Evaluation Toolkit) that closely follows the Design Quality Indicators (DQIs) developed by the Construction Industry Council (CIC) as an industry standard for evaluating building design.

Figure 3 *The Arches Center atrium*

The toolkit provides a useful aid to clients and their advisors, to score designs for their degree of excellence in design. It is also a reminder to those using it, that the environment is a complex organism with no absolute right answers and plenty of contradictions. However, it has served to put issues such as ambience, light quality, and sensory stimulation on an equal footing with 'fitness for purpose' and technical performance.

AEDET Evolution [10] , an updated and simplified version of the toolkit, is applicable to all types of health buildings. The structure links closely with the issues raised in the design reviews and provides a methodical way of comparing design proposals as part of the technical evaluations.

The relative weighting of design to other considerations in the selection of bidders is set by the Trusts, and for some, greater emphasis is put on clinical planning and decanting than design. Whilst this may deliver some short term benefits and clinical support for the schemes, it is unlikely to ensure that the designs will deliver good patient environments and long term benefits in terms of site planning.

Design Champions

Having advocates for good design is crucial and the Design Champions at Board level appointed by each trust are expected to raise awareness about design and intervene in and support project developments. Whilst this initiative is undoubtedly well intentioned, unless it is balanced by design expertise in the project teams, it is unlikely to have sufficient impact on the day to day decisions about design. The name 'technical advisors' is perhaps a further reflection of the low status given by many trusts to their architectural and planning consultants in the PFI process.

Design Quality- in practice

Whilst the quality of schemes reviewed is inevitably variable with a programme of this scale, it is encouraging that most of the schemes now endeavour to make spaces that are comfortable and optimistic for patients and staff. There are however, three significant issues emerging that require further effort:

• Health and the city : the building in its context
• Quality of the internal spaces
• Development of design

These are not unique to the UK but apparent in many critiques of healthcare architecture in many European countries.

Health and the city

There is growing interest in how the built environment can benefit public health through the provision of, for example, parks, open spaces and transport systems. The integration of health into the development of sustainable communities is also beginning to emerge.

How the building relates to its immediate site context and neighbouring developments should be reflected in the overall form of the building. Each site is unique and the design should reflect that. The height and shape of the building may vary depending on whether it is in a built up area or adjoining woodlands and fields; the path of the sun and direction of prevailing winds and views, for example, will affect the internal planning and the specification of materials on the external elevations.

Many trusts describe the desire to make a 'landmark building' and this opens up the opportunity to make an obvious public entrance. Developing a sense of civic pride in a major public building for the community needs to be compatible with resolving the more logistical considerations of access and wayfinding for the various different categories of users, including patients, visitors, staff and support services. Traditionally, design of clearly defined entrances and wayfinding have been poorly executed in the health service.

Most schemes include landscape designs that help to soften the impact of these often massive forms on their surroundings. How well the site is connected to public transport services is a key consideration and can significantly affect the need for car parking, bus routes and stops on site, ease of connecting to train stations and places where people can be dropped close to the entrance, etc. But there is yet to be some radical thinking about the provision for car parking which can both provide for the convenience of patients whilst achieving efficient and sensible use of land.

Quality of the internal spaces

Whilst some schemes are committed to compact deep plan buildings with the inevitable arrangement of internal rooms, other are endeavouring to give priority for natural light and views to patient and staff areas. These are most often formulated around a central atrium or series of courtyards to secure maximum external wall surface for windows. However, the pressing requirement to reduce the overall footprint to keep capital cost low, all too often results in courtyards being reduced to light-wells within a compressed footprint that offers insufficient light at ground level, marginal opportunity to see the sky and little 'elbow room' for the inevitable changes that occur over time.

Many schemes include generous public spaces that offer a clear and welcoming entrance with appropriate formality. The interior design for the public spaces is also well developed- with high volumes, mood lighting, colour co-ordination and robust materials. But this is sometimes in stark contrast to the more functional clinical spaces where conventional finishes and arrangements, mandated by clinical requirements, are more common. This is not to say they should be the same, but rather that each deserves to be treated with care and respect in the internal décor. The clinical spaces are inevitably those where staff and patients will spend a great deal of their time. Providing a dignified setting for nursing and privacy for patients that is stimulating, attractive and uplifting is very important.

Many proposals have arts programme integrated into the designs but how these will be financed and maintained is often rather unclear.

Future-proofing design

Healthcare is undergoing significant changes in the way in which care is organised and delivered. Accepting that change is inevitable, then is it possible to determine the extent and rate of change and how this can be suitably accommodated? How can we ensure that what we are building now will be fit for the future? It will mean shifting away from the notion that service configuration and models of care are static and that space is a fixed commodity. This implies not only a different framework at planning stage but also a shift in the way we think about the management of space over time.

It is impossible to predict changes to care delivery with absolute certainty but there are techniques that can help to imagine the possibilities; from this we can extrapolate some principles and trends to inform and clarify the planning process. For example, using scenario planning we can formulate mental maps of the consequences of certain planning approaches.

The scope and intentions of the scenarios can be wide ranging to test seemingly unlikely or extreme possibilities : though unrealistic in themselves, they may at least help to clarify and distinguish key activities that are more likely to remain constant from those that are susceptible to greater change.Controlled simulation studies enable us to rigorously test our thinking, strategies, plan and policies before making decisions. System dynamics generates visual modelling that identifies patterns rather than focusing on events. It encourages innovative and ambitious thinking and enable experimental 'what if' assumptions to be explored.

Just as these techniques help to formulate degrees of uncertainly in the planning vision over time so they can be used also to help to recognise that different parts of the building will need to change at different rates over their lifetime. In this way, we begin to develop a more sophisticated understanding of the building requirements – one that is also dynamic and changeable- in which we can drive greater efficiency of the utilisation of space through more effective management.

The extent to which the designs in development can accommodate inevitable but unpredictable changes is questionable. Some argue that short life buildings are most suitable since they can be replaced by more appropriate ones as required. For others, the issue of sustainability will be a driver for flexible, elastic and more robust designs at the outset that can adapt over time to the changes in circumstances. The notion of buildings that are designed to be 'long life, loose fit' is a still rather apt with the proviso that due consideration is taken for what will not change.

However, this notion that health buildings need to be flexible is not new- it has been well documented and explored since the last major hospital plan in the 1960s- with theories and practice to illustrate the experimental thinking that it attracted even then. But what is different this time is not so much a technical issue affecting single buildings- the hospital, the GP surgery or health centre- as the impact that integrating planning for acute and primary care is likely to have on the location and clustering of care. Strategic planning of services across these sectors may well result in new service configurations and building types.

We are already seeing the emergence of treatment centres, community hospitals, combined

Figure 4 *CMH*

centres for health and social care, fitness, advice and so on. These are likely to vary according to local need, suggesting that standardised solutions are not appropriate. But whatever these service changes and technological advances bring, the places where patients and health professionals meet face to face will still matter. Design principles for achieving futureproofing are set out in the FHN briefing [11] and include:

• Planning facilities across the system to get good strategic fit
• Optimising investment of people and infrastructure
• Investing in quality real estate- avoiding bespoke solutions
• Making clear and unobstructed circulation routes
• Masterplanning the site to make best use of local amenities
• Maximising the potential to expand and contract buildings
• Distinguishing between parts of the buildings that require different levels of engineering
• Developing the shape and form of the buildings to allow changes over time
• Standardising room sizes to accommodate alternate space layouts
• Using space to maximise utilisation

It is likely that healthcare will change every 5-10 years buildings last for 30- 60 years. These principles can help to recognize that notion and bridge the gap, so supporting amore sustainable investment.

In Conclusion: Realising good design

With increasing pressure on the health service to deliver efficient and economic healthcare, the expectation of new infrastructure to support these developments will increase. This will reflect on the types of buildings, their location, and how they are planned. The shift to a network of critical care hospitals, local nursing care hospitals, supported by enhanced primary care facilities is an obvious solution, and one that some organisations are now trying to develop. The role the built environment can play in helping to deliver a manageable capital spend and sustain an efficient service in operation, given these changes in policy and service delivery, is yet to be fully tested.
The notion of making a building with civic quality that is stimulating and uplifting to patients and staff, is now embedded in the rhetoric of the trust briefs and many of the bidders' proposals. The extent to which quality is realised in the designs and then the actual buildings is, however, disappointing- even greater efforts are required to make quality design a reality.

We are engaged in a massive programme of investment in infrastructure from which to deliver health care. There is a paradigm shift in the way that care will be organised, where it will be located, and who will deliver it. The projects are complex and fast moving and require an understanding of a significant number of factors from many points of view. In this demanding scenario, it would be a tragedy to overlook or underrate, the potential of design to help achieve the transformations being sought. The FHN is supporting a number of trusts to develop better informed project teams about design and strategic planning with particular respect to quality, productivity and sustainability.

Patient expectations of the service and the environment are growing and the culture is developing in the health service that will give greater priority to patient and public involvement in decisions. Given that the environmental factors are often more tangible than clinical ones, it may be that patients will feel that they are more able to assess the quality of the environment than the clinical service. In which case making places special through design will be all the more important in future.

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Evaluation of PFI-Built James Cook University Hospital

Geoffrey Purves

Geoffrey Purves

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1.0 Background

This paper is about one section of a research study which evaluated the design quality of a private finance initiative (PFI) contract to rebuild the James Cook University Hospital (JCUH) on Teesside in the North-East of England. The research study was funded by NHS (National Health Service) Estates on behalf of the South Tees Hospitals NHS Trust and was carried out by a research team from the Universities of Durham and Newcastle upon Tyne. (1)

The team was led by Dr Jane Macnaughton who is Director of CAHHM, the Centre for Arts and Humanities in Health and Medicine, a research group at Durham University and other members of the team were architects, anthropologists and an art commissioning specialist with a full-time research assistant. (2)

The group was deliberately established as multidisciplinary and this presentation describes the examination of the briefing process, which was called the 'Process Research'. A second part of the research examined the outcome of the move from the old hospital accommodation to the new JCUH on hospital users (patients, staff and visitors). This was called the 'Outcomes Research'. Extracts from the Report relating to the 'process research' are included in this paper.

The hospital has over 1,000 bed spaces and offers secondary and tertiary care on a regional basis. It is also a centre of academic excellence and provides national learning facilities in certain specialities and the total building work was in the order of £160 m.

Figure 1 *The new entrance area for the James Cook University Hospital with the large globe forming a focal point. This sculpture was designed by Andrew Barton and was one of the commissioned artworks which form part of the Arts' Programme which was part of the building contract.*

From the beginning of the briefing process the Client had clear ideas about what it wanted to achieve with the new development. It wanted the treatment regime to be patient-focused and it wanted to increase efficiency on a series of physical and clinical criteria. The trust began a series of discussions to look at how departmental relationships could be improved and how day case facilities could be increased.The Trust also began to formulate a series of ideas about how this could be expressed in the brief for the new building and they identified a series of key components which included value for money, greater attention given to patient-focused care, and an acknowledgement of the therapeutic benefits that can flow from a well-designed hospital environment. These were uppermost in the minds of senior management when the early ideas were being formulated. The Trust also had a clear vision that high quality design would generate therapeutic benefits for patients. They wanted these characteristics to be central to the design process.

A diagram of a model promoting wellbeing was a key component in the winning Architects' proposals presented during the selection process for the winning consortium. HLM, the Architects working with Mowlem Construction put forward an integrated design for patient well-being identifying a series of key indicators.

Early on in the design process the Client body decided to rename the hospital The James Cook University Hospital. This idea was successful and provided an over-arching concept on which a whole series of design ideas have been hung. James Cook (fig. 3) was born in 1728 within a few miles of the hospital site and was a great explorer who mapped the coast of Australia and New Zealand. The idea was that a range of activities could be linked to his work – scientific, biology, geography and not least medical ideas - as a stimulus for the arts commissioning work building on 3 great voyages in the Pacific between 1768 and his death in 1779.

Figure 2 *James Cook*

The Chief Executive of South Tees Hospitals NHS Trust and his planning team believed that the solution to these challenges lay in high quality architectural design and the integration of public art - commissioned and created regionally - into the health care environment. The development of JCUH has paid special attention to building design, therapeutic colour schemes, materials, lighting, space, and acoustics.

The design features and colour schemes are intended to individualise departments within the hospital to help create a sense of intimacy within the whole. In addition, £250,000 from the building budget was ring-fenced for the purpose of commissioning artwork for the hospital. The Trust set up a 'Healing Arts' Committee to seek further funding for art works and also to fund artists residencies to create works appropriate to this hospital environment. The Trust introduced to the building a theme of Captain James Cook and his voyages, and some of the artwork reflects the chosen theme.

The theme is intended to link the hospital with the local area and to give the hospital a sense of coherence as a single building. Also, the Trust explicitly intended to use art to link the JCUH with its community. They viewed the art works as having a wider role than purely one of assisting in creating a 'healing environment'.

Purpose of the Project

The study focused on two main aims: firstly, to examine the process by which the concept of patient-centred care was incorporated into the design brief: and secondly, to discover whether that concept was realised in any noticeable and meaningful way by users of the hospital building (patients and visitors) and by staff.

The study commenced before the move to the new accommodation took place so the research team had the opportunity to carry out pre-build and post-build analysis in order that a comparison could be made.

A number of studies have now been carried out into the impact of improved design features in NHS hospitals. Specifically, the research team reviewed the approach and methodologies used by Scher and Senior (1999), Leather (2002), Douglas, Steele et al. (2002) and Lawson and Phiri (2003). All made some use of mixed qualitative and quantitative methodologies in their studies. Lawson and Phiri's approach was to look at patient's outcomes from an architectural perspective.

Methodology

The report states that:
The study team addressed three main questions:
1.How was the design brief for the new JCUH developed and what were the main principles encapsulated in the brief?

2.Were those principles realised and valued in any noticeable way by patients, visitors and staff of the new hospital and did they think the new accommodation was a better environment for patient care than the old?
3.What was the impact on patients, visitors and staff of the artwork commissioned for and placed within the new hospital?
and that the research had two main aims (p.20)
1) To examine the process by which the concept of patient-centred care was incorporated into the design brief.
2) To discover whether that concept was realised in any noticeable and meaningful way by users of the hospital buildings (patients and visitors) and by staff.

In order to achieve these aims the research was carried out under two subheadings:
1) Research on the process of developing the brief (Process Research).
2) Research on outcomes for patients, staff and other users (Outcomes Research).

Preliminary research questions and outcome measures were identified process research as follows:

Objective:
The purpose is to investigate the briefing and design processes to assess how the visions for 'patient-centred care' were carried through into the design of the new hospital.

Underlying assumptions:
1.It is possible to define a 'Patient-Centred Care Strategy' in the brief.
2. If 'Patient-Centred Care' is appropriately articulated in the brief it will be possible to identify the benefits in the completed building.

Research questions:
1. How were 'patient-centred care' concerns articulated in the brief? How was the design process managed to ensure that these priorities were maintained?
2. How closely does the completed building reflect the 'patient-centred' aspirations of the brief?

Outcome measures:
The aim is to understand
• how 'patient-centred' principles are reflected in the built environment,
• how the design quality issues are conceptualised, documented and realised throughout the process, and
• how and why Arts projects were integrated within the design process.

Methodologies Employed
• Examination of documentation prepared to guide the briefing process.
• Interviews with key respondents in the design and planning process.

Ethical Considerations

The research team obtained an approval for the study from the Local Research Ethics Committee (LREC) in June 2002, and discussed the sampling and recruiting strategy with Dr John Drury, the chair of the LREC. The research project was registered with The National Research Register (NRR) which provides a record of Research and Development projects within or of interest to the NHS, and the research team follows the guidelines set out by the 'The Research Governance Framework for Health and Social Care' Health (2001).

Specifically, written consent was given for each interview carried out and anonymity of respondents was preserved except when explicit permission was given to use titles or names.

Interview tapes are stored in locked premises in the University office. Before photographs were taken at the hospital premises, permission was sought and given by the Trust and no individuals can be identified in any photograph taken by the project team.

Results

The senior management team of the Trust were extremely helpful and give the research team open access to all of the documents produced during the PFI process – and were always ready to provide answers to questions and deal with queries. Twenty-two (22) taped interviews were recorded with senior decision makers – each interview lasting approximately one hour. These included from the clients' side both senior administrators and also senior clinicians and on the design side representatives from the contractor and also the architects.

Timescale

The timescale, as is common in the UK for new hospital buildings, was fairly protracted.The original OJEC advertisement was put out in March 1995 and the new building was handed over in a series of phases starting in 2000 and running through to the first half of 2004 – a period of nine years.

Finance

It was decided early on that there was not the time or the resources to make meaningful value for money judgements about the effectiveness of carrying out this project under PFI rules as distinct from traditional public sector finance arrangements.

However, the Full Business Case sets out the economic analysis indicating that in overall terms the solution delivers better value for money and demonstrates a significant transfer of risk to the private sector – that is PFI is a better buy. It shows that the 35 year cumulative net present value of the PFI option is just short of £12 million less than the publicly funded option after risk is taken into account (fig 4). Also, it shows that the area of the hospital under the chosen PFI solution is slightly less than the equivalen-public sector comparator scheme (– about 1½% smaller in area). Although not fully investigated there is some evidence which casts doubt on the criteria used by the Treasury to compare the PSC with PFI.

The construction costs and operating costs for the PFI project were more expensive before the

Risk Adjusted NPV (35 years)

	PSC	PFI	Difference
	£ 000	£ 000	£ 000
Cumulative NPV at 2042/43	186,797	215,568	28,772
Cost of risk associates	21,660	910	40,750
	228,456	216,478	11,978

Area of Hospital

PSC	128,811.70
PFI	128,617.60
	194.1 sq m

adjustment was made for risk. It seems that the estimates for risk in PFI projects are nearly always less than the allowance for risk in PSC projects – and it was this adjustment that tipped the PFI estimate below that of the PSC for the JCUH project.

Development of the design philosophy

The Trust, from the very beginning of this project, had a very clear vision about its aspirations for the hospital and it maintained that objective throughout the whole of the construction process. Its starting point was the "Better by Design" publication written by NHS Estates in 1994 and the key points were that it:

- Functions well
- Looks attractive
- Improves the locality

The Trust's design philosophy statement (fig 5) expands on the importance it places on patient centred care and its brief to bidders for the scheme included seven core values - these focus on delivering patient centred health care which is appropriate, accessible, and of high quality.

The aim is to offer patients the best possible clinical care,

- allow them an opportunity to be part of the decision making process about their health care
- and to ensure that staff respect and support these objectives.

Core value of the Trust's commitment to its patients

- we aim to offer our patients the best possible clinical care by sustaining staff skill and technology at the leading edge of their respective fields
- we aim to give patients the opportunity to play a real part in their own care through informed choices and decision making
- We aim to ensure all staff exchange mutual respect and support in working together for patients
- We aim to protect each patient's right to courtesy and dignity at all times as well as their spiritual and cultural needs
- We aim to deliver our services in the way which is most convenient to patients
- We aim to provide an environment that promotes patients' comfort, security and wellbeing
- We aim to run the Trust in a way that empowers staff to work

Table 1 *Trust's design philosophy statement*

A patient's right to courtesy and dignity which is in line with their spiritual and cultural needs is spelt out – the services should be delivered in a way which is convenient to patients

-the environment should promote patients' comfort, security and wellbeing
-and lastly the Trust wants to empower staff to work efficiently in the patients' interest.

Criteria and weighting of Trust's evaluation

Criteria	Relative weighting
Efficiency of clinical operations	35%
Delivery of high quality, patient-centred care	25%
Delivery of project services	10%
Technical suitability of service	10%
Consortium organisation	5%
Financial viability	5%
Delivery of project construction	5%
Transfer of staff	5%
Total weighting	100%

Table 2 *Criteria and weighting of Trust evaluation*

The weighting system used by the Trust in evaluating the bids it received for the new hospital shows that the delivery of high quality patient centred care had the second highest ranking at 25%, exceeded only by the importance of clinical efficiency which was given 35% (tab. 6).

Design brief objectives

The design brief set out a number of key criteria.
- Patient centred care
- The institute concept (a hospital with a hospital)
- The mall concept (to provide a social and cultural focus for the whole hospital)
- Incorporation of an art strategy

Patient centred care was enlarged on by the Trust in its documentation by saying that there should be optimum functional and clinical adjacencies between new and existing departments. These patient centred objectives are central to the development of the institute concept which groups the facilities needed by a patient for a particular speciality within the same part of the hospital. This minimises travel distances but also maximises opportunities for patients to identify with particular groups of staff and remain within the familiar environment throughout their episode of care. It attempts to maintain some of the sense of individuality and personality which a small hospital might offer, within a large hospital setting. The mall concept is part of the hospital village idea whose heart is located in the central mall – a public space which provides a focal point for the operation of the hospital from the patient's perspective.

Visions and aspirations

From the very beginning of the design process senior clinicians were involved in developing the ideas and the policy of patient centred care so that they took ownership of the brief right from the beginning. Throughout the design process, even after financial close and during the construction phase, the interviews were positive about the benefits that this approach had brought. There was agreement amongst the senior clinicians that although time consuming, the overall benefits were worthwhile. This process was expensive in management time – over 1000 meetings are recorded – but there was a culture that the visions and aspirations were going to be achieved.

What is an ideal hospital environment?

Although the Full Business Case identifies a number of objectives to enhance the target of patient centred care there is little evidence specifically establishing criteria for environmental conditions. Rather there are a series of aspirational statements referring to issues such as sympathetic architectural design and then identifying a series of issues such as landscaped courtyards, maximising natural daylight and shared communication spaces to create a non-institutional healing environment. Above all else the emphasis is on placing the needs of the patient above everything else and key words are homeliness and friendliness. Essentially, the brief sets out the vision of the Chief Executive and the senior management team.

The interviews confirmed that there is widespread satisfaction for most of the areas, including all areas used by patients but there are some back of house spaces where criticism was expressed. Also, there was concern about some FM management issues although this may have been more to do with teething problems in the immediate aftermath of taking over the new building. It is probably premature to be too judgemental about this aspect of the new hospital's operation.

Key Findings and conclusions

Fundamentally, there has been clear leadership on this project from the beginning to the end of the contract. Bill Murray, the Chief Executive at the commencement of the programme was the driving force behind setting clear parameters for patient centred care and ensuring that this programme was adhered to during the development of the brief and into the construction phases of work.

The early documentation identifies that there was a willingness to accept the PFI methodology. The Trust recognised the political necessity to go with the flow. It is outside the scope of the study to consider Treasury rules in detail and to assess some of the risk analysis issues which are being raised by others. Senior clinicians were involved throughout the project from inception to completion, and from the interviews it is clear that this has helped to ensure the original design aspirations set out in the brief were achieved even though it was expensive in time.

The key aspects of the Trust's design philosophy including patient centred care, the institute concept and a mall have all manifested themselves in the final solution.

However, several of the senior clinicians alluded to the difficulties in understanding the 3D implications of design decisions. Although some 3D visualisation was carried out there are several examples of disappointment where the end result for a consultant's room, for example, have fallen below expectations. The interpretation of 2D drawings is often difficult for people outside of the architectural profession.

There was general satisfaction with the ward areas and patient areas, although there was some dissatisfaction with staff areas and consultants' offices in the back office areas. There have also been some problems with wayfinding – this is more to do with the use of language than geography. An example that comes to mind which was quoted by a consultant was asking a patient to go for an x-ray without clarifying to the patient that this would be signposted as the Radiography Department.

Comments about the mall have raised a range of opinions. Generally seen as successful there are issues arising over its use and function; for example, is it a hospital corridor or a community space? is it a space to house works of art?

There has been some uncertainty about whether patients and visitors were free to use the sitting areas for a rest, or to eat their sandwiches. This led to a discussion in a small number of interviews about the philosophical nature of the space (e.g. was the mall a public space in the sense of it not being part of the hospital?) It is not possible to be conclusive because during the interviews some of the retail activities envisaged were not fully operational (e.g. there was a shop but the café was only just opening at the end of the study period). The senior staff were impressed with the quality of the space but questions were raised about the large scale of the mall in comparison to some of the smaller back of house spaces.

The spiritual needs of patients have been provided for with the multi-faith chapel and a holistic care centre.

There have been improvements in travel distances, arising from the institute concept but there are still issues of privacy and dignity for patients. An interesting issue has arisen over the definition of patient only routes. For example, the gynaecology department said that the route from the ward to the operating theatre was much better. It raises the issue of whether hospital design should make provision for dedicated patient routes; the brief does not call for these but the privacy and dignity of a seriously ill patient is obviously questionable if they are being wheeled along a public corridor.

Concerns were raised about the efficiency and cost of FM services – some of this may have been teething problems but there is obviously a period of bedding in and settling down which needs to take place. Although apparently not problematic at the James Cook University Hospital the potential problems of transferring design responsibility from the client to the contractor was raised at some interviews.

At the James Cook University Hospital it would appear that the strong management team ensured that problems did not become significant. Although there was some consultation with patients and patient groups early on in the briefing process, with the benefit of hindsight a number of interviewees said that they thought there should have been more patient consultation, and that they would like to see this occur on other schemes in the future.

Investigations were limited to the internal functioning of the building and comments have not been made about the external works, landscaping and car parking arrangements.

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Hospital Design Performance Evaluation

Chair: Monika Schill-Fendl (Germany)

Healthcare Procurements Methods

David Stark

David Stark

David Stark is Managing Director of Keppie Design, an architectural practice founded in 1854. David has been at the forefront of developing procurement initiatives. As well as advising public and private sector clients on major projects in the UK and Scotland. David has been working in conjunction with the Prince's Foundation, the Centre for Health Architectural Design (CHAD) and the University of Sheffield in highlighting the qualitative aspects of new projects, and testing design evaluation tools. On the basis of his experience of the NHS Achieving Excellence Design Evaluation Toolkit, David was the author of Quality Indicators in the Design of Schools (QIDS) on behalf of the Royal Incorporation of Architects in Scotland.

Introduction and Method Used

The British National Health Service is one of the largest healthcare providers in the world When it decides to embark on a major programme of infrastructure renewal, the task is gargantuan. It has done this twice since it was formed. The procurement methods used to advance such programmes have a significant influence on the design outcome and to explore what these are and the mechanisms involved, a review of a number of hospital projects completed over a 50 year period took place, primarily from the records held by Keppie Design and from interviews held with project architects. The study also reflects the debate currently taking place in the UK about the merits of Public Private Partnerships and the protocols and procedures arising from them.

The First Major Hospital Building Programme

In the 1960s and early 1970s a vast number of hospital projects took place. Few major civic hospitals had been built since the beginning of the 20th century and the need for modernisation was great. In an era still recovering from the effects of two world wars, resources were in short supply and were spread thinly. Industrialised building techniques made up for a lack of labour, but in their novelty they lacked sophistication. If funds were exhausted on capital projects there was no allocation for planned maintenance, facility managers having to scramble to gain a share of the annual hospital budget. Buildings quickly deteriorated. The country borrowed extensively to pay for new hospitals, schools, colleges and houses. The economy lurched from one crisis to another, until the 1974 world oil crisis virtually stopped public funding of new projects.

With money tight, it was spent on essential clinical services and departmental area. Functional planning was paramount and dictated the design of buildings. Area was precious, so the public domain and qualitative features were minimized. Hospitals were 'machines for healing', and were usually soulless. Like much of the output of a very large, nationwide, socialised organisation, consistency in the general level of design provision was more important than achieving excellence.

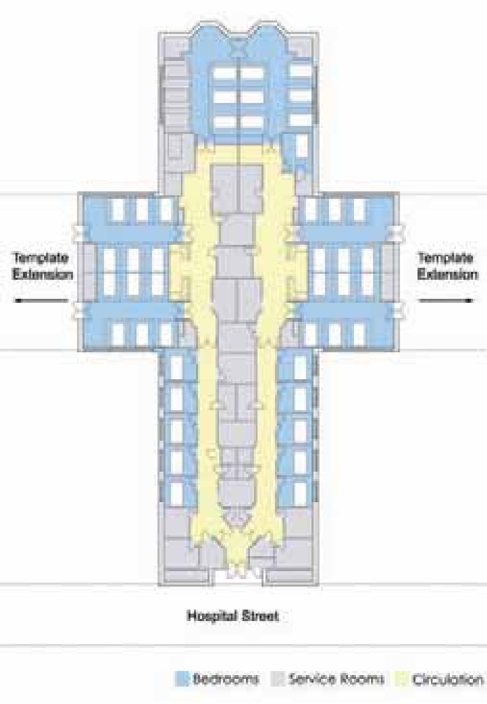

Figure 1 *A Nucleus ward plan*

Standard planning systems and design guidance dampened design imagination and flair. Large hospital projects seemed to last forever as funding stalled during economic low points, and the whole process discouraged inventive designers. An architect being assigned a hospital design was like receiving a life sentence. Then, with money and work in short supply in the 1980s, and with the erosion of the protected professional status of the architect, highly competitive fee tendering led to a reduced design service. Construction was also keenly tendered, with building companies usually seeking extras after they had secured the works, extras that required token savings to be made on the design. Traditional, competitive tendering, using public money to fund projects, did not optimise the design outcome; quite the contrary.

Public Private Partnerships

In the early 1990s, despite another economic recession, public infrastructure was badly in need of renewal. The government did not want to return to the public spending crises of earlier years, with the consequences of high public borrowing, taxation and inflation. It was also concerned that public bodies were not efficient at spending money on large projects, with well-publicised examples of poor cost control and defective new buildings. The Conservative government therefore invented the Private Funding Initiative, where money would be borrowed from the private sector to design, build and operate public facilities, contracts for running the non-clinical services in the hospital being for 30 years. This would keep large capital projects off the balance sheet and treat them as services instead, with monthly payments to private sector operators.

A simplistic way of looking at it was that if one had £100 million to spend each year for ten years, one could build one hospital a year, or pay £10 million a year for ten hospitals over ten years, and have the benefits of new, efficient hospitals earlier. While it costs more for the private sector to borrow money than the public sector, the efficiencies that the private sector would bring to the process, and the risks it would take away from the public sector, would prove better value for money.

The big advantage of PFI projects (or 'Public Private Partnerships' as they have been better termed) is the integration of design, construction, maintenance, and services, such as cleaning, catering and laundry. Before PPP, designers only had some input as to how buildings would be built and maintained, but with the builder and facility manager available at design stage, more robust, whole life design solutions could be considered. For example, at the Royal Infirmary of Edinburgh and University of Edinburgh Medical School, more expensive, higher-quality finishes are used where they reduce maintenance costs

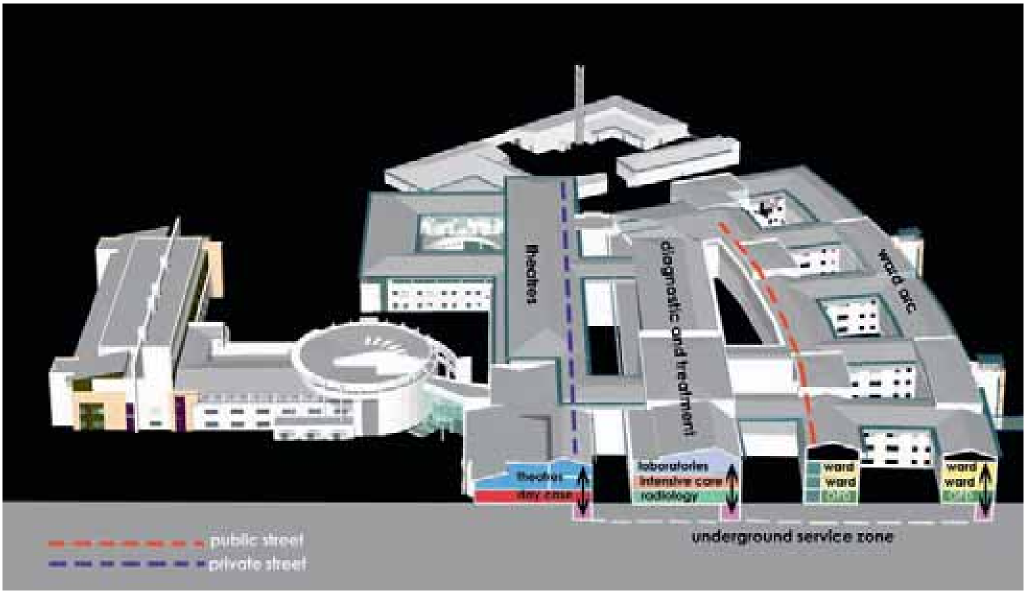

Figure 2 *The servicing strategy at The Royal Infirmary of Edinburgh*

over the 30-year contract period. The additional costs of providing basement service distribution tunnels and extra access lifts are paid for by the enhanced efficiencies in the movement of materials and waste about the building when costed over 30 years. Toilets were prefabricated in a factory to a higher quality than they would have been on the building site.

The hospital had been waiting 50 years for new premises. The public funds of the 1970s had only managed Phase 1 of the redevelopment of the Laurieston Place Infirmary before they ran out. Now with PPP, within seven years, a major hospital had been designed and built, handed over in phases from early 2002 to early 2003. This is very quick for such a large, complex building. The original Ninewells Hospital at Dundee took fifteen years to design and build in the 1960s and 70s.

With PPP, the capital cost is less critical for project creation, and funds can flow to initiate major renewal of public facilities. Politicians love PPPs because they deliver. The initiative has been such a success that there are more schools and hospital projects than the design and construction market can cope with. Its success is its greatest danger of its failure, as demand outstrips supply. As architects, we have left behind the world where standard NHS solutions were the inevitable consequence of tight budgets, and now regularly visit other countries to learn the best of world hospital design. Instead of one or a few projects at a time, and then a famine, there is a constant supply of new hospitals throughout the UK where we can apply lessons learned in conjunction with clinicians, builders and facility managers.

Deficiencies in the Current PPP Process

These are the advantages of Public Private Partnerships, and in many ways the design offer has improved, but usually where it is advantageous to the private sector provider, in the long-term ownership and facility management of the hospital. The high cost of tendering these massive

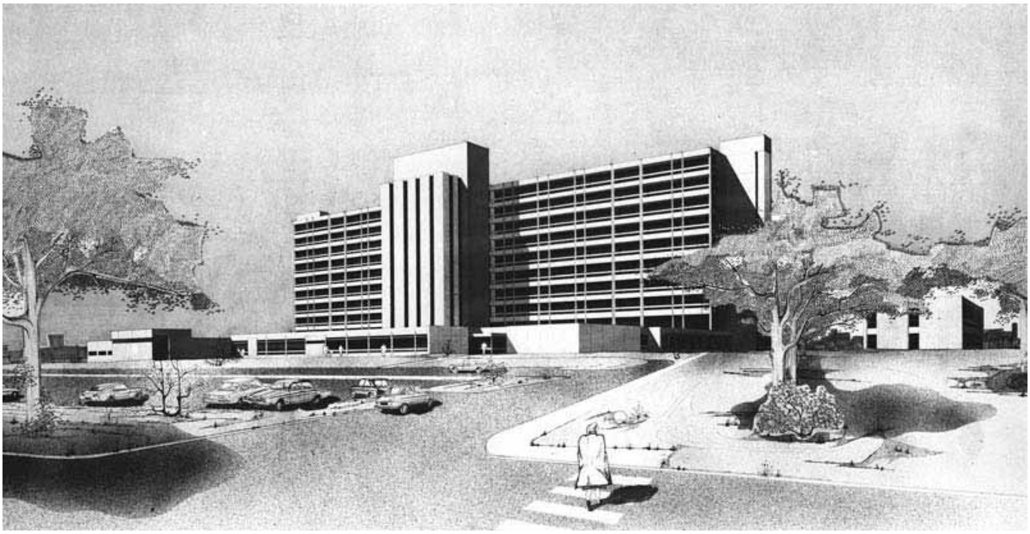

Figure 3 *The utilitarian nature of early NHS hospital design*

service-based contracts continues to be an issue, especially on larger hospitals where there is a complicated, phased redevelopment. The opportunities are many, but the number of large organisations available to bid for them is limited. The deficiencies in the current system can be summarised as follows.

There is little incentive to improve the clinical effectiveness of hospitals

If a hospital capital cost is £x, the running costs for a 30 year PPP contract period, which the private partner can make more efficient, will be over £5x. However, the cost of NHS staff and clinical services within that period might be £200x. Since the PPP provider does not employ doctors, nurses and other medical staff, there is no direct incentive to design the building and facility management services to make their activities more efficient. In PPP prisons, where warders require to be employed by the private sector provider, the whole life costs of facilities have been halved (Scottish Executive Consultation on the Future of the Scottish Prison Estate 2002). Each member of staff saved in a prison due to efficient design saves about £1 million over a PPP concession period.

In hospitals it has been demonstrated that some ward layouts might involve nurses in up to 2 hours more walking per day than others. This is 2 hours that would be better spent with patients, and with medical staff in short supply in most countries, making their working lives more efficient and providing better quality environments for them to work in, would be good value for money. Unfortunately, in this major aspect of the whole life costing, the public sector cannot spend extra on the £(1x + 5x) element (the capital cost and facilities management) to save on the £200x element (the clinical operation of the hospital), but is limited by the old cheapest cost approach on capital spend when compiling its business case. Nor is there time or money during the bid process to adequately explore these clinical benefits.

The quality of patient and staff environments is too low

The low cost culture prevailing in NHS hospitals over the last 50 years has led to low aspirations and expectations of NHS managers. This, and the cumbersome PPP process, especially during the frantic bid stage, are leading to many poor quality design solutions. There is currently a preponderance of deep plan buildings being selected for PPP projects, where views out are poor, natural light and ventilation minimised and public spaces cramped and unattractive. Such buildings may also contribute to HAI problems and may not meet government sustainability targets.

While clinical adjacencies will initially be close and construction costs reduced, such densely planned buildings will be difficult and disruptive to reconfigure for inevitable changes in clinical practice, storing up problems for the future.

Conclusion

When a government finds a reliable method of delivering large-scale projects, it is loathed to make changes to it, despite deficiencies in design outcomes and excessive bid costs. Such deficiencies have arisen from the protocols for PPP projects being driven by accountancy and legal factors which are easier to determine than qualitative ones. The response from the design community has been the development of design tools to objectively measure design outcomes, related to evidence –based quality assessment.

In addition, design is gradually being appreciated to be key to the success of the procurement process in benchmarking the project parameters at the outset and providing a reliable definition of the bid. More design work reduces bid costs and timescales over the project life.

The PPP bidding process is complex, expensive and its outcomes unreliable

Major PPP hospitals cost millions of pounds to bid, since the design, construction, facility management and funding proposals require to be determined. Had the construction industry not been emerging from a deep recession in the mid-1990s when a 1% margin on construction work was good (PPP investments should make a 10-14% annual return), it would not have risked the costs of experimenting with this new procurement method. A £200 million hospital (capital value) will cost at least £2 million to bid, but success might mean a £1.5 billion service contract over the next 30 years. While some new participants have entered the market from overseas in the last five years, only a small number of organisations can afford to bear the costs incurred in PPP bidding, and many large UK organisations will not now bid for large

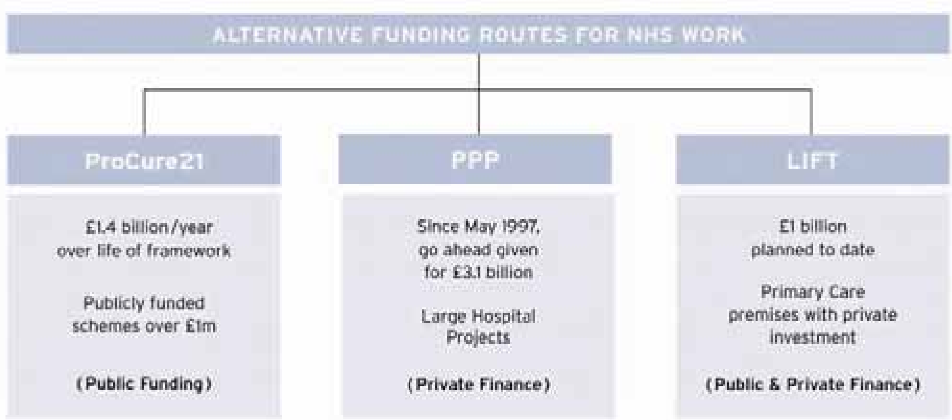

Figure 4 *Funding Chart*

hospitals. Most projects are delayed because the public sector client has not considered its requirements and affordability limits well enough before going to the market. Since bidders have no guide to the affordability level when they start bidding, unrealistic bids are often presented as they respond enthusiastically to the aspirations of the hospital. Last minute changes are made to designs as cost overruns are detected by the public sector client.

Delays compound affordability problems and can lead to a vicious cycle of savings exercises and lost time. Quality inevitably suffers as the public sector project team's control reduces and its options are closed out.

Design is the key to the issues that cause the inefficient and expensive PPP procurement process. Until sufficient design work is carried out, funding packages, construction planning, market testing, facility management programmes and a whole host of other PPP elements cannot be defined. If the design is flawed, the chances are they will also be. The use of public sector design exemplars to benchmark quality and affordability, and the involvement of the private sector in helping to ensure that these are sufficiently robust and realistic, is the only sensible way forward.

Local Investment Finance Trusts (LIFT) and ProCure 21

The imaginative procurement initiatives at the beginning of the 21st century are not limited to PPPs, which are appropriate for large, standalone projects. To upgrade primary care facilities in England, LIFT projects are similar to PPPs in that private sector partners supply the accommodation requirements for health provision via a long-term service contract. However in these projects, a number of community facilities in a locale are bundled together, with the 'client' organisation being a joint venture between local stakeholders (the primary care organisation, local doctors, local authorities, etc.), the private sector operator, and central government in the form of an organisation called Partnerships for Health. Potential private sector providers tender for the work on the basis of the first few or typical buildings, and the successful bidder continues to develop the design and construction of a series of buildings in the local area, with costs benchmarked against the initial schemes. Some of these buildings are quite small, perhaps valued at £1 million, but with the transfer of clinical activity and respite care from major hospitals to primary care facilities in the community, some projects can be valued at over £20 million. A bundle of projects might be valued at £100 million. While the ability to influence design from the start of the project is potentially beneficial, the difficulty in satisfying a wide range of interests is frustrating and time consuming.

The other initiative is ProCure 21, where twelve supply chains were chosen in 2003 to design and build, on a national basis, a programme of publicly funded acute hospital projects, each over £1 million in value. Each supply chain contains national building contractors, local ones, designers, facility managers and suppliers. Having qualified to be one of the twelve supply chains by demonstrating the ability to adopt a partnering ethos, and having set financial parameters and rates, individual projects are then developed and negotiated without recourse to normal competitive tendering, cutting costs and timescales.

Again, hospitals have the combined skills of designers, builders, and facility managers at their disposal from early business case stages of projects. In return, each supply chain must share its design and construction knowledge with the National Health Service to pool best practice towards raising the standards of projects in general. The initiative is sufficiently new that it is not possible yet to judge whether the desired improvements in quality, standards and economies will be delivered.

The Effect of Hospital Building on Patient Recovery

Rotraut Walden

Rotraut Walden, PhD

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Problem: Value and importance of hospital design

Health underpins both work performance and well-being. The built environment affects health to a great extent; Sick Building Syndrome can make us ill. Functional demands have long ceased to be the only concern when constructing hospitals. Patients and visitors should, increasingly, link recovery and well-being with the building itself and therefore should develop a positive image of the hospital. Design is also used as an effective marketing tool that builds trust with patients and visitors and should convey a sense of reliability; or, in other words: "Quality architecture will give the image of quality care."In Design That Cares" by Carpman and Grant (1993), a series of guidelines is listed that has also been applied in the course of this study at three clinics in the Kemperhof Hospital in Koblenz.

In our article, we researched a surgical ward, a women and pediatric clinic with regards to the connection of building features with recovery of patients, productivity of the employees and well-being of all users. The methodological approach of this study uses post-occupancy evaluation (POE), knowing fully well that this is just one step of the International Building Performance Evaluation (BPE) which refers to the complete life cycle of a building (Preiser & Schramm, 1997, 2005; Preiser, 2005; Preiser & Vischer, 2005). Despite conducting just a POE in our study, we develop a methodological structure for our questionnaire in the facet approach (Borg & Shye, 1995) and accomplish a system to judge hospital quality (cf. Walden, 2005) on the basis of qualitative and empirical data. In our opinion both steps help to further our progress in the methodology which is connected with BPE.

The Kemperhof Hospital

The Kemperhof Hospital is funded by the town of Koblenz. Kemperhof is an acute hospital for focussed care with nine main fields of expertise and a total of 641 beds, making it the largest hospital in the region with over 1.000 employees.

Figure 1 *View of the Kemperhof Hospital in Koblenz/ Germany*

Clinics/Departments	number of beds	doctors
1. Surgery	155	20
2.Anaesthesiology	(interdisciplinary)	24
3. Medical clinic I	100	14
4. Medical clinic II	102	20
5. Radiology	5 special beds	12
6. X-Ray		30 (together with Radiology)
7. Women's clinic	64	13
8. Pediatrics	90	19
9. Urology	78	12

Table 1 *Kemperhof Hospital – number of beds and doc tors on each ward*

In close proximity to the main building at Kemperhof there is a helicopter landing pad. The town hospital of Kemperhof in Koblenz is an academic teaching hospital for the University of Mainz.

First hypotheses

1) The judge's assessment of aspects which are linked with environmental control of patients and personnel will be reported.

2) A preference ranking shows the patient's assessments of the building's quality.

3) Personnel and patient's quality assessment differs concerning the hospital's building characteristics.

4) Design and environmental control in the building have a measurable correlation with the performance of the personnel and the recovery

of the patient as well as the general well-being of both parties. The assessment of recovery raises when a high judgement of well-being comes along with it.

5) Qualitative and empirical specifications for important design characteristics are the basis of our system to judge a hospital's quality.

Procedure: Facet Approach, Rating Scale, Sample

The structure of the assessment sheet draws itself from the figure 1 of the so-called category groups. These in this structure of so-called facets are the fundamentals for the creation of the questionnaires.

Individual
Person (p) (a1=assessor 'in situ') **assesses**
(a2=assessor using photographs)
(a3=patient)
(a4=staff member)

Reference
(cognitively/affectively) **the** (b1=single features) or
(b2=overall impression)

taken from the following **Environmental Areas**:
(c1=exterior appearance / grounds)
(c2=main entrance)
(c3=pediatrics)
(c4=emergency room)
(c5=surgery)
(c6=maternity ward)
(c7=security)

Criteria **Environmental Control**
with respect to (d1 = functional value) **regarding** (e1 = neglect/dilapidation)
(d2 = aesthetic value) (e2 = vandalism)
(d3 = social value for communication) (e3 = aesthetic improvements)
(d4 = ecological value) (e4 = evidence of any individual changes)
(e5 = ability to regulate own environment)
(e6 = no ability to control own environment)

with regard to their effect on patient recovery, the well-being of staff and patients and on staff performance as

Rating Scale
(f1 - 1 ☺☺ = very good)
(f2 - 2 ☺ = good)
(f3 - 3 😐 = average)
(f4 - 4 ☹ = poor)
(f5 - 5 ☹☹ = very poor), as well as
(f6 - 9 = not been able to answer).

Figure 2 *Mapping Sentence to Judge the Subjective Effect of Hospital Design on Recovery, Well-being, and Performance (cf. Walden, 2005)*

At the end of each section of questions, space was left available for participant's individual thoughts.

Sample: To begin with, 34 student assessors from the University of Koblenz were questioned "in situ", along with 42 independent assessors using photographs (242 items), 28 patients and 28 staff members using 84 items. Completing the questionnaires took up to 2 hours for all 242 items.

Results

In the first description of our results for student assessors "in situ", we focussed on the evaluation of environmental control and the overall assessments: performance of the staff, recovery of patients and the well-being of both groups. Environmental control means positive or negative design aspects that patients themselves. In the second part of the descriptions of our results, the feedback for the hospital planners is given from the view point of patients and staff followed by a summary with detailed comparisons of the results from the four groups of assessors.

Student assessors "in situ"

The goals set for health, performance and well-being are fulfilled to a particular degree in the pediatric and maternity departments. Surgery follows with around 1 rating scale value for poor assessment. In particular, there is a need for improvement in the aesthetic appearance of the surgical department and in its functionality.

Correlations in the answers

Aided by Pearson-Product-Moment-Correlations, it should be determined, for example, whether there exists a connection between well-being and the quality of the hospital from the assessor's point of view. Correlative values with a significance level viewed at $p < 0.01$.

Figure 3 *Decorations for little patients at a staircase in the pediatrics ward*

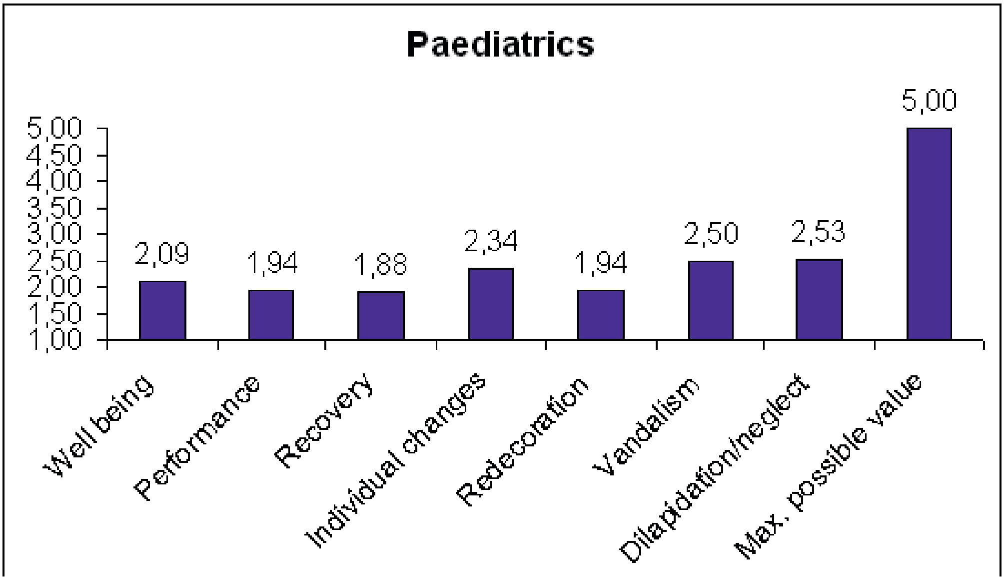

Figure 4 *Assessment "in situ" by student assessors (Number of individuals/N=34). The questionnaire includes 242 items. Mean values on a scale reach from 1 = very good to 5 = very poor.*

Because of the abundance of these values we have only analysed highly significant correlative values over 0.7.

About hypothesis (4):
The assessors estimate the performance of the staff at a higher rate when the level of well-being is also high (rxy=0.78). From the point of view of the assessors, the greater the subjective opportunities for design and control on the part of the staff and patients (for functional improvements and aesthetic appearance), the higher the level of staff and patient well-being (rxy= 0.72).

Personal information from those questioned using the photographic assessment (N=42)

In all, 42 people were questioned as independent assessors. The evaluation is considered in the conclusion. A more exact representation has been left out due to space restraints.

Patients (N=28)

28 patients filled the questionnaires with 84 items out (N=28). They are divided up as follows:

- pediatrics: 8 subjects (four children; four adults)
- Surgery: 9 subjects
- Women's clinic: 11 subjects

The most positive and most negative items in descending and ascending order of mean value, as well as significant differences in the ratings given by staff.

In the following paragraph the items that were rated in all three departments as (very) good and (very) poor should be viewed. Along with these, the top ten best and ten worst features of the pediatric clinic were considered.

First, the items (features) rated as very good or good in all three departments are described (table 2, table 3, table 4) Altogether, the women's clinic has the best ratings from patients, followed by the surgical ward, with pediatric clinic

Table 2: Pediatrics		Significantly poorer ratings from staff t-Test (p<.05)
Item	**Mean**	
Lockable cupboards/lockers available for staff	1,00	
Central heating that can be regulated in patients' rooms	1,25	2,80
Natural light in patients' rooms from windows	1,38	2,08
Corridors of the clinic are bright and decorated	1,50	
Through corridors in the clinic are sufficiently wide	1,50	2,83
Staff allowed to brighten up lounge areas	1,50	
Floor covering ensures safe movement	1,63	
Shade from sun available in patients' rooms	1,75	
Sisters' offices located centrally	1,75	
Map of hospital located in main entrance	1,86	
Brightening up or redecoration of exterior and grounds by patients and staff	3,60	
Changes in main entrance made by staff and patients	3,67	
Handrails suitable for children and disabled	3,67	
Patients' rooms not overcrowded	4,00	
Smokers' room/zone available for visitors	4,00	
Telephones available in patients' rooms	4,00	
Sufficient number of public telephones available in the main entrance	4,14	
Privacy facilities available outside	1,17	
Privacy facilities available in main entrance	4,17	
Adjustable seating available in main entrance	4,80	

at the bottom of the scale.

Connections in patients' answers (development of correlations) (hypothesis 4)

From the patients' point of view, we can see that a real connection exists between the well-being of the patients and staff performance (rxy= 0.91). In addition, it could be substantiated that well-being and recovery are clearly linked (rxy= 0.84), as well as a connection between staff performance and patient recovery (rxy= 0.94).

Staff members (N=28)

Questions concerning staff members' personal information

28 questionnaires returned from the following clinics: Pediatrics (N=12), Surgery (N=11), Women's clinic (N=5) Short summary of results obtained. It is striking that in the assessments of clinics by the staff, pediatrics does well, with the most positive values (1.92-2.5). Surgery, on the other hand, is rated as the worst clinic in comparison, with the lowest score of positive values (2.3- 2.5), and also the most negative value of 4.73 (adjustability of seating). Pediatrics was judged completely differently by the staff and patients. However, it must be noted that the positive assessments made by patients overall clearly outweigh the negative ones. Negative

assessments dominate in the staff's responses. The staff assessments and those of the student assessors are therefore very similar, but are based partly on different impressions of individual features.

Figure 3 *Two available seats in the main entrance*

The following aspects were rated positively by all three clinics:
- The sisters' office being located centrally
- Patient rooms all having access to natural light
- Staff and users being able to make functional changes and can modify the aesthetic appearance

These aspects should be maintained as a result.

The following aspects were rated negatively by all three clinics:
- smoker's room
- few privacy and recreational facilities
- few seating facilities in the main entrance
-sign-posting and direction signs throughout the hospital as a whole were also criticized
-generally, the staff assessed many aspects more critically than the patients (compared with t-Tests).

Connections in the answers (development of correlations) (hypothesis 4)
The same stipulation applies to the examination of correlations that applies to the other studies (that is, only correlations with high significance are used [rxy >+/- .60]).

Clinics (design)
The overall impression of the hospital contributes to good staff performance, which is connected to well-being (0.88). The overall impression of staff performance in clinics shows connections between individual improvements in aesthetic appearance (0.68), the existence of personal items (0.65) and the overall impression of well-being (0.89) – from this it is understood that some redecoration and personal items increase well-being, which undoubtedly also has a subjective influence on the estimations of staff performance.

Figure 4 *Decorations by a medical doctor*

Conclusions for the construction and alteration of hospitals

In every hospital, the building blocks for success are good staff performance, patient recovery that is as fast as possible (proven by a high quota of success rates), and the well-being of staff, patients and visitors. Since a hospital's architectural design has an effect on staff performance, patient recovery and the well-being of staff, patients and visitors, future hospital construction or renovation projects should give the same amount of consideration to the architecture of the building that is given to its medical equipment and furnishings. This conclusion is based on the subjective assessments of four groups of people, not on objective data. To collect objective data to add to this is a task for future evaluations of this kind. As a result, using a posi-

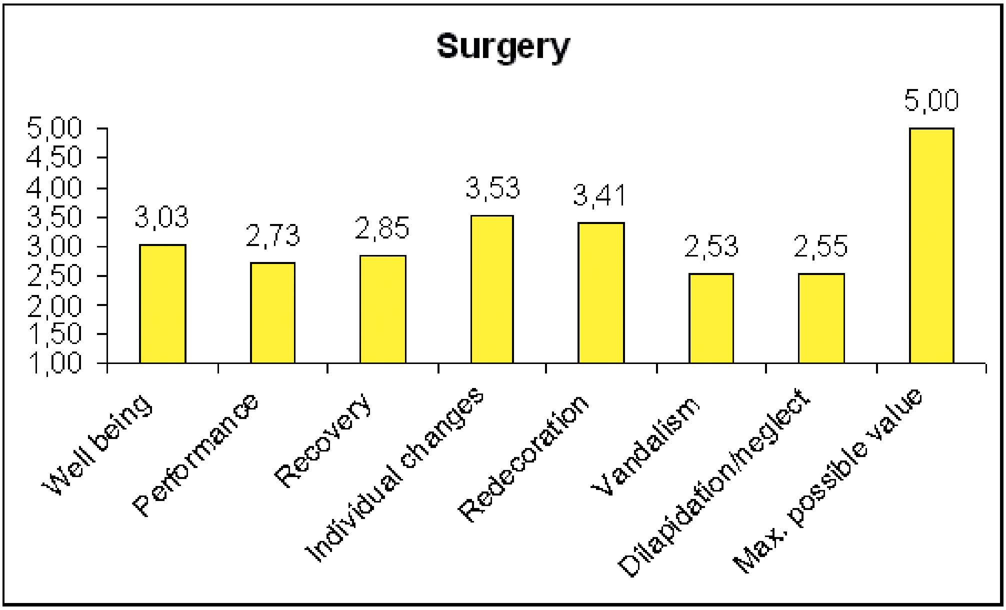

Figure 5 *Assessment "in situ" (N=34). Mean values on a scale reach from 1=very good to 5=very poor.*

tive architectural design could raise employee performance, record shorter lengths of stay for patients in the hospital's annual report through its positive influence on recovery times, and in addition, increased levels of well-being in the hospital would leave staff, patients and visitors alike with a more overall positive impression of it, under which certain circumstances could result in a better image of hospitals as a whole being expressed amongst the general public.

Figure 6 *Surgery examination room without decorations*

There are numerous architectural features that can influence the named aspects of recovery, performance and well-being. These have already been listed in the summary of results. The most important features can be found in the following tables; what significance they have for outsiders, patients or staff is variable.

However, the clues of the varied meaning of the characteristics inform the concrete results of our empirical study. The meaning of the characteristics can, however, appear completely different in other hospitals when the specific problem situation is taken care of. What is more important is the development of a procedure to assess the quality of the hospitals that provides a pool of judgement criteria for hospitals all together. On the basis of such a system, new surveys and tests could always be generated that would then be tailored to the corresponding local situations. The effects of the design features on the

Table 3: Surgery		Significantly poorer ratings from staff
Item	**Mean**	
Telephone available in patients' rooms	1,56	
Lockable cupboards/lockers available for staff in the clinic	1,60	
Sisters' offices centrally located	1,67	
Staff allowed to brighten up the lounge	1,71	
Patients' rooms are suitable and friendly	1,75	
Main entrance is clean and hygienic	1,78	2,73
Patients' rooms not overcrowded	1,78	
TV and radio available in patients' rooms	1,78	
Plugs, light switches, emergency call buttons available in patients' rooms (ease of use and functionality	1,78	
Natural light through windows in patients' room	1,78	
Adjustable seating available in main entrance	3,63	4,73

Table 4: Women's clinic		Significantly poorer ratings from staff
Item	**Mean**	
Natural light in patients' rooms from windows	1,00	2,40
Sisters' offices centrally located	1,25	
Central heating that can be regulated in patients' rooms	1,38	
Shade from sunlight available in patients' rooms	1,55	3,00
Lighting in patients' rooms is suitable for patients	1,55	
Telephone available in patients' rooms	1,55	
TV and radio available in patients' rooms	1,55	
Staff allowed to brighten up the lounge	1,60	3,00
Fittings available in baths for easy use	1,73	
Effect of overall impression of the clinic on staff performance	1,78	
Library available	3,50	
Comfortable seating areas available in main entrance	3,60	
Sufficient number of public telephones available in main entrance	3,73	
Personal items allowed in lounge	3,80	
Privacy facilities available in lounge	4,00	
Adjustable seating facilities available in main entrance	4,33	

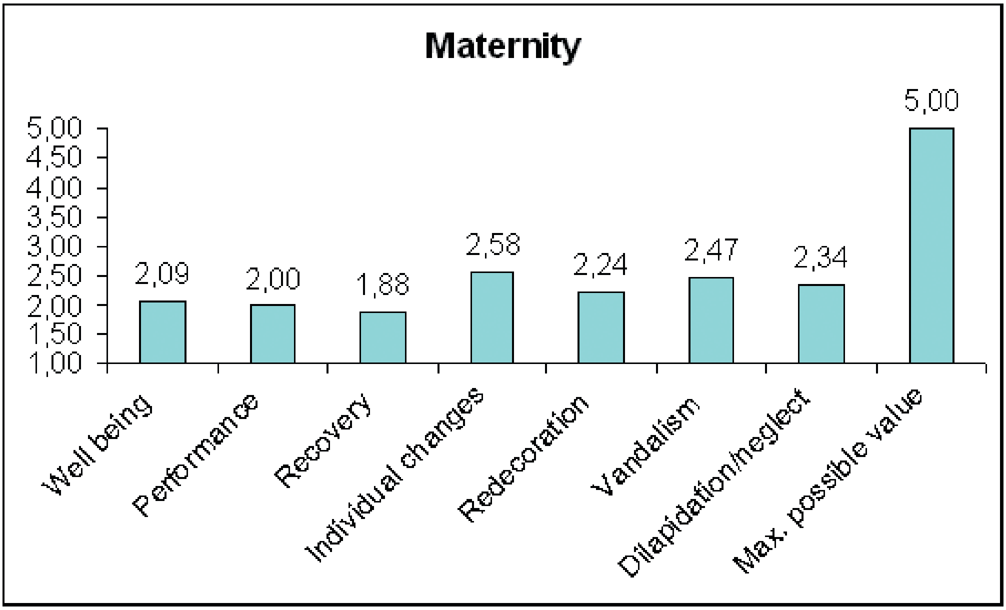

Figure 7 *Assessment „in situ“ (N=34). Mean values on a scale reach from 1 = very good to 5 = very poor.*

recovery, performance and well-being should be checked with a greater random sampling (N>30 per group) and with the help of calculation through the regression analyses (cf.Walden in preparation).

Figure 8 *Sign pointing to the delivery room*

System to judge the quality of hospitals

The elements of the system to judge hospital quality were developed based on the important design features which are mentioned in the literature (Carpman & Grant, 1993; 2002; Dilani, 1999; Reizenstein Carpman, Grant & Simmons, 1985; Monz & Monz, 2001; Shumaker & Reizenstein, 1982; Walden, 2005; Zimring, 1994) and on the results of interviews with experts containing exploratory questions such as:
Which mistakes should be avoided;
Which aspects of the building as it stands now can be judged positively;
Which particular aspects do you consider to be most important for future hospital buildings...?
Hospital environments can be assessed using four criteria, namely the functional, aesthetic, social, and ecological. These criteria are developed by applying the basic central themes of architectural trends, such as “form follows function” to architectural psychology. What is meant by this is that functional aspects save time and energy; for example, layout, wayfinding and quality of materials. Aesthetic design results in feelings of beauty or newness. Social-physical aspects can result in conflicts that arise from si-

multaneous use of one setting by multiple parties (for example concentrated work disrupted by someone using a pneumatic drill in the vicinity) or in opportunities through communication. Ecological aspects mean that the consequences of a building's existence are taken into account - from breaking ground and recycling, to health concerns.
The structure in the Mapping Sentence also followed these 4 criteria.

Table 5: System to judge the quality of hospital buildings (cf. Walden, 2005)

However, a hospital's architectural features are not the only things that can affect recovery, performance and well-being. The present study has shown that opportunities for designing and controlling the building and for organization, from the perspective of staff and patients, can also have an effect on staff performance, patient recovery and on the well-being of both groups (cf. Burger, 1992, S. 171; Clements-Croome, 2000; Ehlers, Greisle, Hube, Kelter & Rieck, 2003; Voordt, 2004).

Improvements are desirable for patients with all types of influences in an individual's environment from the opportunity to be able to relax (privacy), to the operation of everyday objects such as lighting, heating, air-conditioning, television, radio, blinds and bed etc., and the influence of personal design touches – for example, displaying or putting up personal things or being able to influence decision-making). The opportunity for staff and patients to design or control elements such as these should be granted to a much greater extent in the future, in order to produce a positive influence on the different aspects of recovery, performance and well-being.

Conclusion: Achieving perceptible changes and effects form part of people's well-being and recovery. Only data from all involved individuals in a multi-method-approach forms a complete overview of the running of a facility.
Furthermore, the data should be appraised concerning the economic benefit of improvements of the architectural design in the future targeted through BPE's

Gifford (2002, p. 371) reported that an investment in workspace design can result in a productivity improvement of between 10 and 50 per cent; and Brill, Margulis, Konar & BOSTI (1984) calculated a 17 percent improvement. With hospital construction and the realization of such improvement measures, a corresponding benefit is expected in the form of earlier patient recovery and superior personnel work performance.

Environment Criteria	Patients' rooms applicable to all wards	Sisters' offices/treatment rooms/ hallways etc.	Hospital facade and grounds, including main entrance	Environment / Infrastructure
Functional (use value)	- Layout (size) - Breakdown of space - Connections to bathroom, hallways, sister offices, and other rooms (central location, easy contact) - Easy-to-maintain materials - (childproof) plugs, light switches and emergency call buttons, (accessibility and ease of use), windows, electrical items (TV, radio (individually activated, with headphones), equipment for therapy) - Corridors suitable for patients (space for gurneys, wheelchairs, etc.), accessibility to all daily necessities; surrounding views in relationship to each other - Overnight rooms for parents (children's ward) - Available furnishings / comfort - Quiet room (maternity ward) - Sanitary facilities (washrooms, communal bathrooms, (suitable for children) - Beds (compatible with their function, adjustable) - Night stands (accessibility, ease of use, (suitable for children) - Appropriate lighting (bedside and individually regulated	Size, height, and number of rooms and storage space in near vicinity with respect to - Breakdown of space - easy-to-maintain materials, stairs, corridors, supplied with electrical connections, heating - functional spaces: rooms for heating systems, storage, washing etc - Stairwells (practical, clean) - Equipment of corridors (wash basins, disinfectant dispensers to counter the spread of germs, trolleys with treatment equipment, handrails for patients etc.) Seating areas/waiting room - available? - recreational facilities, privacy - can be modified? - Access for the disabled - Handrails for patients - Corridors for gurneys, trolleys etc. - Visitor restrooms - Location - Cleanliness, hygiene - Sister offices (centrally located) - Reception/ treatment rooms - Central location - Rooms signposted - Way-finding using signs and colored markers	Convenient and efficient location of trash cans; childproof materials - Cost of maintenance - Protection against rain (roof); size of grounds for various functions; parking spaces, helicopter landing pad, pathways, accommodation for emergency medical services, useful plants, facilities for relaxation, storage depots, fleet of vehicles, etc. - Doors (width; automatic or manual) - Elevators (height of control panel, width) - Information boards, colored markers - Floor plan - Telephone booths (location, number) - Shop/snack-bar Consideration for steps, corridors, lighting and handrails for patients, and entrances suitable for the disabled (using wheelchairs, gurneys, stretchers etc.)	Distances and links to other medical and social services,shops, etc. - Transport links: tramway/ subway; bus - Road network - Signposting - Highway (airport) - Traffic safety, protection from crime - Footpaths - Shop/Kiosk, etc. - Childproof ponds or lakes, safe playgrounds - Sidewalks, ramps for wheelchairs, pushchairs - Pathways, steps, routes and corridors suitable for the disabled - Florists - Bookshops - Grocery store/shop

Table 5 *System to judge the quality of hospital buildings (cf. Walden, 2005)*

Environment Criteria	Patients' rooms applicable to all wards	Sisters' offices/treatment rooms/ hallways etc.	Hospital facade and grounds, including main entrance	Environment / Infrastructure
Functional (use value)	- Wardrobes (height, size, lockable) - Telephones - Heating/air-conditioning (that can be regulated)	- Emergency exits; well signposted and marked) /smoke alarms - Fire extinguishers (readily available, signposted) / sprinkler systems - Fire doors / surveillance cameras - Floor coverings (smooth, flat, non-slip) - Lockers for staff/ checkroom - Air conditioning (that can be regulated)		
Aesthetic (form, geometry etc.)	- Colors, forms, surface materials (ceilings, walls, floor coverings, windows, doors) - View from windows - Type of light / direction of light (natural, from the windows, view), protection from the sun (blinds) - Design (suitable for children, friendly) - Friendly, personal things	Colors, forms, surface materials - Stairs, walls, ceilings, floor coverings, (flagstones, PVC, etc.), wallpaper, tiling, window seats and frames - View from the windows and light coming through them, brightness (natural light, windows, view), protection from the sun (blinds) - Decorations, flowers - Traces left by users (dilapidation; destruction of serviceability; signs of individual alterations, e.g. brightening up/improvements made by users/staff) - Friendly, light, personal things Originality of the design.	Colors, forms, surface materials - Roof, facade, balconies, gates, entrances, etc. - Plant arrangements - Blends in with neighborhood - Type of paving (Tarmac, slabs, paved, etc.) - Traces left by users (dilapidation; destruction of serviceability; signs of individual alterations, e.g. brightening up/improvements made by users/staff)	Uniformity, attractiveness, complexity, interest - Suitability for the environment (commercial, industrial and living quarters, nature etc.) - Removal of dirt - Upkeep

Table 5 *System to judge the quality of hospital buildings (cf. Walden, 2005)*

Environment Criteria	Patients' rooms applicable to all wards	Sisters' offices/treatment rooms/ hallways etc.	Hospital facade and grounds, including main entrance	Environment / Infrastructure
Social (value for communication	- Density (dependent on size and use: number of patients per room) - possible conflicts in use between patients - viewing contact /connections between patients and guests - curtains for privacy - Feeling of constriction due to bed layout - Atmosphere (hectic, noise level, quiet)	Possible conflicts in the use of communally-used spaces (hallway, ward bathroom, patient and staff restrooms/ kitchen, etc.) - Routes, corridors: patients, staff, visitors - recreational facilities; privacy, roller shutters - Visual connections from seat height - Atmosphere (hectic, noise levels, quiet) - Communal room (playroom, library, smokers' room/smoking zone also for visitor use) - Visitor's room - Kitchen with tea-making facilities - Staff room	Division and links to neighboring houses (fences, gates, walls, alcoves (cut off from view)) - Benches in the park for patients and visitors to meet on - Design of park area (table tennis, chess, checkers) - Recreational facilities, privacy - Central/ information/ registration (central location) - Information board - Cafeteria - Opportunities to sit down in main entrance area (availability, adjustable seating, recreational facilities, privacy)	Availability of playgrounds, benches, pedestrian areas, churches, etc. - Frequency - Density - Courtlike layout vs. anonymity - Positive insights and perspectives; positive controls (helpful attitude, protection from crime)
Ecological value	- Direction (of sun and light intensity) - Clocks for thermostats - Temperature, noise, air, humidity, smells (opportunity to regulate these) - Ecological quality of materials used (effluvium)	independence of the functional requirements of each space - Sound and heat insulation (-permeability) of windows, doors, floors etc. - Protection from sun and air-conditioning - Disturbances from noise and odors - Temperature / heating / air-conditioning (ability to regulate these)	- Flora and fauna - Natural paths (pavements) directions/ - signposting - Insulation from noise made by neighbors and traffic (helicopter, traffic, railways, etc.) - Water games for children and for relaxation in the park - Thermal insulation	Trees, parks, lakes, streams/rivers; toxic emissions, wind, thermodynamics, formation of gases from rivers and roads; residential streets - Security on footpaths (lighting) - Waste management and its utilization - Sporting facilities - High-voltage power lines

Table 5 *System to judge the quality of hospital buildings (cf. Walden, 2005)*

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Evaluation of the Ward in the Erasmus Medical Centre

Liesbeth van Heel

Liesbeth van Heel, M. Sc.

M.E. (Liesbeth) van Heel, MSc, has been involved in Erasmus MC's hospital redevelopment project since 1998. She acts as secretary to the Steering Committee and heads the Expertise group New building within Erasmus MC's department of Corporate Real Estate. She coordinates patient participation aspects in the project, is responsible for PR and communication about the project, and has developed a sensitive ear and eye for healing environment issues. Over the last 6 years she has scouted nationally and internationally for contacts and research valuable for the project in Rotterdam, including the research on single patient rooms presented in this paper.

Introduction

In the late 1990s, Erasmus University Medical Centre Rotterdam (Erasmus MC), faced with the renewal of its buildings on the present site, was given the opportunity to formulate and develop the model university medical centre of the 21st century. In this paper I will focus on a single aspect of this project: the concept of providing single patient rooms only in the new facility. At the time this was not only new for university medical centres in the Netherlands, but for general or acute hospitals as well.

How this concept was thought of, formulated, shared, enriched and questioned is described in this paper in chronologic order. The overall perspective of this narrative is that of a hospital planner working on the new Erasmus MC, but where possible it will be broadened to encompass other hospital projects in the Netherlands. This is why I have given this paper the title: "Introducing Single Patient Rooms in the Netherlands."

1999: the very start

The start of the Erasmus MC hospital renewal project in the late 1990s was the one time opportunity to formulate new strategic goals and thus requirements for a model university medical centre of the 21st century. We took this up by introducing the concept of the 'themed' hospital that become known as 'thinking differently': with existing and virtual centres of academic excellence under one roof, we would concentrate the care for related, recognizable patient groups in separate sections within the total complex. Among other things, this would enhance way finding and reduce patients' travelling times within the hospital complex. The 'thinking differently' concept inevitably resulted in related concepts: 'working differently' and 'building differently' [1]. So, 1999 also saw the start of the 'working differently' concept within this themed hospital. It focussed on the patients routing through the necessary care-elements, by standardized patient pathways, better planning of facilities, and bringing together all relevant disciplines around the patient, aided by IT-facilities. This will lead to quality improvement, straightening the path for patients and staff, and finally also result in a cost reduction.

When planning a new hospital in the Netherlands, it is important to note that the allowed square footage is limited and based on the allowed number of beds. The government reduced our allowed number of beds to 1080 (excluding the Psychiatric Hospital), but gave freedom to so-called substitution within that number of beds. Government regulations saw reduction of beds throughout the system, enabled by reduced length of stay and an increase of treatment in ambulatory care settings. This government driven reduction of Erasmus MC's size (in close co-operation with the local health insurance companies) necessitated a fundamental rethinking of our services, with growing ambulatory care facilities and shorter stays of more severely ill patients in a tertiary care referral centre. It also made us more aware of our 'front door' (GP-practices) and 'back door' (home care, nursing homes etcetera) policies. Considerations like these gave birth to the first ideas about introducing single patient rooms as a way of reducing the physical number of beds required. For this concept could help bring down length of stay, allow better use of the beds available and enhance patient privacy, comfort and rest). Furthermore, it enables rooming-in (which was at the time only accepted in children's hospitals) possible for all patients.

2000: early days for all involved

The Dutch government requested reference projects for this new 'themed' hospital we were thinking about, which we found in the Mayo Clinic in Rochester, Minnesota (with its clinical Practice Integration Project) and the plans for the pavilion-built clinical care centres at St. Olav's Hospital in Trondheim, Norway. In Rochester we find evidence of the trend providing only private rooms in virtually all newly built hospitals throughout the USA. St. Olav's Hospital (which has a similar size and concept compared to Erasmus MC) has also chosen to provide single patient rooms only.

After having been informed about these reference projects, the Dutch government now shows an interest in this idea. However, they then demand evidence based-data as to the effect of private rooms on length of stay, patient satisfaction etcetera, demonstrating that the physical number of beds 'built' can be reduced even further. In the Netherlands, the number of beds still is the main driver in financing, building and maintaining a hospital. Dutch healthcare insurers also are interested now, for reasons as given above.

The Netherlands Board for Healthcare Facilities is interested as well, but states that the larger square footages for each bed thus required must be found within the overall standard for university hospitals, i.e. 96 m2/bed net footage, based on the allowed number of beds. They think it is too early to allow extra square footage for housing inpatients in private rooms (as the effect on recovery time is yet unknown) and suggest space must be found by building less physical beds or reducing the space needed for other hospital facilities such as laboratories, treatment rooms, kitchens or staff accommodation. Erasmus MC decides to go along with this line of thinking, and plans to provide for 985 beds out of the 1080 allowed, including 100 day care beds . Day care, however, will continue to use multi-bed rooms.

While Rotterdam is still planning for 885 single patient rooms in its new hospital, the new AvL/NKI Oncological Centre in Amsterdam is the first to provide single and double patient rooms only (as opposed to the generally used mix of four bed bays, double and single patient rooms); this project opens in 2003. This innovative mix is argued for on the ground that this specialized cancer hospital admits fewer, but more seriously ill patients. So, for this specific patient group this mix of facilities seems acceptable to all parties concerned, as everybody knows cancer patients are really ill when in hospital…

Meanwhile, not all doctors in Erasmus MC are convinced that the introduction of single patient rooms is the right thing to do. The benefits are generally accepted: reduction of hospital acquired infections (single patient rooms on a new ICU-ward have shown significantly better results in our hospital) and of course more comfort for the patients [2]. On the other hand, many objections are raised: We might not be able to attract the number of nurses needed, "certain patients need stimulation from roommates to get well". How about joint care programmes for hip-replacement patients. Will we have enough beds when this further reduction takes place, etcetera. These sentiments are noted, but not given much feedback, as planning is still at an early stage and realisation is still a long way. However, in the first discussions with our patient representatives board we encounter mixed feelings as well, New pros and cons come up: e.g. better privacy, better opportunity for sleep/rest, private bathroom on the one hand, and patient safety risks, loneliness, etcetera on the other hand. These pros and cons are debated intensively, but at the time no consensus can be reached.

2001/2002/2003: The idea is taking shape

In these years we plan to invest in some serious research about the prospect of a new facility with only private rooms. For one, we propose to build a scale model of our future patient room, for everyone to see and try, with innovative design features. Then, we also propose to equip a renovated ward in the old hospital with 10 single patient rooms, which would enable us to obtain reliable data on the effect of single patient rooms on length of stay (comparing similar patients in single rooms and multi-patient rooms), nurses' workload, patient satisfaction, etcetera. The actual realisation of these plans, however, is hindered by planning permissions and uncertainties further in the project. In 2002 the first drawings are discussed by various interest groups within the hospital and by our patient representatives board.

Figure 1 *Room for social support in our mock-up*

Creating a 'healing environment' for the patient by providing a private room enters the discussion in Rotterdam as the project team discovers this subject to be a major issue in modern healthcare architecture and development. New evidence in scientific literature is found to support the chosen path towards private rooms only (with the exception of those groups of patients that benefit from stimuli from their direct surroundings) [3,4]. The literature is surveyed for evidence-based design guidelines, not only for the patient rooms, but for the hospital and its users in general [5]. The possibility to influence one's own environmental circumstances (temperature, light, opening a window or closing sun-shades) figures eminently in this research as a factor that can be facilitated by providing private rooms.

From personal experience in this period of time, I became a fervent believer in the concept of private rooms and its beneficial effect on recovery by enhancing facilities for social support and privacy. What joy when your partner can just sit with you, read a newspaper, and can pick up your pen, bring you some water, walk you to the bathroom, without you having to call a nurse (and this not just during regular visiting hours). What relief when you can speak to relatives and friends on the phone about your condition, without three pair of ears tuning in, etcetera. But ever since my own hospital experiences, I have also realised the downside of private rooms. Elderly people, for instance, might be lonely without visitors to offer social support, might get disoriented without the clearness of mind to know when to call a nurse, might ask the same question 30 times a day (and get to be ignored…), and might endanger their own therapy by not taking their medicine by lack of supervision (by roommates…). This aspect requires our attention as hospital planners and architects! Therefore I am glad that our planning team has identified the need for communal spaces on a ward with private rooms: places where you can share your meals with other patients, where you can go when you want to talk to fellow patients, be activated as an important aspect of recovery (provided it does not endanger your own and others' safety…). The idea of having rooming in facilities within each private room, however, is reconsidered, in favour of space for families on the ward and an adjourning 'family house' (such as the Ronald McDonald concept for children's hospitals).

Figure 2 *"Mobi" and "iCarus" in use in our mock-up*

In April 2003 Erasmus MC receives government permission to go ahead with the planning process. However, the number of beds (as the measure of allowed square footage and investment cost) must be reduced yet another 8%, bringing it down to 1000 beds, excluding the Psychiatric hospital. This condition forces us to review our plans again. Yet I am glad and proud that our decision makers have consented in making 'room' for our 21st century healthcare model, even though we have to make do with fewer beds than originally planned.

Spring 2003 we first meet up with the project team in Trondheim: their mock-up of the 'sengetun' is truly inspirational; we wonder, however, about en-suite bathrooms or the idea that toilets might suffice (when your are fit enough to take a shower unaided, you might as well go home). We appreciate the Norwegian emphasis on bringing in daylight and creating rooms with a view, even from a lying position in bed. We find kindred spirits in plans for a nearby patient hotel – available for relatives as well [6].

Around this time Erasmus MC's infection prevention unit conducts a literature survey on prevention of hospital acquired infections [2]. Although not peer-reviewed and published, it is translated in English and presented at an European Health Property Network meeting. Based on this literature survey, research is planned on the renovated ward with the 10 single patients rooms (coming in use in 2006).

We find that in these later years other hospitals (non-academic mostly) planning new facilities in the Netherlands have adopted the idea of including more single patient rooms within their mix of inpatient facilities or even planning for private rooms only. Running ahead of us, these initiatives will be ready before we are… The Netherlands Board of Hospital Facilities then publishes a new building guideline for hospital wards in which this trend is recognized and given status. It says: "The changing role of the patient, manifesting itself in his active involvement in his own care process, as an informed health consumer, with changed expectations regarding privacy and continuation of his personal lifestyle, quality and accessibility of services within the room and outside, autonomy and ability to take care of oneself, has led to new concepts of healthcare in designing patient wards, and even to concepts with only private patient rooms." [7] In the southern part of the Netherlands, Orbis Medical Park has chosen to build 426 private rooms, replacing its 677 present beds, based on a patient-and-process redesign focused hospital development project. Thus far it is the only hospital being this strict in its choice for private rooms. The private rooms will open up by glass sliding doors to a communal inner ward space, where social interaction among patients is facilitated.

2004/2005: The idea is becoming more mature

Early 2004 the mock-up of the Erasmus MC private room is opened to 'the public', i.e. patient representatives, Erasmus MC staff involved in the project, and others. Researchers from Delft Technical University's Industrial Design Faculty have designed some innovative features for the mock-up. Special attention was paid to the en-suite facilities: a sliding wall enabling wheelchair access in toilet/shower, while optimizing the space around the bed, when the en-suite facilities are not in use. Being a mock-up, and being still several years from the final interior design of our private rooms, we encourage this innovative work and have enabled design students to use the mock-up for their graduation projects . While at present the Erasmus MC hospital's exterior shell and floor framework is being designed, there is still time to give some more thought to the ideal single patient room for our university medical centre, the exact number of beds needed in 2012-2014, and the configuration between private and 4-bed rooms required. The shell and floor framework and IFD-design principles should allow for flexibility in converting 4-bed rooms in day-treatment wards to private rooms, whenever the needs arises (or vice versa). This possibility to convert within the standard ward lay-out was seen at the brand new NIH-facilities in Washington DC, and seems to us the way to proceed.

Final drawings for the pilot-ward are made, the contractor for the whole 'facelift' of patient wards in the existing hospital is selected by the end of 2004, and work is started. While at first we thought to study just the regular patient group of this Urology ward, we now consider-

Figure 3 *Room for social support in our mock-up*

studying different patient groups over the years to come. Research models are developed together with the Health Care Management Institute of Erasmus MC, to study the business process as well as the patient satisfaction aspects of the 10 private rooms with en-suite and rooming-in facilities.

Some insights for the period to come

Our network and awareness on the subject of evidence based design and the role of the private room in creating a healing environment for today's and tomorrow's seriously ill patients has grown over the last few years [8,9,10,11,12]. Our patients are thought to leave the Erasmus MC secondary but mostly tertiary care facility at the first possible moment, being discharged to go home, or (back) to regional general hospitals or nursing homes. Where in 1999 the idea of 100% private rooms in the Dutch context seemed revolutionary, five years later the subject is 'hot' although still disputable, as side effects are recognised as well.
The Netherlands Board of Hospital Facilities has been caught saying they may have discovered this subject rather late. Now they sponsor research by Maastricht University on the interior design and function of private rooms in hospitals, a research project in which Erasmus MC is again involved.

A thesis by a Erasmus University Master of Health Care Management student focuses on the considerations for Dutch hospital executives while choosing between strictly private rooms and a more traditional mix of private, double and 4-bed rooms in their new facilities [13]. He used the Pebble Project's Fable Hospital, Ulrich

	significance score 1-3	much better in private room	better in private room	neutral for choice	better for multi-bed room	much better for multi-bed room
PATIENT FOCUS (20%)						
privacy	3	x				
autonomy	2		x			
social support	2			x		
envionmental factors	2		x			
STAFF SATISFACTION (15%)						
QUALITY (35%)						
HOSPITAL EFFICIENCY (30%)						

Figure 4 *Scoring "Chamber choices" using J.J. van Geest's model*

and Zimring's literature survey, and Erasmus MC's preliminary research as a starting point [14,15]. The factors influencing choices are summarized in illustration 5, and point towards private rooms.

In constructive debates with patient representatives and those involved in primary processes in care and cure, our Executive Board holds the view that given current evidence it is not fair to offer patients in a university hospital a second rate solution by placing them in multi-patient rooms.

However, we must not close our eyes to the possible negative effects of a 'one size fits all' solution. We must realise that hospitalized patients nowadays and in the future will vary in their needs, and look for new solutions while designing this vital part of the hospital. Solutions may lie in creating space within the private room to accommodate those providing social support to the patient, or by allowing space for communal day-rooms for shared therapy, contact with 'fellow sufferers' as well as private sleeping quarters. It goes without saying that good quality of care is all-important for the patient's experience in hospital. Patient safety should be a main focus, but I am convinced that other aspects influence the healing process as well.

Earlier this year we were pointed to early findings from the Ringerike Sykehus, Hønefoss, Norway. This new hospital with 128 private rooms was able to reduce the number of staff on duty during the night, because patients being properly asleep need less (non-medical) attention. We will visit this hospital later this year with some of Erasmus MC's leading people involved in the discussion about unit size, management of beds over the classical department borders, etcetera. Questions still unanswered are, for example, whether step-down care is preferred over rooms adaptable for various levels of acuity so that patients need not be transferred, which reduces the risk of faults and miscommunication. Also, what diversity of patients can be nursed on a single ward, due to the mix of

Figure 6 *"Mobi" in use in our mock-up*

medical and nursing skills involved? Luckily our planning process in Rotterdam allows us the time to seriously consider all these aspects!

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The Hospital Building Flexibility and High Tech Environment

Chair: Elliot Paul Rothman (USA)

Managing Change: the application of Open Building in the INO Bern Hospital

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Dr. Kendall is a registered architect, architectural educator and researcher. He directs Ball State University's Building Futures Institute (www.bsu.edu/bfi) and guides graduate students in studies of adaptable architecture focusing on residential and health care architecture. He lectures to academic and professional audiences internationally, has published more than 30 journal papers, authored a number of technical reports and co-authored a book on adaptable architecture or "open building". He has conducted a number of funded research projects and is joint coordinator of the CIB W104 Open Building Implementation (www.open-building.org).

Abstract

This paper discusses a significant and innovative architectural management method, used for the first time in a medical facility under construction in Bern, Switzerland. The 50,000 square meter project – the INO - is being managed by the Canton Bern Building Department. The client and the management team recognized - when the decision was made to build a major addition - that complex buildings such as this only become "whole" over time. They had come to realize, after many conventionally procured buildings, that inevitably the program of functions changes to meet new medical procedures, new regulations, and new market and insurance conditions. Recognizing these dynamics led to a decision to adopt an entirely new process for procuring the facility, and with it a concept of distributed design management. A competition was held to select a design and construction firm for each of three distinct "levels". The primary level is intended to last 100 years and is expected to provide capacity for a changing mix of functions. The secondary level is intended to be useful for 20+ years, and the tertiary level for 5-10 years.

The approach discussed in this paper deals in a new way with problems of facilities change, and the concomitant management of distributed design and construction responsibilities. As such, it represents a good example of "open building" theory and practice, an approach to facilities design and construction that is conventional in the office and shopping center markets and increasingly in multi-family residential construction worldwide. The INO project is the first known project to apply these principles of architectural management in health care architecture. It therefore sets a new standard for adaptable medical facilities, offering an alternative paradigm to meeting critical needs in the field of health care architecture.

Background

For at least the past three decades (Prins et al 1993; Brand 1994; Templemans Plat 1995; Kendall October 1999, Venturi and Scott Brown, 2004), facility managers and clients of commercial and office buildings in many countries have learned that dynamic societies require agile architecture. Two alternatives face clients with dynamic requirements:

1. Scrap and build – design and construction according to presumably "fixed" programmatic requirements, resulting in facilities requiring expensive renovation when uses change and entangled systems must be upgraded, or premature demolition when economical upgrading is impossible.

2. Stock maintenance – design and construction according to analysis of both current requirements and provision for unknown future uses and technical upgrading. This is called "open building" among some practitioners internationally.

There is new evidence that "stock maintenance" practices are being applied with increasing frequency to medical facilities. A sharp departure from conventional functionalist thinking and architectural management practices, open building is increasingly recognized as a prerequisite to deliver sustainable built facilities of the scale, quality and capacity called for in the medical campus of tomorrow. Designers, facility managers and medical facility administrators are slowly adopting new ways of working. The evidence of this is ubiquitous, but not easy to name or recognize from the perspective of the management thinking in which we have been trained to operate.

This paper reports on a project that may be among the first in the world to apply "open building" management principles to the design of a large medical complex. But before introducing the project, it is useful to review a number of principles and problems facing health care architecture.

Basic Principles of the Behavior of Complex Environments

The "open building" strategy for architectural management, discussed in this paper, has its roots in the way ordinary built environments behave. That is, built environments are under constant change, and responsibility for these transformations is widely distributed. No one makes all decisions, at all environmental levels, over any extended period of time. There is a definite hierarchy at work that inherently organizes this transformation process. For example, the framework of streets sets the context for the properties on which individual buildings are constructed. Individual buildings – such as office buildings or shopping centers – are built and then filled-in, with an almost constant "churn" of the so-called "tenant fit-out", designed by architects other than the designer of the building. We have experiences that show us that if the street network adjusts, the buildings situated in the spaces between the streets are affected. But the buildings can adjust without impacting the street network. The same unsymmetrical relation exists between the building and its fit-out.

Lessons for Hospital Facilities Clients

This hierarchical structuring of the ordinary built environment makes complexity manageable. It also allows distribution of responsibility with minimal fuss and conflict. Some of the buildings we appreciate most – those most suited to agile regeneration - were, not surprisingly, organized in congruence with this hierarchical structuring. Constructed in the 19th century in the pre-functionalist or pre-Modernist period (Brand 1994, Venturi 2004), these are among the buildings that are being saved and renewed today and used as models for new work. Built by one party and one architect one hundred years ago, they are now being adapted by other architects for new uses.

The reason they are being successfully adapted is not first of all because of their style, although now we seem to want to preserve these historic buildings because the public, clients – and many professionals – doubt the current profession's capability to deliver better buildings. These buildings are models of the kind of buildings hospital administrators are increasingly expecting from their architects and engineering consultants. Not only do they fit into a coherent

Figure 1 *The Insel University Hospital Campus in Bern, showing Phase One of the INO in the foreground*

urban pattern, they are simple to build and offer spaces of remarkable quality, as well as spatial and technical capacity. Most important, they are not tightly integrated with programs of use – they are not defined "functionally". They are "open" buildings, sustainable in the large sense because they can accommodate change.

The Insel Hospital and the INO Addition

Many clients and their design teams are exploring new approaches to the problems of change in medical facilities. One such departure from the norm was a radically new way to construct a large 50,000 sq meter medical facility on the Insel teaching hospital campus in Bern, Switzerland, part of which can be seen in Figure 1. As with all medical facilities, this project was planned under tight budgetary, regulatory and environmental constraints. The story of this project is worth recounting since it represents the decision of a large client and its facility planners to alter the management methods it had been using for decades, in order to obtain a new facility to meet the future with more assurance. (Building Futures Institute 2002).

The Insel Hospital is a hospital for intensive care, emergency and surgery. For several years, the facilities planning group of the Canton Bern building department, responsible for this major primary health care facility, tried to fix a program of uses so that a design team could produce construction documents for a major addition, called the INO. Each year, a series of events occurred that prevented them from fixing the program: new medical procedures were introduced, a new head of surgery was hired with new staffing, space and equipment requirements, a change in the market for services occurred, new regulations were introduced, the pediatric facility was scheduled to be expanded, and so on.

As a result of these continual changes, the facilities group found it impossible to get the addition they needed. To solve the problem, they decided

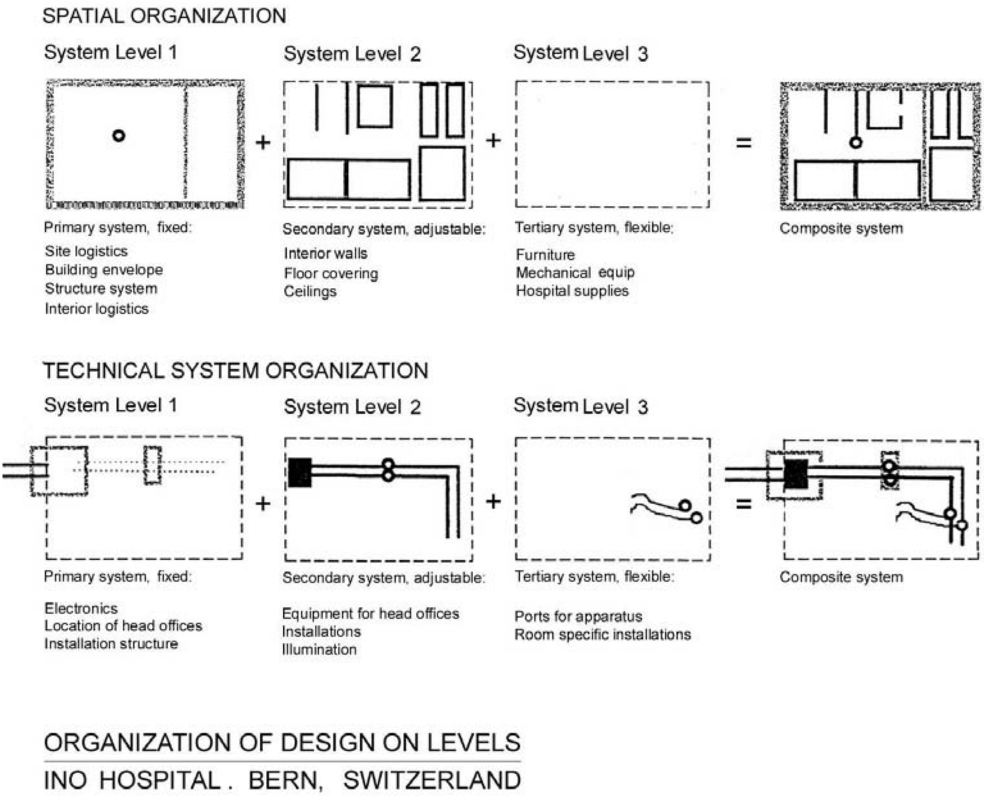

Figure 2 *illustrates the basic approach to managing this complexity*

to adopt an entirely new planning and management process, recommended by Mr. Urs Hettich, then architect and Director of the Canton Bern Building Department. The client's demand for long-term value in the addition to their facility defined the most important aspect of the new design and decision process: the ability to assure optimized adaptability in the face of changes in technical, social and political circumstances.

The traditional idea of delivering health care facilities up to now had been that it was easier and more economical to optimize a construction project by comprehending the "whole" with all its inter-dependencies. But in very complex buildings like hospitals, the hospital administration had learned that it is never possible to do so - that such facilities are too dynamic and can not be planned and built as if they are somehow "programmatically static". Rather, the "whole" will come into existence over time, in an incremental way. This means that large and complex buildings are never finished. In recognition of these realities, the project was split into three systems organized and conceived according to their expected life spans:

Primary system (nearly 100 years)
Secondary system and (nearly 20 years)
Tertiary system (nearly 5 -10 years)
The following diagram (Figure 2) explains the basic approach to managing this complexity.

The primary system determines the structure of the hospital and gives conditions for the development of the following systems. The interfaces

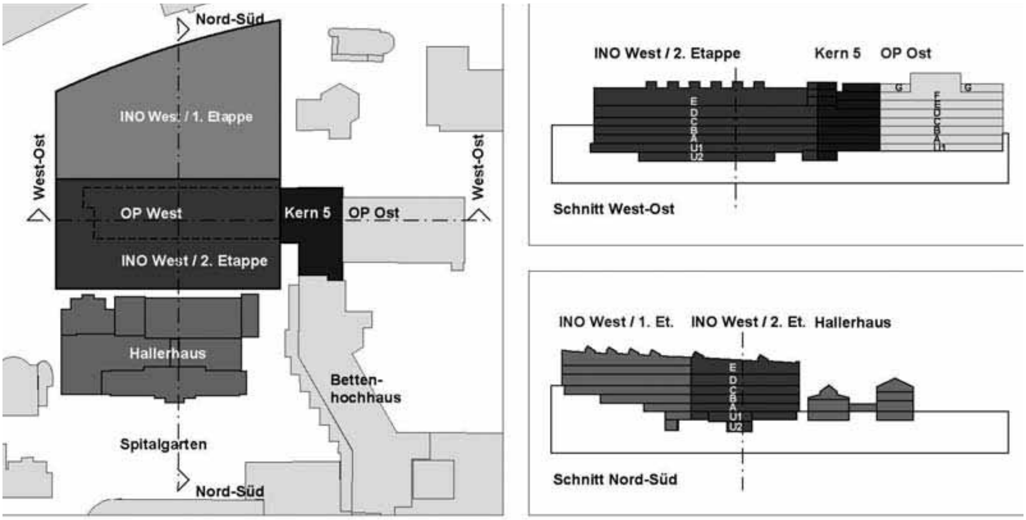

Figure 3 *Phasing of the INO. The "OP West" is the wing of the 1970's building that would be demolished to make way for Phase Two of the INO. The "Hallerhaus" will be demolished upon completion of Phase Two to make space for a landscaped garden at the heart of the Insel campus.*

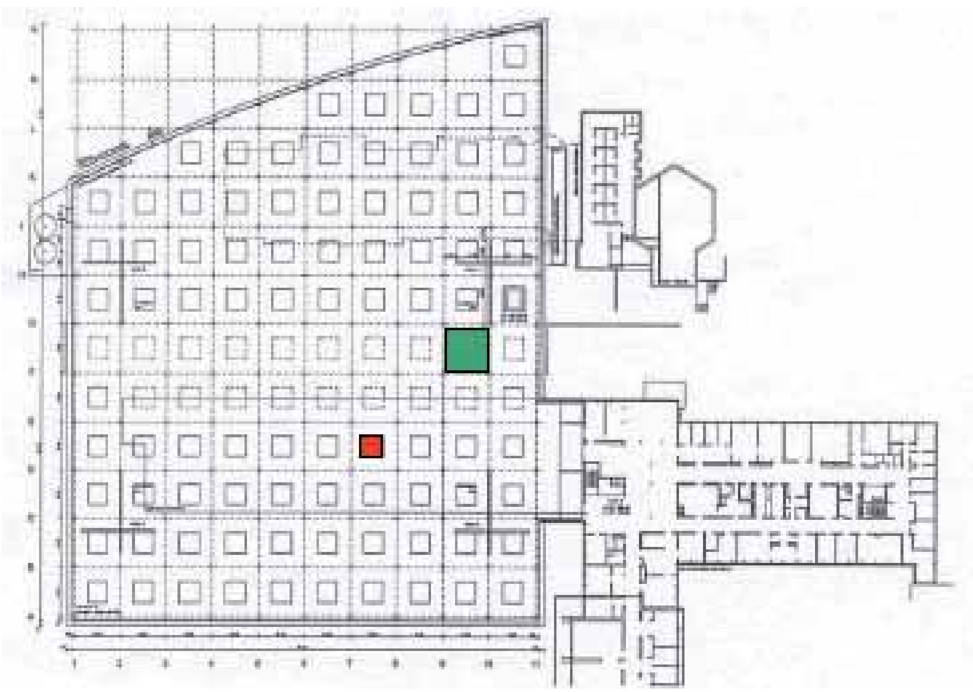

Figure 4 *Plan of a typical floor of the primary system, showing an 8.4m x 8.4m structural grid. The primary-system architect was Peter Kamm and Kundig, Architects. This firm had designed one of the pioneering residential open-building projects in Zug, Switzerland, in 1973.*

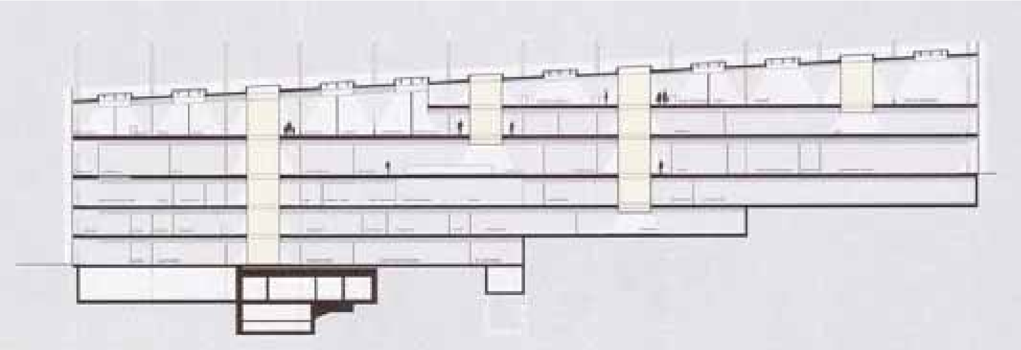

Figure 5 *Building section showing one possible distribution of vertical light shafts The actual shafts now in place are different from those initially proposed in the secondary system because the functional layout changed twice before secondary system installation even began.*

Figure 6 *Roof of Phase One of Primary System - a "green" roof with skylights*

are exactly defined, but the independence of lower level (secondary and tertiary) systems is as large as possible, in both technical and management terms.

The Jury Process

Primary System

After an international publication and call for entries in 1997, ten architecture teams were selected for the competition to design the primary system. One of the criteria for this invitation was that the design team had never designed a major hospital project. The presentation requirements for the primary system were very open for the competitors except for the gross building area. A declaration of cost/capacity calculations and ecology/energy analysis were required. But layout scenarios were not required for the primary system. In addition, the competitors did not receive space-planning templates. Some projects proposed for the primary system were totally empty; some showed spatial arrangements of departments and spaces. It was up to the competitors to show the quality of their "open building". According to the project manager, it was not a problem for the jury to abstract and to compare. The Canton Bern building department used layout scenarios of the expected surgery theatres in the jury examination process.

The winning entry for the primary system was designed by Kamm and Kundig Architects, an architecture firm in Zug, Switzerland. This firm had designed one of the pioneering residential open building projects in Zug, Switzerland in 1973. What follows is a description of their scheme.

The INO – no matter which design was selected, was to be implemented in two phases.

Figure 7 *Interior view of the top floor of the empty primary system, showing skylights, openings for light-wells to the floor below (on right of picture), and precast columns with four sleeves at the base of each column for possible vertical drainage piping. Also visible is the inner layer of the double skin envelope, showing operable wooden windows.*

Figure 8 *West façade showing double skin with operable windows behind an outer layer of glazing.*

Figure 9 *One floor plan of the Secondary System, designed by Itten and Brechtbuehl, the winning team*

After completion of the first Phase, the operating rooms and ancillary functions in an adjacent building would be moved into the new building and the old building demolished. This building was constructed in the 1970's and was already obsolete because it was incapable of being adapted.

The architectural scheme for the INO proposed by Kamm and Kundig is remarkable in its simplicity but is controversial in a number of respects. One aspect that raises most questions is the very large floor plate. Most hospital architects maintain that narrow floor plates are necessary to allow natural light and ventilation to all spaces, and also allow the most planning flexibility. For a number of reasons – having to do with the site organization, concepts of massing and also fresh insights about internal adaptability and access to natural light – this scheme has broken from these traditions.

Fixed mechanical systems risers are placed in each quadrant. Fixed vertical and horizontal circulation routes are also located as part of the primary system (see below). One of the planning innovations of the primary system shown in Figure 4 is the placement of 3.6m square "punch-through" opportunities (red square) in each structural bay (green square). Each of these (red) squares is a portion of the 20cm thick concrete slab without reinforcing. This offers the possibility of vertical penetrations at any location in the floor plate for vertical circulation, mechanical systems, or light shafts (see Figure5)

Secondary System

For the secondary system the project managers demanded solutions for distribution of mechanical services and layout scenarios as well, showing typical patient paths. The competitors for the secondary system were required to be experts in hospital design. They each received a documentation of the primary system and the layout templates of the existing hospital. Submissions were required of firms submitting proposals for the secondary system to demonstrate - with drawings - how, for example, its proposed fit-out system could be deployed according to a range of programmatic scenarios within the given base building (already under construction).

The Primary System enabled the planners of the secondary system – and the client – to study a variety of layouts for the OR suite on one of the floors. During the planning period, this was vital as other functions of the new addition were also in flux In both jury processes – for both the Primary and Secondary systems, competing proposals were expected to demonstrate a number of attributes: technical performance (building engineering, cost, ecology), serviceability (building structure/flexibility, function, construction timing, ecology) and architectural (formal properties).

The Organization of the Process

In addition to the distinction between autonomous systems levels based on the concept of expected durable value, the INO project is divided into three major system levels that consist of distinct and separate (but nevertheless coordinated) "management levels". This distributed management process – a radical departure from conventional procurement in hospitals but not in office buildings and shopping centers – was adopted to assure that the building would avoid the rigidity so often resulting from conventional procurement methods. In Figure 12, Team O is a firm providing the coordination of both the design and construction activities. The other teams each have their respective level of decision-making. As this report was being prepared, the installation of the secondary system was underway, with completion expected in early 2006.

Figure 10 *One alternative layout of the OR suites*

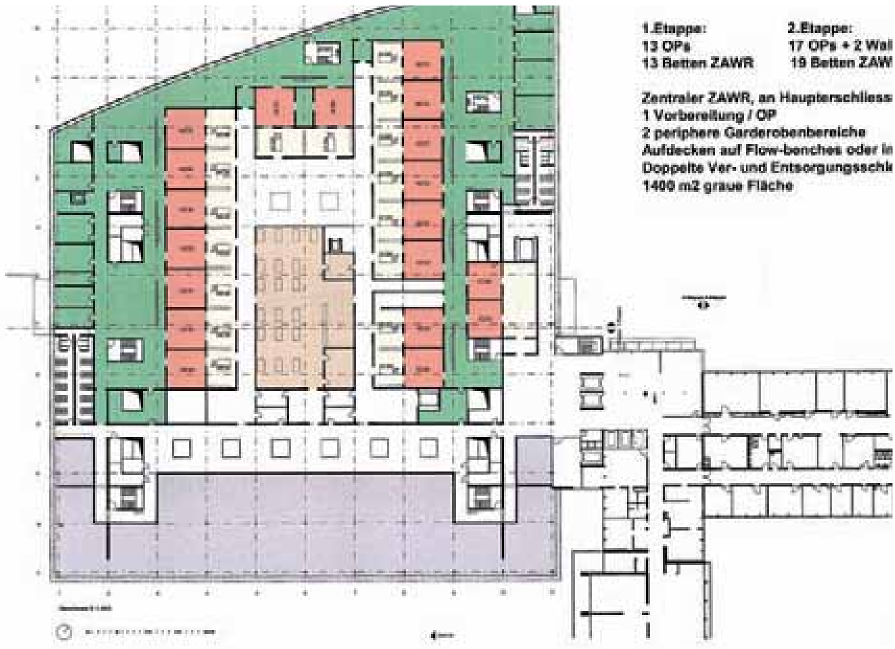

Figure 11 *One alternative layout of the OR suites*

Principles of Work Restructuring and Distributed Management

The idea of dividing a large project into these autonomous levels differs from conventional project delivery methods used for medical facilities and presents challenges, not all of which were for-seen, concerning coordination between the separate firms responsible for each level. It is worth noting that large shopping centers and office buildings are routinely managed in this way, but for some reason the principle has only now migrated into health care architecture in an explicit, structured way.

An open building strategy organizes the project in terms of the anticipated duration of value of a cluster of subsystems. It does so to avoid waste, to optimize boundary conditions, to prepare the facility for long-term manageability in concert with anticipated changes, and to reduce costs of future adaptation.

These are also the principles advocated by lean construction (Lean Construction Institute), a production management based approach to project delivery representing a new way to design and build capital facilities. Lean production management has caused a revolution in manufacturing design, supply and assembly. Applied to construction, Lean changes the way work is done throughout the delivery process. Lean links the objectives of the production system–maximize value and minimize waste–to specific techniques and applies them in a new project delivery process. Lean Construction is particularly useful on complex, uncertain and quick projects. It challenges the belief that there must always be a trade-off between time, cost, and quality.

Open-ended Medical Architecture

This particular example of distributed design management is one way of organizing an "open building strategy" for the design, construction and long-term management of medical facilities. It is not necessary for different designers to be assigned to each level. But the "partitioning" of design management in this way is a strategy particularly well suited to institutional clients whose interests are long term, scrutinized by the public by means of state legislative action, and also must recognize competition from other similar institutions'. Inevitably, firms other than the original design teams are called upon to renovate medical facilities. In principle, then, this management strategy is not fundamentally different from the way large and complex medical facilities behave "in fact" (if not in the theories of "integrated whole buildings" now in currency).

The reason the Canton Bern decided to formulate and adopt this strategy is that it is aligned

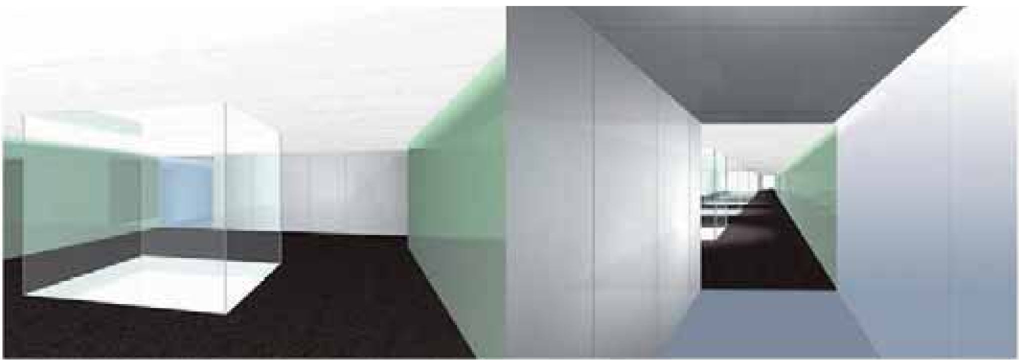

Figure 12 *Interior perspectives of light-well lit corridors, part of the Secondary System design*

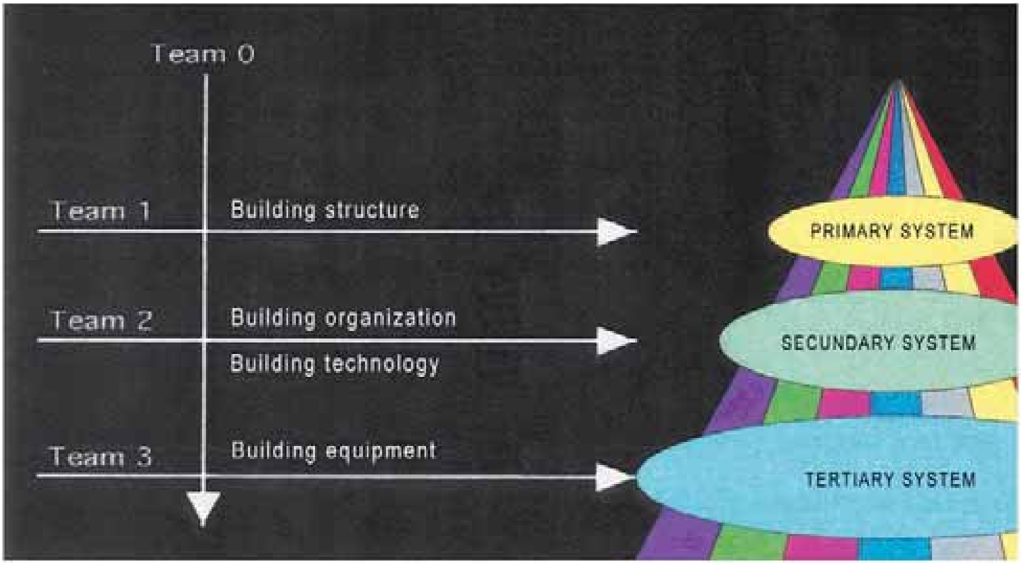

Figure 13 *Organizational diagram for project management*

with the principle of variable life-cycle value of certain "clusters" of building elements and decisions – called "levels" in the open building literature (www.open-building.org). This is a principle that corresponds in fact, to the behavior of large complex facilities. That is, change and adjustment takes place on "levels" that cut across strictly technical systems and trade boundaries. For example, when a new illumination design is specified, it uses existing cable infrastructure "up to a point". When new partitioning is specified with an adjustment of offices, the design will seek to limit the perturbations of this change on contingent building parts, to save cost and disruption – i.e. the floor and ceilings will likely remain undisturbed, while some of the electrical cabling buried in the partitions will be changed but only "up to a point". Usually, the technical systems are under the control of different parties, in part because the work is distributed in time and also because no one party can or should be responsible for all work.

Accumulated knowledge about medical facility behavior under conditions of change should begin to teach us lessons about the boundaries of such "levels". They are likely to be cross-cutting, involving multiple trades and supply channels and therefore calling for new logistics and coordination methods.

Conclusions

As John Habraken (1998), Stewart Brand (1994) and others help us to see, the built environment is not static. Transformation is pervasive, operating at various time scales and at various "levels". We would be surprised if things were otherwise, and not only that, we would be out of work. It is, after all, the work of architects and other designers to help manage what should be built. But to a large extent our working methods are not yet congruent with this reality. We are only slowly recognizing transformation and stability as twin realities. Our teaching, our design and construction practices and our analytical and accounting tools are not yet sufficiently organized in recognition of this.

Product manufacturing is much more advanced. Lean construction recognizes this reality, as does some pioneering engineering research.

The commitment of the Canton Bern Building Department and the INO Hospital to open building implementation should be applauded and scrutinized. At the time of this paper's preparation, the Canton Bern Building Department Administration is developing guidelines for the procurement of all future projects based on the lessons learned in the INO project. The guidelines explicitly define "levels" and "interface rules" and performance based on distributed design management in the service of flexible architecture. This decision, according to interviews with the staff, flows from the efficacy already exhibited in the separation of the three levels. Their autonomy (the word used by the Director of the Building Department) must be maintained as a matter of principle. Changes made in the functional program since planning began seven years ago already demonstrate the effectiveness of the strategy.

In evaluating this project, it is important to distinguish several innovations. The first is the commitment to defining autonomous systems levels, based on cycles of change. The key word is autonomous. The second is the commitment to distribute design responsibility for each level to a different design team. These need not be connected. It is possible to implement the first without the second. Lessons learned from the INO may lead the Canton Bern Building Department to continued adoption of the first without the second, because difficulties in resolving coordination issues between separate firms was the cause of significant problems in the implementation of the INO process.

Finally, while the client of the INO selected the Kamm and Kundig scheme from a juried competition, the specific design of the primary system in the INO is not an inevitable consequence of designing on levels. The large floor plate is not the only answer. If shortcomings are found in this scheme based on its implementation and use, they should be studied carefully, but should not stop others from using the concept of levels to manage change and complexity in entirely different designs.

Acknowledgements

Stefan Geiser, Architects, Manager of the INO Design Coordination Team at the Canton Bern Building Department, has been instrumental in helping us study this project, supported by the Director of the Canton Bern Building Department, Giorgio Macchi. Our research team has included the following individuals: Douglas Reddington, BSA LifeStructures; Dr. Thomas Bock, TU Munich; Dr. Quinsan Ciao, formerly at Ball State University Department of Architecture; Dorothy Dettbarn, former Graduate Student, Department of Architecture, Ball State University.

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Designing the Digital Reading Room

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While much attention has focused on the global benefits of electronic medical information management, many of the details of designing digital work environments remain elusive. A case in point is the design of digital radiology reading rooms. It is not uncommon for healthcare providers to invest millions of dollars for state-of-the-art image acquisition equipment while simultaneously overlooking some of the basic physical requirements necessary to properly design the spaces where digital images are reviewed, examined and reported on. Yet, the reading room – radiology's central command station – is at the very heart of medical imaging. The sole purpose that million dollar acquisition devices (such as MRI, CT and PET scanners) exist in the first place, is to enable image reading, and ultimately diagnosis which occurs in the reading room. For this reason, it seems inappropriate that these mission-critical spaces be overlooked as priority areas for appropriate human factors design. Furthermore, todays (and tomorrow's) digital reading rooms demand very different design interventions than did their film-based predecessors.

After years of considering Picture Archiving and Communications Systems (PACS) as a philosophical concept not yet ready for cost-effective implementation, many radiologists and radiology administrators are now becoming acutely aware of how unprepared they are for soft-copy reading without a properly designed reading room. In recent years, radiological organizations throughout the nation have begun transitioning from film-based to digital practices at an unprecedented pace. Some industry experts predict that by 2006, 60% of all US hospitals will have adopted some form of digital imaging system . In most cases, the absence of a properly designed reading room remains as an impediment to realizing the potential benefits of automated image management.

There are numerous reasons that both designers and radiologists alike have historically focused their attention on the design of spaces other that reading rooms:

- Funding for PACS implementation is frequently biased in favor of tangible capital costs, such as the purchase of image acquisition and storage systems. When image display components areconsidered, emphasis is often placed on equipment selection – such as computer hardware – with little consideration for designing the physical environment in which the equipment is placed. Ironically, image interpretation is arguably the most important step in the multi-phased process of image management. Reading an image and generating a report is the ultimate reason an image is acquired in the first place.

- A poorly designed traditional film-based reading room (although undesirable) is less detrimental than a poorly designed soft-copy reading room. As a result, "non-designed" reading rooms have become an accepted practice. In contrast, reading soft-copy images in an improper reading environment can lead to eye fatigue, repetitive strain injuries, headaches, decreased reading efficiency and even decreased reading accuracy. Ongoing pressures to read more and complex images, and for longer reading sessions will exacerbate work-related injuries.

- Many designers do not fully understand the process of soft-copy reading. As a result, they are rarely trained to implement design interventions that mitigate the detrimental effects of reading in an inappropriate space. Many architects consider the reading room as an office-like space. As such, they improperly design it with standard office lighting, furnishings, finishes and accessories.

- Contradictory space requirements are inherent in the reading process. For example, there is frequently a need for visual and acoustic privacy (spatial enclosure); while at the same time there is a need for intense collaboration among colleagues (spatial openness) . Solving either need usually results in compromising the other. A hybrid environment – in which both soft copy and hard copy reading occur simultaneously – combines contradictory lighting requirements in which light emitted from film illuminators or alternators creates unwanted glare on computer monitors.

Enclosure

How big should a reading room be? How many people should each workstation accommodate, and how many workstations should be in each room? Although the answers to these questions vary based on individual user preference, most reading workstations should accommodate at least 2-3 primary users with an option for up to 6-8 people to occasionally review cases together. Exceptions include teaching institutions where even larger groups may need to be accommodated and private radiology practices where images may be read in private single-occupancy offices.

Individual reading rooms can accommodate either single or multiple workstations. However, if a single room contains too many workstations, lighting and acoustics will be difficult to control. One approach is to place several 2- or 4-workstation rooms in proximity to one another. Within each room, individual workstations should be screened from the others for visual and acoustic privacy.

Lighting

Lighting control is the reading room's single most important design requirement. Control of lighting becomes more difficult when reviewing both softcopy and hardcopy images simultaneously. Most hardcopy films can be eliminated (or at least reduced) by digitizing previous film images into a digital format for comparison with current digitally acquired studies.

Two distinct types of lighting are needed in the reading room. Dimmable ambient lighting provides low levels of evenly distributed background illumination for reading softcopy images (with higher illumination levels available for maintenance and housekeeping activities). Supplemental task lighting enables manual tasks (such as writing and paperwork) without disturbing others in the room. Ambient lighting should be broadly dispersed and indirect (bounced off ceilings or washed along walls) if possible, while task lighting should be narrowly focused. A ceiling height of at least nine and a half feet above the floor surface will facilitate indirect light fixtures hung from the ceiling. If this height is not available, indirect light fixtures can be wall-mounted or integrated within the workstation assembly.

Sources of light (such as film illuminators, light fixtures, etc.) should not be visible within peripheral view of anyone sitting at the workstation. Veiling glare – the reflection of light sources – on the monitors' surface should be minimized. Flat panel monitors, liquid crystal displays (LCD) and plasma screens tend to be less glare-prone than are cathode ray tube (CRT) monitors.

Ergonomics

Ergonomic design in the reading room is concerned with three points of contact; where your eyes meet the monitor, where your hands meet the input device, and where your bottom meets the chair . For this reason, movable adjustable computer furniture and work surfaces are preferred over built-in casework. Recognize that most reading workstations are shared by several individuals during the course of a day . Thus, users will vary in size, weight, age and visual acuity. Adjustability is also beneficial in single-user workstations to avoid muscle fatigue. Ideally, adjustability should range from sitting to standing positions. The height and angle of input devices and monitors should be adjustable as should the distance between the user's eyes and the monitor surface.

Acoustics

As voice-recognition systems become an integral component of softcopy reading, acoustic control within the reading environment also grows in importance. Complete acoustic control is only possible in a private office – a solution that does not foster collegial interaction. However, some measure of acoustic control is possible through the strategic application of

Figure 1 *Non-radiology modular furnishings adapted for use in a radiology reading room (courtesy of HermanMiller for Healthcare)*

sound absorbing floor, wall and ceiling finishes. Modular systems furniture – designed for non-radiologic workplace installations – can be adapted to meet the acoustic needs of the reading room (see figure 1). Confidential conversations should also be confined within the reading room for HIPPA compliance.

Connectivity

Wire and cable management is often an afterthought in reading areas that may otherwise be well designed. Management of telephone, data, power and other lines is often best solved by integrating raceways within modular furniture systems – a concept common in workplace design. Wireless communications systems may solve cable management problems, however they may in turn introduce security and transmission interference challenges.

Appropriate soft copy reading environments – although seemingly illusive – are easy to achieve if appropriate attention is given to their design. The greatest challenge is often getting the design tram to comprehend the physical and functional requirements of the space. Considering the importance of reading and report generation coupled with the radiologist shortage crisis, a small investment in proper design can quickly be amortized through improved reading efficiency, reduced work-related injury and user satisfaction.

Improving Healing Performance through Aesthetics, Art and Culture

Chair: Mohinder S. Datta (USA)

Aesthetics: A Source of Health

Synnøve Caspari

Stress reduction by using Art in an Intensive Care Unit

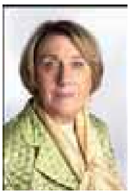
Åke Forsgren

The Effect of Music on Inpatient Children

Susan B. Wesley

Aesthetics: A Source of Health

Synnøve R. Caspari



Synnøve R. Caspari
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Introduction

The patient is the one who has the shoe on! Medical health care has over the last century made enormous progress, in terms of both physical and in psychiatric treatment. The importance of a holistic focus becomes more and more evident. For the human being, confronted with sickness, death, evil and existential questions, there has always been a need for a counterbalance. This is to a degree found in meeting with and experiencing Goodness, Truth and Beauty. These three ideas each show different sides of the same concept, and in a way they are the same concept, as the one cannot exist without the others. According to medical health care, the assumption is that Beauty, represented by aesthetic surroundings, is of vital importance, both to patients and also to the caring staff. Man has a need for beauty, aesthetic creation and aesthetic experiences and we know that it stimulates, increases health, reduces suffering and creates well-being. It is an important human need and still, it seems to be a neglected area at many hospitals. Little priority is given to patient environments. Hospitals should be built to meet the requirements of the patients, relaxing, calming, and giving a sense of security, but one can ask to which degree the patient is consulted?

The aim of this study was:

* 1 - To find how aesthetics are attended to in Norwegian hospitals

* 2 – To find how the patients and the staff nurses evaluate the aesthetic area

* 3 - To develop foundations or a framework for a theory on aesthetics in hospitals

* 4 - To increase knowledge about the aesthetic phenomenon from a philosophic and from a caring scientific perspective

The assumption was that aesthetic surroundings increase the well-being of both patients and the caring personnel. Much can be done to elevate and improve the aesthetics in hospital surroundings just by the daily attention, the staff being observant and aware of the consequences. When renovating it is important that competent experts are consulted, that the interior is not just decided through votes of the staff. In planning and building new hospitals it seems that the aesthetic surroundings, the environment, are given considerable consideration', but still I am not sure that the 'architects' have asked the patients – what does the patient wish to be met by as a patient?

One negative example was told by a patient that was terminal ill with a cancer diagnosis. She had to go to the hospital several times every month to get a special treatment. The cancer had made her body only skin and bone, it was deformed and with outgrowths like antlers on her head, back and extremities. The patient told that the first thing she met, in the entrance to the hospital, was a sculpture, a deformed human being, with antlers and buckles; she felt it was a picture of herself and her ugliness!!!

Figure 1 *Sculpture*

This is not a well chosen or appropriate sculpture!

In this paper I will give a short brief from the studies.

The first step, after a theoretical study, was to analyse strategic plans from all the Norwegian general hospitals. Documents that had been used through the last two years, that concerned strategies and guidelines for the aesthetic area, was collected from 74.4 % of the total 86 hospitals, and analysed according the following table that presents the categories upon which we focused.

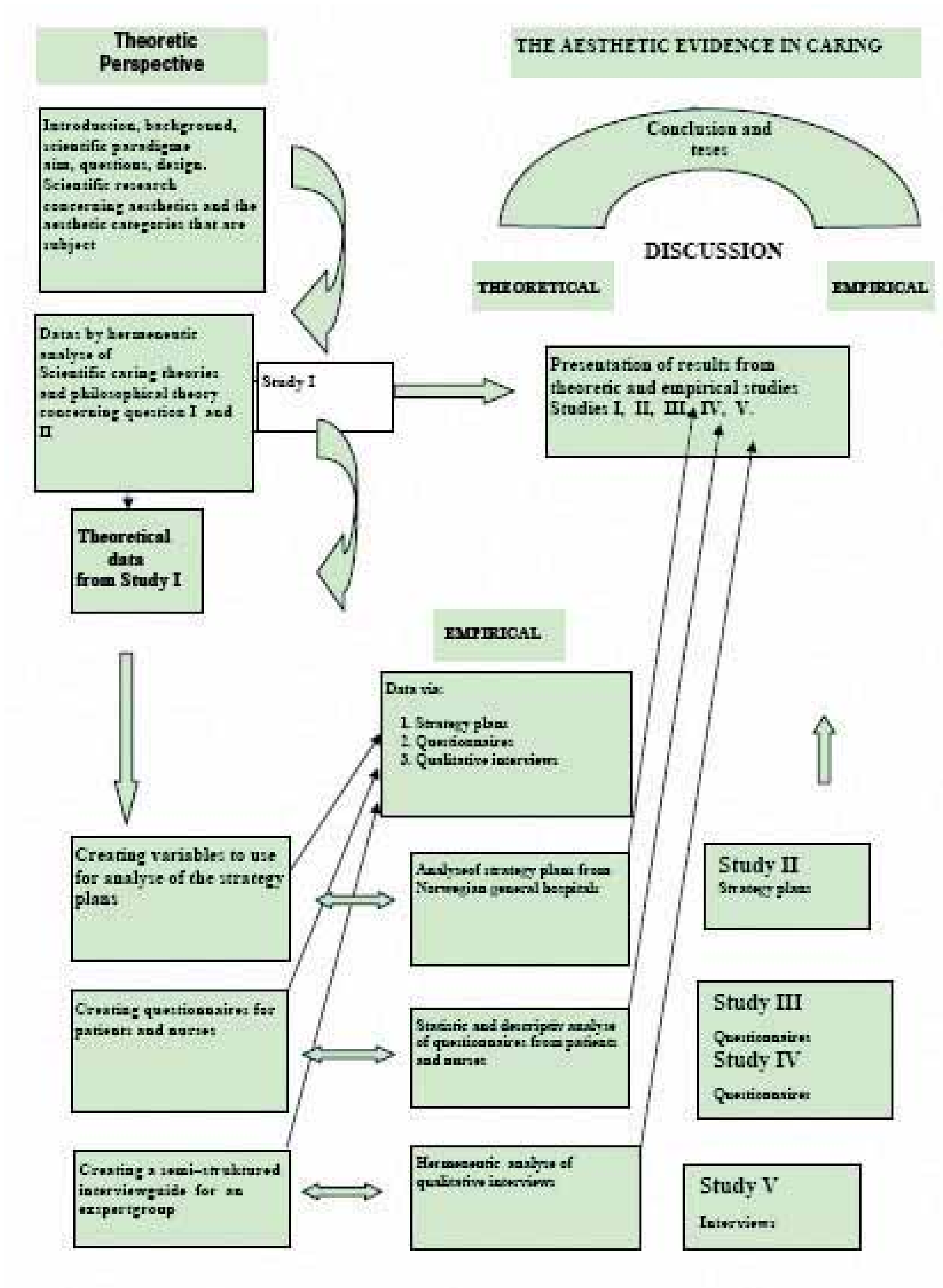

Table I *Design*

Harmony	Food:	Art:	Room:	Light:	Colours:	Design:	Sound:	Nature:	Aesthetic:	Quality:	Z
Order	Colour	Paintings	Patient	Sun	Walls	Furniture	Noise	Plants	Beauty	Competence	A
Tidiness	Looks	Sculpture	Visit	Electricity	Ceiling	Curtains	Songs	Flowers	Beautiful	Choice	B
Balance	Service	Pictures	Exterior	Lamps	Floors		Music	Trees	Nice	Quality	C
Harmony		Carpets	Corridor	Armature	Textiles		Sounds of nature	View	Tasteful	Experts	D
Hygiene		Decor	"Guard-room"		Curtains		U-sound	Air	Sense	Committee	E
Laughter		Mosaic	Bath-room		Furniture			Ventila-tion	Perception	Entirety	F
Humour		Water	Shower						Sensation		G
Game			W.C.						Perception of sense		H
Smile											I
12	1	4	3	2	7	3	5	10	9	36	

Table II *Categories used in the analysis of the strategy plans for Norwegian somatic hospitals.*

Results from study II

The results displayed that very little attention was given to the aesthetical dimension in the strategy plans. Occurrence of the aesthetic categories and subcategories found in the strategy-plans from 64 hospitals (response 74,4%) was as follows - Harmony: in documents from 12 hospitals, Food: in 1, Art: in 4, Room: in 3, Light: in 2, Colours: in 7, Design: in 3, Sound: in 5, Nature: in 10, Aesthetics: in 9, Quality: in 36.

Conclusions

• In general, very few guidelines and administrative arrangements relating to aesthetical surroundings were found in the strategic plans .

How are aesthetic surroundings considered by patients and nurses?

To get more information it was thought fruitful to have an evaluation from the patients and also from the nurses, on how they would classify and evaluate the aesthetics in their hospital surroundings. This was done by working out questionnaires which were distributed to patients (400), and nurses (400), located in 6 hospitals . Evaluation on a scale (Likert) from 1 – 6.

Results from the questionnaires

The analysis of the questionnaires showed as a conclusion that:

• The aesthetic field, in general, was evaluated as worse than relatively good, the architecture as relatively bad and the possibility to choose between aesthetic input were relatively bad.

• Patients and nurses thought that aesthetics have a large to a very large influence on health and on their social condition.

There was high accordance between judgements from the patients and from the nurses.

Interviews of experts

To get further and more concrete information, the study was expanded by getting 16 expert's opinion of their evaluation of the aesthetic field in the hospitals. An expert was considered as one who has an education and who works within an aesthetical area. The method was qualitative interviews.

Results from interviews of experts

The interviews were performed in June – August 2001. The 16 experts that were interviewed are all working in different fields of the aesthetic areas: architecture, paint artists, designer, actor, head-cook, master builder, flower-designer, interior decorator, administrative director and active artist, cosmetologist, cromatolog/colour designer. Four of the experts are, in addition to their aesthetic field, also registered nurses. All the experts had connection to hospitals in some way, as patients themselves, by someone they were related/close to, or through employment. The results from the interviews resulted in these theses:

*Aesthetics it was concluded are as close to absent in the hospitals
*Design is a foreign word
*Aesthetics have a very high degree of influence on health and well-being
*Variation in the aesthetic surroundings is important and can brighten the day

The main conclusions were generally that the aesthetic dimension is a source to health and wellness, and that it is an ethical obligation in caring and caring science to accommodate this area. The interviews which discussed the significance of aesthetics in relation to health and wellness in general hospitals, developed concrete areas which are referred to as invariance's and variances. The informants indicated interesting fields and preferences that they considered important for improving treatment and therapy. These invariance's and variances can be valuable as guidelines when planning, restoring or upgrading general hospitals; it indicates a framework for what it is important to attend to and what the patients emphasize. A framework gives guidelines and suggestions; one can say outer boundaries, according to the wish and desire of the patients and also the staff.

One of the goals for providing aesthetic surroundings must be to encourage the rehabilitation and the healing process. The environment must accommodate all the different patient categories: children, adults and geriatric patients, short and long term patients and so forth. The needs will be heterogeneous.

Still, the results from the interviews can give guidelines concerning what the patients emphasized. They had concrete opinions according each of the invariance's in table 1, what they wanted, how and why.

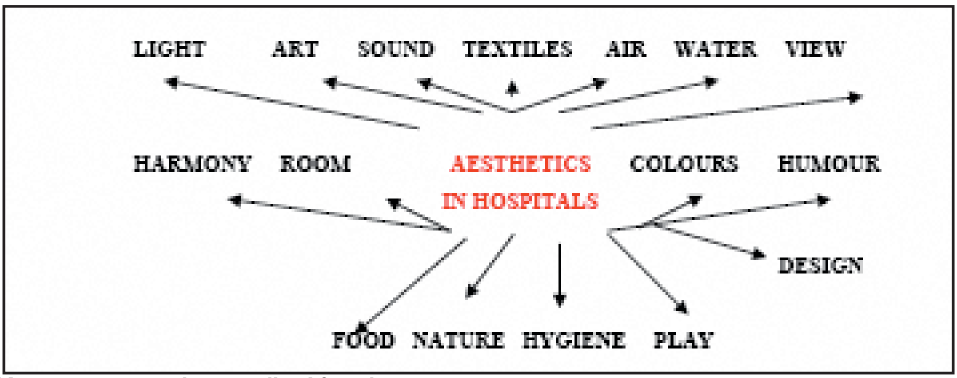

Table III *Invariance's that crystallized from the interviews*

Light is emphasized, natural light that makes it possible for the patient to see, for instance, the dawning of the day, and colors of the season. They wanted views through big windows to draw nature into the room, as they expressed it, views that made it possible to have access to the outer world, to see the sky, the clouds, trees and maybe a bird.They appreciated paintings and pictures from nature and daily life. These are not complicated, but rather soothing and comforting. Colors that are clear, light and friendly.

As the invariance's emphasised were in accordance with the categories used through the research, it was interesting to notice the variances to which patients gave priority, for a psychosocial aesthetic environment. These are displayed in table IV. The informants gave concrete opinions and wishes according to these areas. They expressed, for instance, that they felt ridiculous and made fun of by the hospital clothing

The research altogether resulted in a very negative evaluation of the aesthetics in the hospital environments. Art might be interesting, beautiful and artistic etc., but it is very important that art fits into the context. This study shows that patients, when sick, need relaxing and soothing environments, that art, paintings for instance, should not be to complicated and challenging. This painting by Monet could be an example.
The interview with the cromatologist/colour artist differed from the others. She could refer to a hospital, where she had been involved in making plans for and designing the colors and the interior. This led to an excursion to the hospital, an interview with the staff/nurses and a spontaneous conversation with two patients. Already when analysing the strategy-plans, this hospital was noted as interesting for an excursion, as they had definite plans for the aesthetic environment. The aesthetics got a high rating at this hospital, very laudatory, both from patients and from the staff.

The experts had concrete opinions and wishes according these areas. They expressed, for instance, that they felt ridiculous and made fun of when they had to wear the hospital clothing All the different smells and odours could be frightening.They wanted be in a hospital that had a friendly atmosphere and all of the experts used the word homeliness. As they said – a patient is worried when he has to go to the hospital, he is anxious about the diagnosis and examinations, for many patients it is a frightening new world they are entering.

At the hospital it is important that they are welcome, that they are met with a friendly atmosphere, that they feel security and openness and are taken care of as an individual and important person.

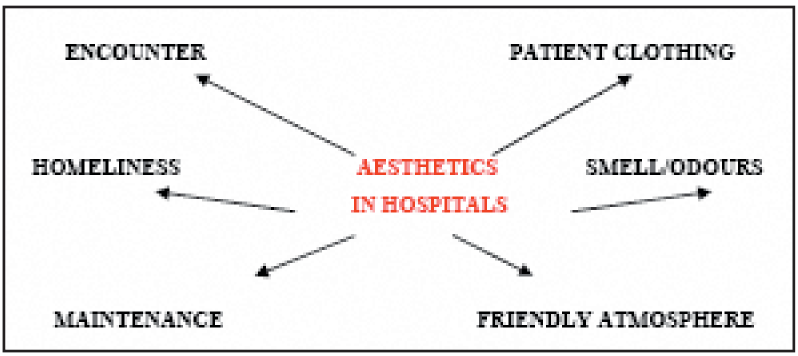

Table IV *Variances that crystallized from the interviews*

Figure 2 *The Terrace at Sainte Adresse 1866*

Guideline for a theory on how the hospital should be according the patients and the staff

Location of the hospitals should preferable be built on open areas where nature is close and the architecture of the building should not be overwhelming. Today it was said that many hospitals resemble and look like prisons.

Light is emphasized, natural light that makes it possible for the patient to see for instance the dawning of the day, the sun and the colors of the season. Electric light that is not harsh, lamps or the light-sources should be pleasant to look at with a good design and connected in a way that made it possible to be regulated by the patient. Light curtains that can filter the sunlight and bright side curtains that harmonizes with the colors in the room.

View through big windows to draw nature into the room, as they expressed it. They wished to have a view that made it possible to have access to the outer world, to see the sky, the clouds, the trees and maybe a bird, in short - the nature outside. Often you find that it is the patient in the bed by the window that is the lucky one, especially when the curtains around the bed are drawn. The other patients in the room just lie there!

Nature - Plants and flowers were highly valuated. Even artificial ones if it was a risk for infections.

To have **windows** in the ceiling would be wonderful for patients who have to stay in bed. The ceilings also give possibility to different decorations or installations.

Fresh air - All the different smells and odors could be both scaring sickening and heighten their worries.

Desireable **Colors** should be chosen according to the activity in the room. The patient room should have colors that are clear, light and friendly, not boring grey and not soup colors - as it was expressed.

Textiles should be inviting, soft and also harmonizing with the other colours in the room.

Furniture should have a good design, be inviting, not cold and rejecting and should not look as if it was bought on a flee-marked (as some of the experts expressed their reactions.

The patient room should have an architectonic design with balance in the vertical and the horizontal lines, pleasant and harmonic, not sterile. It is important to have well functioning ventilation, especially if there are many patients placed in the same room. It was said that some of the patient rooms resembled coffins. Noises and sounds are often problematic, that is: noises from other patients, from the traffic outside, general noises in the corridors- clacking heels, voices etc. Better and more effectual isolation is important. Water was emphasized as positive, fountains inside and outside, view to lakes or ocean for instance, where it is possible.

Art – as aesthetic inputs appear to be very important in different expressions. The patients appreciated paintings and pictures of nature, pictures that were not complicated, but rather soothing and comforting.

They wished to have the opportunity to choose and also to have the pictures changed if they should stay at the hospital for a longer period. Art might be interesting, beautiful and artistic etc., but it is very important that art fits into the context. This study shows that patients, when sick, need relaxing and soothing environments, that art, paintings for instance, should not be to complicated and challenging.

Conclusion

A study like this will always be limited by the focus of the informants. Still, this investigation has quite a wide range of informants, the studies result in valuable data, which can be generalized. In short, one can impress that scientific knowledge and experts, on the different fields are engaged. The interior questions, for instance, should not be decided through ‘staff votes’.

Man has a need for aesthetic experiences, for variations, for creating, and as a contributor when experiencing. The aesthetic area, in the hospital environment, was generally considered of very high importance. It can be said that it is an ethic duty to esteem the human dignity, to try to ease sufferance, to be aware of the fact that needs and wishes are different when you are sick.

Aesthetic surroundings might be stimulating and curative. Today one has many investigations that give valuable knowledge on the different fields. This knowledge has to be applied!

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Stress reduction by using Art in an Intensive Care Unit

Åke Forsgren, BA

Åke Forsgren, BA

Åke Forsgren is Secretary of Culture at the Culture Department, Uppsala County Council. The Culture Department works with cultural issues at a regional level - strategically, financially and consultatively – as well as within the county organization. Åke Forsgren is responsible for integrating art in hospital wards, health care centres, dental clinics and other facilities. Artworks and artistic treatments of specific features in buildings are commissioned and developed in cooperation with architects, interior designer and other consultants in the planning process. The purpose is to create a supporting and stimulating environment for staff and patients. Additional aims are to make contemporary art accessible to a broader public and to support artists. Åke Forsgren has a Bachelor of Arts from the Department of Art History at Uppsala University, where he also has lectured.

General background on Uppsala County Council, Uppsala University Hospital and the 1% Rule

Uppsala is the fourth largest city in Sweden, situated 70 km north-west of Stockholm. In Sweden, County Councils (CC) are a middle level of government, in between the national and the local level. The CC has its own political organization and its own tax funding. Its major objective is health care but the CC is also responsible for regional development, public dental care, public transport and cultural development.

The Uppsala University Hospital has 1, 100 beds and a staff of 8, 000. It serves the county and, in several specialities, also the regional and national needs. It´s also a hospital for training and education, in cooperation with Uppsala University.

Most Swedish public builders have adopted the 1%-rule, earmarking 1% of building costs for artistic enhancement. Artists are involved in the planning process to develop artistic solutions and embellishments in architectural settings. In hospitals, these are often executed as commissions, due to the complexity of ward premises.
Uppsala CC, being a major operator, has an annual budget of 3 MSEK (270 000 €) for art.

THE NEONATAL ICU AT UPPSALA UNIVERSITY HOSPITAL

Background

The neonatal ICU is a total rebuilding of older premises with an area of 1, 900 sq m (19, 000 sq f). It includes twelve incubator-places in three ICU rooms, two rooms with six places for intermediate care, nine separate family rooms and two isolation rooms. There is also an operating room and sufficient space for administration, supervision and the usual staff and family needs. The neonatal ICU was planned to meet new standards for neonatal intensive care (see http://www.nd.edu/~kkolberg/DesignStandards.htm) These standards specify physical requirements (space, light, sound, equipment, communication etc) but also stresses the emotional needs of the infant, the parents and the whole family. An important objective was, therefore, to empower

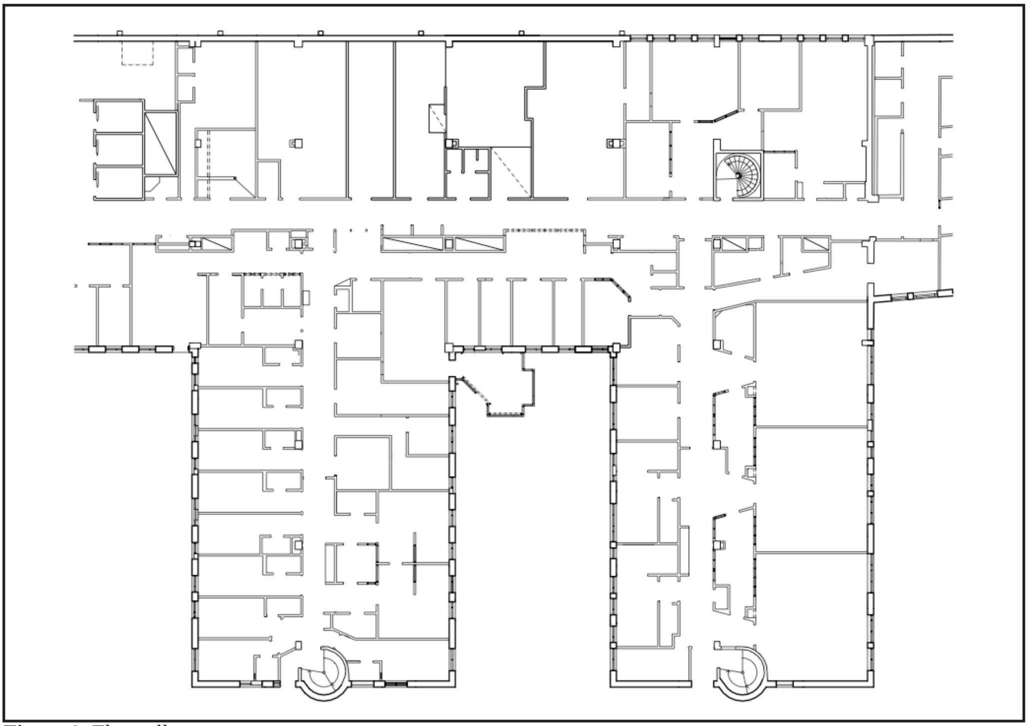


Figure 1 *Floor pllan*

parents to active participation in care giving, both beside the incubator and by using the Kangaroo method (maximum skin contact between infant and parents). This objective was met by planning extra space for parents beside the incubators and as the infants recover offering rooming-in and of course extra consideration of the parents' needs from staff.

However, what is a normal working place for staff is perceived as a strange and frightening high technology milieu for parents – especially with a sick infant. An equally important objective was therefore to reduce environmental stress factors and to create a positive setting. Stress reduction was a touchstone in several aspects; in planning and choosing lighting, choice of materials to reduce sound, the desire to lead day-light as far as possible into the building, to use discreetly designed or concealed fixtures and fittings etc.

But there was also an ambition to add "positive stress", that is to stimulate parents and staff with artistic means, thus making the whole setting a more positive experience.

Artistic Cooperation

The change in focus from medical functions to parents' (and infants') experience of the milieu demanded new views and new competencies in the planning process.

To get new ideas, a project was formed together with the University College for Arts, Crafts and Design in Stockholm. 10 graduate students in the Department of Textiles worked on the theme "How does it feel – how do we make it feel better?" They held seminars on health care design, visited other wards and interviewed staff and parents on positive and negative aspects of the ward setting, especially on the effects of interior design, coloring, technical appliances etc.

The students worked with separate room functions. They decided to work within the theme "Nature". Partly because they thought that under these special circumstances, nature might offer a soothing effect in contrast to the technical side. Partly because the theme still allowed large variation in techniques, motives, expressions, etc.

New Proposals

After a month, ten models and proposals for different rooms were presented, along with inspiration and background material, technical solutions and requirements for the execution. The proposal's impact and feasibility were discussed at a joint meeting with the art group, architects, technical consultants and staff. They were evaluated according to the dual objectives of stress reduction and added values/stimulation. Six proposals were chosen and further developed in cooperation with the architects. Several adjustments and alterations were made due to practical considerations and program changes. In cooperation with interior designers the proposals were used as a basis for coloring, furnishings and textiles through the whole setting – thus creating harmony in the usually fragmented impression of a modern hospital ward. The proposals were then integrated in the building plan, handing over parts of the execution to the contractor.

Five Examples

These are different approaches to artistic cooperation, they might be called Integration, Redesigning architecture, Redefining functions, Developing materials and Art as unifier.

Figure 2 *ICU int*

ICU Rooms – integration

An important objective in the ICU rooms was to put parents at ease in spite of the high-tech environment. It was necessary to handle the "overall unit design" - the visual impact of the ICU - as well as addressing the sometimes conflicting needs of parents and infants vis-à-vis staff.

The artist proposed to divide the room into a lighter middle zone for staff's needs and darker zones along the walls for the infants. The walls are white in the middle and have dark blue hues in the periphery.

Figure 3 *ICU Floor screen*

The floor is patterned with big squares, lighter in the middle and lined with blue. Low screens with colour-matched fabrics are used for temporary seclusion.

Figure 4 *ICU Wall*

To emphasize the walls, an enlarged foliage pattern was designed, painted blue on blue. It is abstract at a close range but more clearly nature-like at a distance.

Figure 5 *Bench milieu*

The central work bench is designed with rounded forms and a white Corian top, which is easy to clean but foremost – due to its thickness – reduces sound. The dividing cabinetry has the same top material but a dark zebrano laminate.

Figure 6 *ICU incub. devider*

A variety of light fittings are used, with subdued and indirect armatures over the incubators and more normal lighting over the work zone. The milieu is developed as a totality in close cooperation between the artist, the architect, the interior designer and other consultants. It is impossible to conceal so much equipment but the elaborate handling of details, colouring

Figure 7 *Silent Room*

and materials creates a setting that counterbalances "technology-stress" and gives a positive impression. (A major setback might be noted: parent participation and care in the Kangaroo method demands furniture that can serve both as a chair and a recliner. It should also have adjustable height. No such furniture was found on the market, and this limits parent participation to some extent.)

Silent Room – Re Designing Architecture

Sorrow and mourning is an everyday experience in this ward, both for parents and staff. The only available area for mourning and leave taking was a windowless room in the middle of the building. Instead of making mock windows or elaborate paintings to compensate for the lack of view, the artists decided to work with the architecture and materials.

A hallway was created by using a partition wall. The wall has opaque glass panels with integrated lighting, the floor has blue and grey tiles and the walls are painted a darker green grey colour. The inner room has a different expression. Walls are painted white; the floor is dark tinted oak instead of ordinary plastic flooring.

A painting directly on the wall picks up the colours in the room and introduces an organic or vegetative pattern.

The furnishing is adapted to the colouring and expression of the room. The lighting is treated with great care. Tube fittings placed above the ceiling give an indirect light through the slits, a couple of wall luminaries activate the back scene and a few recessed ordinary bulbs illuminate the centre.

Figure 8 *Silent room entry*

By dividing up the area the artists made an "emotional passageway" to difficult experiences. By playing down decoration but enhancing materials, lighting, colouring etc they created a calm setting for conversations and leave taking. It is also neutral vis-à-vis different tastes and religious creeds.

Figure 9 *Silent room cieling*

Children's Waiting Area - Re defining functions

The waiting area for children was planned in a long and narrow room with a standard set of small furniture. This solution was judged as "meagre" and neither welcoming nor stimulating for children.The artist redefined the functions. To guide the viewers' interest along the wall she made a cut-out forest silhouette in many layers. For activation she made a big soft sculpture that children can climb on, rest on the soft top and hide in the holes. Instead of the play table, a long sofa was designed. Children can cuddle with siblings and parents and use toys and books, stored in the holds below.

Figure 10 *Kid entry wall*

This room is so articulated that it's perceived as a secluded oasis in the ward. It is also a room where kids can be physically active as well as rest, mourn and be comforted – and these are important functions in a ward that welcomes the whole family.

Staff Rooms – Developing materials

The two rooms for supervision, charting, etc are located between the ICU rooms and the corridors. Staff wanted openness for visibility and light transmission into the corridor but also seclusion. These needs were met with sand-blasted windows.The artist used a nature motif – a branch – and varied the motif in size and positioning.

Sandblasting permits both light transmission and a limited view through the windows. The blasted areas also vary in lightness according to angel of view. The motif thereby gives a varied rhythm and impression of sunbathed foliage through the corridor. This was judged as a great improvement compared to the usual solution with blinds. The same motif was used to screen off the reception room, which has similar needs for both seclusion and openness.

Isolation Rooms – a motif as unifying factor

The isolation rooms are fairly small, especially the adjoining room for parents. This was considered a problem, since parents and infants often stay in isolation for a long time. The artist decided to use a cloud pattern as a general motif.The pattern is painted on the walls in the parent's room, printed on curtains, and sand blasted on dividing glass doors.

The use of a single motif creates unity through the cluttered rooms. The cloud pattern is appreciated, both as a "wall-opener" and in the dual function of abstract design and a play with figural interpretations. The glass doors are especially appreciated since they, besides light, provide seclusion without use of unhygienic drapes.

Figure 11 *Isolation family room*

Figure 12 *Staff Room*

Figure 13 *Glass detail*

Family Rooms

The family rooms are not artistically decorated, though parents can choose a print to hang in their room during the stay.. However, the objectives of stress reduction and creating a positive setting had a strong impact on the design.

The rooms are furnished in a hotel fashion with a bed-settee, easy chair, desk etc. Each room has a different colouring. Necessary medical equipment is collected in a ward panel, though outlets are concealed with flaps. Other fittings are equally treated/hidden to make the milieu more like home than a hospital ward.

Figure 14 *Family room*

Sum Up

Artists working with commissions take the whole milieu into consideration, thus making an extra check of the visual and practical devices. They have competencies in colors, spatial conception, design, etc from which the staff can benefit. A major consequence of this project was that the artists' involvement improved staffs' knowledge of how the milieu is perceived as a totality, and especially by someone who does not work there everyday. In these aspects, artists can reduce negative stress in the ward settings. The family rooms are but one of many examples of how the artist's proposals and suggestions strengthened staff's commitment to a better and more articulated ward setting.

In the aspect of positive stress – or stimulation - artistic involvement is perceived on three levels:

1 Physical: architectural features like floors; walls; windows; glass sections etc can be further developed and articulated, thus creating a better milieu

2 Expressive: Artistic articulation – whether figurative or non-representational - adds cultural stimulus, i.e. feelings, opinions, experiences, memories etc

3 Experience: Cultural stimuli engage the beholder in other and wider experiences than the actual situation of the affliction. This increases well-being and is a positive stimulus for parents, staff and visitors.

Artists can articulate the staff's general intentions, values and views in a visual form, thus embedding these views in the architectural setting of the ward and creating a uniform statement of the premises. This also leads to the staff's greater involvement and continued commitment to creating and maintaining a positive milieu. The theme of this conference session is Improving healing performance through "Aesthetics", "Art" and "Culture". I would advocate that, in the general trend towards a more humanistic, salutogenic hospital design, these factors are already an established means to better healing performance. I hope to have shown some of the benefits of taking these factors seriously – without quotation marks - and in using artistic cooperation in health care design on a regular basis.

The Effect of Music on Inpatient Children

Susan B. Wesley

Susan B. Wesley, Ph.D.

Dr. Wesley is the head of Music Therapy Service at the Acadia Hospital, Bangor Maine. The Music Therapy program focuses on the use of both live and recorded music with children and adults as inpatients with psychiatric treatments needs. Dr. Wesley, a Neurologic Music Therapist, received her Ph.D. in the Arts in Human Development, from the University of Akron. She is holds a teaching faculty position at Husson College in Bangor, Maine, and also maintains a private practice with a focus on the impact of the built environment on major life transitions. She has published on this topic in selected books related to life changes and the impact of the aural environment.

Preface

The term "Integral" Architecture may be new for the attendees of this congress, however, Integral is the fundamental concept at the heart of the mission of the academy. This paper intends to provide two levels from which to view Integral insight and practice in a specific built environment. The first level uses Integral as a conceptual basis for the research and project rationale of this particular study. The second level uses Integral as a conceptual basis for implementation of an action plan for a specific hospital.

The basis of Integral practice is found in the work of contemporary philosopher and researcher Ken Wilber. Simply put, "Integral means comprehensive, inclusive, balanced, not leaving anything out. When it comes to human beings, integral means maps, models, and practices that include the full spectrum of human potentials, often summarized as "exercising body, mind, and spirit in self, culture, and nature." The template for Integral is four quadrants: Individual-Interior, Individual-Exterior, Collective-Interior, and Collective-Exterior. Another way to label the quadrants is Spiritual, Psychosocial, Cognitive, and Physical. Each quadrant includes all states and stages of experience and development, in other words, opportunities for growth. This is often referenced as AQAL – All Quadrants All Lines (states, stages, types and traits.)

For nearly a decade, the work of IADH has demonstrated that, if health is a priority, a variety of perspectives must be held and valued by those who design, build and work in community environments. The Integral model can assist in further clarifying and deepening such values. Introduction of such philosophical issues may feel out of place, however, it is timely. To that end this paper continues the discussion related to the use of passive music interventions on the children's inpatient unit at the Acadia Hospital with the ongoing study of Acoustic Considerations and Recorded Music Interventions Within a Psychiatric Hospital.

Introduction

A night of peace and quiet, after getting the kids to bed at a reasonable hour, is what most parents look forward to. For most staff, who work on many an inpatient psychiatric children's unit, it generally is an illusive dream. But, it is the

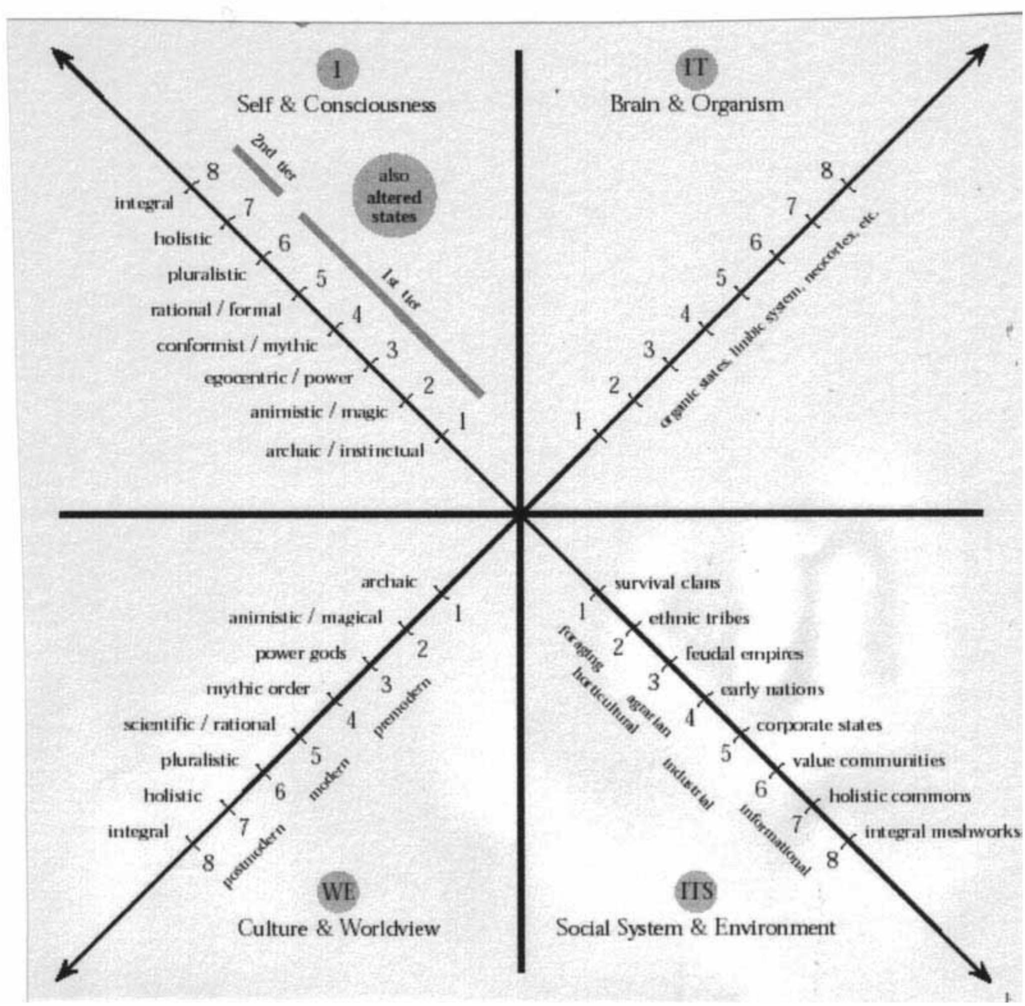


Table 1 *AQAL Template (Wilber 2003)*

constant and persistent goal of all providers of 3 North at The Acadia Hospital. Literature sources abound discussing quality of life related to patient care. There are also more and more studies examining specific sensory aspects of hospitalization and how these impact patients' perception of and satisfaction with care. The impact of sound on children during bedtime routines on an inpatient psychiatric unit is a question about specific sensory input and perceptions.

Trauma as a Primary Diagnosis – The State of Patients on 3N -

An essential reason to ask about sensory perceptions of these children at bedtime is because many children have experienced physical and sexual trauma with many of these assaults occurring at bedtime or naptime. So getting a good night's rest is not their concern – being in control is. Reasons for hospitalization of the children on 3 North include suicidal tendencies, fire-setting, assaultive behavior, inappropriate sexual contact, over sexualized behavior and aggression. Such behaviors are typical of traumatized persons. PTSD is the diagnosis given for many of these cases. Additional symptoms include depression, anxiety and attachment disorder. Random reviews of most of the case histories for these children generally reveals overt reports of or implication of trauma. No trauma can be experienced without the body holding the memory due to the frequencies absorbed by the senses particularly auditory, visual and olfactory.

In the ongoing work on the topic of trauma, major researchers such as Bessel VanderKolk (1994) and Bruce Perry (1997) increasingly reference the body's "memory" of traumatic events as having an impact on the "development" of the individual specifically delayed development. The term delay is applicable to all dimensions of growth of a person, not only physical. Robert Scar (2001) and Peter Levine (1997) have also added literature to the increasing resources lists on trauma by also examining adult physical symptomology and linking such illnesses as chronic fatigue and lower back and neck pain to early life traumas including surgeries. The body does remember and carries the burden of traumatic events as easily as the memory of petting the family cat.

One might ask "How is it that the sensory or perceptual system of the human body can "see, hear or smell, taste and touch" and not remember?" What is small is huge and, in this case, what is small is vibration and frequency. In fact the age old question "If a tree falls in the forest, does it make a sound?" is relevant here as well. Energy can be neither created nor destroyed. It can be captured for a time but does not stop moving. It is a flow of life force that is present in all things seen and unseen by humans and technology and it is the basis of the universe. When energy is captured in a way that confines it "unnaturally" it does not dissipate but continues to move even in constricted spaces until it can find a path of less resistance and flow again freely. Virtually all sensory input is frequency based and that moves us to re-think how the human system is stimulated and soothed. The terms allostasis and allostatic load will help to further refine the understanding of how particular frequencies and vibrations impact the Autonomic Nervous System and not only affect behaviors but physical health as well.

Trauma, Homeostasis, Allostasis and the Environment – States of Biology

In the very recent publication Allostasis, Homeostasis, and the Costs of Physiological Adaptation, (2004), 14 authors present varied perceptions of the body's attempt to adjust to change. Although the term homeostasis has been accepted as the natural inclination of an organism to adapt, there is new and refined insight as to what lengths the organism must stretch in order to adapt. Homeostasis has mostly been referenced as "stability through constancy" (Sterling, 2004) and emphasizes the role of the central nervous system in the regulation of the internal milieu (Schulkin, 2004). Allostatic regulation, however, reflects neural involvement in systemic physiological and behavioral adaptation (Schulkin). The originators of the term allostasis put it this way "allostasis . . . . involves whole brain and body rather than simply local feedback," and this is "a far more complex form of regulation than homeostasis (Sterling and Eyer, 1988). Now back to the children and how it is that they become "hospitalized".

When the spark of life occurs, that very instant has provided a container for energy to move in some way. The path of energy's flow is formed by the container including how the container was formed, including the force, light, sound, texture, smell and, ultimately, the "gut" reaction to the event of the spark. Basically, the complete environment and ambiance of the moment of conception is in the body's memory. The newborn cannot "talk" of the experience and neither can the infant, toddler, child, adolescent or adult, but the behavior of an individual at any age will reveal that for which words may not be available. This is especially noticeable in the emotion of fear. In order to understand the thread of: (1) the emotion of fear; (2) to resulting behaviors; (3) then to hospitalization; it is essential for a closer look at the mechanics of allostasis.

Allostasis means maintaining viability through change of state or bodily variation. It appears that the physical body should be flexible and develop additional physiological and behavioral baselines depending upon the environmental demands. Indeed, the repertoire of responses to environmental demands may be developed but if demands arise too often or quickly, the system may not have sufficient time to "recover" and reset therefore being "stuck" in a full-steam ahead physical adjustment. Basically this means a state of hypervigililance and hyperextension of biological processes. This results in what is now called allostatic load. "In other words, allostatic overload via several mechanisms of overactive or inefficient responding can cause systems to breakdown." (McEwen, 1998). "For anxiety and depression, overactivity or prolonged responding of feed-forward processes that function normally during adaptive fear, change thresholds for future encounters by sensitizing fear systems so that they respond with exaggeration or at inappropriate times." (Rosen and Schulkin, 2004).

The Body as a Recording Mechanism – State of Body Determines Recording

Basic to the understanding about what biological, more precisely, neurological mechanisms are pressed into service when a body is required to adjust, is knowledge of the ANS or Autonomic Nervous System. The research of Bruce McEwen, Stephen Porges and John Chitty, relating to the 10th cranial nerve also known as the vagus is very useful. Vagus means to wander and so it does. The nerve is hard wired into the brainstem and then meanders its way in a loop from right side to left through the body finding a path into every major organ. There are characteristics of the vagal nerve, specifically in its mylination, that help to explain something of its outstanding ability to send information to the brain. Interestingly enough, however, is that many resources discuss the 20% efferent nature of the vagus as of greater importance than the 80% afferent assignment of this happy or not so happy "wanderer".

So what does the vagus, mylination, and music have to do with traumatized kids at bedtime in a hospital? Understanding the body memory is essential in answering this question. As humans we share the vagal system with anatomical systems from the most primitive states to the Einsteins of the world. The unmylinated dorsal vagal is essentially at the "gut" level and perceives, especially well, air driven sounds and surface vibrations. These are in the 0-50 Hz range and can often be more "felt" than essentially "heard". For the untraumatized person generally this has no particular behavioral response except for a sense that something's up – like someone is looking at you from behind or a person just came into the room – not an "auditory"/ear response simply a "gut" hunch. For an individual who has had strong emotional (as fearful) encounters, the gut hunch is more behaviorally evoking and can result in a range of responses from immediate scanning of the space to bolting; shouting; punching or in other words a "meltdown".

In the specific environment of hospitals, sounds as vibrations and frequencies, if not absorbed by wall, floor or ceiling surfaces travel and resound easily. Contributing sources for such sounds are HVAC units, turbo carpet fans, lighting and technology in use on the unit. Some of these frequencies may be physically picked up as surface vibrations when children sit or lie on the floor for any myriad of activities. Not all encounters with low frequency vibrations/sound terminate in assaultive behaviors. Many other factors come into the mix especially time of day. Since many instances of abuse occur around the bedtime or naptime for children, the anatomy of these children, in a sense has a biological clock that sets an alertness based on their prior experiences. This is a learned adaptation called allostasis and it has been learned as a coping and/or preventative alerting measure.

Program Development Music Based Interventions – AQAL

Since the autumn of 1998, music based interventions have provided increased insight and useful results in both understanding and meeting particular needs of the anxious 3 to 12 year old population of inpatients at this hospital. Over these past years such interventions as music and relaxation exercises; music and imagery activities; live lullaby evenings; live classical chamber music evenings; and recorded new age ambient and classical music have been provided. From these, a number of important questions have been answered and in turn, provoked even more important questions. In other words, some techniques have been identified as: often useful; occasionally useful; and not a good choice. As well, more sophisticated issues have percolated to the surface such as how sounds travel on this unit; at what intensity are sounds perceived on the unit; what frequencies and vibrations instigate and which sooth; and when is less more?

The components of the music based intervention program continue to evolve as information is gathered not only through data collection of documented aggressive behaviors but from some of the observed behaviors and comments of patients, staff, and visitors. Results have determined such action as moving or relocating music delivery sources based on floor plan of

categories		categories	
I	Resistive Bx	IV	Physical aggress-self
.i	extreme disruption	.i	self-injury gestures
.ii	refuses verb.dir.	.ii	ingests nonfood
.iii	ref to walk/req escort	.iii	bangs head/throws self
.iv	runs/hides	.iv	pulls/picks, digs self
.v	blks door	.v	bruise/burn/cut/etc
.vi	attempts elope	.vi	attempts strange/suff/hang
.vii	off unit-bolts		
		V	physical aggress-others
II	verbal aggression	.i	swings/grabs/projects>others
		.ii	hits w/obj>others
III	Physical aggress-obj	.iii	strikes/hits/kicks w/o injury
.i	slams/pushes door	.iv	strikes/hits/kicks w/ injury
.ii	punch/kick obj	.v	none given
.iii	climbs/jumps>furniture	.vi	charges @staff
.iv	throws/kicks/tips>funr		
.v	breaks obj/destructive		

Table 2 *Aggressive Behavior Log Codes by Category and Type*

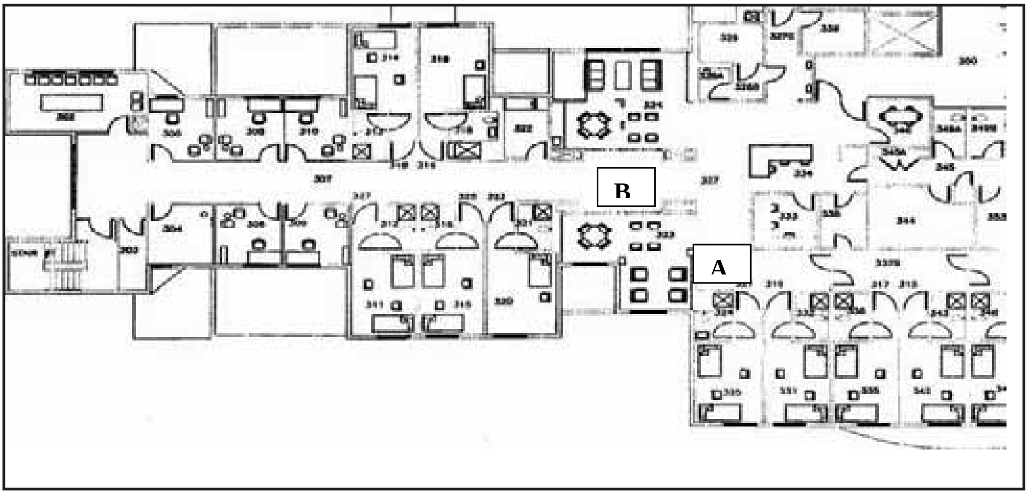


Table 3 *North Floor Plan*

the unit, and consultations with acoustic and sound professionals. Additional information has been gathered such as: patient ages and genders; unit census; staffing patterns; evening activity patterns; holiday and seasonal influences; HVAC cycles and "re-admissions" in order to bring greater understanding to the effort to provide a comforting and safe feeling to the unit at bedtime. Analysis of unscheduled events such as staff orientation and number and scheduling of pool staff along with significant scheduling changes for all staff from 8 to 12 hour shifts are additional areas for gathering data that should also provide greater insight into milieu response at the bedtime hour.

Keeping in mind the AQAL lines, states and stages, staff awareness of unit flow and their behavioral response can also play an important role impacting value of programming. When a staff person is new to the unit or returning to unfamiliar programming, such as phases of the music intervention studies, there is generally a period of assimilation to evening activities. The trust building, for what might be viewed as unconventional activity, is essential and must be timely. Children, particularly hypervigilant children, "read" adult curiosity and skepticism extremely well. If staff person is doubtful or indecisive about an activity, children can translate staff response as "this is an activity not to be valued or trusted." So another dimension for examination is staff education. But at this point, it would be helpful for the reader to examine Tables 2 and 3. Table 2 provides the Aggressive Behavior Log Categories and Codes. Table 3 shows the Unit floor plan for 3 North.

A review of the Phase interventions follows beginning with a simple overview of Phase I; followed by a concise presentation of Phase II and a more detailed presentation of Phase III.

Phase I – Overview – State and Stage and Integral Information

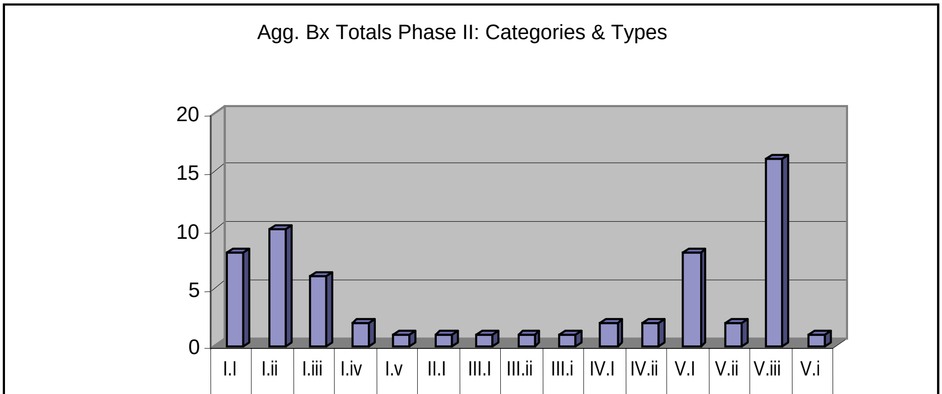
Three styles of recorded music were studied during this phase in order to determine potential approaches to reducing aggressive behaviors among an inpatient population of children (ages 3-12) in an acute care psychiatric hospital during the bedtime and overnight hours (1830-0630.) The music styles included recorded classical, new age electronic, and vocal lullaby. The data provided by Phase I showed that recorded classical music was more useful than the other two styles. However, the single live music evening for the unit continued with lullaby style music. The Lullaby evenings continued to demonstrate usefulness for quieting the milieu parallel to the results of classical recorded style. Specific problems identified in Phase I were: (1) the delivery system (five boomboxes); (2) lack of rhythmic structure and imbalance (toward low end) in the frequency ranges in the recorded new age electronic music; and (3) out of phases boomboxes with recorded lullaby music (which depends on word dissemination through the music.) The question of live verses recorded music loomed large and the next phase focused on live music using both acoustic instrumental duets and vocal with guitar.

Phase II – Spiraling up to next State and Stage: Applying Integral Information

The scheduled music intervention included two nights of lullaby music (vocal with guitar accompaniment) and four nights of live instrumental classical music (instrumental duets). The music selection criteria was based upon tempo, dynamic level, instrumental groupings and sensitivity to timbre, tonality and complexity of composition. The lullaby repertoire was selected from traditional and contemporary children's music literature. The instrumental ensembles included flute duets two evenings, clarinet and flute one evening, and classical guitar and flute one evening. Repertoire for these groups came from collections of traditional Baroque, Classical and Romantic compositions. The intervention was for six evenings weekly (no music was available Monday nights) for six weeks. (The evening time frame of 1830-2000 remained a constant as in Phase I.)

The design for the six weeks of the live music intervention intended that the instrumentation, musicians, assigned to specific nights of the week would remain constant. The schedule did adhere to vocal and instrumental music maintaining the same evenings, however, there were alterations in individual musician participation for four of the 36 evenings primarily due to weather related problems.

Data was again gathered by counting occurrences of incidents from the Aggressive Bx Log from a period two weeks pre and post intervention and the intervention term of six weeks. The music delivery again was 18:30-2000, with data gathered for the hours of 1830-0630. Between Phase I and II, hospital revision of Aggressive Behavior categories and codes occurred and significantly changed how incidents would be documented. The revised categories and codes indicated more specifically the type of aggressive behavior, escalated or decreased aggression



	I.I	I.ii	I.iii	I.iv	I.v	II.I	III.I	III.ii	III.i	IV.I	IV.ii	V.I	V.ii	V.iii	V.i
Incidents	8	10	6	2	1	1	1	1	1	2	2	8	2	16	1

Table 4 *Agg. Bx Totals - Phase II*

and all the interventions used during the incident period. In other words, the Aggressive Bx log not only provides a count of incidents (each incident is logged only once) it also documents the codes as determined by the intensity of the aggression. Therefore, the number of logged incidents is NOT equal to the number of codes which is often much greater. Table 4 provides ONLY the Categories and Codes for logged incidents for the entire 10 weeks. The average weekly unit census was 118 across the 10 week period of Phase II. There was a total 43 different patients during this time. The data also revealed that all 18 logged incidents for the 10 week period can be attributed to eight male patients. Table 5 show by categories and codes the logged incidents during the intervention evenings.

Insights and Competing Events Impacting State of the Unit: Integral Information

Week one of the intervention began with two corridor locations per evening based on the design of the unit. Music was played for 45 minutes first on the short corridor then 45 minutes on the long one. Both locations were chosen from two the five placements used for boom boxes and the two locations used for the live lullaby music as per Phase I. By the end of the second evening, it was clear that live instrumental music on the shorter corridor (A) was problematic. This was due in great part to the wall and ceiling configurations, the amount of glass, and angles of the unit structure. The location of musicians on the long corridor (B) was appropriate. The sound projected sufficiently from that area into the shorter corridor. Beginning the third evening, and for the remainder of the intervention, all music originated from the long corridor location.

A Code Red or “fire drill” interrupted the intervention on the third Sunday of the study. The milieu spent approximately 20 minutes at the end of the hallway awaiting the “all clear”. During this period vocal/acc music was used at the request of staff, in order to focus and calm the children. Such types of drills, as well as, major changes (e.g., holidays, seasonal weather alerts, etc.) in unit routine can also influence patient behavior. The traditional February “school break” which occurred February 17-21 meant a return

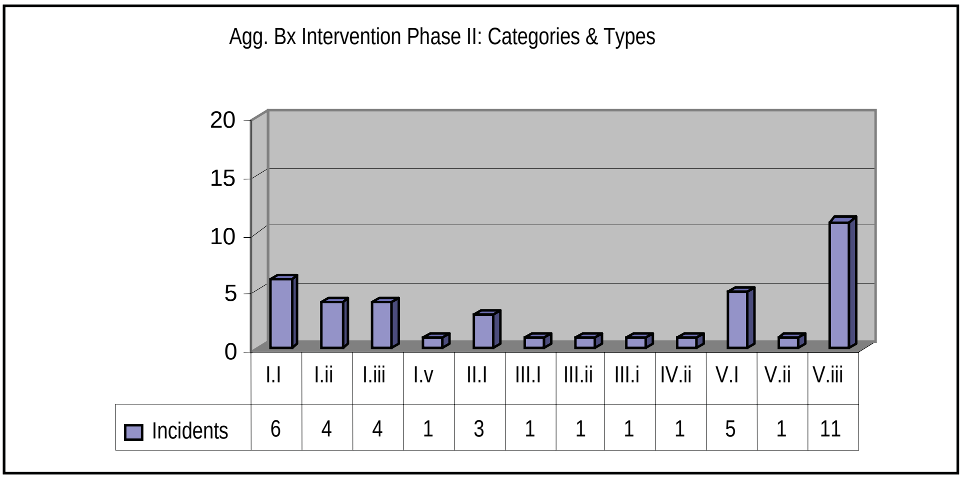


Table 5 *Agg. Bx Intervention - Phase II*

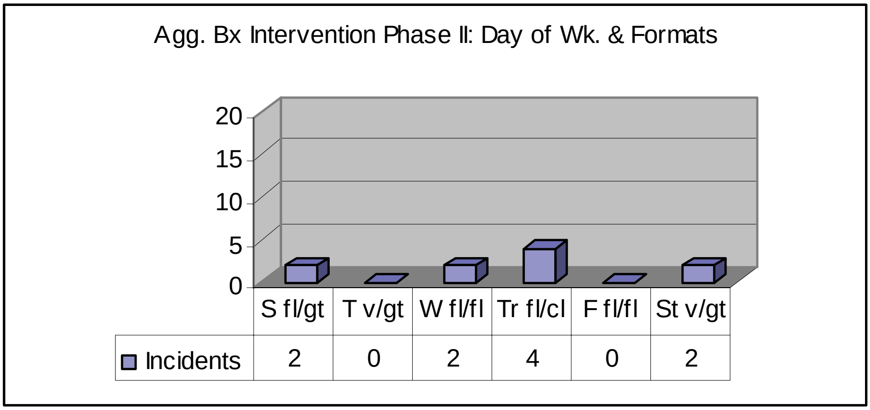


Table 6 *Bx Log during Intervention by format*

to unit routine at the start of week four (live music). The only incident logged for weeks three and four occurred the on this particular Sunday evening. Table 6 follows with the number of incidents logged during particular nights, providing more information about what impact particular formats of live music appeared to have.

Review of the instrumentation used on particular nights, suggests that the flute and clarinet duo could be considered less than useful for music intended to be a behavioral intervention. The impact of music delivered by the flute duos appears useful on Friday but Wednesdays not so. Flute and guitar duos also offer limited insight initially. A look at "day-of-the-week" and change of routine influence might be useful.

The two incidents logged on the evenings of the music played by the flute duos show logged incidents occurred one the first week during the two corridor approach and the last week of the intervention when a weather event forced an adjustment to personnel scheduling that evening. The two incidents logged on the evenings of the music played by the flute and guitar duo resulted one from the first week acoustical problems and the second from the evening of the Code Red. Tuesdays and Saturdays were the vocal with guitar or "lullaby" nights. The two documented incidents for this instrumentation were both logged on the second Saturday of the intervention. Again it appears unclear what in particular may be attributed to the music and "day-of-the-week" issues might be useful to examine.

While it is true that the type of rhythmncity, found within the melodic and harmonic structure of classical music, can provide an entrainment and an unconscious sense of predictability, there remain frequencies that upset hypervigilant systems. Phase I findings suggested that nature sounds, or electronic unmetered music cannot provide the necessary sense of beat for the entrainment useful to feed and calm an anxious auditory system. Further, scanning for low frequencies is one of the responsibilities of the dorsal component of the vagal system for survival, thus, in the most alert of states, auditory filtering goes on for survival's sake. The frequency organization of selected classical music may absorb intrusive low-frequencies of the ambient environment, in a sense transforming them.

There were identifiable problems with live music appearing to be related to the acoustical environment of this particular inpatient unit. Location of duos provided dissemination point for the music and determined, to a large extent the dynamic levels and kind and amount of distortion particularly as overtones from specific instruments interacted with various surfaces and angles of the built environment. When location changes were made, changes in behavior patterns appeared to follow.

The question now seemed to be how to maximize the lessons learned from both Phase I & II. The next step was to design a study to investigate if both recorded classical and live vocal with guitar could be useful as interventions on particularly difficult nights of the week.

Phase III - Spiraling up to next State and Stage: Applying Integral Information

This phase of the study was designed to incorporate the particular information gleaned from phases I & II. Information such as the relocation of sound sources, limitations of battery operated boomboxes and types or styles of music live and recorded informed the focus for investigation. This time there were two goals. One was to determine if both classical recorded and live vocal might be equally useful as an intervention for disruptive behaviors in the milieu around the bedtime hour. The second goal was to select a high incident night according to the Aggressive Bx Log and maintain the Tuesday night changing only the styles used both nights. The design time frame this time was six weeks of each intervention - live vocal with acoustic guitar accompaniment then six weeks of recorded classical. Data from the Aggressive Behavior Log was collected for a total of 16 weeks. The music during the 12 week intervention was provided only two nights: (1) the traditional Tuesday night; and (2) Friday night, since this evening historically shows more aggressive behavior incidents. The delivery of all music during was from the B location which was identified as optimal during Phase II.

The source for recorded classical music was the SAMONAS (Spectrally Activated Music of Optimal Natural Structure) library of CQ (concert quality) CDs. These recordings are specifically engineered to be acoustically loyal to the environment in which they were recorded so as to retain the “live” integrity of the performance to the highest standard currently available in the industry. The recommended speaker system for playing this level of sound (two MSP5 Yamaha Monitor Speakers) was used throughout this Phase. Four Curtis Mathes portable CD programmable players (one for each disc CQ124, 104, 102 & 101) were employed in order to minimize transition time between discs and programming. The music therapist/project director operated and monitored the equipment for the entire study. CD tracks were chosen for the quieting potential and musical potential to “temporally” downshift the motion of the unit during the 18:30-20:00 time frame.

Only instrumental recorded music was used. The music program was chosen through careful attention to the melodic, harmonic, rhythmic, and structural components of the selections as well as the instrumentation. Using such guidelines meant that the music was chosen to provide a dynamically quieting ambience with tempi relative to focused but calm heart rates shifting over the course of the evening to more resting heart rate selections. This was done, in order to alter the pace from a faster and louder environment to a quieter, calmer state. This is called entrainment which is a concept employed for influencing pace of movement or attending skills within an environment. The use of entrainment is at the heart of many well known psychological therapies including EMDR and DBT both of which have shown positive results with patients diagnosed with PTSD. Entrainment is a consistent underlying consideration for the music interventions used in all phases of this project.

The collection of data from the aggressive Behavior Log continued as the objective measure for Phase III. Tables 7 & 8 provide the graphic interpretation of the information from the Aggressive Bx Log collected from the pre, post and two interventions periods of the study. The range of the census for the 16 week data gathering was 69-119 with an average of 114 patients per week. Incidents for entire phase can be attributed to 10 patients. The range of patient ages was from five to twelve years. Patient population by gender was 42 males and 15 females.

There were 17 logged incidents which included a total of 74 codes for the data collection period. During the evenings of the 12 week intervention there were five logged incidents with a total of 24 codes. Two incidents were recorded on the live music schedule one on each of the intervention days (1 female & 1 male). These occurred during the sixth week of the vocal music intervention. The following week recorded music was introduced as the intervention and the first incident was logged on the start up night for recorded music. The next recorded incident was logged the following Tuesday and the third was not logged for the next 2.5 weeks (3 different male patients.) The project then continued for an additional two weeks with no incidents logged for either of the recorded music intervention evenings. The five logged incidents were attributed to five different patients, one female and four males ages seven to eleven.

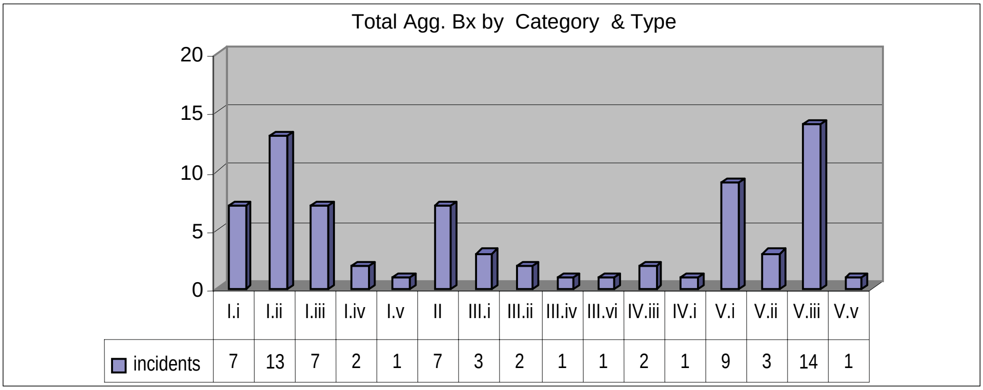


Table 7 *Bx Log totals for Phase III*

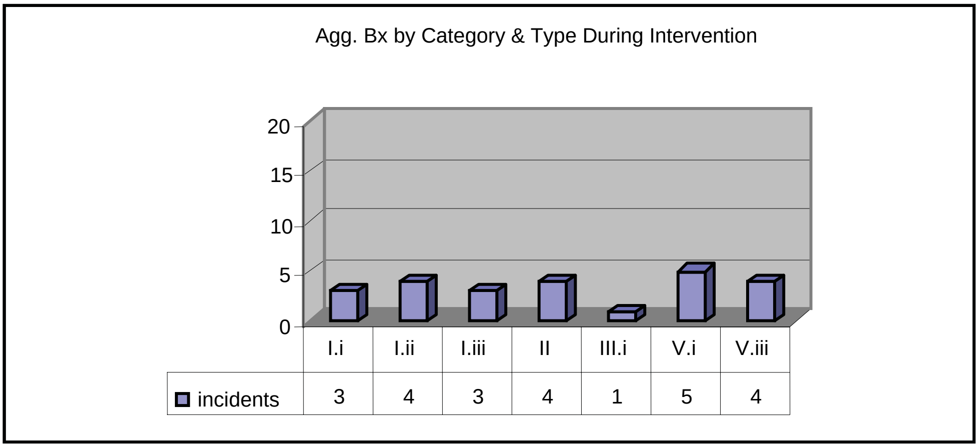


Table 8 *Bx Log during Intervention*

An interesting sidebar is that the Tuesday evening following the close of the interventions, the lullaby schedule was resumed as per unit program. There were two logged incidents on that particular evening. A serious consideration may have to be taken related to consistency in programming. The fact that, during the study, when the intervention changed from live to recorded music logged incidents rose, then settled then rose again when the recorded music was stopped and live resumed. The six week length of intervention perhaps provided a stable enough pattern in on those particular evenings and when a changed occurred it was enough to be perceived as instability in the general environment.

Traffic patterns were also observed during this phase as per recommendations from Phase II. There appeared to be peaks and lulls in aggressive behaviors during the 18:30-20:00 period appearing as dependent upon the flow of scheduled activity on the unit. Some noticeable

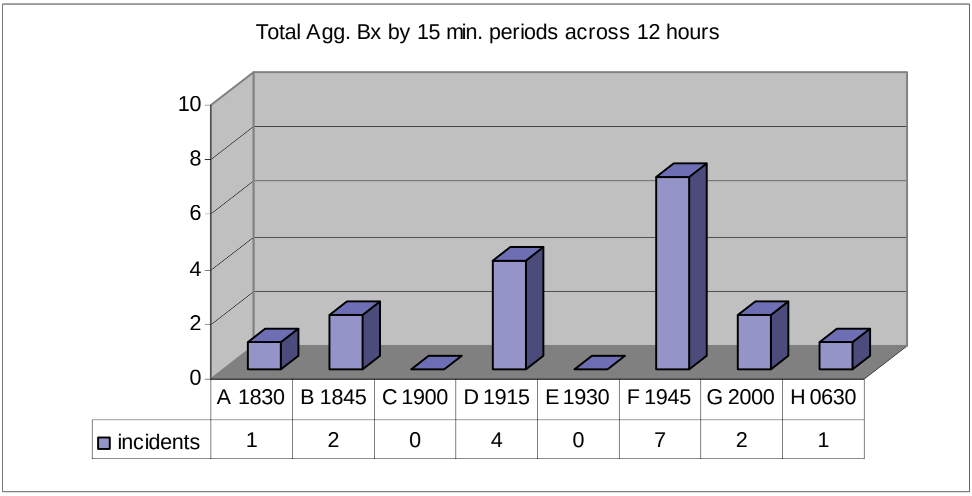


Table 9 *Total Bx logged across 12 hours @ 15 min. intervals*

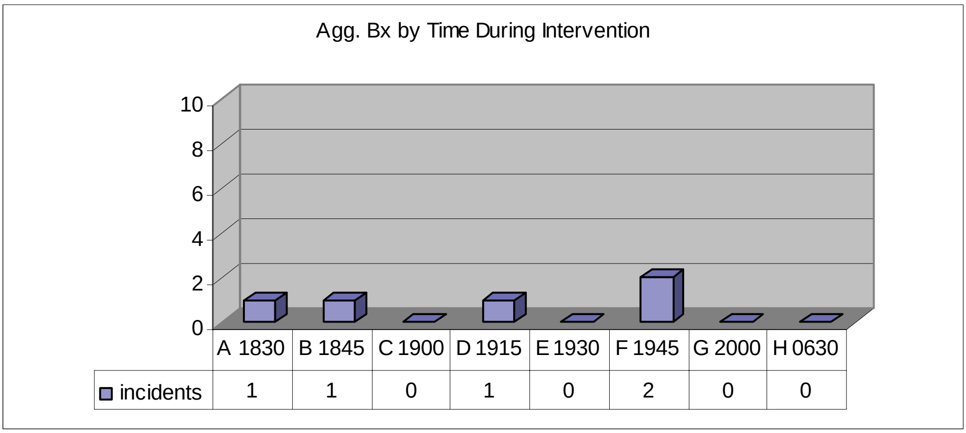


Table 10 *Intervention Bx logged across 12 hours @ 15 min. intervals*

examples of spikes in aggressive behavior were around the end of visiting time, snack time, "store" (behavioral reward time), ventilation fans kicking in, and med rounds. Tables 9 & 10 provide a view of the data by 15 minute intervals. Multiple transitions in a confined time period may be problematic within the milieu when one or two patients struggle.

Additional Insights & How this is Integral

Over stimulation of the human auditory system can negatively impact treatment in health care settings. Given the anatomical, biological, psychological, emotional, historical and social network of the vagal nerve, the human auditory system is defined as the entire body. And this system has a definitive memory that includes but is not exclusive to the brain. Keeping in mind that the whole is greater than the sum of the parts, this further implies a field beyond the individual body and that includes the immediate environment both built and natural. Field can be defined as the inclusion of all components internal and external, immediate and past, subjective and objective animate and inanimate – and now the discussion approaches the spiritual dimension. For ultimately the principals of Allostasis, Homeostasis, wellness, illness all rest upon perception.

The hospitalized individual perceives levels of treatment, including peripheral enhancements and annoyances, at both conscious and unconscious levels. Providers do the same. Further, when enhancements or annoyances are identified these are often obvious components such as meal quality, lighting, temperature, and of course specific pain and/or injury resulting in hospitalization in the first place. Treatment success for acute care facilities often means "get them in and get them stabilized and move them out." If time is money and money drives the industry then an Integral platform is likely a cost benefit. For over the decades greater numbers of healthcare environments have demonstrated increased patient satisfaction leading to shorter hospital stays and decreased drain on resources. These facilities, however, are not the mainstream nor are they as fully functional as possible.

Health and well being are perceptions. Perceptions are individual and can only be so. That being the case no perception is invalid. This is a significant understanding when working from an Integral perspective. Whether physician, patient, nurse, dietician, psych tech, administrator, family member, maintenance, visitor, taxpayer, clergy, passerby, and potential "others" all perceive progress of treatment, based on their personal experience. But the patient's perception of his/her own treatment is a major responsibility both to him/herself as well as those attending. The conscious awareness of the self and it's presence in the process is both a philosophical position and a practical position. Empowering all persons involved, in order to maximizing treatment, requires two particular efforts. The first effort is acknowledging the best of what each person can bring to the treatment; and the second is trusting that acknowledgement. Both efforts involve trust or surrender as well as presence in the moment, with each event and person throughout the treatment process.

Iatrogenesis is an old word receiving increasing renewed interest. It is defined as: Iatrogenic-an adverse effect caused by a physician's actions, including reactions from prescribed drugs or from medical procedures: A state of ill health caused by treatment, usually due to mistakes made in treatment. The word literally means "caused by a doctor", though such conditions can be the fault of therapists, pharmacists, staff, nurses, clinicians and others as well. In his provocative book of essays, The Iatrogenics Handbook, (1983) Robert F. Morgan, MD, provided a forum for a critical look at research and practice in the "Helping Professions." He defined his theme for this anthology this way: ". . . .iatrogenic behavior refers to those incidents where the cure is worse than the disease, where (often) well intentioned helpers create substantial problems for themselves or others through helping."

Interest is increasing for recognizing a patient's role in healing and contributing roles for healthcare in supportive environments for healing. All players - patients and providers and all settings dimensions – physical structure to sensory experiences within it, ought to assist decreasing stressful or traumatic experiences in the healthcare setting and thus thwart contributions to individual allostatic load. Holistic examination of healthcare environments are on the increase particularly related to life supportive or life diminishing aspects. But sooner or later someone asks if all this "noticing" and philosophizing will decrease costs or increase them – their ultimate question is "Does this leads to a black or red "bottom line?" A reframe of this question is "Who will step forward and be responsible for the examination of a patient's care then provide a cost analysis in terms of that particular human's life?" This is an Integral Question pushing against Iatrogenic behavior.

In terms of the studies presented in this paper and the ongoing work at Acadia Hospital, there is evidence of integrated/Integral thinking and action. For most people, the effect of auditory stimulation is an unconscious experience, but on 3 North it continues to evolve as conscious choice and option for treatment individually and collectively; for patients, providers, and for families and visitors as well., both The project phases have raised consciousness awareness of auditory over stimulation and impact of ambient sound on patient behaviors. In this one particular hospital setting, for one small population and their staff, the musics and the availability of music is providing positive moments of respite, diversion and focused activity as the use of the evening music programming continues. Even though the information in this paper may appear inconclusive or illusive, it is part of a larger "whole environment" proposing to provide a safe and environment for stabilizing and re-orienting patients in need of acute psychiatric care.

This paper began with an image of getting children to bed – the tucking in, reading stories, singing a lullaby and turning out the lights. Certainly a romantic notion of sleepy children snuggling under the covers and moving on to dream land. Staff on 3 North often do read stories at bedside and sometimes kids will ask to be tucked in. But on that "certain" night often kids and even staff will ask for specific songs or recordings and then at 8 PM, when the lights are turned down for the night, and phones are put on call light, the children one by one close their eyes and surrender to the stillness – their stillness.

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Future Trends in Hospital Design

Chair: Andrew Pinkerton (UK)

Hospital Design for Emotional and Cultural Needs

E. H. Zeidler

Eberhard H. Zeidler, FRAIC, Hon. FAIA

Eberhard Zeidler, is Partner in charge of design of Zeidler Grinnell Partnership with offices in Toronto, Canada, London, Berlin and West Palm Beach. Born in Germany, Zeidler educated at the Bauhaus Weimar 1945-48 and the Technische Hochschule in Karlsruhe from 1948-49. He emigrated to Canada in 1951. Important completed projects in Canada, U.S.A. and Germany as well as buildings in London, Moscow, Beijing, Shanghai, Kuala Lumpur, Jakarta, Barcelona, Montreal, and Mexico City. The firm has received over 100 Canadian and international awards. Zeidler has received the Gold Medal from the Royal Architectural Institute of Canada and is an Officer of the Order of Canada. From 1983 to 2000 he was a professor at the University of Toronto.

We are all aware of the first dimensions in healthcare buildings: the layout and design of these structures so that they can function efficiently and economically as needed by care givers. Yet little is said and done to satisfy the second and the third dimension of healthcare, even though they are of vital importance.
The second dimension which I spoke of is the realization that the practice of medicine is constantly developing new and better ways to heal and concurrently abandoning old ones. These changes happen in approximately ten-year cycles and are now hastened even faster by the advent of globalization. The result of this is that major changes in particular areas of hospitals can become necessary after approximately ten years of usage. Often the changes involve the expansion of one high tech area and the relocation of services for this high tech expansion. Such changes themselves can be more expensive than the cost of the initial construction of the area. Since buildings should have a life span of fifty years or longer, it seems to be a terrible waste of the initial investment if change is necessary in ten years. Ways should be found to reduce this cost of change. This has a profound influence on the design of a healthcare building.

We have gone through various ways to find solutions to this problem.

Our initial solution was the interstitial hospital combined with a flexible mechanical and electrical system. The concept was to place between the various medical floors a structural floor in which the mechanical and electrical services could be placed and change could be made at any time as required without destroying the basic building. Ideally these services were designed for the heaviest mechanical conditions, but built only for the present need. If it was necessary to change the uses of an area, the needed mechanical and electrical services had only to be added without wasting what had been done before.

These buildings have a long and economical life span. However, they were more expensive in the initial stage. In the thirty years that we have been able to follow the performance of such buildings, the combined capital and operating costs have been substantially less than in a standard building. Unfortunately, so often capital and operating costs are not considered together, but regarded independently as they usually are paid from different sources and at different times so the immense savings fall by the wayside.

We have attempted to reduce the construction cost of the interstitial hospital and succeeded in a series of hospitals that we designed for the New Brunswick government of Canada. In an independent report prepared for the government, these buildings were investigated and found to be only approximately 3% more than a standard hospital, but had almost all the advantages of a full interstitial hospital. We thought this was a brilliant solution, but it didn't change the market.

The present way in which we are exploring this problem is the "de-bundled" hospital. The concept is here that a healthcare building consists of various uses and not all hospital areas need the heavy mechanical services that some parts of them do (such as operating rooms, etc.). The concept is to separate the uses into normal and heavy services and have interstitial spaces only installed in the latter areas, but still at the same time have the heavy service areas located in such a way that the unknown future expansion would be possible. This does not allow total flexibility in the long term, but allows flexibility within a foreseeable range. This plan of course is only viable for projects that are all new.

Most of the construction of healthcare buildings, however, is adding to existing buildings where it is impossible to introduce interstitial spaces. It is possible, however, to arrange the services in such a way that changes can be made without losing the initial investment in its entirety.

For example, the Hospital for Sick Children developed into a referral hospital. A number of beds were changed into outpatient clinics. The initial hospital of 700 beds was rebuilt into 400 bedrooms, which was further reduced to 250. These changes were easily achieved by relocating the dividing partitions -- at minimum cost -- into an arrangement that suited the new outpatient purpose. It is unfortunate that this second dimension has not been properly regarded in general hospital construction and unnecessary sums are being wasted this way.

There is a third dimension which I spoke of in healthcare buildings - how it responds to the emotional needs of its patients and also its staff as well as its visitors who are involved in the healing process. This is the dimension of emotional response.

Let's look at the needs of the patients. There is a famous scientific research project done by Roger Ulrich[1], who investigated the reaction of patients in a surgical ward. The investigation was not by interviews, but was based on medical records during a ten year period. There were six rooms in a surgical ward that looked into an open area with trees and the other six rooms that looked at a brick wall. Ulrich investigated the severity of the operations, the nursing staff, the medical staff, as well as the patient profile and concluded that there was no difference in the treatment in the two types of rooms. But when he checked how much analgesic drugs the patients had taken and how quickly they were released, he found that the patients in the room with a pleasing view had taken 30% less analgesic drugs and were released 30% earlier than the patients with the view onto the brick wall. We had similar research evidence in a hospital we designed in Edmonton, Alberta, Canada: emotions are involved in the healing process.

The emotional hospital experience of patients is of course not concluded with a view out of the window. It starts when human beings arrive at the hospital, the way they move through the hospital, the presentation of the room, the view out of the room, the appearance of the various treatment areas and on and on. Each issue must

Figure 1 *The Hospital for Sick Children, Toronto, Ontario, Canada*

be carefully investigated to fulfill its emotional function. In addition to the emotions of the patients, we also have to consider how the general staff, the medical care givers and the visitors feel about the hospital and how that in turn influences the patient's recovery.

Figure 2 *The Hospital for Sick Children, Toronto, Ontario, Canada*

First, a hospital will have to fit into its neighbourhood, either if it is in a crowded urban setting, a suburban setting where it has to respond to the height of its neighbours, or if it stands alone in the countryside and has to respond to the feeling of a natural setting. When you finally arrive at the building the first glance that opens itself to you should give you a feeling of the community you are about to enter and show you clearly where you have to go but at the same time give you the feeling that you have entered a pleasing atmosphere that guides you to your destination in a relaxing way, that offers you places to sit down and wait, to create pleasant connections, and also gives you the opportunity to buy some essentials when you have time to spare which would give the hospital the opportunity to increase its resources. The cafeteria should not be a necessity only for the staff, hidden away, but should be in full view so you can't miss it as you pass by. It should be a wonderful way to wait and to create revenues for the hospital. All activities that are needed in a hospital and used by the public should be displayed in these public walkways.

It is important to organize the vertical transportation in such a way that it separates the public visitor elevators and hospital elevators, because it is most unpleasant and risky to have hospital beds in the same cab as visitors. The visitor elevators should be located so that they are easily visible from the main pathway through the hospital. For instance, in Edmonton they open from a public gallery, and in the Hospital for Sick Children, they are in the centre of the nursing units. In both hospitals, the hospital service elevators are separated and located in the service wing.

The nursing units themselves should be organized so that each unit can be entered separately by visitors and not by walking through another nursing unit. The first person that one should meet should be the nurse at the nursing station. It is therapeutic in a children's hospital to be able to have the playroom surveyed from the same nursing station. The bedrooms should be as close as possible to this nursing station. In children's hospitals we have experienced that single rooms with a bed for a parent create the most successful arrangement.

These issues, of course, affect all three dimensions. Let us look at some case studies – evidence of how we have brought the third dimension into the hospital without neglecting the other two. These buildings span a time of over 30 years and I believe it is important not to just look at new hospitals but see how ones built some time ago have lasted.

Figure 3 *The Hospital for Sick Children, Toronto, Ontario, Canada*

The McMaster Health Science Centre is now 35 years old. It was the first interstitial hospital that integrated a mechanical and electrical service system. At its time it was world news. We had over 30,000 experts from across the world visiting and investigating it. But as the building was completed its healing environment seemed to get just as much attention as the rational system. From the laboratory to the cafeteria and to the nursing station the building brought also the emotional element into the healing process.

The Edmonton Health Science Centre was to replace an existing hospital on the university campus and use the new building as a connection to the existing research facilities at the south and the existing teaching facilities to the north. Two glass roofed galleria achieved the desired connection and divided the new hospital into three sections. The upper floors contain two nursing wings on the exterior with a common service wing in the middle. Each nursing unit was T shaped to allow the closest relation between beds and nursing station as well as having a direct nursing station controlled entrance for each unit. In this hospital we experience the 30% drop in the use of analgesic drugs when we placed the first 400 patients into the new hospital while 600 remained in the existing building until the total new building was completed.

The two glass covered galleria proved to be less expensive than if we had left them open because the inside walls changed from the more expensive exterior cladding to interior cladding and the vertical duct connections from the interstitial spaces could be left exposed. The west gallery was the connecting walkway from the teaching facilities to the research facilities and the east galleria contained the cafeteria and a resting space.

The existing Hospital for Sick Children had to be renewed on its tight urban site. An outdated nursing home and an above-grade parking garage to the east were demolished. The parking was put below grade and the site could be used to build the nursing stations, the emergency ward, the surgical unit, the I.C. Unit, outpatient units, kitchen and cafeteria while the existing building was maintained for Radiology and Administration and its remaining area transferred to research.

Figure 4 *Walter C. Mackenzie Health Sciences Centre, Edmonton, Alberta, Canada*

The T-shaped nursing units were arranged around a central enclosed atrium as this proved to be more economic than leaving this area open. This created a feeling of community for the hospital as the nursing units could look into this space just as done in Edmonton. The roof was lifted and the exterior walls were transformed to less costly interior walls and substantial money was saved. We also came to the conclusion that one-bedrooms would be more efficient than multi bedrooms. In this referral hospital the average stay is 10 days. In the old hospital the patients had to be moved 3 to 5 times in order to find roommates of similar age and similar medical problems. We felt that in a single bedroom

Figure 5 *Walter C. Mackenzie Health Sciences Centre, Edmonton, Alberta, Canada*

the patient would never have to change rooms. A parent staying with the patient would lower the anxiety and assist in the care of the patient. We had problems in achieving the official approvals as it was felt that this would be more expensive. However, we accommodated this nursing unit in the same square foot area as a normal unit of 1, 2 and 4 bedrooms.

The inclusion of a parent into the room has been a great success as over 40% of the time a parent has stayed with the patient. This is considerable if you consider that this means each patient in average has his/her parent staying for the first 4 days there. Again the nursing station is close to the beds but also close to the entrance and the play area.

The Sunnybrook Health Science Centre needed a new surgical suite, ambulatory care and clinical services. The existing hospital has been arranged along a 1000' long linear corridor.

We located the new building parallel to the existing and created rectangular connections to reduce the walking distances. A new main entrance into the hospital for visitors and general hospital users was created. An ambulatory drive-in entrance was placed below. The new general entrance was enlivened by retail and pharmacy dispensers and visually connected with the lower ambulatory entrance. The main entrance connected the main hospital spine with a new elevator bank for public use; the hospital traffic with its elevators are separated. An atri-

Figure 6 *Sunnybrook and Women's Health Sciences Centre, Toronto, Ontario, Canada*

Figure 7 *Sunnybrook and Women's Health Sciences Centre, Toronto, Ontario, Canada*

um was achieved between the old and the new buildings and was used as a cafeteria as well as a general meeting space which became the community focus for the hospital.

The operating rooms have an outside glass corridor, which serves also as the patient waiting area. Furthermore, the operating rooms have window views through this area into the outside landscape.

The Ontario Cancer Institute / Princess Margaret Hospital was relocated into the hospital district of University Avenue in Toronto. The site available was too small to develop a typical horizontal hospital. It also had an additional problem of having two historic buildings occupying half of the already tight site, one adjacent and one north of the Mount Sinai Hospital to the south. Due to the tight downtown site, the various departments of the Hospital had to be arranged horizontally with the Oncology Department in the basement, the ambulatory treatment area as the first section above ground, the research section on the next level and the bedrooms on top.

While University Avenue was the major visual presence of the hospital to the outside world, the existing historic buildings made it impossible to have a convenient drive-in entrance. This had to be provided by Murray Street, one street to the west. While the 1930's historic building to the north had to be maintained in its entirety, the 1910 building needed only to keep its facade, because what was behind had been destroyed by previous renovations. This allowed us to create a new connection to University Avenue.

In order to use this square site efficiently it was necessary to introduce an atrium. But we felt that to make it the full height of the building would create a dizzying experience. So the atria were separated. The lower atrium with five levels was for the ambulatory treatment section which opened to below and brought daylight into the waiting areas of the Oncology Department. The second atrium above was devoted to research connected by a glass skylight. Locating research between treatment and the bedroom section above emphasizes that cancer treatment is still in a research stage. These research atria became the meeting place for the researchers. Watson and Crick, for example, got a crucial piece of information for the discovery of the DNA double helix not in the laboratory but in a common area. Therefore, this space around the research atrium could be as important to science as lab benches.

Figure 8 *Sunnybrook and Women's Health Sciences Centre, Toronto, Ontario, Canada*

The bedrooms are on top of the buildings with views into the green university campus and landscaped interior courtyards. The cafeteria was located to have splendid views towards University Avenue. The elevators were organized to be separated for various functions and visible from the courtyards related to the atrium they had to serve.

Figure 9 *Princess Margaret Hospital, Toronto, Ontario, Canada*

Figure 10 *Princess Margaret Hospital, Toronto, Ontario, Canada*

Figure 11 *Assuta Medical Center, Tel Aviv, Israel*

The Homer Gudelsky Building in Baltimore, U.S.A. had to be added at the southeast corner of the University of Maryland Medical System. This created a gallery that improved the existing heavy general and outpatient traffic of the hospital. By putting this traffic around the existing building it freed the overused interior corridors which could now be used solely for medical purposes. All the existing and new elevator banks could be reached from this new corridor which at the same time created a pleasant environment for visitors and outpatients by its restful waiting areas and an attractive cafeteria. The new Homer Gudelsky elevators are visible from the gallery and connect immediately to the nursing station control areas and open each department to its special treatment areas and nursing stations.

The Herzzentrum in Coswig, Germany is solely for heart operations. The hospital functions are organized into two wings, one containing the high-tech treatment and operating rooms and the other containing the bedrooms. Both are connected by the main entrance. A separate connection not visible from the entrance links the treatment wing with the nursing units. This glass entrance creates an attractive structure with waiting areas and a coffee shop that looks out onto a beautiful landscape.

The Assuta Medical Center, Israel was one of the most complex hospital designs we have ever been involved in. The institute had purchased a beautiful site that was part of an existing development where the footings had already been built. This dictated the outline of the hospital. It appeared to be an impossible task to create a functioning hospital with these restrictions, but after many alternates we achieved a well-functioning solution. The visual concept of the building to separate the base from the tower was an allusion of local traditions.

The site is between a pleasant urban street and a beautiful park. Naturally, we wanted to relate the park to the hospital. The main entrance from the street leads past retail stores into a cafeteria facing the park. The ambulance entrance and ambulatory clinics are also entered from the street side and face the park. The outpatient clinics, administration, outpatient recovery and Diagnostic areas are above. The next floor is Surgery and I.C.U. with an interstitial floor for the necessary mechanical services. On top of this base is a patient tower with outpatient and inpatient facilities and beautiful, therapeutic views into the park.

The design of a hospital is not a one dimensional affair but needs the integration of these three dimensions to function truly as a healing environment.

[1] View Through a Window May Influence Recovery from Surgery, Roger S. Ulrich, Science, Vol. 224

Step into the Patient Room of the Future

Terri Zborowsky

Terri Zborowsky

Ms. Zborowsky is armed with a very unique set of qualifications. She is a registered nurse and spent time working in an orthopedic/acute spinal cord injury unit at a large teaching hospital in Canada. Since then, she has focused her energy on design-oriented degrees at the University of Minnesota where she is currently a PhD candidate. Terri has now become a seasoned interior designer, healthcare planner and medical equipment planner at Ellerbe Becket.

When sixth century Greek philosopher Heraclitus said "nothing endures but change," he easily could have been referring to the healthcare field, an arena in which advances come quickly as medical technology improves and caregiving methods evolve. The business side of healthcare delivery also has seen dramatic changes. This constant transition is perhaps most evident in hospital patient rooms, where creating flexible designs is becoming critical to cost-effectively staying atop quality care.

Looking Ahead

The patient room is a key element of a hospital. What will the adaptable patient room of the future be like? That's the question Ellerbe Becket medical planners, architects, interior designers and engineers set out to answer. Continuing education exercises were conducted to stimulate discussion about what will be important to the hospital room during the next several decades to explore the possibilities to better ourselves for our clients.

During charettes (intense work sessions yielding resolutions and action steps), Ellerbe Becket professionals worked through key issues to arrive at an optimum design. The process started with consideration of healthcare trends that will influence the room's features, including

- Change in Consumer,
- Change in Nurse Demographics,
- Information Age,
- Advances in Medicine & Technology,
- Spiraling Healthcare Cost/Shrinking Reimbursement,
- Patient and Staff Safety, and
- Sustainable Design

Aging Boomers, Limited nurses

Hospital patients during the next 30 to 40 years largely will come from the baby boomer generation. As these individuals grow older they'll have a greater need for healthcare and will frequently have multiple problems. They also may be having elective procedures and a general expectation of a higher level of care, including spa-like amenities. Obesity also will be a factor among patients.

Meanwhile, the nursing shortage will continue and existing nurses will age, making professional caregivers scarce and tasks more strenuous. This creates concern for staff and patient safety. For example, overweight patients are harder to move, potentially harming caregivers and the patient. Placing room functionalities, such as sinks and storage space, where they aid efficiency will save time and therefore labor costs. Additionally, family members will become an important part of the caregiving network so the future patient room must have space for them during all hours.

Ready for Anything

The room must be universal enough to allow changes dependent upon hospital needs. During a 30 year period a room may be part of a labor and delivery, pediatric, or an intensive care unit. The room even could be used for minor procedures making it a treatment room and more of a profit center. The key is to make the room flexible so transitional expenses are minimized. Additionally, using 'green' building techniques will continue to be important for environmental preservation and to cost-effectively construct facilities long term.

When you consider that the medical technology of today did not exist even 10 years ago, it is easy to understand how important it is to build a room that can accommodate advances. Buildings need to be adaptable enough to work well without knowing exactly what the future holds. The building's structural, mechanical and electrical infrastructure has to be in place to support these changes.

Optimum Design

With all these factors in mind, Ellerbe Becket's healthcare contingent considered inboard toilet room designs (where the toilet is located along the corridor wall thereby allowing more natural light and extra space for family members) and outboard toilet designs (where the toilet is located along the exterior wall to provide maximum patient visibility for hospital staff) before deciding on a room design with toilet areas side-by-side between patient rooms.

Three distinct zones make up the oval-shaped side-toilet room design: one each for caregivers (blue), the patient (purple) and family members (green).

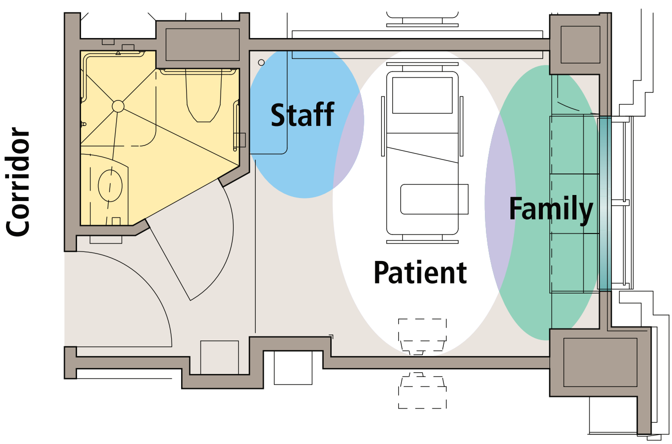

Figure 1 *Patient room layout with toilet along the corridor wall*

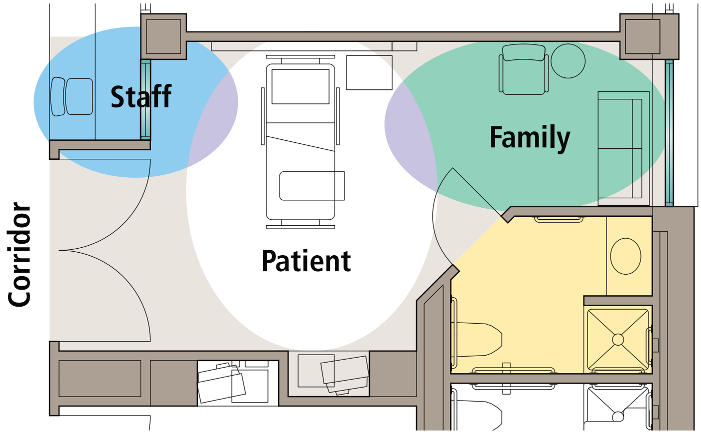

Figure 2 *Patient room layout with toilet along the exterior wall*

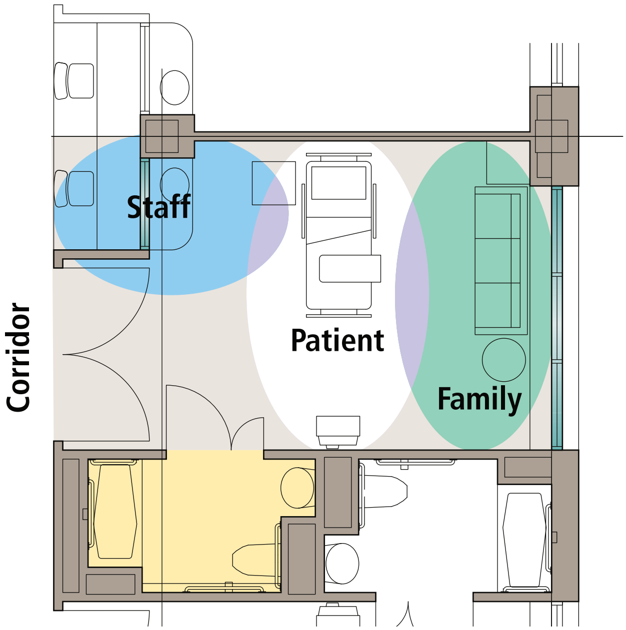

Figure 3 *Patient room layout with toilet between patient rooms*

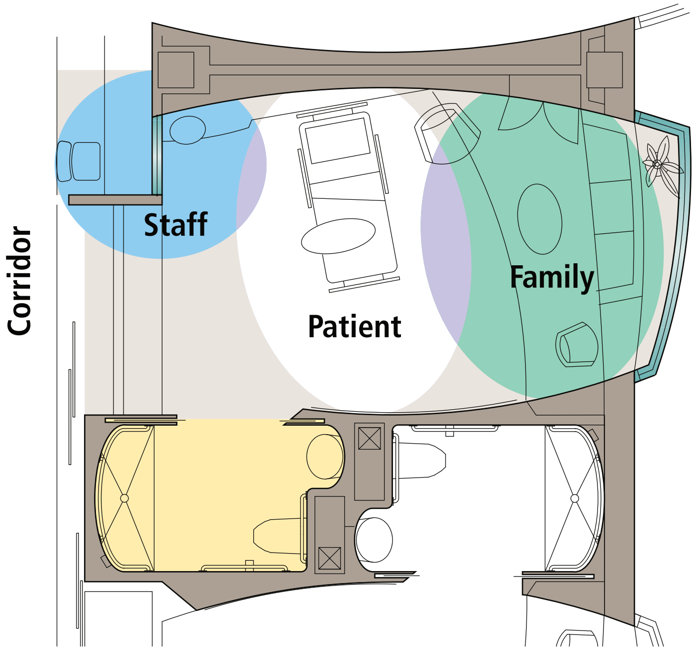

Figure 4 *New Patient Room layout*

Figure 5 *Patient Room view*

Figure 6 *Patient Room view*

The portion of the caregiver zone outside the room entrance includes space for staff to perform electronic charting with a view into the room. Nurses could monitor several patients from this location. Inside the room, the caregiver has a hand-wash sink and work counter, plus easy access to the patient headwall.

The bed is the main feature of the patient zone, one that allows easy transporting to the bathroom to prevent caregiver injuries. A flat screen television and large window for visual access to the outdoors. In the family zone, a day bed provides sleeping arrangements, while a desk enables family members to continue work while supporting their loved one. Wireless technology gives online access throughout the room. With fewer nurses, family members will assume more and more patient-care responsibilities, they need space and amenities to be comfortable and continue their lives while in the hospital.

While both inboard and outboard toilet rooms have merit, the side version allows the best of both worlds — a view to the outdoors and family space, while maintaining staff visibility into the room for better patient care. This layout is also flexible enough that remodeling to accommodate unit changes would be minimal. Only interior features would require changing. No plumbing needs to be relocated.

The side toilet room plan also marries high tech with high touch. While it can accommodate the latest medical technology, its interior design characteristics are serene, comfortable and conducive to healing. The environment is like a spa — calming and simple. The curved wall and ceiling forms are a departure from the traditional institutional feel. Surfaces on walls, floors and furniture are textured but easily cleaned. Sights, sounds and smells are appealing.

Positive visual and auditory elements can be introduced on the room's video screen. From their bed, a patient can pull up a wooded scene with a babbling brook, which can lower stress and aid recovery. This is especially important for hospitals in urban settings where there are no views of nature. The video screen allows some patient control and also can be used for videoconferencing with their children at home, speaking to medical specialists, communicating with nursing staff and more.

Assessing Size

One drawback of the side toilet version may be that the overall nursing unit becomes longer. The floor plan has 18 linear feet versus the typical 15 linear feet of corridor space per room. This equates to longer travel times to support spaces for already busy nurses. However, this is assuming a 28 to 32 bed unit. In the future, units may be smaller making the increased size not as much of an issue. Overall, buildings with side-toilet rooms will be longer but not quite as wide, meaning costs typically won't increase.

Flexibility in design has always been a goal of healthcare visionaries. Durable, sustainable design, if implemented properly, will allow future healthcare executives to hold the line on costs and continually improve the quality of patient care.

A case study of the application of this prototype was also discussed. St. Rita's Hospital Suite of the Future in Lima, Ohio was developed from a Patient Room of Future and the reality of constructing this concept revealed an ever evolving patient room of the future -- one that holds true to the original concept of high tech and high touch, flexibility, adaptability and efficiency.

Figure 7 *Patient Room view*

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Credit

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Workplace Re-Engineering in Hospital

Sarita Chand

Sarita Chand

Sarita is a Principal of Bligh Voller Nield, an Australian architectural practice with offices in Sydney, Brisbane, Canberra and Melbourne. She is the National Director of its specialist Health & Science Architecture Unit and has spent the last 25 years designing acute health care facilities. Sarita's critical input lies in the strategic and conceptual resolution of health projects. She has particular expertise in the interpretation of user requirements into briefing and physical planning, ensuring the optimum synthesis of medical planning and building design issues. Sarita has delivered several talks at national conferences on various aspects of the "Response of Design to Changing Clinical Practice" and is currently conducting inhouse research into the "Hospital of the Future" which she believes should be a completely different monster to the typical hospital of today.

Introduction

The emphasis of recent research into Healthcare architecture has been mainly on the design of hospitals in terms of Patient areas. The hypothesis of this paper is that whilst appropriate Patient environments have been investigated, not enough thought has been given to the design of the Hospital as a Workplace – as a workplace for clinical staff who provide the care for which Patients come to hospitals.

The Hospital is a 'people building', in the same realm as Airports and Offices.Since 1980, when IBM introduced the personal computer, the nature of 'work' changed forever. The new technology, coupled with changes in the nature of corporatisation and societal values, forced a serious re-consideration of the design of the office workplace, heralded by organisations such as DEGW and individuals such as Franklin Becker. The results of these studies have forced organisations to re-think the design of the workplace, a process known loosely as "Workplace Reengineering". Airports, too, have undergone a total transformation in the past fifty years, brought about by advances in communication, aircraft technology and globalisation. Both these types of buildings have adapted themselves dynamically to changing work practices, the advent and march of new technologies, employee and customer expectations and financial imperatives of the market place.

The discoveries of the 'New Workplace' have not been translated into, or adapted for, the Hospital environment, which is rather perplexing, given that the human resource that is the workforce is the most essential ingredient in health care delivery.

What are the reasons why similar thinking has not been applied to workplaces in the Hospital? Perhaps it is so because the Hospital has developed under the burden of being regarded as a quasi-sacred beast, its status guarded by clinicians, its internal goings on understood by the very few. Non-clinical professionals have been intimidated by this mysticism and therefore have not delved into its workings to offer unbiased objective advice on optimum organisational patterns for its workforce.

The importance of investigating the optimum environment for staff will perhaps be better understood if one realises a few basic facts:

There is a minimum of 3 staff to every 1 patient in a hospital organisation.

Patient well-being depends to a large extent on the capability and efficiency of staff.

Whereas patients are in hospital for a limited period, hospital staff has to deal with an unending, continuous cycle of patient care.

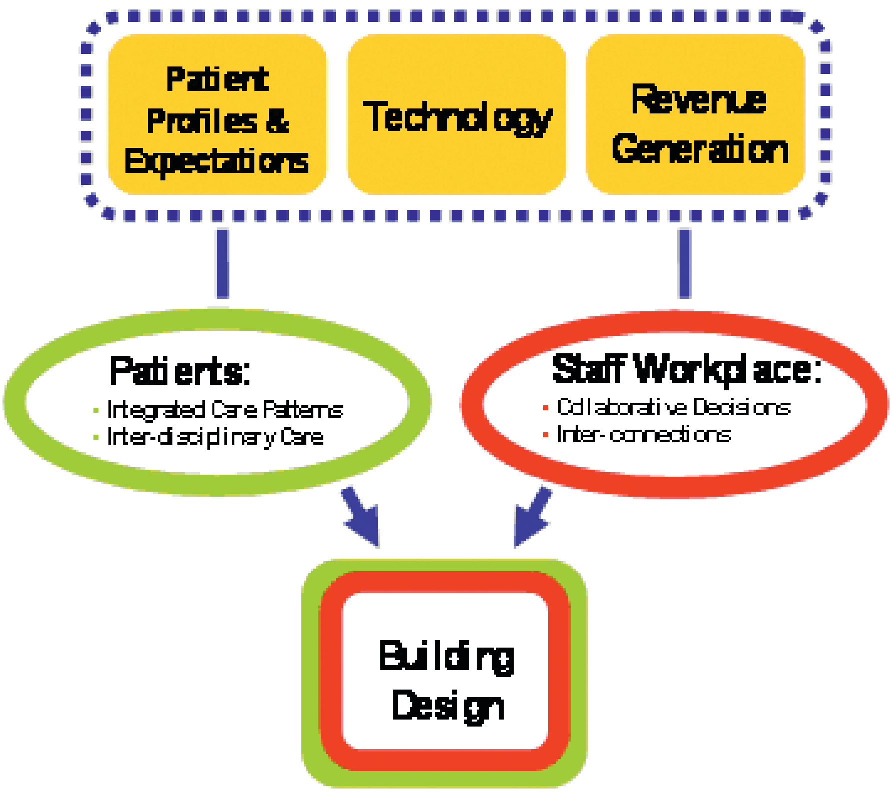
The hospital is, in the end, a business entity that needs to use its most valuable resource – its staff – in the most efficient and productive way possible.

In the current climate of skilled clinical staff shortages and patient expectations this becomes even more critical.

The Intelligent Hospital will be one that has a direct link between functionality and building form. It will resolve two environments in parallel – the hospital as a patient care area, and the hospital as a workplace for its clinical staff.

I have identified 3 key ideas that should be understood and explored in the creation of an appropriate Workplace for health professionals in the 21st century:

1. Changing clinical practices and integrated care patterns
2. Ecology of the collaborative workplace
3. Socio-technical system: Interconnections



Changing Clinical Practices and Integrated Care Patterns

As diseases of old continue to be controlled - by preventive measures, powerful drugs and bold new therapies such as genetic manipulation - patients presenting to acute hospitals are those with chronic disease problems spread over multiple organs. Obvious examples of major chronic diseases are cancer, cardiovascular diseases, neurodegenerative diseases, diabetes, asthma, and musculoskeletal disorders. These account for the greatest burden of human suffering and the greatest expenditure of health resources.

This changing face of patients is demanding healthcare to be delivered in integrated care patterns spreading across several clinical disciplines. Any look into the future points clearly towards an integrated approach to the dispensing of health services, from a micro-level (in hospitals) to a macro-level (across health and community agencies, across state and federal governments).

"Surgery has been revolutionised in the last century and a half. The heroic excision techniques of a century ago have given way to the age of restoration and replacement. The more systemic approach to treatment required by replacement therapy is nowadays challenging, perhaps dissolving, the ancient professional boundary between surgery and other medical disciplines, and illustrating medicine's increasingly interdisciplinary character." - *Roy Porter (Blood and Guts, A Short History of Medicine)*

The medical professional has realised that unless a continuum of care is designed for patients, they will return to the already over-burdened health system at some point or the other. To minimise this risk, managed clinical pathways are now being defined, such as cancer and cardiac pathways. These multi-disciplinary care plans acknowledge the inter-dependence of body organs, and therefore spread across several clinical disciplines and levels of healthcare. Overwhelming evidence points to them saving money and improve patients' outcomes. Teamwork will be maximised in the managed clinical pathways system, with care being delivered by groups cutting across departmental boundaries.

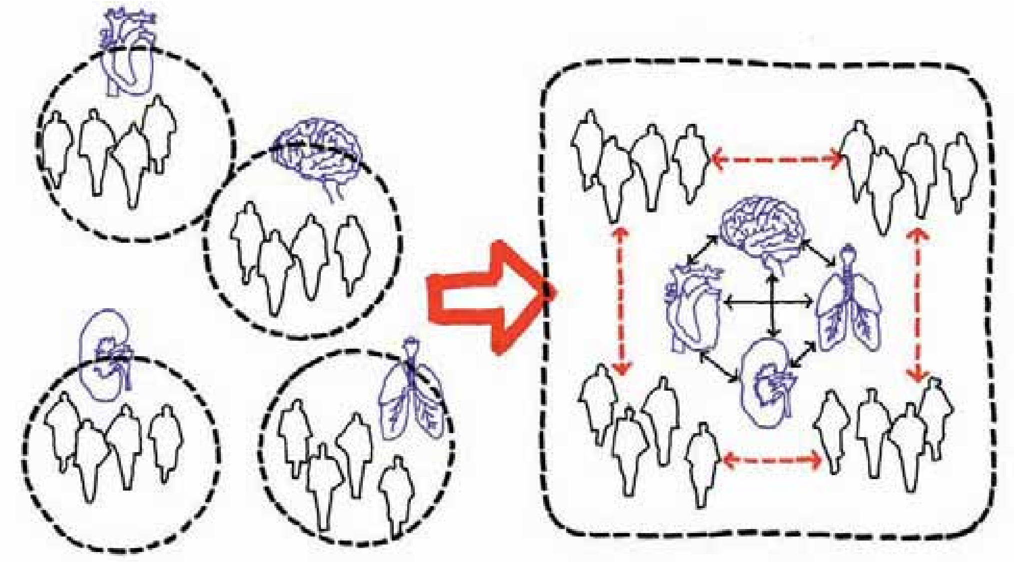


Figure 2 *Organisation by organ to organisation by inter-clinical pathways*

Future care will be considered from a whole systems approach with appropriate inter-agency working to ensure seamless care. Networks will be integrated across organisations and institutions, and staff will need to work more flexibly to meet patients' needs. Swift movement through the pathways will require a rapid flow of information to support the care. This flow will be dealt with by clever IT and intelligent communication mechanisms no doubt, but critical to its success will be close personal interaction between caregivers.
The workplace strategy of hospitals will have to provide an appropriate environment for the execution of efficient work processes between interdependent disciplines, and the successful hospital will be the one that will allow the physical location of teams to handle the whole process of dispensing integrated, interdisciplinary care.

Our recent experience at the Redevelopment of the Mater Hospitals in Brisbane, Australia, has proved the hypothesis of clinicians wanting to work in an integrated environment as opposed to sitting in their individual 'empires'. When site constraints made it impossible to locate both the Birthing Suite and the Neonatal Intensive Care Unit on the same level, it was unanimously decided by the Directors of both departments that they would rather continue to sit where they are now - in a somewhat grotty 50-year old building - rather than be separated in a new building. Their reasons were identical – they believed it would be hugely beneficial for their patients to have their treatments discussed in a collaborative manner by obstetricians and neonatologists working together – and that this would be most efficiently done if they sat together in their workplace.

As British professor of cardiovascular science, John Martin, recently observed, "a multidisciplinary team is more likely to give rise to nonlinear fantasy [or innovation] than a monovalent team."

Ecology of the Collaborative Workplace

The intensification of work space in recent years has been brought about by the necessity of quick resolutions to complex issues, enabled to a large extent by increasingly integrated communications and computer technologies. These changes to work practice have changed many aspects of organizational life, and have manifested themselves in a physically different workplace.

The more non-routine the work, the more likely it is to involve the integration of different forms of expertise, increased networking and more personal meetings. The design of the Workplace of the Future supports and nurtures human activity and contributes to a reduction in impersonal communication, such as emails and internal phone calls, to be replaced by face-to-face contact among staff.

The 'bump' theory pushes the boundaries even further by theorising that the best human interaction occurs in incidental areas such as in corridors and around photocopiers. As well as facilitating 'bump', innovative design aims to break down 'silos' or divisions between departments by providing opportunities for communities to emerge and flourish.

These qualities of a human and efficient Workplace can not be provided in cellular layouts. Neither will they be promoted in a 'barn'. The optimum size of project teams, according to Workplace experts, dictates a project area to accommodate up to 30 staff in flexible seating arrangements, with a range of meeting and project workspaces for ad hoc meetings. Workspaces and teams will be defined by specific projects, and will re-configure and cross-fertilise as new projects demand.

The subject of enclosure and access should not be resolved by suppressing either requirement. The answer lies in bringing about relative degrees of enclosure. We can start with the premise that we all are vastly more productive with a territorial enclave. However, we must immediately couple this with the need for an opening and access, and most importantly the ability to survey and participate in the organization to which he or she belongs.

The new Workplace should allow for project based teams, with a core team and then temporary specialists who move from one core team to another. It should allow people to come together and collaborate, creating a sense of connectedness. People should be able to make eye contact with up to 70% of their colleagues. There is no doubt that an open environment fosters connectivity among staff.

I will not labour on the design of physical co forts such as natural light, external views, temperature control, and appropriate workstations. Enormous progress has been made in understanding the effects on worker performance of environmental conditions in the office, and learned papers on the Work Environment have been presented at earlier Congresses. The principles espoused in these papers – of Physical, Psychological and Functional Comfort - should equally apply to the Hospital Workplace.

Socio-technical System: interconnections

There is no doubt that future health care will be delivered by a more generic workforce, with fewer demarcations between professional groups and subgroups. No discipline will be an island, and input from several disciplines will make advances in health care possible.

This must lead to a greater level of interdependence between individuals. There are now no 'demi-gods' treating patients in isolation; rather, clinical staff will be required to interact with each other, across all levels. The aim of the design of the New Workplace should be to minimise communication difficulties inherent in demarcation.

The strategy for the New World, according to futurologist and US guru on work practices Robert Reich, is the building up of 'relationship capital' – a trusted network of people willing to go the extra mile, who understand constraints and who have worked together for some time. Sitting isolated in cellular office areas does not build up this productive model.
The future workforce will be characterised by shifts in traditional boundaries between disciplines, a growth of multi-disciplinary working. The aim is to create a less fragmented workforce that is able to respond quickly to the care process, with less staff time spent on co-ordination and communication. Employees themselves want to work as interconnected members of a team because they want to see their contribution to an overall big picture.

Paraphrasing Frank Becker's (*Cornell University International Workplace Studies Program*) theory of 'Collaborative Work' for modern businesses espoused in 1990, and applying it to a clinical organisation: "The premise is to bring all the players in the process together as a team at the project's inception. The model emphasises teamwork that cuts across disciplines and departmental boundaries, on freeflowing and face-to-face communication, on information and ideas circulating among all players from the very beginning of the process and not in some preordained sequence". The study showed that each of the three re-organised offices benefited from cross-functional co-location of core team members.

The same sentiment, reiterated by Gail King (*Bank of Boston, systems analyser*): "Move people closer together. Take down the barriers between them, allowing people who are doing the work to communicate directly with each other at the moment of transaction as opposed to in a circuitous fashion."

Though each member of senior clinical staff has a unique role to perform within the program of a clinical pathway, he or she relies heavily on knowledge and inputs of other members of the group in order for the task (diagnosis and treatment) to be complete. The characteristics of and appropriate Workspace will therefore be high physical proximity to allow better interconnections and to facilitate more brainstorming type tasks.

A report on how to improve care at a leading hospital in Australia, commissioned after the discovery of several 'clinical errors,' identified that most of the problems were symptoms of underlying weaknesses in the organisational and professional cultures. These included an inability to communicate effectively and work as a team. The different clinical professions (and especially medicine and nursing) did not know how to work together. Junior doctors could not communicate with senior doctors, partly because of the culture of paternalism within the medical profession.

The different clinical professions often kept their separate notes, and there was seldom a consolidated care plan for each patient. The author of the report had discovered similar issues at hospital reviews in Slovenia and Japan. A study in 1999 by the US National Academy of Sciences claimed that 100,000 inpatients die each year in the US due to clinical errors. Internal investigations clearly discover these errors are largely the consequence of poor communication between clinicians.

Social psychology studies show that many of the fears, antagonisms and forms of negative behaviour stems from not knowing what others are doing. Every office has a climate of social expression that can either be destructive or constructive and, to a large degree, this is affected by the physical expression we give it.

One of the great assets of a more frankly interactive and open office expression is the improved social structure it offers. This structure supports the development of social relations on which the trust is built that characterises high performance teams. The whole team becomes an organic community of individuals working with a tangible sense of belonging and useful contribution.

The new hospital organisation will allow its organisational requirements to generate its own natural order, unlike traditional organisations that impose order. Just as in biology, where ecologies of organisms have complex interdependent relationships, likewise now – there will be a decentralised web of connections, where people assemble for a project and then disperse again.

The creation of inter-agency frameworks for the planning and development of services will be eased by pooled budget mechanisms. It is then a short step to colocate services in shared facilities which can be accessed by all staff. Such cooperation will require culture changes on all sides.

Conclusion

Workplaces must reflect what we do, the tools we use, and the results demanded of us. Though the basic structure of all of these has changed dramatically over the past fifty years, the Hospital Workplace is still designed as it always has been. It has not responded to changing clinical practices, changing patient presentations, changing communication technology, and importantly, to the imperatives of revenue generation. It stands to reason that the workplace of the future must be re-thought – in terms of social, professional and technical changes.

The intention of this paper is to open wider debate about the 'Hospital as a Workplace', to analyse it and investigate solutions for the future. How this hypothesis is organised into physical strategies needs to be underpinned by further research and analysis.

I hope my basic thoughts will arouse interest and engender a collaborative research project in at least one of the organisations or institutions represented today.

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Guidelines and Design for Effectiveness of Hospitals

Chair: Stephen Kendall (USA)

Healthcare Facilities from Planning to Design

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Abstract

This paper defines guidelines for architects involved in the design of healthcare buildings featuring different degrees of complexity. As most complex buildings lifetime is less than 30-50 years, we argue that future building projects should allow for innovation, especially as far as diagnostic-curative technologies are concerned. The methods we have used for our guidelines draw upon State and international agencies research data such as demographic-sanitary expectations as well as surveys undertaken by bio-tech experts, by teams of equipment and diagnostic-curative system's designers and project managers. As a result, we illustrate possible scenarios of future demand for health treatment, formulated on the basis of health needs placed on an importance scale. Finally, we translate health needs into 'guidelines and standards' to shape future planning by planners and architects.

1. The reference model

The health sector is marked by a constant phenomenon of diagnostic and therapeutic innovations, largely stemming from other areas. This involves an increase in the struggle between the technology of diagnosis and care and the spatial organisation of the hospital, between the "container" (the hospital) and its "content" (the technologies and the medical knowledge that revolve around them).

This requires a review of the planning approach that re-evaluates the planned introduction of the hi-tech biomedical equipment. This modifies the traditional typological and organisational models of the hospital and of other parts of the national health system, providing greater effectiveness of the services and of the running costs. There exists, therefore, a strict interrelationship between technological innovation and the evolution of the organisational model of the hospital. Among the fundamental principles of a hi-tech and high-care hospital we find "humanisation" and "innovation". "Humanisation" means a hospital focussed on the patient where a central role is assumed, from the outset, by ergonomic planning, understood as the correct interaction between users of the service (staff, patients), equipment and environments. "Innovation" means the possibility for the hospital to deal with ongoing technological innovations, by means of its own internal and external (structural, functional and planning) flexibility.

The redrawing of the basic hospital network is one of the prime purposes of the Italian National Health Plan (2004-06). This which defines the role and activities of the para- and pre-hospitalisation health centres. It also identifies the scientific and technological parameters of the hospital system of excellence with a strong element of super-specialisation.

Among the subsystems, a decisive role in reducing hospitalisation is the realisation of short-stay extra- (intra- or para-) hospital subsystems: from the out-patients clinic, to the multi-specialty or single-specialty day hospital, to the general or specialist day surgery. All diagnosis and related pre-hospitalisation could be dealt with outside of the hospital. The hospital has to assume more and more the character of a structure dedicated to Accident and Emergency (A&E), (areas of intensive therapy, resuscitation, etc.) as well as that of treatments that cannot be carried out elsewhere. Such as the riskier hospital treatments linked to the major general illnesses but, above all, to those illnesses of a specialist nature.

In consideration of an ever-increasing elderly population, that usually presents multiple symptoms, difficulties in recuperation and consequently long recovery times, what's needed "downhill" of acute treatment, is a subsystem of health "centres" that gradually, moving from the acute phase, lose their hospital connotation. This subsystem goes from the rehabilitation hospital to domestic hospitalisation; from the RSA (Residenze Sanitarie Assistenziali - assisted health residences) low-intensity rehabilitative refuges for permanent or temporary assistance where people can continue to live in the family circle, to the hospice for palliative care.

The questions which are at the top of the planning process of health service buildings are:
1) demographic variability;
2) rationalisation of the regional health system;
3) integration of hospital work with external-hospital work;
4) use of hospitals in accordance with a standard but flexible model, without the rigidity that is usually found in the distribution and use of space.

A "technological pole hospital" (referred to henceforth as "ASL hospital") imposes an investment, towards the acquisition of diagnostic-therapeutic computer technology and spatial reorganisation within the hospital. Such a proposal is an important decision because today substantial resources are invested primarily for ensuring buildings comply with the law instead of being radically rethought for carrying out the hospital function. The national hospital system that is proposed relies on the integration of the centres and consists of two models.
1) instrumental diagnosis (bio-imaging and laboratory and endoscopic diagnosis);
2) services offered in an outpatient or day hospital context (outpatients clinic; day hospital; dialysis centre; day surgery).

As far as laboratory diagnosis goes, it is preferable to have a *single point of treatment for biological materials with many sampling points* throughout the region, managed directly by GPs and collected by a single laboratory. The reports can be transmitted by computer or phone to the GP who carried out the sampling.

The *Dipartimento Emergenza Accettazione* (DEA – Accident & Emergency, henceforth A&E) has to be thought of as largely autonomous of all the other sectors of the hospital with a separate staff and budget. It manages the 118 network (emergency telephone number), the patient-transport sector (helicopter ambulances and ambulances) as well as the emergency doctor services, providing for their training and their professionalism. The A&E of an ASL is the crux of the network of regional A&Es and it utilize, through agreement, specialists of other ASL hospitals and firms to guarantee a qualitatively correct response. Specifically, the A&E, in relation to its position, can be characterised

Relief level	Territorial areas	Structures	Health referring operators
1st level "Generic"	Basic regional	- private clinics - public clinics of the regional unit of primary assistance (UTAP)	- general practitioners (GP) - GP's association
2 nd Level "Specialist"	Health District (DS) Regional	- Public and private outpatients clinics - Radiological consulting rooms	- Specialist physicians - Paediatricians
3 nd Level "Generic"	Health District (DS) Hospital	- Community hospitals	- GP - Professional nurses
4 th Level " Specialist "	Health District (DS) Hospital	- General day hospital - Single speciality day hospital - Day surgery general and specialist - Dialysis centres	- Specialist hospital doctors (in exceptional cases on NHS)
5 th Level "Basic Specialist "	Local Health Firm Hospital (ASL)	- support hospitals to the ASL hospital	- Specialist hospital doctors
6th Level "Basic to Medium Level Specialist "	Local Health Firm Hospital (ASL)	- Asl Hospital - Single laboratory of clinical analysis of the ASL	- Specialist hospital doctors
1st Rehabilitation level	Health District (DS) Regional	- Rehabilitation centres	- Rehabilitation therapists
2st Rehabilitation level	Local Health Firm Hospital (ASL)	- ASL rehabilitation hospital	- Medical physiatrists - Rehabilitation therapists

Table 1 *Classification of the health structures for assistance levels and regional areas*

as a "trauma centre".

Alongside the A&E module are the Unità Operative (UO-operational units) of the wards and of the intensive therapies (IT) specialties. Such a system is referred to as the "elective area". There are two aspects of the elective area:
1) *rehabilitative convalescence* within a specialised hospital;
2) *rehabilitative convalescence* at home with the help of the domestic integrated help (ADI).

The introduction of computerised biomedical technologies, day hospitalisation, and an efficient system for the treatment of emergencies, allows a reduction in the number of bed places in the UO wards. This allows a full and more rapid use of the bed places with a substantial reduction of the fixed expenses (staff, various materials). To the extent that the inpatient units will no longer be identified (that is to say assigned to a single specialty) but rather undifferentiated as "functional areas", the savings will be substantial. This is a path that could be taken by the ASL hospitals, in line with the law. It would be more difficult to apply "functional areas" to nationally important hospitals, to the institutes of recovery and care of a scientific nature - IRCCS - and to the teaching hospitals. The regional system presents itself as closely linked with the external hospital health services and with a direction that plans from a very unitary point of view. The hospital technological pole is the planning projection of itself on the other

garrisons whether they are within or without the hospital. This technical direction is unique on the part of the hospital "technological pole".
With the first results of the "human genome project" being delivered, there is underway in Italy, as well as in the more economically advanced countries, a thorough examination of the fallout of the scientific-technological innovations in biomedicine. This will effect the functional and regional organisation of the health garrisons, especially those of the hospitals and, consequently, of the effects on health expenditure.

To formulate proposals of functional reorganisation and of regional rationalisation of a hospital network it is necessary to take into consideration numerous factors. This will include social-economic-demographic variables regarding population, health professionals, regional context, economic-functional resources, health organisation, levels of involvement and of participation of the population and of the staff and so on. This reorganisation is accompanied by a shortage of hi-tech medical-surgical garrisons that doesn't allow diagnosis and therapy appropriate to the times.

The strategic sectors of innovation are essentially: drugs, bio-imaging, life-saving technologies (resuscitation, intensive therapy, transplantation of organs and devices, etc.). Future scenarios are extremely exciting for biotechnology with applications on a large scale (e.g. stem cell research; embryos for the production of spare body parts; cloning technology); with a hi-tech that will allow thought transference by machine, both computer and robot, and, the other side of the coin, cerebral manipulation, and so on.
Undoubtedly the sector of excellence in innovation is the pharmaceutical one, both as regards therapy and in preventative medicine. It is, above all, the genetic drugs that will allow personalised and differentiated treatments. The innovation of "personalised" medicines is predicted to occur within a few years. The pharmaceutical industries predict 5-7 years as the maximum before they appear on the market. But at the present time it is the hi-tech in bio-imaging that will cause an epochal and decisive leap in diagnosis and therapy.

Innovation in this field modifies the distribution of care as well as the organisational model of the hospital itself. With scientific innovation and the massive networked introduction of the hi-tech, one could attempt that organisational-functional innovation that is the prerequisite to better quality and efficiency, at a minimal running cost. The organisational innovation will organize the hospital into three areas which may not necessarily situated in the same building, preferably adjoining, and run autonomously. The areas are identified on the basis of their diagnostic-therapeutic intensity. They can be typified as:
- A&E;
- area of elective treatment;
- area of rehabilitative convalescence.

The central pole about which the system of the "areas" rotates is that of "instrumental diagnosis":laboratories, bioimaging, nuclear medicine and endoscopy. Depending on the size of the A&E area there's no reason not to have two poles of instrumental diagnosis: one for A&E, the other for the elective rehabilitative convalescence area. The sequence of the path followed by a patient emphasises proximity and is the basis of a building programme. This will allow, in the future, the re-dimensioning of a programme of new construction or functional renovation of existing buildings adapted to hospital use. This will allow close examination of both the costs of the technological innovation as well as of the organisational innovation of the physical environments and of the management savings that might follow.

In the area of elective treatments a central role is again taken by day hospitalisation, where there are two innovative structures.

1) The day hospital widely experienced with in

the area of medical clinics, of prehospitalisation and of post-hospital day treatments, is the link with domestic hospitalisation and recovery. This structure can assume specialist or general or polyclinical characteristics. This is the illustrated case. The specialist day hospitals were initially psychiatric and rehabilitative, followed by paediatric and geriatric.

2) The day surgery is more recent, but widely experienced in different North European and North American hospitals. It is a development of a branch of outpatient surgery that with the introduction of surgical endoscopy, of partial anaesthetic techniques, of therapies for the treatment of pain of protocols of intervention at any point, and has proven to be a strong defender of the rights of the patients. They are not left to their own devices, but rather the organisation of the surgical team that operates in the day surgery is on permanent call in case of complications.

A big reduction in hospital bed places has been realised, therefore, through the innovation that it has a good selective ability and, at the same time, to the extent to which a regional system of socio-medical services is activated whose foundations are: the presence in the region of the services of the ADI (domestic integrated help), the specialist structures of prevention-therapy-rehabilitation (from family planning clinics to centres for mental health to centres for drug addicts) to the physiotherapy centres for the return to work of people who have suffered accidents (to the arms, to the hands, to the locomotive apparatus, to the brain, etc.), to the residential rehabilitative structures, such as the RSAs (health relief residences) or residential-curative (such as the hospice). It is in the measure to which the protective network is widespread and diffused that one can reasonably try to aim for a reorganisation of the number of bed places in a region, as long as in any such operation the GPs and paediatricians are strongly present and involved, as well as the doctors of the emergency doctor service and so on.

The steps illustrated above are particularly important in the vision of a process that realises “new hospital armour” characterised by a concentration of biomedical technologies, of appropriate professionalism and of a low number of bed places, on which the A&E system is based, so as to stop - if not reverse - the migratory hospital flows in direction of the better-equipped centres in the North.

The other operation is the downgrading of the scattering of “unsafe” hospitals, from the point of view of the patient, in extra- and para-hospital structures strongly anchored in the region, in accordance with a plan that foresees: outpatients - day hospital, day surgery - instrumental diagnosis, connected functionally, as well as by computer, with the hospital of reference of the region, that will furnish - on the basis of coordinated planning - the specialists and the other personnel necessary for the carrying out of the health functions, and this will guarantee the turnover. This structure, looked at again like this, will be the hinge between a strictly hospital system and a system of para-hospital garrisons of high health value, such as the “rehabilitation centres”, post-acute phase, with medical-surgical wards or RSA (Residenze Sanitarie Assistite - assisted health residences) for patients who, because of age or impairment, or because of a prevailing illness of a degenerative character, need help and supervision for long periods, or brief periods, depending on their family situation.

2. The planning of the network

The hierarchical system foresees three levels of acute care:
1. zonal or basic
2. provincial
3. regional

Such levels refer to the “population basins”:
1. zonal or basic hospital from 25,000 to 50,000 inhabitants
2. provincial hospital from 300,000 to 400,000

inhabitants
3. regional hospital from 800,000 to 1,000,000 inhabitants
The specialties present, in accordance with the classification contained in the law, go from those considered more frequent to those considered rarer.

The specialised hospitals, with standards of reference relative to population that are double that planned for the acute hospitalisation, in turn are defined as:
a) provincial
b) regional
Over the years other standards have been established, for example of hi-tech diagnosis. The reference point is always the population (ministerial decree [DM] 29 November 1985; DM 2 August 1991).

Subsequently, standards were proposed relating to the functional system of the A&E, both of the 1st and level 2 (DPR [presidential decree] 27 March 1992). In this case one passes to the obligation of functional systems. The population parameter is acquired indirectly and derives from the obligation that there be present in the emergency system some of the specialties that were characteristic of the ex-regional hospitals, that have population basins of about one million inhabitants.

Another set of standards referring to population basins was proposed by the DM of 29 January 1992 on medical-surgical specialties. The "hinge" between the hospital care system and that of healthcare and welfare is, without doubt, the "regional para-hospital service" that encompasses:
1. primarily diagnostic functions of specialist medicine. The structure of reference is the *outpatients clinic*;
2. primarily therapeutic functions of specialist medicine. The structure of reference is the day hospital (DPR 20 October 1992) in its variations of polyclinic day hospital; of rehabilitative and back-to-work day hospital (*); of psychiatric day hospital; of general and specialist day surgery;
3. functions of instrumental diagnosis (clinical

LEVEL	DENOMINATION	HEALTH DIAGNOSTIC-CURATIVE FUNCTIONS								
		WITHOUT HOSPITALISATION					WITH HOSPITALISATION**			
		Outpatients clinics	Day Hospital * Day Surgery	Dialysis centres	Laboratories	Bioimaging	A	B	C	D
1st	GP surgery									
2nd	Outpatients clinics	■								
	Bioimaging					■				
3rd	Community hospitals		■ opz.				■			
4th	Day Hospital		■							
	Day Surgery		■							
	Dialysis centres			■						
5th	Support hospital to the ASL hospital	■	■	■		■		■		
6th	ASL hospital	■	■	■	■	■			■	
1st	Regional rehabilitative centres		■*							
2nd	Rehabilitative hospital		■*			■				■

Table 2 *Presence of health functions in the structures*

bioimaging and analysis).The structures of reference are the *radiological clinics* and *the laboratories of clinical analysis*.

3. Planning of the physical structures: the ASL hospital

The specialist literature of planning and designing breaks the hospital organism down to the level of "system" in three sectors – hospitalisation (wards), diagnosis and therapy (health services), and general services - and it is at the level of "subsystems", in functional areas, that the totality of the basic spaces can be identified – closely related to each other by specific spatial, functional and organisational relationships

LEVEL	DENOMINATION	LEVEL OF CARE			LEVEL OF EQUIPMENT			PROFESSIONAL MANAGEMENT	
		LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	MEDICAL	PROFESSIONAL NURSES
1st	GP clinics	■			■			■	
2nd	Outpatients clinics		■			■			■
	Bioimaging		■			■		■	
3rd	Community hospitals	■			■				■
4th	Day hospital		■			■			■
	Day surgery		■			■		■	
	Dialysis centres		■			■		■	
5th	Support hospital to the ASL hospital	■			■			■	
6th	ASL hospital			■			■	■	
1st	Regional rehabilitative centres	■			■				■
2nd	Rehabilitative hospital		■			■		■	

Table 3 *Intensity of care and the biomedical equipment present in the strctures*

LEVEL	DENOMINATION	POPULATION BASIN	THEORETICAL NUMBER OF BED PLACES	THEORETICAL REQUIREMENTS FOR AN ASL *	
				PHYSICAL STRUCTURES	BED PLACES
1st	GP surgeries	1.500	…	134	…
2nd	Outpatients clinics	40.000	…	5	…
	Bioimaging	40.000	…	5	…
3rd	Community hospital	40.000	20	5	100
4th	Day Hospital	40.000	8	5	40
	Day Surgery	40.000	8	5	40
	Dialysis centres	40.000	4	5	20
5th	Support hospital to the ASL hospital	100.000	100	2	200
6th	ASL hospital	200.000	200	1	200
1st	Regional rehabilitative centres	40.000	…	5	…
2nd	Rehabilitative hospital	200.000	60	1	60

Table 4 *Theoretical standard of population ande bed places in relationship to the levels of health structures*

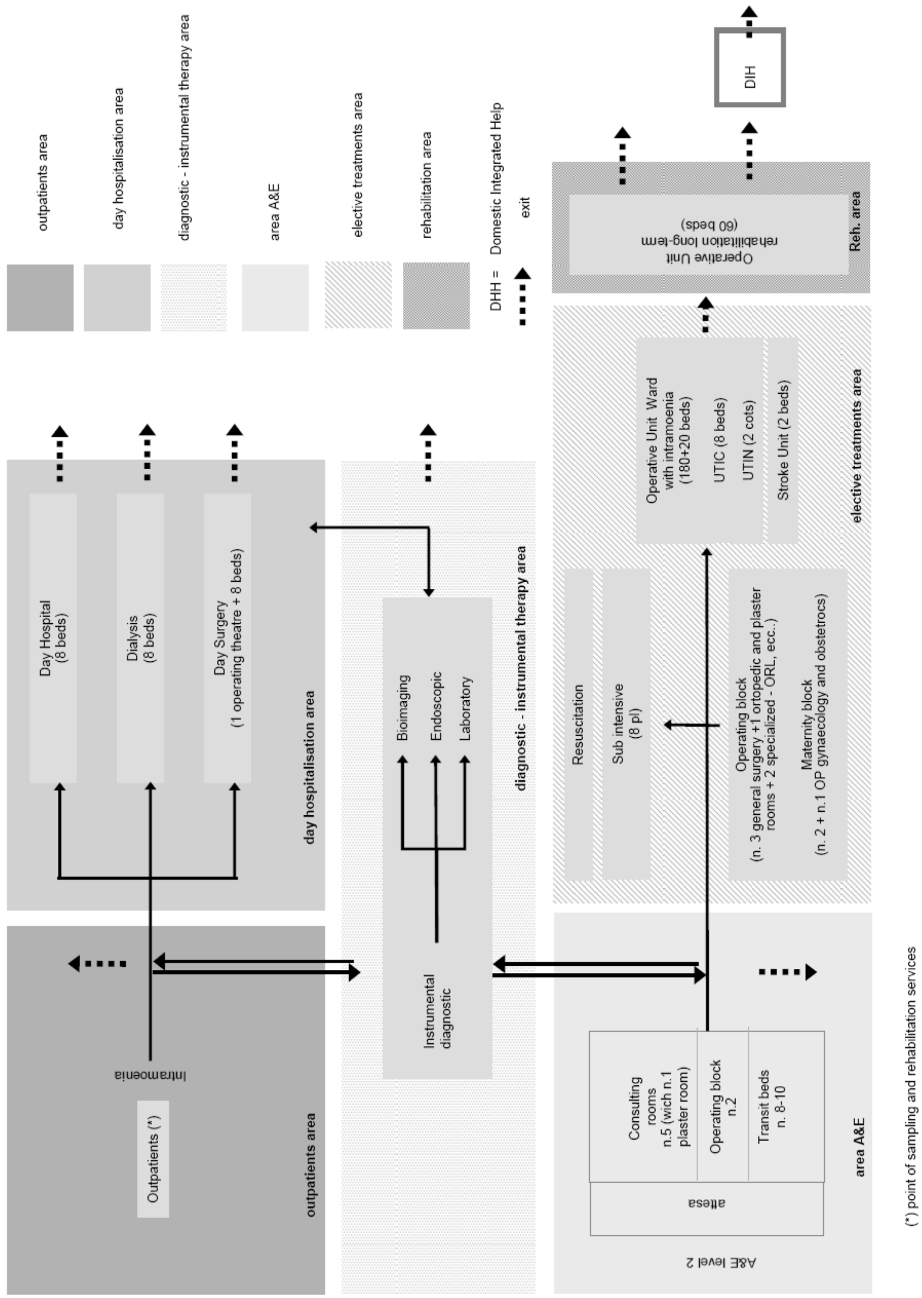

Table 5 *Functional scheme – population basin 200.000 (242 bed places which 24 are day places, 200 normal and 18 intensive/subintensive resuscitation bed places)*

SECTORS	FUNCTIONAL AREAS		SPATIAL UNITY
WARDS	wards	Day, ordinary, specialist, and rehabilitative	day hospital/day surgery
			specialist
			ordinary
			rehabilitative
		Intensive care and supervision	intensive/sub-intensive
			infectious
			resuscitation
SERVICES OF DIAGNOSIS AND THERAPY OR HEALTH SERVICES	surgical area		day surgery
			surgical block
			maternity block
	diagnostic instrumental area and laboratories		analytical laboratory
			hystoanatomical pathological research
			research laboratories
			functional and endoscopic examinations
			diagnostic imaging
	outpatients		dialysis
			surgery
			radiotherapy
			day hospital
			transfusion centre (blood bank)
			sampling centre
	emergency and first aid area		A&E level 1
			A&E level 2
			first aid point
GENERAL SERVICES	administrative services		Admission
			general computer service
			health administrative offices
	social services and other		Chapel
			cafeteria and social areas
			rehabilitation services (gym, swimming pools, etc. where anticipated)
	services of support		pharmacy
			sterilisation and disinfection
			mortuary service
			changing room
			cleaning services rooms
			stores
			kitchen
			laundry
	technological plant		heating system
			cooling system
			water system
			fire prevention system
			electrical substation
			distilled water production
			sterilisation system
			disinfection system
			elevators, etc.

Table 6 *Sectors, functional areas and spatial unity*

SECTORS		SQARE METRES	% WEIGHT
WARDS			
- Day Hospital and Day Surgery wards		900	3 %
- Ordinary and specialist wards		7,000	26 %
- Resuscitation- intensive- sub-intensive *		900	3%
	TOTAL WARD SECTOR	8,800	33 %
DIAGNOSIS AND THERAPY			
- Outpatients clinic		2,000	7%
- Operating block Day Surgery		600	2%
- Dialysis		800	3%
- Radiology – ultrasound - mammography		1,500	6%
- CAT and NMR		900	3%
- Radiotherapy - linear accelerator		700	3%
- Functional and endoscopic examinations		800	3%
- Laboratory		1,000	4%
- level 2 A&E		3,000	11%
- Operating block (6 operating theatres)		1,800	7%
- Maternity block		1,000	4%
	TOTAL DIAGNOSIS AND THERAPY SECTOR	14,100	52 %
GENERAL SERVICES			
Administrative services			
- Admissions			
- General computer service			
- Health administrative offices			
Social services and other			
- Chapel			
- Cafeteria and socialising areas			
Services of support to diagnosis and care			
- Pharmacy			
- Sterilisation and disinfection			
- Mortuary			
- Changing rooms			
- Rooms for cleaning services			
- Stores			
- Food sorting room			
- Laundry sorting room			
	TOTAL GENERAL SERVICES SQUARE METRES	4,000	15%
TOTAL GENERAL		26,900	100 %
Other spaces to be calculated (to be added to the supplementary total)			
Corridors, stairwells etc 15 % to the total		about 4,000	
Undifferentiated container (20 bed places)		900	
General services - technological plant		3,500	
	TOTAL SURFACE AREA CALCULATED SQ.M.	35,300	
	TOTAL SQ.M TO BED PLACE	145	

Table 8 *Planning quantity reference: ASL Hospital*

– aimed at the carrying out of complex activities or of a single complex activity, and articulated as a sum of elementary activities.

In the three hospital sectors, the articulation of the functional areas and of the corresponding spatial units is illustrated in Table 6. Every hospital structure is characterised, then, by a determined percentage relationship between the three sectors, thus identifying the prevailing function. Such a relationship, according to the literature, is modified in time along with the evolution in innovation of the technologies applied to medical practices and managerial models.

In relationship to the functional scheme no. 4 "ASL hospital – population basin of 200,000 inhabitants - 242 bed places", in the sphere of the hypothesis regarding the restructuring of existing hospitals or of new builds, it is thought necessary furnish signposts to the programming of the planning.

For a hospital that's defined as having a high technological content, such as that previously defined as the ASL hospital, the "optimal" percentage ratio between surfaces of the three sectors (equal to 100% of hospital surfaces), in the light of the considerations above, has to be articulated as follows:

- ward sector	30% - 35 %
- diagnosis and therapy sector	50 % - 55%
- general service sectors	15%
- total hospital surface	100%

Such a relationship underlines the heavy weight given to the services provided by the sector of diagnosis and therapy. The articulation of the theorised model is summarised in the chart below where, for the characteristic functional areas, the planning quantities have been rendered explicit.

As mentioned above, the hospital structure is characterised by a relationship determined between the three sectors that make it up. For the purposes of the proposed planning, by reuniting the functional areas within connected sectors, the percentage ratios of the hypothetical model are calculated. From the calculations it is deduced how this is characterised by a greater weight of the diagnosis and therapy sector (52%) in the total of the sectors, anticipating the ongoing tendency that sees the sector being that that is most interested in the phenomena of technological innovation, in full expansion, including dimensional, for its potential.

Conclusion

All physical places created to respond to people's health needs, which were held to be unchangeable and permanent, undergo, in time, processes of restructuring and/or transformation.

The hospital is the exemplary structure of the contradiction between the evolution of an individual's health needs, scientific progress and social-cultural processes. The text pursues the objective of providing an aid – cultural and technical at the same time – for planners so that their work may take into account three interdependent questions: the humanisation of the hospital environment (and hopefully of treatment); scientific-technological innovation both in materials and building systems and in medical equipment and the biotechnologies; planning for the building of a hospital system which will meet the needs of a population living in a defined area.

Australian E-Guidelines for Health Facilities Workshop Design

Jane Carthey

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Synopsis

Is it possible for a health facility guidelines system to be a 'lifejacket' that enables the briefing, design and delivery of a greater number of better quality health facility buildings with resulting high levels of user satisfaction, designed using targeted and effective client consultation, meeting available budgets and delivered in accordance with realistic programs? Or……… Is a health facility guidelines system inevitably a 'straight jacket' that stifles innovation and creativity, with the result being poorer quality health facility buildings with lower user satisfaction, designed with poor levels of client consultation, unrealistically low budgets and highly improbable delivery programs?

This paper sets out lessons learnt in the development of health facility guidelines for NSW and Victoria, which will be translated during 2005 into Australasian National Guidelines. These lessons include conclusions regarding the nature of health facility guidelines, and what they should contain. They also include knowledge gained from developing a practical and efficient guideline creation process and the setting of protocols for guideline use.

Taking heed of these lessons should ensure that the outcomes from the use of health facility guidelines are those of a 'lifejacket', rather than a 'straight jacket'. As a result better, more appropriate health care facilities will be created achieving higher levels of client satisfaction and delivered within available capital budgets and asset development programs.

Background

Australia has a population of nearly 20 million people and, in 2002, an annual health budget of $66.6 billion. Of this approximately $3.8 billion was related to capital expenditure i.e. about 5.8%. (AIHW, 2004, Appendix Table S43) Australia is a Federation of seven States and Territories. Almost all capital expenditure on health facilities is the responsibility of the States and a set of autonomous health systems has resulted. Historically, design guidelines to assist in the planning of health facilities have been developed in many States of Australia. For many reasons, including the high cost of maintenance and keeping them current in paper hard-copy format, they have tended to become out of date, to lose credibility with industry users and as a result have not been as well utilised as was expected. Although approved in principle for several years, the development of a national set of health facility guidelines is only now about to commence.

In 2002, the Victorian Department of Health and Human Services developed a set of design guidelines for the regulation of private hospital and day procedures facilities in that State. These guidelines were created in an electronic database format, with the intention of making them available via an interactive web page. Following an initial review by industry Victoria issued its guidelines for further review in mid 2003 and has recently issued an updated version via the web for industry-wide use.

At the time of the first release of the private hospital guidelines in 2002, Victoria made available to NSW the database format and its contents as a contribution to the initiation of a national health facility guidelines project. The national project had previously been endorsed by the capital works managers from the majority of Australian States, and the development of the Victorian database offered the opportunity to move this forward.

Using the Victorian database as a starting point for development, NSW Health initiated a project that resulted in the development of a NSW Health Facility Guidelines system that in 2004 issued a first set of Health Facility Guidelines to guide the planning and development of public hospital facilities in that State.

In 2005, both Victoria and NSW Health will undertake further work on their guidelines, whilst in parallel the Centre for Health Assets Australasia (CHAA) will commence work on an Australasian set of guidelines that will draw on the Victorian and NSW projects to create guidelines for use in all the States of Australia and in New Zealand.

Introduction

Health Facility Guidelines are standards for the design, construction and equipping of new and renovated healthcare facilities. These are generally interpreted as 'minimum' standards for the design of physical spaces that accommodate and support clinicians in the delivery of health services to their patients.

The need for health facility guidelines has been agreed by a range of diverse health industry participants that includes health service organisations, design consultants, contracting organisations and public funding bodies such as Health Departments. The reasons behind this need include the differences between health building design and construction projects and other more general types of building project.

The design of health buildings reflects the nature of the health service delivery environment which is increasingly complex and multi-faceted. It reflects the characteristics of the highly paid, highly trained health service staff who work within it using increasingly complex and expensive technology, and the increasing demands of an ageing population placed upon it. All of these characteristics must be accommodated within the limitations of increasingly finite community resources.

The nature of the health service delivery environment directly affects the design of the physical settings for health service delivery - the health service buildings. Health buildings are complex to design and there is little space for the 'beginner' in the process; the level of technical knowledge required from a designer is high and there is little room for error.

There is rarely a larger body of organisational knowledge available within a health service organisation. This is often the result of high levels of staff turnover and the pressures of also performing in their 'real jobs' for those staff assigned to assist in the development of capital projects.

Ongoing reductions in capital budgets or the expectation of the achievement of better value for money in the expenditure of available funding have required that greater efficiency in project delivery throughout all its stages is pursued. However, pursuing efficiency in project delivery cannot occur without an understanding of how far this can be pushed without impacting on the quality of buildings required for patient care.

Setting the 'minimum' or acceptable standards is the main purpose of health facility guidelines, and requires an understanding of design, plus research into both the quality and quantity of space provision accepted as the 'norm' by the wider health service delivery industry and an investigation of the evidence sustaining this 'norm'. Wider investigative research can enable the recognition of patterns that may be extrapolated in terms of commonly accepted minimum, and then as preferable standards for healthcare facility design and operation; these standards are then documented by health facility guidelines. Ideally, these standards are also comprehensively cross referenced to a body of evidence that underpins them and that can be challenged, tested and reviewed as circumstances change over time.

To be a 'lifejacket', rather than a 'straight jacket', health facility guidelines must be widely available, used and endorsed by those designing, building and using healthcare facilities. They should be flexible enough to accommodate the needs of individual projects, but not so flexible that they become a launching pad for endless claims for special treatment and exemptions from their application. Nor should they be slavishly applied to every project without consideration of specific project needs and requirements. Used in this way, they become a 'straight jacket' that stifles innovation, with the associated risk of delivering dysfunctional healthcare buildings unfit for purpose.

The following case study outlines the development of health facility guidelines by the States of Victoria and New South Wales that will be translated to Australasian National Guidelines in 2005. It illustrates the lessons learnt regarding guideline development and the design of the associated systems for their use that should be heeded in achieving the desirable objective of guidelines as 'lifejacket' rather than 'straightjacket'.

Health Facility Guidelines as a System for Delivering Healthcare Buildings

Health facility guidelines are part of a wider system for the delivery of appropriately designed healthcare buildings that support and facilitate the delivery of high quality healthcare services. As part of this system, they have an important role to play but they are not the only factor that ensures the desired outcomes are achieved.

Other components of this system include:

- The regulatory environment within which healthcare facilities are designed;
- The requirements of both public and private healthcare funders in terms of project delivery processes that may include the use of user groups, particular sign off provisions, staged setting of capital budgets, etc;
- The roles assigned to professional consultants in the design of healthcare facilities;
- Feed back loops aimed at ensuring ongoing quality improvement in the delivery of healthcare projects;
- Current and anticipated political issues/climate that can have a disproportionate effect on the delivery and outcomes of healthcare facility projects.

These components must be accounted for in the development of health facility guidelines and in managing their use.

'Lifejacket' versus 'Straight Jacket'

The ideal situation is clearly one where health facility guidelines act as a 'life jacket' rather than a 'straight jacket' in the delivery of health-care building projects. Yet what are the characteristics of each of these alternatives and how can the process be skewed towards the first outcome? In summary, health facility guidelines with the qualities of a 'lifejacket' should be a well designed standards framework and decision support system that ensures that:

• Minimum functional performance requirements are met on every project;
• Sufficient flexibility is available to respond to the needs of individual projects, enabling design professionals to innovate and respond creatively within overall guideline parameters;
• The setting and achievement of realistic project capital and operational budgets is possible for every project;
• There is a transparent hierarchy of rules governing facility design that are first and foremost performance based, with a prescriptive approach included either only as a last resort or where particularly appropriate in response to an individual problem or situation.
• Evidence of investigation, research and cost-benefit analysis is provided for key guidelines requirements, especially where these may be more costly or controversial than past commonly accepted practice
• In the future, the opportunity will always be available to change and adapt the guidelines in response to evidence based research
• Confidence is inspired in those using the guidelines, without 'slavish' adherence ever being necessary or required.

Clearly, health facility guidelines with the qualities of a 'straight jacket' have many characteristics quite different to those above. However, even the best 'lifejacket' guidelines system can quickly become a 'straight jacket' if applied inappropriately or without tailoring or adequate thought about their use.

In reality, there are two main issues that determine whether health facility guidelines become a 'life jacket' or a 'straight jacket' in the delivery of projects. These are:
1. The content of the guidelines and how they are initially developed, reviewed, adapted and updated over time.
2. How they are used in the design and delivery of projects.

The next section of this paper examines these issues in more detail by referring to the lessons learnt in the development of both the Victorian and NSW Health Facility Guidelines.

Lessons Learnt from the Victorian and NSW Health Facility Guidelines Projects

Need for Health Facility Guidelines

The Victorian project arose from the need to regulate private hospital facilities in that State, whereas the NSW one began from a public sector perspective. However, fundamentally both the NSW and Victorian projects were intended to positively influence the production of more and better facilities within available health capital budgets, without the endless rounds of negotiation regarding space and regulatory requirements that occur on many projects. Some of the ways they do this are as follows.

• The production and use of endorsed guidelines will successfully contain the many 'ambit claims' for space and other resources by clinicians and other users by streamlining the negotiations embodied in traditional user group processes. In this context, accurate clinical spatial needs are more easily defined in response to evidence-based benchmarks for space utilisation that demonstrably support best clinical and operational practice.

• By extrapolating from the benchmarks, industry accepted standards for space provision are defined by guidelines and these can be regarded as a 'minimum' level of provision for acceptable and safe clinical practice.

These standards can also be regarded as an 'optimal' provision or a 'maximum' provision depending on the attitude of the funding authority in the jurisdiction where they are applied. However, there are dangers associated with the 'maximum' or 'optimal' approach including the provision of inadequate and inflexible spaces unable to accommodate, for example, specific local cultural requirements or even quite small changes in clinical practice over time.

To some extent, these dangers can be overcome by developing a special appeals system to review guideline provisions on the basis of a one-off situation or a specific need to cater for future foreseeable changes in practice in a particular location. However, this appeal system should always be seen as a last resort, and part of achieving this is to use a high level filtering process to ensure that only the genuine 'special cases' are reviewed and not those merely put forward by disgruntled user groups whose space demands have been curtailed.

Functions of Health Facility Guidelines

The NSW and Victorian guidelines were produced with the following key functions in mind. These functions were and continue to be considered essential for the proper use of guidelines in the design of health care projects. The guidelines must:

• Be 'useable' standards and guidelines that apply to most, if not all, health facility types including public, private or a mix of the two.
• Offer a range of facility briefing and planning solutions that relate to the classification of a facility in terms of the sophistication of its services and the volume of activity or throughput it accommodates.

• Provide endorsed and challengeable standards and guidelines that can be referenced by electronic and other proprietary briefing systems produced for interpretation of the guidelines for users, designers and contractors.

• Provide information for health service managers, clinicians and designers regarding functional space utilisation that reflects current accepted operational practices without making the resulting spaces so inflexible that they cannot accommodate future changes in practice

• Enable facilities to be built that respond to and anticipate the health service needs of the target population including responding to cultural issues such as ethnicity, and different locales such as metropolitan or rural situations.

Producing Guidelines to Fulfil these Functions

The following lessons were learnt from the Victorian and NSW projects about how to produce guidelines to fulfil the above functions.

1. *Information regarding the development, structure and content of the guidelines must be made explicit and available to all those involved in the Guideline development process.*

For the NSW and Vic HFG projects (which are intended to eventually result in an Australasian set of guidelines), a Design Framework document has been produced that sets out the reasons behind and processes used for the development of the guidelines.

2. *The reasons behind 'contentious' guidelines decisions must be made transparent and challengeable.*

Just as clinicians are expected to act on the basis of evidence-based practice, so guidelines for physical space provision must be evidence-based and this evidence must be the result of appropriately documented research by reputable and unbiased researchers.

3. *It must be recognised and stated that guidelines are a briefing tool and are only the 'starting point' for a facility design.*
Guidelines are not a substitute for an individual facility design. They are never intended to replace the need for specific project analysis and a detailed project brief developed by an experienced designer.

4. *Although guidelines are never intended to be a template for a 'final' design, their provisions must be as realistic as possible, and tested to ensure that they are translatable into 'real' physical space and that they never mandate incompatible or mutually exclusive parameters.*
Where the guideline defined spaces are adjoining or form part of a much larger whole, the spatial allocations should be practically tested alone and in combination before the spatial allocations are recommended in the guidelines themselves.

5. *Guidelines should be written in a way that encourages user groups to explore their options in defining an operational model for the unit or facility. It should be possible to use defined spaces to support more than one operational model.*

6. *Guidelines must look towards the future and not only respond to what is happening now locally, they should anticipate likely trends already foreseeable in other locations.*

Steps in the Process for Developing Guidelines

The Victorian and the NSW guidelines projects have both demonstrated that the following essential steps should be followed and refined in the guideline development process.

1. Review the needs of those who will use the guidelines i.e. review the needs of the target audience which may include experienced & inexperienced designers, clinicians, health service managers, professional bodies, etc.

2. Develop the guidelines using a process that allows for input, review and endorsement by those who are experts in their field, whether they are managers, clinicians, or designers. In addition allow for input by other stakeholders such as clients, patients, relatives and families of patients.

3. Ensure that all guidelines are useable by building designers - make them realistic, and develop them in the language that designers understand. While never intended to replace a good designer, they may be used by a client to help them recognise good design.

4. Never consider the guidelines finished – they will at best only ever be 80-90% complete. Guidelines are a living system that needs to be used, reviewed and refined continuously. Therefore a timetable for continuous evaluation and feedback must be built into their development and ongoing use.

5. Make the guidelines readily and easily available to the target audience. In the case of both Victoria and NSW the guidelines will be accessible via a dedicated website. It is intended that the guidelines are issued to industry users free of charge, to ensure wide use and acceptance of initial and updated versions.

Use of Guidelines in the Design and Delivery of Projects

There are many cautionary notes to be raised regarding the use of health facility guidelines in the design and delivery of healthcare projects. Many different people, from a variety of professional backgrounds and with diverse experience, use the guidelines in developing a project and the needs of these diverse groups require recognition and addressing.

This paper has already addressed some of these needs including those of managers and consultants attempting to contain excessive space demands made by highly experienced clinical staff with little experience in designing and building physical facilities. It is one of the major challenges of the guidelines to convince these experienced clinicians and other health service users that there is almost always a great deal more common ground between all health projects than may first appear significant at the initiation of their own user group process. These clinicians are often aided and abetted in this initial misconception by the many 'helpful' design consultants who have been professionally trained to believe that the client is always right!

The other fundamental problem that arises in the use of guidelines can perhaps, perversely, be noted as the problem of 'slavish' adherence to their provisions. This is more likely to occur when inexperienced design consultants are engaged or worse still where no design consultants at all are involved, perhaps in an attempt to save money in delivery of the project.

Guidelines are intended as a framework for design, and an indicator of safe and best practice spatial provision. However, it should be remembered that they illustrate this, rather than reproduce it in a literal way that requires no further project specific interpretation.

To achieve the best outcomes, projects need both a well structured and well developed set of guidelines and the skill of a thoughtful and experienced designer to translate project requirements into an appropriate project brief that will then inform the creation of a well designed and functional facility. This is the best and most efficient use of guidelines and is, in essence, their intended purpose.

Summary and Conclusions

Guidelines best serve their purpose when they inspire confidence in those using them that the fundamentals are correct and that a careful, considered and thoughtful process including widespread consultation with health industry professionals such as designers, managers and clinicians, followed by expert review of all recommendations has been followed in their development. To ensure continued confidence in their use, a process should also be in place that ensures all guidelines are tested and reviewed over time, and that they are never regarded as 'finished' and unalterable.

A documented evidence base for contentious recommendations, and cost benefit analysis of proposed major changes are other elements that will also inevitably increase user confidence. Only when these conditions are met, can guideline use be safely mandated as a starting point for every project.

In use, departures from the guidelines at the briefing stage of a project must be tightly controlled and allowed only on the basis of evidence that in a particular situation, there is sufficient justification for a different approach. In reality, there should be such trust in the guidelines in their generic application, that only truly special cases seek dispensation.

This is the real challenge in guideline creation and use, defining the difference between the characteristics of guidelines as either 'life jacket' or 'straight jacket'. It should be readily apparent that guidelines as 'life jacket' are infinitely preferable to those that act as a 'straight jacket'. Within the parameters defined by guidelines, innovation in the design of health facilities must be encouraged as one of the paths contributing towards continuous quality improvement.

Producing guidelines that act as a 'life jacket' will assist them to fulfil both their original and ultimate purpose of creating a greater number of high quality functional health facilities, implemented within their funders' capital programs and budgets. The facilities created will meet more closely the requirements of their expert clinician users and their health service managers.

Most importantly, they will also more closely respond to and meet the needs of their patients, ultimately the highest purpose of healthcare buildings.

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Energy Saving Strategies for the New Design Meyer Children Hospital in Florence

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http://web.taed.unifi.it/sala/index.html

Abstract

The article is referring to an ongoing Research under the European Union's Fifth Framework Programme for RTD, entitled " HOSPITALS - EXEMPLAR ENERGY COUNSCIOUS EUROPEAN HOSPITAL AND HEALTHCARE BUILDINGS" (EU Contract NO: NNE5-2001-00295), with a five Hospital buildings selected as demonstrative case studies.

The implementation of sustainable energy systems is an objective of the European Union's energy policy. This policy aims to support and promote secure energy supplies with a high quality of service at competitive prices and in an environmentally compatible manner.

The HOSPITALS initiative aims to demonstrate that renewable energy technologies may be used with very positive results within the European health care building sector and in this way encourage the exploitation of renewable energy.

This paper aims to illustrate methods of obtaining large energy savings using bioclimatic design strategies from the first stage of building design. The amount of energy saved and the resulting reduction in CO_2 emissions are quantified.

Bioclimatic Design Concept

Bioclimatic Design approach covers a range of strategies to save energy in buildings, and this article contains general information, guidelines and strategies with a focus on hospital buildings from the first stage of building design.

Building orientation and form

It is important to consider the local climate during the first stage of building design. An energy conscious design which results in an energy efficient building has to be based on the local climate. In a new hospital, the form and the orientation of the building should be first defined considering the climate of the area, the wind, the temperature and the solar radiation. The aim is the reduction of the annual energy demand balancing the various requirements: Patient comfort is clearly of paramount importance.

Objectives:
- the reduction and control of solar radiation;
- the provision of natural ventilation and natural cooling of the external buildingsurfaces by evaporative cooling.

Figure 1 *View of Deventer Hospital*

Actions:
- minimize the surface area of the south facing façade;
- at the same time provide for natural lighting and shading;
- avoid excessive solar gain during the cooling season;
- use the roof as an active skin.

Building envelope and materials: Glazing and Double Skin Facade

To guarantee a thermally comfortable indoor environment it is necessary reduce the energy losses through the building envelope. A Double Skin Facade is an additional external skin for a building that optimize the indoor climate and reduce the energy demand of the building.Building materials has to be carefully selected, based on criteria for: emissions, adsorption, surface roughness and cleaning, in order not to affect the indoor air quality.

Wall insulation

Energy losses are normally stated in terms of heat flow through a square meter of wall per unit of time. The losses depend mainly on the temperature difference between the inside and outside face of the wall and the thermal resistance of the material, or combination of materials, of the the wall. Main way to reduce losses is to prevent heat conduction by adding thermal insulation to the building envelope.

Figure 2 *The building envelope of the new hospital uilding at Fachkrankenhaus Nordfriesland has been designed with high insulation levels and a double skin façade. Windows are optimized for additional ventilation, daylighting and visual comfort.*

Cavity insulation: Is the cheapest way of insulating, but can only be used when a cavity wall is present. Retrospective insulation of a cavity wall can be done by injecting expanded clay granules, mineral wool flakes or polys-

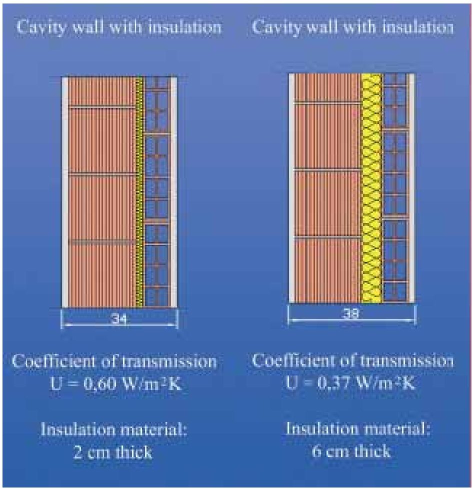

Figure 3 *Two options for insulating the walls of wards at the Meyer Hospital have been studied. The two drawings above show the options with different thicknesses of cavity wall insulation.*

External insulation changes considerably the appearance of the exterior. A single, thick insulation layer can be applied, which makes it possible to achieve desired insulation value. The main advantage is to remove and prevent cold bridges.

Figure 5 *100 mm exterior insulation used for Torun Hospital*

Internal insulation: fitted on the inside of the walls of a building is an isiest intervent on existing buildings, but reduces the interior surfaces of the rooms and need carefully execution in order to prevent condensation by cold bridge.

Integration of Renewable Energies

Photovoltaic (PV) cells convert sunlight directly into electricity through semiconductor materials such as crystalline silicon. PV systems integrated into building façades allow energy production to be combined with other functions of the building envelope, such as shading, weather shielding or heat production.

Substantial cost savings can be made combining these functions, e.g. in expensive façade systems where the cladding costs may equal the costs of the PV modules. Building integration does not just mean mounting PV modules on a building.

Real integration can involve much more, including all steps of the design process.Solar water-heating systems use solar collectors, to heat either water that circulated from the collector to water storage tanks similar to those used in aconventional gas or electric water-heating system.

Figure 7 *At Aabenraa hospital three solar collector systems were implemented All the systems were roof mounted. For architectural reasons and in order to avoid glare, solar collectors were mounted so that they arent visible from outside the building. Special attention was given to the risk of legionella bacteria, by using electrical backup system to ensure that high water temperatures required for avoiding legionella growth were always achieved. Each system includes approximately 50 m² solar collec tors, which provides an annual energy yield of about 27 MWh per system. This provides about 60% of the annual energy requirement for water heating.*

Figure 6 *Fachkrankenhaus Nordfriesland Hospital The large ceiling surface has a shallow north facing slope; here a white curtain is used to reduce solar radiation. On the south facing steeply sloping roof section, polycrystalline PV modules are integrated into the glazing to act as solar shading while generating electricity.*

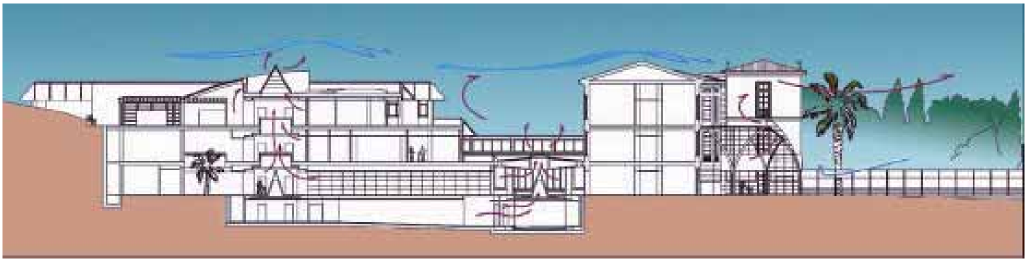

Figure 4 *The section view of the Meyer Hospital, partly sunk into the hill: This diminishes the impact of the building on the site and contributes to energy conservation by providing shelter*

Green Roofs

To reduce heat losses it is necessary to insulate all opaque elements in a building, including the roof. A greenroof can insulate a roof and at the same time help to protect the environment by diminishing the environmental impact of the building. Green roofs can provide a fresh architectural approach with visually appealing organic architecture. It is assumed that a good environment has a positive influence on the recovery of patients. Hospital buildings should therefore be considered as a part of the treatment of patients. Selecting building materials with low levels of emissions such as green roofs can lead to an improved indoor climate, which will benefit the patients.

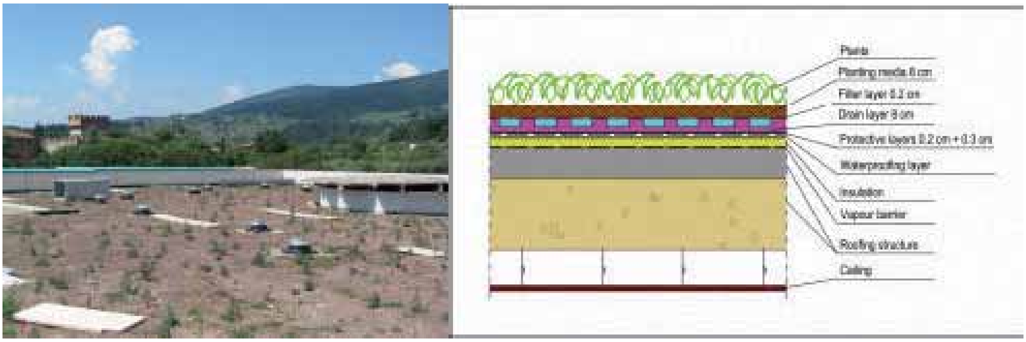

Figure 9 *A green terrace solution is planned for the Meyer Hospital. The final design, with increased amounts of insulation material in the cavity walls and a green roof - reduces the annual energy demand for heating by 36% per patient room.*

Water

The rational use of water is an important issue for saving water resources. It has to be taken into account from the first stage of the design.Collected rain water can contribute to maximizing the thermal comfort during the summer season when used in external spaces or atria to provide water to fountains, ponds and pools.

Figure 8 *Lake and pond in Fachkrankenhaus Nordfriesland Hospital*

These architectural elements are able to mitigate and influence microclimate and provide patients with a relaxing area and view. The evaporation of water from liquid to vapour is accompanied by the absorption of a large quantity of sensible heat from the air. The efficiency of the evaporation process depends on the temperatures of the air and water, the vapour content of the air and the rate of airflow past the water surface.

The main disadvantage of a pond or a fountain is the increased moisture content in the ventilation air supplied to the indoor spaces. Psychological aspects are very important for hospital patients. Patients need a friendly place to recover from sickness. Plants and water in the buildings and external areas give patients contact with nature, providing a relaxing hospital environment in which to recover.

Daylight Strategies

An energy conscious building aims to optimise the use of passive solar energy, natural ventilation and natural light to create a comfortable and energy efficient working environment.The use of daylight for interior illumination can reduce energy use within buildings and has a positive effect on visual comfort.

If considered at the design stage, the use of daylight allows for a significant reduction in electricity used for lighting and can reduce overall energy consumption. Daylighting depends on the availability of daylight, location, size and orientation of windows. Several strategies can be used to achive visual comfort when using daylight including: Rooflights, Atria, Glazing, Transparent Insulation, Lightpipes and Lightducts, Shading. The integration of rooflights is an effective daylighting strategy. The sky is generally brighter at its zenith than near the horizon: this is the reason why horizontal rooflights admit more daylight per square metre of glazed area than vertical windows (three times more than a vertical window).

Figure 5 *A Pictures of the sun pipes used at Meyer Hospital for daylighting. Sun pipes were installed to give good luminance levels in each patient's room. Each room accommodates two patients and has two windows, one looks outside and is day lit, the other is illuminated by sun pipes. At first sight the sun pipe installation gives the impression of being lamp lit.*

Sunpipes are among the more mechanically complex daylighting devices.

Sunlight is collected by heliostats (mirrors controlled by a tracking device), concentrated by mirrors or lenses, then directed inside the building through shafts or fibre optic cables.

Shading. Type, size and positioning of any shading device will depend on climate, building use, and the source of the light to be excluded (direct sunlight, diffuse sky light, or perhaps reflected light from outside).

Figure 5 *Shading devices at Aabenraa Hospital.*

Figure 5 *Shading system at Fachkrankenhaus Nordfriesland Hospital*

Figure 8 *Meyer Hospital. The surface of the sunspace will incorporate a semi-transparent PV system with a rated capacity of 31 kWp of renewable energy. The Meyer's sunspace is orientated to the south.. Design strategies consider not only energy and environmental aspects but also social impacts: the primary objective is to create a pleasant "socializing" space that can be used through much of the year without requiring any extra energy. This social space is integrated with the green park. PV installation was financed by the Ministry of Environment after a national competition on "PV High Architectural Integration".*

Conclusions

Demonstration with a pilot projects that energy efficient and sustainable hospital buildings can fully meet all the architectural, functional, comfort, control and safety features through the application of innovative and intelligent design and integrated design. This demonstration effect could contribute to a better acceptance of innovative and renewable technologies in public buildings.

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Wellness Factors for Health Promotion

Chair: Leuder F. Clausdorff (Germany)

Daylight, View and Good Circulation in Hospital Design

Ed Jackmauh

Ed Jakmauh, FAIA, ACHA, LEED AP

Mr. Jakmauh is responsible for the oversight of all Ballinger's health facilities programming, planning and design work. He has completed a number of significant large projects which have acted as catalysts for urban rejuvenation. Ed earned his Bachelor of Architecture and Bachelor of Science in Building degrees from Rensselaer Polytechnic Institute and his Master of Architecture in Urban Design degree from the Harvard University Graduate School of Design. He was a Fulbright Research Fellow in Regional Planning at the London University, London School of Economics. Ed is a Fellow of The American Institute of Architects, and is a member of American College of Healthcare Architects, and the Academy of Architecture for Health Editorial Board. He is board certified in healthcare planning by the American College of Healthcare Architects and is a LEED accredited professional.

Introduction

From earliest times, civilizations have revered the sun. Daily activities were governed by its presence and movement. Belief sets were developed to worship it. As settlements developed, courtyards and squares, gardens and crop fields were arranged to catch the sun's rays. This paper traces the evolution of daylight, views and circulation as major determinants of built form. The conclusion suggests that a fusion of new construction technologies, particularly the use of glass and gardens with some of the oldest sensitivities to daylight, can result in energy-efficient and easy-to-use concepts for one of the most complex building types: hospitals.

The point of these early images is to show that an awareness of sun, views, vistas and sequence or circulation were fully absorbed in the general consciousness of the arrangement of rooms, houses, villages and cities. These illustrations are biased toward advanced Western Greek and Roman examples because of the proliferation of materials and documentation available to us in the West. Many early cultures in Africa, Asia, Central and South America, India, and China show an equal awareness of sun, views, vistas and movement as determining factors in the arrangement of their public and private structures.

A few examples in paintings from Holland in the 16th and 17th centuries solidify the notion that direct sunlight entering private dwellings was essential to the execution of routine domestic activities such as sewing, childrearing, cooking and cleaning, if not the mental health of the occupants. The examples are the work of Pietre de Hooch (1629-1684), a contemporary of the more famous Jan Vermeer. The paintings of de Hooch are especially appealing because of their heightened sensitivity to how light reflects from different surfaces. This awareness and concern with reflectivity of light will appear in some of the groundbreaking examples in the work of thoughtful architects several centuries later.

Fast forward to 1934 to the concept drawing for an expanding nursery school by the Hungarian-

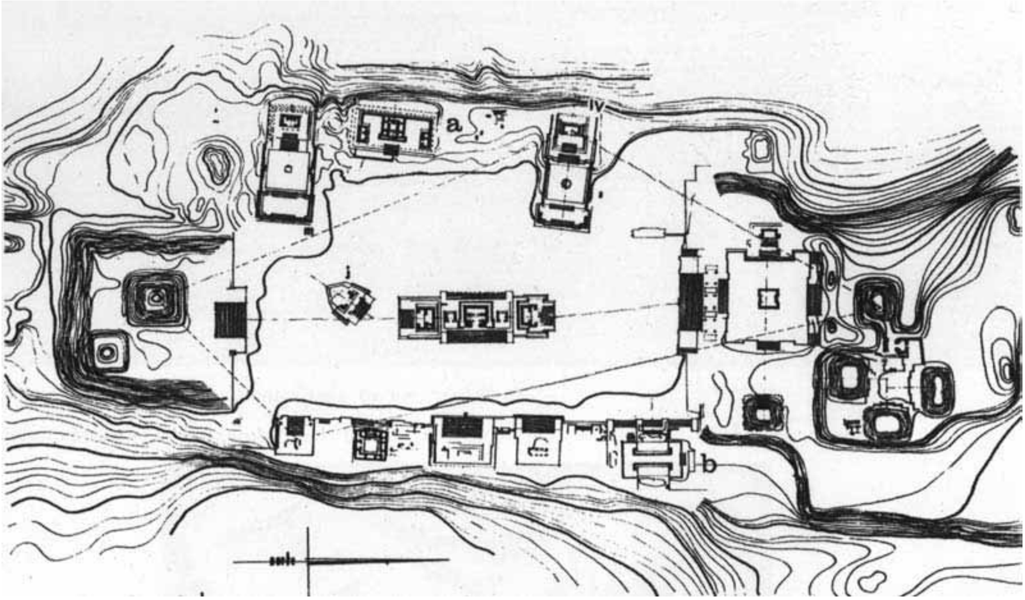

Figure 1 *Monte Alban, the first public observatory*

English architect, Erno Goldfinger, and one sees an equal sensitivity to how daylight is going to enter the room and determine its feeling and ambience. One could imagine de Hooch and Vermeer doing similar light and shade studies for their paintings.

The sensitivity to how light enters rooms and houses, no matter how modest, is evidenced 350 years after de Hooch in the work of the exceptional teacher/architect Samuel Mockbee. With the Rural Studio set in impoverished Hale County, Alabama, Mockbee worked with students from Auburn University School of Architecture, with his, their, and often the future owner/occupants' own hands, usually with very inexpensive, unusual and innovative materials to produce extraordinarily creative structures. Although seemingly "ad hoc" at first visual assessment, the variety and subtlety of light, shade and levels of transparency of these modest buildings are groundbreaking in the quality of light and space. The gradation of light levels, and the variety of ways light enters spaces, shows sensitivity as exceptional as the spaces created by de Hooch's depiction of perceived Dutch domestic reality. Mockbee was awarded the MacArthur 'genius' award, one of the few architects to ever receive this prize. He died prematurely of cancer in the early 1990s.

Figure 2 *Rural Studio*

The survey would be remiss without a quick mention of monasteries. Often constructed by the monks themselves (often because of their relationship to Christianity which flourished, or was promoted most successfully, in warm, brightly lit southern climates), the monasteries kept alive a sensitivity to light, shade and natural climate control during the dark and middle ages. Thick stone walls provided a measure of security, durability, and quiet for contemplation and study. Many monasteries and their female version, convents, also cared for the ill and those with incurable physical and mental disorders.

Figure 3 *Pennsylvania Hospital 1750*

Initially, artificial light was available only by candles and, somewhat later, gas. If a complex, elective procedure (one requiring optimal lighting for both the nuances of the work and the teaching of it to the students in the galleries) had been scheduled and the day turned out to be dark, cloudy and without good sun/light, the procedure would be cancelled and rescheduled-for a sun-filled day.

Growth: the loss of light and views and the proliferation of circulation chaos

The industrial revolution in the 1780s in England, followed shortly in the USA from the early 1800s on, led to unprecedented growth of cities. Huge numbers of poor families moved to cities from rural areas and less prospering countries, seeking a better life. This put enormous pressure on hospitals and other institutions to expand. Initial master plans for new hospital buildings and medical campuses were informed by a very profound awareness of the importance of natural light, good ventilation, views, vistas, and gardens. In the case of two new campuses being planned in the 1870s, The Johns Hopkins Hospital in Baltimore, Maryland, and The Reading Hospital and Medical Center in Reading, Pennsylvania, site visits were made to many of the newest and most innovative hospitals in Europe. Both Hopkins and Reading were modeled after the new Klinikum Manneheim in Germany, recently opened and considered to reflect many of the very best ideas for patient care. Abundant daylight and gardens in the form of many courtyards were an integral part of the designs. The problem was, or became, the huge influx of immigrants and their unabated need for medical care.

Figure 4 *Typical hospital corridor, 1950*

The invention of the light bulb allowed windows to be eliminated and the courtyards filled in to allow growth where it was needed most: everywhere. Light laws were passed in parts of Europe and England, requiring all rooms to be certain distances from windows. This helped prevent buildings becoming too deep and without natural light, but did not prevent vistas, views, gardens, and clear circulation from getting lost in the shuffle to rapidly expand. These pressures still exist at most of the world's large urban medical centers, putting the challenge to the architect and healthcare planner to not only come up with excellent functional spaces and correct adjacencies, but to restore a modicum of the lost qualities of daylight, views, vistas and clear circulation. A few notable exceptions from Holland and Finland did appear in the 1920s, and although they still remain groundbreaking examples of how hospitals and complex buildings might be arranged, it must be noted that they were both constructed in open, Greenfield sites.

The tuberculosis or TB sanatorium, architectural historian Kenneth Frampton writes, "was dedicated to the treatment of tuberculosis, then prevalent among diamond cutters", the result of the fine particles of diamond dust resulting from the cutting and polishing of the raw diamonds coming in from the DeBeers mines in South Africa. Frampton continues: "It epitomizes in a subtle way the transcendental wing of the Dutch functionalist movement which was polemically known as the New Objectivity."

The plan features a reception or welcomes center off the main access road with four large double wing pavilions or separate buildings set out in such a way as to maximize exposure to the sun and views of the park and gardens.

The noted Finnish Architect, Alvar Aalto (1898-1976), was aware of Johannes Duiker's Zonnestvaal 1928 building, and utilized the planning concepts in his and his partner and wife, Aino Marsio's, competition entry for the large new sanatorium to be built at Paimio in 1927-1930. The Aaltos won the commission. Aino's rational thinking often counterbalanced Alvar's bubbling exuberance, perhaps making this project one of their more equal collaborations than many history books record.

Figure 5 *Federal Courthouse, Baltimore*

Patient rooms and rest cure lounges all face south, with circulation and support structures expressed in a somewhat random, but expressive, manner on the north. The interconnected buildings have been compared to a fan splaying out into the wooded landscape with wonderful distant views. Windows in the patient rooms, lounges, dining areas, and stairways are all oversized; with the white walls reflecting a high percentage of the light, the rooms are bright and airy. Roof terraces are planted, so nature is close in to where the patients are resting. The plantings also serve to soften the smooth geometry of the exposed and painted concrete surfaces.

1960 to 2005: Hope for the present and future: light, views, vistas, and circulation emerge as determining factors in planning and building design, particularly in dense urban settings

In the 1960s, as a student of architecture, two projects grabbed my attention for the creative and powerful way in which they allowed circulation to determine building form: one was the plan for a new section of Tel Aviv by the Dutch team of Van den Brook and Bakema; the other was the Piano and Rogers winning entry for the Place Beauborg/ Pompidou Center in Paris (construction:1971-1977).

In Tel Aviv, the buildings shapes were generated by the arrangement of the roads, some existing and some new. New roads were arranged to shape, enclose and form major urban spaces. The thinking seemed to recognize the influence of the automobile and its movement as a generator of urban form, and in recognizing it somehow tamed and channeled its force for the better.

Figure 6 *Pompidou: Expressed Circulation*

At the Pompidou Center, the main circulation is via a glass-enclosed escalator which makes its way from the ground up the eight-story building, revealing ever more breathtaking views of Paris and its landmarks. This moving stair is executed and detailed in a technologically deterministic way, yet has an expressive feeling that results in a uniquely iconic quality evocative of a friendly serpent.

Inspired by some of the innovations in the Pompidou Center, namely the expressed circulation overlooking a plaza defined by the building, this building is one of the first U.S. courthouses to place the public access on the outside of the building. The goal was to reduce the wayfinding confusion that often results from long, internal, non-day lit corridors, and to bring a measure of animation to the north facade. Baltimore, Maryland, which has an almost tropical climate in the summer, made the less temperate-sensitive corridors ideal for the north side of the building. Extensive sunshading devices, complete with sun shelf reflectors, were planned for the south side overlooking the scenic harbor. The original concept was to clad all the circulation, including the elevators, in glass, but to conform to a previously set low budget; this was changed to the more economical precast concrete.

In these 150-year-old "impacted" campuses, a concept was sought that would bring order to the public circulation and integrate movement and wayfinding with daylight and gardens. As shown earlier, particularly for the Hopkins original buildings and plan of 1876 modeled after the Kninicum Mannheim, these qualities were present, but had been lost through pressures to expand rapidly as one of the nation's top academic medical and research centers. On both campuses, a grid or circulation framework was integrated with south-facing courtyards: glazed over at the Naval Center, and open to the sky and frequent views of the historic dome at Hopkins.

The examples that follow, from the mid 1980s on, illustrate how an awareness of history and of the principles reviewed have, consciously or not, been utilized to bring order, clarity, rigor, and a sense of delight, joy and caring to a variety of projects. This mixed-use development on a Greenfield site in Clinton, New Jersey allowed for many of the design and planning principles reviewed to be applied. The program includes medical office space with parking for several hundred cars to be as ‘close-in’ to the office entrances as possible. The fitness / wellness component contains swimming pools and a large fitness area with exercise and rehabilitation medicine equipment. The buildings themselves are used to screen the cars and parking from the restful meadow overlooking the river bank where there are walking and running trails. Large windows at different levels in the buildings open the interior to nature.

Weill Cornell Medical College - This small 1/3-acre site is being developed into a large, 350.000 SF (35,000m2) specialty ambulatory care center at 70th and York Avenue in New York City. Daylight, views and water features are present wherever possible in the public areas: from the ground floor arrival and reception space to the entrance to the ‘sky-lobbies ‘directly off the elevators on the upper levels. Taking advantage of the views to the north of upper Manhattan and the existing collegiate gothic buildings of the Weill Cornell medical campus, the entire east, north and west sides of the building are clad in glass. To avoid too much sun, glare or heat gain, the glass is treated with frits or a reflective pattern of dots of varying density depending on the exposure and activities inside.

At the Robert Wood Johnson University Hospital in Hamilton, New Jersey, the unwritten campus redevelopment and hospital brief were to add healing gardens and views to nature in the presently impacted and crowded buildings. The goal is being achieved by positioning the new construction around a large garden or mini park, reclaiming outdoor space that had been a service yard. The new circulation at all levels overlooks the new garden, as does the new dining area on the ground level which opens out to the garden.

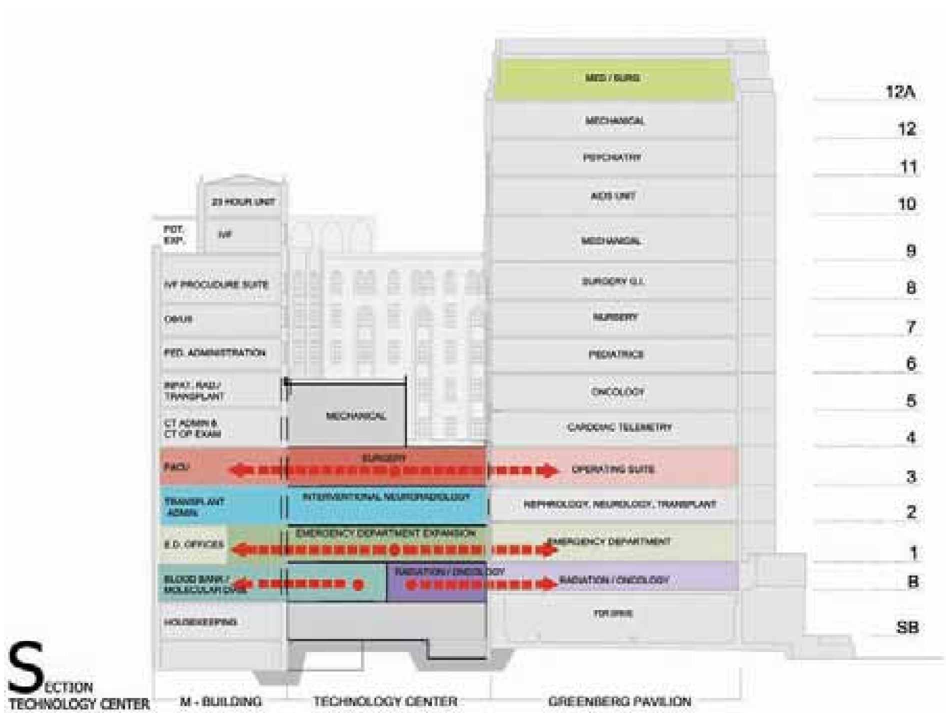

Figure 7 *Weill Cornell: Section*

Figure 8 *Clinton Wellness at Dusk*

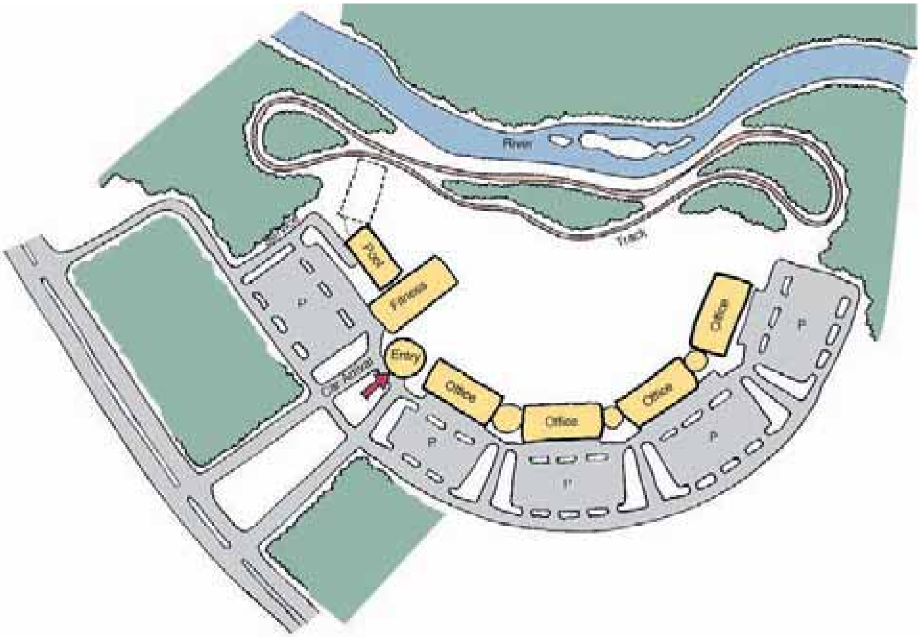

Figure 9 *Clinton Wellness Master Plan*

In the private patient rooms, the windows are oversized, and include a light shelf very similar to the one used be Erno Goldfinger in his Willow road houses of 1927. To be sure the patient has control over the light level; windows are fitted with motorized shades and are controllable from the bed. Even the bathrooms have windows with translucent glass, so they are not the usual dark caves.

At the Jersey City Medical Center Wilzig Hospital, all the campus and hospital planning is informed by an awareness of views and daylight, in particular the views of the local icon, the Statue of Liberty ("Ms. Liberty").

Songdo, South Korea - This completely new, 1,300,000 SF (130,000m2) academic medical center for a consortium of Philadelphia teaching and research hospitals is a wonderful opportunity and challenge to test what has been learned from this survey of the evolution of daylight, views, vistas, and gardens as determining factors in site planning and hospital/mixed use development. A mini-park has been placed the lowest level of the 1600-car underground parking garage. The garden will contain a water feature, oriented to the south, and forms the below grade level focus of the entire campus. The mini-park concept is continued into the three concourse levels along the south side or the buildings at the lower levels. This linear winter garden allows southern light directly to the oncology entrance and public areas located by necessity due to the weight of the vaults below grade. All public areas have gardens as an integral part of the circulation routes, together with views out to gardens or parks. This approach allows the Diagnostic and Treatment building to be a large 'loft' or flexible support building with large floor plates, without loss of clarity of circulation.

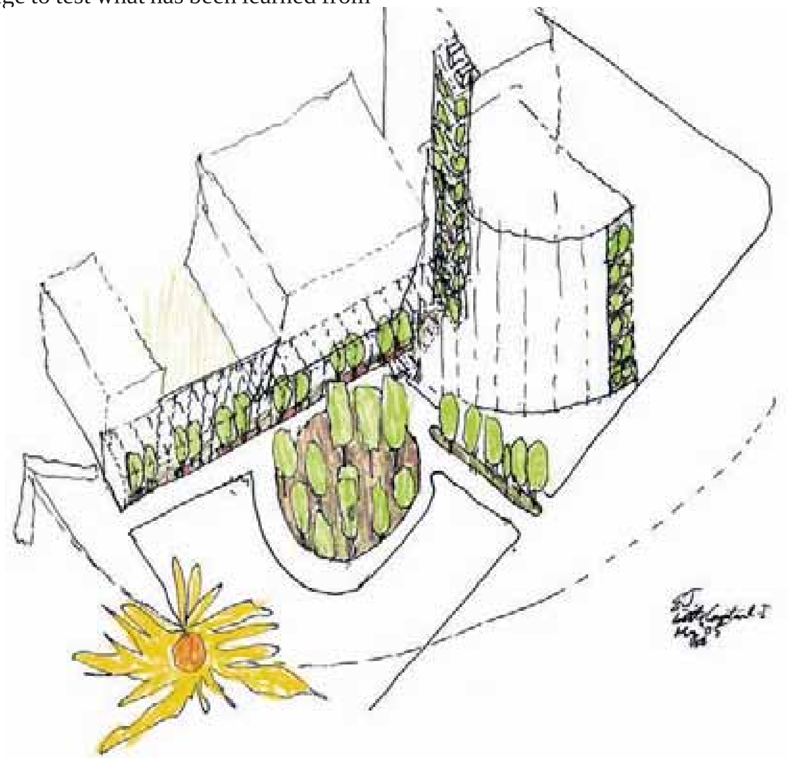

Figure 10 *Songdo, South Korea - New Academic Medical Center*

Figure 11 *Songdo, South Korea - New Academic Medical Center*

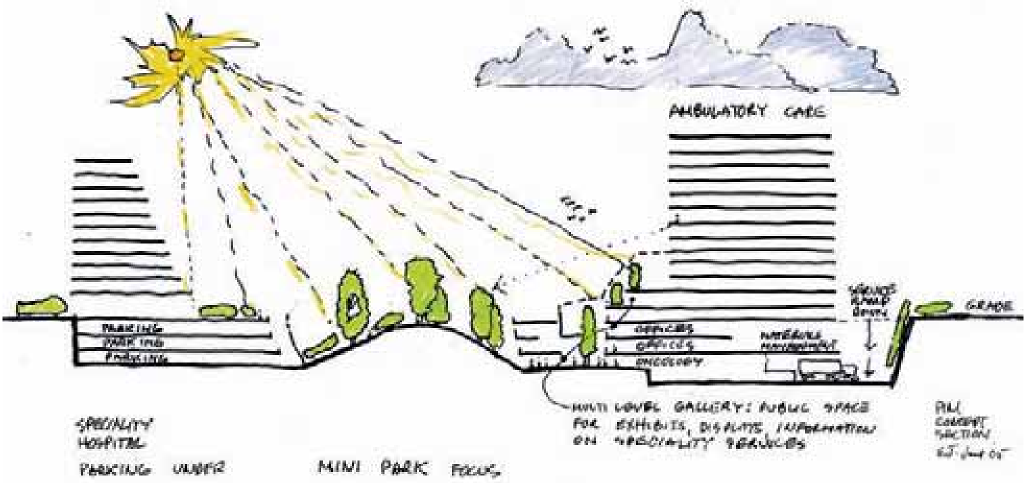

Figure 12 *Songdo, South Korea - Nature, Daylight and Views: Informing the Concept*

PART IV **How can the effects of these planning and design principles be measured or verified?**

Clients contemplating a major building project often make field trips to recently constructed facilities to see the results first-hand of comparable projects. Discussions can take place with peers as to what worked out as planned and what might have been done differently. This practice continues today. Architectural practices which specialize in certain building types also keep records of Post Occupancy Evaluations or POEs, for both their own designs and those of others. The three or four schools of architecture in the U.S. that offer Master and Ph.D degrees in health facility design and planning encourage and require work that follows more rigorous scientific protocols. Control groups are tested and evaluated against other groups in altered environments. Although a relatively new source of data in the sense that papers have been written and made accessible over the wed for only the last few decades, many have addressed the topics reviewed here. A key measurement is comparing the recovery rates of patients who have views with those who do not: those with views have faster recoveries.

A very promising mission in the U.S. is the Center for Health Design's Pebble Project. Membership and participation requires a fee to defray administration costs, and is open only to hospitals and medical centers. There are approximately 27 hospitals in the U.S. that are participating, with specific topics or issues to be measured against agreed-upon criteria for improvement. Procedures and protocols for measuring outcomes are shared with other members.

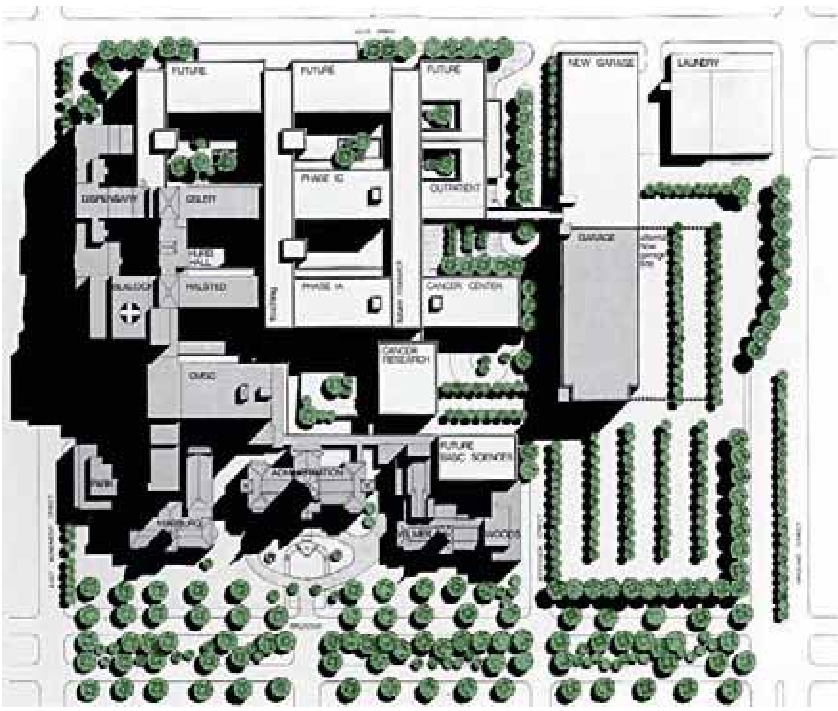

Figure 13 *The Johns Hopkins Hospital Master Plan*

Figure 14 *Jersey City Medical Center Exterior View*

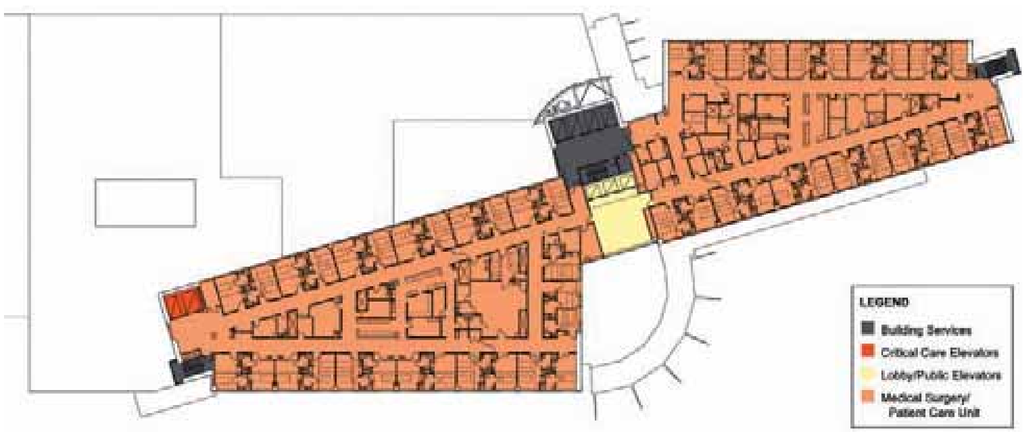

Figure 15 *Jersey City Medical Center Plan*

Topics presently under study include reduction of wait times for emergency care (speed with which one can make an appointment to be seen and receive follow up care). Administrators of hospitals often have training in healthcare or business as opposed to architecture or design, so it is not surprising that at the moment there is a bias in the study of improvement to activities that relate to operations and profitability. But competition for staff and patients can cause an expansion of interests to areas such as the amount of daylight, the presence of gardens and proximity to nature, and ease of circulation and wayfinding.

The Robert Wood Johnson University Hospital, shown here, is perusing a green building not only for the sake of the environment and positive recognition, but as a recruitment feature for new physicians and staff. In office building design, many case studies have documented that the presence of daylight, garden views, and vistas to nature have substantial positive benefit on productivity and a reduction in absenteeism. I am optimistic that these amenities formerly somewhat rare in the commercial work place are much more the norm, and are now finding their way into hospital and medical center planning in a more objective way.

There are many connections one can make to the examples surveyed. Frederick Law Olmsted (1822-1903) worked for several decades to promote, design and see the park built. His firm carried on by his sons designed the grounds of the Reading Hospital we have seen.

Figure 16 *Robert Wood Johnson University Hospital Garden*

Figure 17 *Weill Cornell view - rendering*

Figure 18 *The Gates - Central Park, New York City 2004*

The Gates project is obviously about daylight, views, vistas, and circulation. It attempts to make the subjective objective. What I liked best, when my wife and I experienced it, was how relaxing it made one feel and how much more one could appreciate the natural features of the park. Large outcroppings of rock are transformed form obstacles into pleasant events to be explored and successfully navigated, guided by the colorful orange gates or flags. Human perception is both accentuated and relaxed at the same time. I heard many visitors in many languages, especially children, say, "I never realized how nice the park is." This is the effect a successful application of the planning and design principles reviewed here will have on complex building types.

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By Peter C. Sutton
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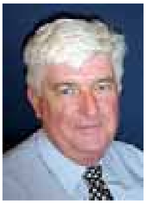
Using Landscapes as Wellness Factor for Patient Therapy

Ian Forbes



Ian Forbes, Professor

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Introduction

We are all aware that human identity and personal fulfilment depends to a large extent on our relationship with nature. It has been demonstrated scientifically and we know anecdotally, there is an influence of the natural world on our emotional, cognitive, aesthetic and even spiritual development. We know from the ancient gardens of Mesopotamia and the intricate gardens of early China the great lengths to which people went to maintain this connection with nature. It is not a modern phenomenon. In more recent times there is recognition that psychological well-being is generated through stress reduction and we believe that access to nature helps with stress reduction (Ulrich 1983, 1993). The promotion of physical health has been the justification for two hundred years of public parks and gardens like those seen in Paris and London. Can we postulate that more than at first is obvious with this deep and intimate relationship humans seem to have with living things around us?

Biophilia

Edward Wilson, a Harvard entomologist in 1984 coined the term "Biophilia" meaning literally "love of living things" (Wilson 1984). He used it to hypothesis about human responses to nature. He noted both Biophilic (positive/approach) and Biophobic (negative/avoidance) might be inherent through a genetic predisposition. His idea was that humans evolved as creatures deeply enmeshed with the intricacies of nature and we still have this affinity ingrained in our genotype. Those humans who developed sensitivity to their environment survived. The rewards and dangers associated with the natural environment favoured those who readily learned and remembered adaptive responses.

Considerable research by bio-scientists in the past 30 years suggests that humans gain enormous psychological, physiological and certain health responses by engaging with living things (Kellert 1993). There are numerous studies which show that humans respond immediately (unconsciously) in positive and negative ways to the natural environment that can't be linked to learned responses. These responses are consistent across different cultures and peoples having different life experiences. They are reflected in a metaphorical symbolism of animals within all cultures across the globe (Lawrence 1993). These factors might explain such things as an immediate fear of dangerous insects or animals and the liking for places that are safe.

Roger Ulrich (1993) points out that if this hypothesis holds true then certain risk reducing probabilities will immediately be associated with specific depth and spatial configurations that create a liking for landscapes felt to be safe and useful (water, food opportunities, etc). Recognition of safe spaces are reflected in numerous studies showing a peoples' attraction for "savannah" type settings in which groupings of trees are placed around open lawns (Ulrich 1983, Heerwagen & Orians 1993). These settings are consistently preferred among quite different groups being studied. These preferences are hypothesised to a genetic reminiscence of places with lower probability of encountering something dangerous hidden in long grass or an enclosed forests. Also the trees and surrounds provide cover to hide and shelter. Additionally this supports people's preferences for longer views across rolling hills where visual distance is achieved.

In the past twenty years design has been affected by a large research literature which describes studies that have developed affinity and emotion-laden rating scales that can be used to identify landscape preferences (Kellert, Ulrich 1993). These preferences can now be designed into health facility landscapes to achieve an immediate unconscious liking by their users, either public or staff. This will reduce emotional stress and anxiety, and provide peaceful places to sit and walk, away from the healthcare work place.

International Examples

Internationally there are recent examples of landscapes being integrated into hospital and health settings to reduce the stress created by visiting such faculties and to distract and comfort people waiting for care. Research shows the increased appreciation by older people of landscape settings especially where there is the need for repeat attendances.

One example is the Trillium Health Care Centre, an ambulatory facility at Queensway in Toronto, Canada, designed by Perkins Eastman and Black that provides a dramatic green pathway through the existing buildings and links the new building (Black 2004) . It reflects wellness and is known to be an anxiety reducing space inspired by the healthcare program itself.

Another example is the Healing Gardens at the San Diego Children's Hospital where the care by parent program is supported by access to gardens that enable interaction by the children or just quiet sitting, often these spaces are for watching others play and interact.

Again the Bronson Methodist Hospital in Kalamazoo, Michigan, has deliberately achieved positive distraction through stress reducing indoor gardens. They use natural light to all private rooms that have access to nature and enjoy external landscape views.

All of these examples follow the key elements suggested by the literature: connection to nature, control of access to nature and the use of landscapes to provide social support.

An Australian Solution

Now for the first time in Australia a hospital has developed specially designed "Healing Gardens" (Forbes 2005). The Biophilia principles have been designed into the landscapes around the Queen Elizabeth Hospital at Woodville, west of Adelaide in South Australia. The first stage of the redevelopment designed by Woodhead International architects used the opportunity created by the shape of the building to develop special gardens that would extend the treatment regimes and influence the healing of

Figure 1 *The Queen Elisabeth Hospital site plan*

the patients whose accommodation is adjacent to them. It also applies to outpatients' who visit the hospital for routine treatment.

The hospital was designed with a veranda around the outside of the ward blocks. This invokes a new vernacular expressing the traditional country hospitals built in colonial times in Australia. Veranda's were designed to ensure that the hot daytime sun did not fall on the outside walls and windows, thereby heating up the building. Since the 1970's hospitals in Australia have become air-conditioned and have tended to ignore the benefits of designs used for climate control. Recent introduction of ESD (Environmentally Sustainable Design) principles have reawakened an interest in making context and site important elements of health facility design.

It was also noted that the old style verandas allowed patients to sit outside their rooms and connect with the outside, especially gardens and surrounding flora and fauna usually present in country hospitals. An important element of the new design for the QEH addition was this connection with nature and to have patients move easily out into the gardens. This is recognised as an important stress reducing element (Stigsdotter 2003). Two levels were built under the veranda so that people on the upper levels could see down into the gardens and in higher locations the floors above could see over to the gardens.

The Biophilia principles employed were:

- Hospital in a garden – a place to promote healing
- Focus on water, shade, sunshine and breezes
- Use of "savannah" settings with lawns surrounded by peripheral bushes and trees
- Use of low maintenance plants, both exotic and native that change with seasons and mix quick growing annuals with slower perennials – as a reflection of life
- Caters for a variety of ages, functional and treatment needs and accommodates different physical and psychological capabilities
- Use of water in a number of ways from running water that is touchable, to possible storm water retention for irrigation.

Figure 2 *Journey garden*

The Gardens Described

The first of the gardens is the Atrium Garden in the centre courtyard used for staff to retreat for lunch and sit quietly. The next is the "backyard" garden off the geriatric ward. It was designed as a walking space and replicates typical South Australian backyards with comfortable seating that provides familiarity for demented residents. It has trees, lemon and other fruit trees, colourful bushes, low maintenance flowers that provide familiar fragrances. Ideas for the future are to add a barbecue, clothes line, post box, and bus stop.

The next garden is a small Fragrant Garden outside the neurology ward with rows of fragrant plants interspersed with stone paths. This provides pleasant fragrances shown by research to be very calming for these patients and also useful for pain distraction. It also provides comfort through impressions and memories evoked by the experiences from the fragrances. It is deliberately located adjacent to the arboreal walkway so that visitors can gain from the fragrances.

The Journey Garden is an outreach garden from the Rehabilitation Ward and the Allied Health Department. It is designed to promote active movement and gate training while walking in the garden. It offers different surfaces, rises, steps and seats for resting. There is a deliberate use of "savannah" settings with seats in the shade to promote feelings of safety and be stress reducing.

The Palliative Care Garden is designed with a wooden "bridge" to push patients out in their beds under the trees. This garden is an extension of the verandas on the hospital. There are walkways with many locations for families to sit on rocks and benches. The natural bush setting has rock features to promote the connection with nature and a water pond for contemplation.

An Indigenous Garden is designed with assistance from the hospitals aboriginal counsellors. It is located near the hospital entrance so that patients can wait out of public view. It provides places for family groups to sit and uses a mix of native plants and big existing gum trees. The accessible lawn is ideal for sitting under a tree.

The Elemental Garden has paths to separate smoking and non-smoking groups, located off the veranda from the respiratory ward. It is separated from the indigenous garden by berms and bushes. The garden gets lots of breezes and fresh air and is mostly for observing but used for sitting in. It is a mix of "savannah" lawns and colourful flowering bushes and trees.

The last garden is the Sunken Garden. It is the largest garden that links the old and the new buildings. It provides a public crossing and waiting area for ambulatory programs near by. The centre is sunken to reinforce seclusion and provide a safe enclosure. Its form is symbolic of family groupings and new birth using circular paths. It is outside what was the maternity ward which reflects in the ideology of new birth. This garden makes an important use of water, bridges, shaded seating locations having greenery from ground cover and bushes, but open for viewing the water and general people movement.

Figure 3 *Palliative care bridge*

Figure 4 *Savannah setting*

Figure 5 *Ward outlook*

The Evaluation

It was agreed that a proper evaluation should be conducted to determine if the gardens achieved their design objectives and to learn from this study what should be done to improve future gardens. An initial evaluation study was conducted by Dr Meegan Gun a radiologist at the hospital, to explore the value of the gardens by questioning various users and a follow-up study was undertaken by the Woodhead International team to test the Biophilia Hypothesis with Dr Gun's support. Detailed interviews were conducted with patients and staff and a second round of questionnaires were completed by the staff on the wards adjoining the gardens. The results showed conclusively that the principles are supported and that the gardens are a great success.

Table 1

Round 1 Respondents No.=82	**% of Respondents**
Staff n=52	**63%**
Medical	29%
Allied Health/clerical	29%
Nursing	5%
Patients	**28%**
Inpatient	10%
Outpatient (62% regular)	18%
Visitors (60% first time)	**9%**

Table 2

Round 2 Respondents No.=50	**% of Respondents**
Staff Nurses n=23	46%
Patients n=15	30%
Visitors n=12	24%

The initial round of questionnaires was completed by people randomly assigned as they came into the hospital.

The second round was given to staff and patients/visitors who attended the wards adjoining the gardens. Although recognising the potential for selection bias through not using random selection, the second questioning round was used to balance the range of respondents to ensure information on how the gardens were being used for therapeutic purposes. The consistency with the earlier response categories gave confidence that bias was not evident. In-depth interviews were conducted with 15 self-selected people using the gardens. These were used to examine several issues arising from the questionnaire rounds.

Table 3

Biophilia Characteristics - Priorities	**Score (1 - 5)**
Staff	
Colour & Blossoms	4.4
Water	4.2
Flowers & fragrances	4.1
Hearing birds and leaves	4.0
Having open spaces	3.9
Feel stress reduction	3.9
Having Savannah setting	3.4
Patients and Visitors	
Feel stress reduction	4.8
Having open spaces	4.5
Water	4.3
Hearing birds and leaves	4.1
Having Savannah setting	4.0
Colour & Blossoms	3.9
Flowers & Fragrances	3.8

Respondents consistently gave support for the identified Biophilia elements however the order of preference was different. It was assumed that this simply reflected the different benefits that could be gained by these groups in their use of the gardens. The staff were looking for relaxation and distraction while patients/visitors were seeking anxiety reduction and privacy. Comments given during in-depth interviews tended to support this view.

Table 4

What 10 features are essential?	Percentage by Respondents
Water	25%
Trees/shade	14%
Sit and relax	13%
Layout garden	11%
Flowers/Fragrances	10%
Plants generally	7%
Open space	7%
Spaciousness	5%
Colour	4%
Lawns	4%

Respondents were consistent about items that they felt were important to their enjoyment of the gardens as well as those elements which they believed were essential to make the gardens useful to them. These items cross referenced well with the Biophilia elements providing stronger support for the hypothesis.

Table 5

THE FUTURE	
More gardens?	**% of Respondents**
Yes	76%
No (with comments)	24%
More Money for Gardens?	**% of Respondents**
Yes	72%
Neutral	16%
No (with comments)	12%

This table shows there is a limit that people were prepared to accept regarding more funds and space being put into gardens when funding for clinical support was also necessary. Supportive comments received from the interviews range from a belief that the gardens help to de-institutionalise the hospital, through to clear evidence that people feel the gardens make them feel better. Staff gained from having a place to retreat for lunch, away from the building, and many believed that having the gardens to improve the general ambience of the hospital would help with staff retention.

It is clear that staff on night shift feel they have been disadvantaged by not being able to use the gardens. Positive comments were however received from those who couldn't get out but gained enormous benefits (peaceful feeling, something to look at, etc) through being able to see down into the gardens. The general immobility of many patients was described by staff and visitors as a limiting factor in greater use of the gardens.

Conclusions

Evidence supports the use and effectiveness of the gardens. Data shows 87% of respondents felt the gardens had a positive impact on them and 86% of respondents supported key Biophilia elements in the garden design. We could confidently say the design solution appears to have achieved its objectives.

It can be observed that such designs to be effective need to be underpinned by solid evidence linking cause and effect. We felt that there needs to be a good theoretical underpinning to support the design philosophy and this needs to be properly evaluated at the conclusion.

It is necessary to recognise that design research is not the same as clinical scientific research and we are unlikely to have double blind trials to generate this sort of finding. The use of social science methods are needed if we are understand the mechanisms involved in the design and to gain support for these experiments. Evaluations can be used in a systematic way to test these hypotheses providing confidence in the generalisability of the outcomes. Regardless, clients and especially government providers must have the courage to try new approaches to achieving better hospital designs.

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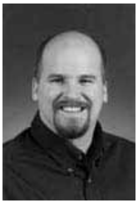
The Impact of Stair and Elevator Design on Daily Excercise

Philip G. Mead
Laura Harris, Robin Hearn, Rebecca Stephens, Tara George, William Thornton, Rob Breier, Samantha Garlow, Nate Tunnell, Jeremy Mitchell, Joshua Devereaux



Philip G. Mead, Professor

Professor Mead is a faculty member at the Department of Architecture at the University of Idaho where he teaches design, environmental systems and history. Mead's research examines how health related needs for light, views, exercise and fresh air impact design. A graduate of the University of Texas Charles Moore Program, Mead is a registered architect who has practiced and taught in San Diego, Texas and Idaho. Professionally, Mead has contributed to works designed by Charles Moore, Antone Predock and Bertram Goodhue. Mead's research has led to numerous publications and presentations at design and health related conferences.

Introduction

The rise in obesity has prompted the medical community to encourage moderate forms of exercise such as stair walking. When integrated into daily routines, stair climbing appears to raise intermittent moderate exercise (Dunn et al..) leading to weight loss and increased bone density. (Bronwell et al…) As a result, studies have focused on ways of increasing stair travel in existing buildings by using promotional signs or banners. (Anderson et al…, Kerr et al…) or by providing , artwork and music in fire stairwells. (Boutelle, et al…)

This study differs in that specific design elements are examined that can potentially increase stair use. These include the elements within and surrounding the stair such as:

- The stair's visual access from main circulation paths
- Stair placement in relation to nearby elevators
- The elevator's visual access to main circulation paths.
- The impact of slow speed hydraulic or high speed traction elevators
- Building height
- The aesthetics of the stair shape and journey

Method

Four case study buildings with stairs ranging from two to five stories at two adjacent universities were examined. Stair/elevator combinations were chosen for their visual accessibility, travel convenience and aesthetics. Three of the four buildings were open to the broader campus population while one was occupied mostly by students and instructors. Of the two campuses, the University of Idaho is less populated and consists primarily of three to four story buildings with slow moving hydraulic elevators. Nine miles away, Washington State University's student population is half again larger with buildings that are three to eight stories which use high speed traction elevators. Of the four case studies, two of the buildings' stairs are fire escapes while the other two buildings boasted grand stair cases.

Although the research examines both up and down travel, only those heading in the upward direction are reported because of the higher degree of physical exertion. Therefore, the stair use percentages are conservative. Initial observations were conducted in the spring of 2004 and 2005 followed by three confirmation studies in the summer and autumn of 2005. Observers consisted of architecture and interior design students in their third through fifth years of study.

Case Study 1: Grand Staircase at the University of Idaho Commons

This stair/elevator combination was chosen because of the stair's high use. The stair is a story and a half and is adjacent to a highly used interior lunchroom court. When seen on a broader campus scale, this stair acts as a critical bridge that links two major parts of the university through the building itself. The adjacent elevator on the other hand is geared more to those who work within. It is slow and has poor visibility because it hides behind the grand stair. It was found that most of its users were the kitchen staff that use it for transporting supply carts up three stories to cater meeting rooms.

Figure 1 *University of Idaho Common Stairway*

Predictably, the stair's 97% use overwhelms the elevator's 3% use. These percentages are based on the observations of 243 people going up the stairs and elevator in late March and early April of 2004 on five separate occasions during the weekdays at ½ hour intervals in the morning, afternoon and evening.

97% Stair Use: Contributing Factors and Discussion

The high stair use is attributed to the following:

- The stair-path on the building's main circulation is connected to a campus arterial.
- The elevator is out of sight of the main circulation path and interior court.
- The hydraulic elevator is inconveniently slow.
- Only a story and a half is traversed.
- The stair is wide and inviting.

Of the four case studies, this stair rates the highest use. Similar planning relationships and elements are also repeated in two other successful case studies. However, case study #2 is the exception.

Case Study #2: University of Idaho Main Library Stair

This four story building was chosen because of its less than ideal stair/elevator relationship. Since the elevator is prominently displayed at the end of the main circulation axis and the fire stairs are partially hidden, it was predicted that most people would choose the elevator. This hypothesis proved false on two separate observations in both the spring of 2004 and summer of 2005.

The 2004 spring study found 65% stair use over the elevator's 35%. Observations were restricted to the first floor at the main point of decision between taking the elevator or stair. However, a one year follow-up study during the summer session in late June yielded even higher percentages (74%) for upward stair travel. This study differed from the first in that all the floors' entry "points of choice" for either stair of elevator were tracked from one outdoor location. This study also proved useful for finding-out how many people traversed up two or more floors.

Here it was found that 60% chose to use the stairs over the elevator.

For the spring 2004 study, both the stair and elevator count totaled 320 for those traveling up. Observations occurred on nine separate occasions during weekday mornings and afternoons. For the following summer study, both the stair and elevator count totaled 43 for those traveling up one or more floors. For those traveling up two or more floors, the count totaled 25. These observations were taken on three separate weekday late afternoons in one hour periods. The afternoon was selected because it was thought that higher elevator use would occur due to the afternoon heat and work fatigue. No such correlation was found.

60-74% Stair Use: Contributing Factors and Discussion

Higher stair use was attributed to:

• A slow hydraulic elevator

• The stair fire doors are left open making the stairs more visible when approaching the elevator.

• A pleasant stair journey

Figure 2 *University of Idaho Library Elevator/Stair view at the "Point of Choice"*

This study confirms that a slow moving hydraulic elevator is a significant deterrent for not taking the elevator. It was often noted that users would impatiently push the elevator call buttons several times, then abandon their wait and start-up the stairs when no elevator movement was detected. One wonders that if the stairs had been as prominently placed as the elevator, would stair use be higher? Whether the pleasant stair journey, which consisted of views of small gardens and campus views, played a decisive factor in its use is hard to determine.

Case Study #3, Washington State Carpenter Hall

This five story building was chosen because it was thought that the prominent placement of the high speed elevator in combination with the partially hidden stairs would generate higher elevator use. An additional incentive to use the elevator is that the school administration is located on the fifth floor. The hypothesis was supported by observations found on the first floor, but on the next floor, the high speed elevator had less influence.

On the first floor it was found that 57% chose to use the elevator over the stairs. The observations occurred in the spring and fall of 2005 where a total of 91 users were examined traveling up on non-studio days (Tuesday and Thursday) in the early morning, noon and late afternoon for two periods of one hour and one period of one half hour.

Observations on the second floor yielded significantly higher stair results because the elevator is placed out of sight from the main circulation path which probably accounts for its low 19% usage. Second floor observations of 119 students going in the upward direction occurred in both the spring and fall of 2005 on both studio and non-studio days (Thursday and Friday) with four one hour observations and one 1/2hr observation. Early morning, noon and late afternoon times were covered.

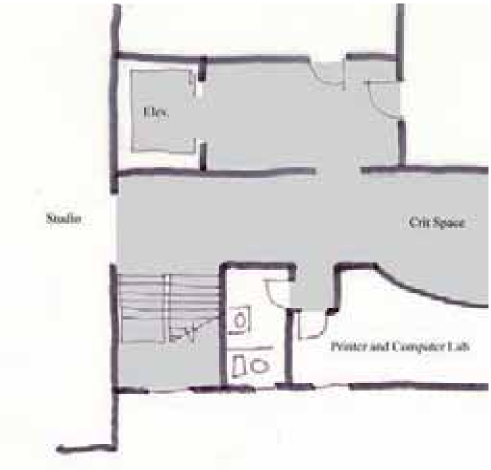


Figure 3 *First Floor, Carpenter Hall at WSU Second Floor*

43–83% Stair Use: Contributing Factors and Discussion

First Floor: 57% elevator use is attributed to:

• The elevator is in clear sight of the main circulation hall and small building café

• The stair is not in sight of the café or most of the main circulation hall.

• The building is five stories high with the school administration located on the fifth floor.

• The elevator is high speed.

Second Floor: 83% stair use is attributed to:

• The stairs are in close proximity and are in clear view of studios and main hall

• The elevator is out of sight and away from the main circulation space.

Since the second floor did not have an inconspicuous place to observe stair and elevator use, the mere presence of the student observers may have increased the stair use.

Case Study #4: Lighty Student Services Building at Washington State University

This four story building offers a variety of services from new student orientation to routine bill payments. Building users range from older staff to new high school graduates. The building was chosen because of its two dominating grand stairs which act as focal points in two large four story interior courtyards. Additionally, two high speed traction elevators are hidden between the two main interior courts. The east interior court is brightly day lit by a Kal Wall roof while the west court is dimmer with smaller skylights. Because the two stairs are clearly visible from the interior courts, it was thought that stair travel would overwhelm elevator use.

The hypothesis was correct in that 88% chose to use the stairs over the elevator in the upward direction. For those who chose to travel two or more stories up, it was found that 61% used the stairs over the elevator. This figure is similar to the two story stair walkers at the University of Idaho Library who also boasted a 60/40% stair/elevator split.

The study took place during the summer break in late June 2005 on a Thursday, Friday and Monday where 192 people were tracked. Roughly an equal number of younger students and older faculty/staff were counted. Nine observation periods lasted for ½ hour segments for all times of day. Because there was only one observer, the stairs and elevators were examined separately at different times of the day. If the courtyard stairs and elevators were examined at one time, the observation period would have lasted one and a half hours.

61-88 % Stair Use: Contributing Factors and Discussion:

High stair use is attributed to:

• The stairs are in plain sight next to the surrounding four story courtyard circulation. One stair is next to a popular snack bar eating area.

• High speed elevators are not immediately apparent from the main circulation paths or interior courts.

• Students are easily oriented upon entering the building because upper floor destinations are spotted from across the interior courts. Appropriately, the stairs fall within the visual path of

Figure 4 Washington State Lighty Student Services Center Second Floor

most of the upper or lower floor destinations.
• Both stair journeys provide pleasant and dynamic views of either the interior courts or of the outdoors.
• The stairs are well daylighted.

As with the previous case studies, the clear visibility of the stairs in combination with the visual inaccessibility of the elevators accounts for the much higher stair use.

Conclusion

From all four case studies, it appears that three dominant factors increase stair use.
• If the stairs are in plain sight next to well trafficked circulation and activity areas, then the stairs will be well used.
• Elevators that are mostly out of sight of the main circulation and main interior space are not as well used as stairs that are within sight of the same areas.
• Slow hydraulic elevators, even when prominently placed, appear inconveniently slow in comparison to stairs.

Other probable contributing factors for high stair use:
• Low rise buildings two to four stories in height probably have lower elevator use because the stairs offer a quicker path.
• Stair journeys that have pleasant and interesting journeys probably generate a higher use.

From this study it appears that a slow hydraulic elevator has more impact on increased stair use than a high speed traction elevator has on increased elevator use. Further studies examining the relationship of demographics and stair/elevator design might be conducted to find the impact of planning elements on different age and gender groups. Additionally, since this study focused on two to five story low-rise buildings, future stair use studies on buildings five to seven stories tall could yield different results.

Unfortunately, no aesthetic correlations were found in this study. However, it is believed that if the shape of the stairs and journey are interesting enough, people will go out of their way to climb stairs. Along these lines, the following projects are designed with the aesthetic intent of providing a pleasant and engaging stair journey. Designed by the fall 2004 second year beginning design students at the University of Idaho, the following project required the design of a stand-alone park stair that would inspire people to engage the stairs through workouts or curious exploration. The objective of the assignment was to create an interesting journey and to be rewarded at the top by a favorable prospect. Students were encouraged to stimulate the users' imagination with playful and engaging forms.

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Stairs to a Viewing Platform

Designed by the 2004 second year design students at the University of Idaho.

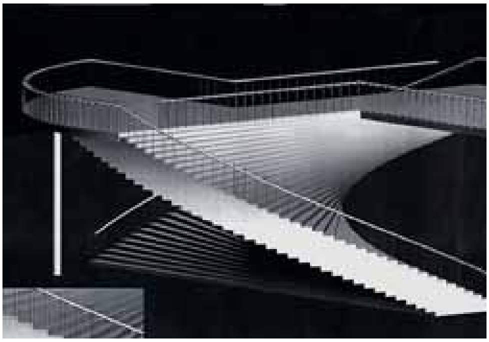

Figure 5 *Tim Grissom Stair*

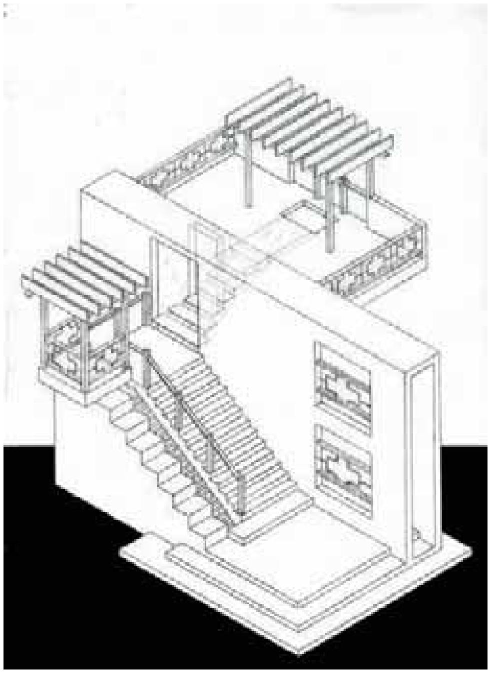

Figure 6 *Tim Grissom Stair*

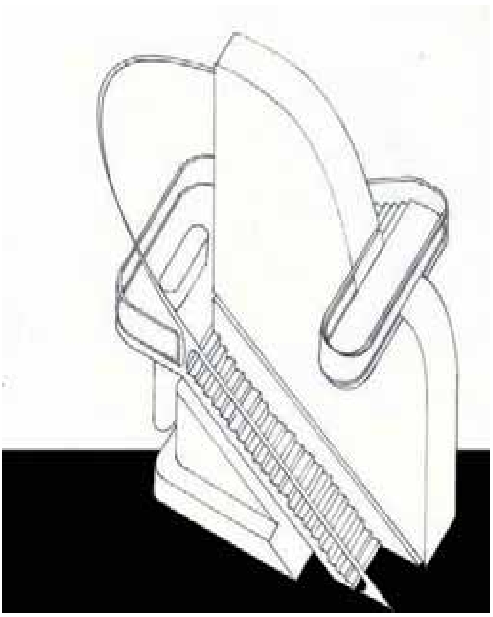

Figure 7 *Kira Wisniewski Stair*

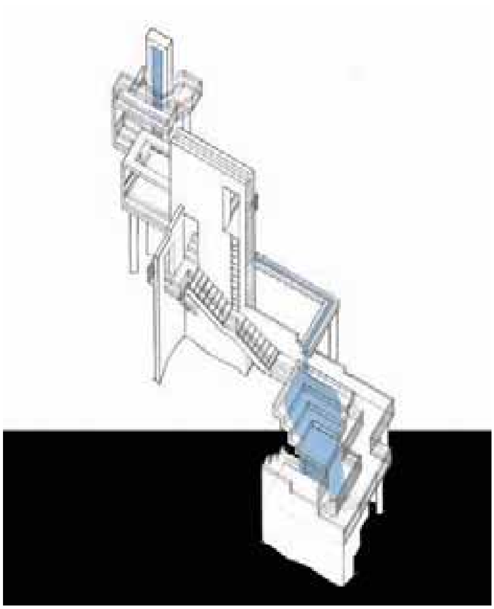

Figure 8 *Kenny Bissegger Stair*

The Master Plan of the Shanghai International Medical Zone

Susan Black
Nadia Tobia

Susan Black, MRAIC, OAA, AOCA

Susan Black is director and founding partner of Perkins Eastman Black Architects in Toronto and a principal and director of Perkins Eastman Architects in the United States. After graduating in interior design at Ontario College of Art, she obtained her M. Arch at the University of Manitoba. She is a member of the American Society for Healthcare Engineering of the American Hospital Association, and a member of the Society for College and University Planners.

Every so often a project of unprecedented size and scope raises the bar in a broad generic category. In the realm of healthcare and wellness, the 11.5-square-kilometre Shanghai International Medical Zone (SIMZ) is an order of magnitude bigger than anything that has come before. An entire city based upon health and wellness, SIMZ represents China's bid to seize the lead in healthcare and medical manufacturing in Asia.

After two rounds of an international competition inviting entrants "to create something groundbreaking and of exceptional quality," Perkins Eastman Black won the commission to masterplan SIMZ. The competition documents asked for wellness; we spelled out what that meant by setting the following objectives for our master plan:

• Create a world-class, modern medical campus that will help make Shanghai a destination for care in China and indeed all Asia.
• Create international hospitals that will be prototypes and will serve as the focal point and catalyst for the development of a world-renowned healthcare district in Shanghai.
• Create a healthcare, medical education, research, academic exchange and manufacturing zone that will attract leading doctors, medical research scientists, medical technicians, clinical staff and medical-equipment companies.
• Attract large numbers of patients seeking high-quality care.
• Be a model guiding the growth of the healthcare system in Shanghai, China and Asia.
• Create a zone where complementary initiatives help Shanghai become the manufacturing hub for medical equipment in Asia.
• Embrace international standards of construction, including "universal design," to permit easy access by all populations and age groups.
• Create a campus where best practices in medicine, teaching and research naturally interact.
• Create sufficient diversity and scale of components where best practices in medicine, teaching and research interact. These synergies will foster a critical mass or virtuous circle attracting the best international talent.

The concept and key organizational structure is based upon landscape. Concentric circles of greenery radiate outward throughout the site, creating a "medical garden" evoking the life-giving forces of nature. For a community based on health and well-being, its structure, appropriately, is metaphor for the growth rings in the tree of life. A multi-layered composition of existing canal networks, expanded waterways and lakes, road networks and the functional programs of seven specific zones is incorporated in an open, flexible matrix. The resulting master plan is a health complex that is truly green, with arcs of woodland, parks, orchards, gardens and other natural features that symbolically and functionally link the identity of SIMZ with nature. Whether viewed from the air, from a tall building on the campus or on the ground, the plan will offer impressive vistas.

Counter-balanced by a strong foundation of modern medical planning, the strong reference to nature in our concept will distinguish the Shanghai International Medical Zone and give it wide-spread appeal and a unique identity while attracting the best global talent.

The complex will comprise two 1,000-bed teaching hospitals, spe¬cialty hospitals and clinics, a medical school planned for 10,000 students, a major rehabilitation centre, a centre for

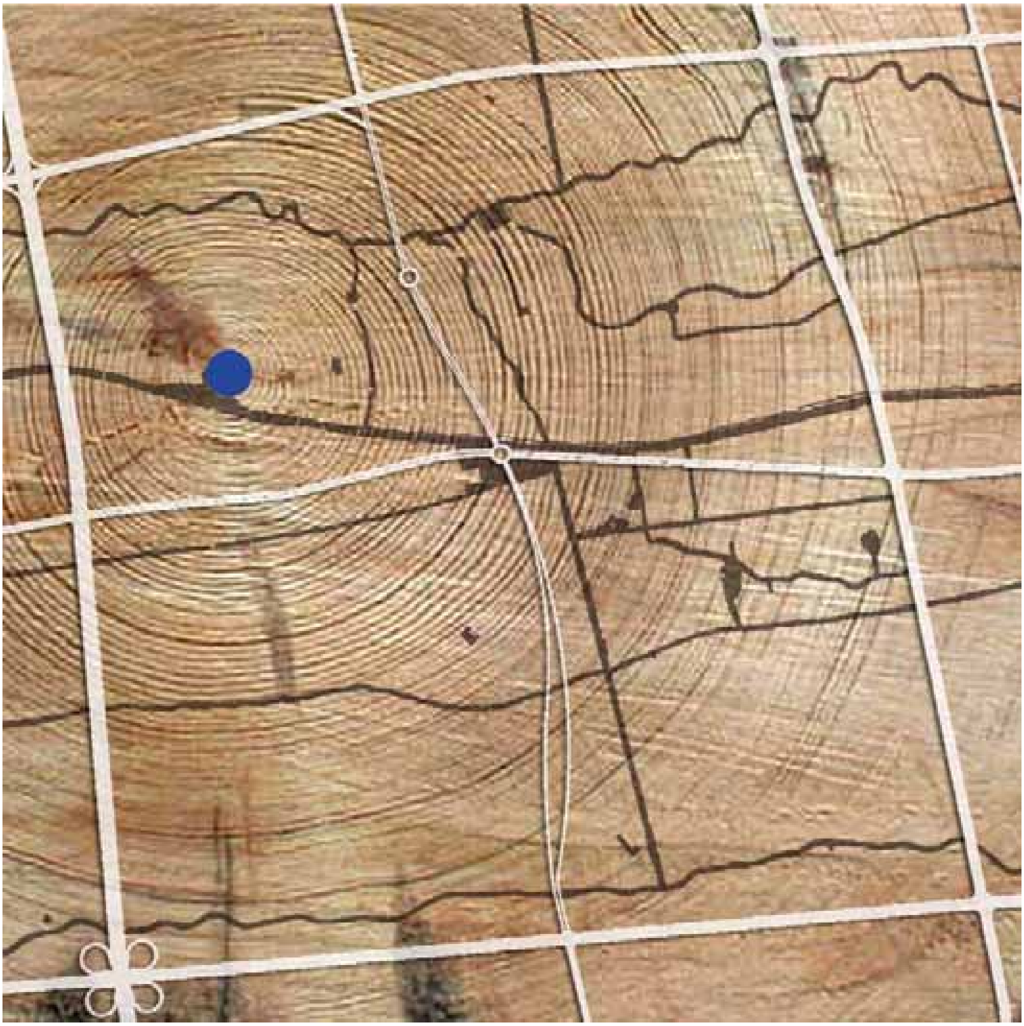

Figure 1 *Shanghai International Medical Zone Concept*

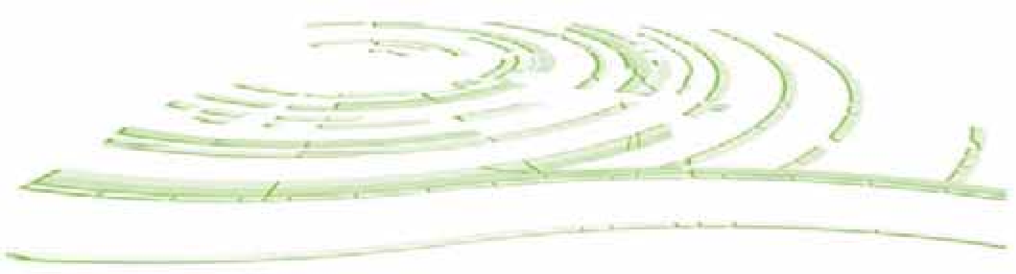

Figure 2 *Shanghai International Medical Zone Graphic*

medical research and development, and a large medical equipment manu¬facturing zone with associated research-and-development facilities. Housing for medical students and a neighbourhood for fam¬ilies will include town centres with children's daycare and early-education facilities.

During the planning and research stages for SIMZ, we realized that while there are specific and idealized precedents related to components of the program, there has never been such a site organization designed to encourage the potential synergy created by grouping the zones complementary elements on one campus.

We studied several large, world-class medical centres in North America and abroad, including the Mayo Clinic in Rochester, Minn., with 1,951 patients; the M. D. Anderson Medical Centre and Baylor Medical School in Houston with 6,041 patients; and, in Manhattan, the Upper East Side Medical Zone (Memorial Sloan-Kettering, New York Presbyterian Hospital, Cornell University Medical College, Hospital for Special Surgery, and Rockefeller University) with 2,721 patients.

However, most of these campuses are accommodated in relatively dense urban centres and have expanded over long periods of time within these constrained contexts. They have grown incrementally, either by expanding their own buildings or by acquiring others. Too often the result is uninspired planning and design. What hospital visitor hasn't been confused by the spaghetti of multicoloured wayfinding paths snaking along the lobby floor?

Unlike virtually every other major medical complex in the world today, SIMZ has an unique opportunity to strategically use a greenfield environment. Instead of being located in a dense city where the physical environment is more a problem than a health benefit, the large natural backdrop of our medical garden will demonstrate how a health complex can be healthful and green.

The property sits on farmland in the Nanhui District of Shanghai, two km south of Shanghai's outer loop road. Normal rush-hour driving time to the city centre is about 30 minutes. The site is 19 km southwest of Pudong International Airport and 36 km northwest of the new Luchao port. Nanhui District planning guidelines mandate planning concepts that reflect "man in harmonious co-existence with nature." The guidelines call for an increase in wooded area, green corridors created by landscaped edges for roads and waterways, and green boundaries around major developments. Our master plan respects these criteria.

As called for in the program, four major canals traversing the site will be preserved. The historic Su's Mansion will be 'restored'. Our detailed program recreates this legacy as a faculty club for the international centre. All other existing structures are to be demolished.

Figure 3 *Shanghai International Medical Zone Master Plan*

As the growth of the medical zone expands from this starting point in the northwest quadrant, we envision that the key organizing structure will be rings of green radiating outward through the site. Other landscape features will symbolically and functionally link the centre to nature. Like growth rings in a tree trunk, the green circular pattern will become the defining structure of on-going growth.

The circle has been a recurring theme in urban development history in Chinese and other cultures. But these circular patterns typically define the hard, manmade parts of the environment. For SIMZ in its exurban, natural setting, we propose that radiating circles define the soft green elements.

The pattern of radiating circles is not just symbolically important, it is also functional. The swaths of green form boundaries between the districts, giving each of them a stronger presence as well as ready access to nature for patients, visitors, staff and residents. The green areas will differ one from another, lending an individual sense of place to various parts of the development and offering a range of choices for people to enjoy.

Strategically placed woodlands and parks will serve as windbreaks, helping to create better microclimates within the site. The green zones will help maintain good air quality, absorbing carbon dioxide, giving off oxygen and filtering air pollution. These large areas of open space will also provide built-in flexibility to absorb increases in growth and density without compromising the zone's functional or design concept.

Since the radiating circles are mainly flexible landscape elements, they create a practical development framework. They can be continuous or, when necessary, discontinuous. In the concept plan, they are interrupted by the existing large-scale grid of regional roads and canals, allowing the canals to maintain their layout without the need for costly new infrastructure changes.

In some places, new local roads follow the arcs of green space, reinforcing the overall plan pattern while adding a desirable local plan feature, such as the gently curving roads of the rehabilitation neighborhoods.

Circles have radials. In our concept plan, radials define axes between key areas of the medical garden: between the two main hospitals, for example, and between the central hospital and the medical school campus. Other radials define the axis of important views or highlight prominent buildings.
The curves and radials open up opportunities to create dramatic building designs. Some buildings, including the international hospital at the hub of the plan, are curved or facetted to follow the curvature of the pattern; others are rectangular buildings positioned along, or at the end of, main axes.

The circular pattern of our concept creates opportunities at the smaller scale of the medical garden. In some of the long curving green spaces of our concept plan, we have created parks with large-scale undulating land formations. Aside from adding visual interest, these topographical variations further appeal to our client. The Chinese not only like circles and other organic forms, their mythology likens rolling vistas to dragon's humps. (Unlike Westerners, Chinese perceive dragons as friendly beings.) For example, the dragon is a favored creature in the Chinese culture, symbolic of good fortune and long healthy life. Most representations of the dragon are at a small scale. In some of the long curving green spaces of our concept plan, we have created parks with large scale undulating land formation, symbolic of the body of the dragon that lives underground.

Dragons come in different colors. Turquoise, for example, is associated with the east and the rising sun. To add further enjoyment to our landscape, we could cover the undulating "bodies" of the dragon with planting in different colors, representing different dragons. We could even use a combination of plantings that flower at different times of the year, changing the dragons' colors. The dragon of the medical garden would offer enjoyment for patients, residents and staff alike, in a way that integrates a healthful symbol with the garden's abundant green areas.

This emphasis on nature is counterbalanced by a strong foundation of modern medical planning. We see this technical dimension being carried over into the building fabric in a way that respects the natural environment.

SIMZ will not only be a delightful green environment, it should incorporate building and

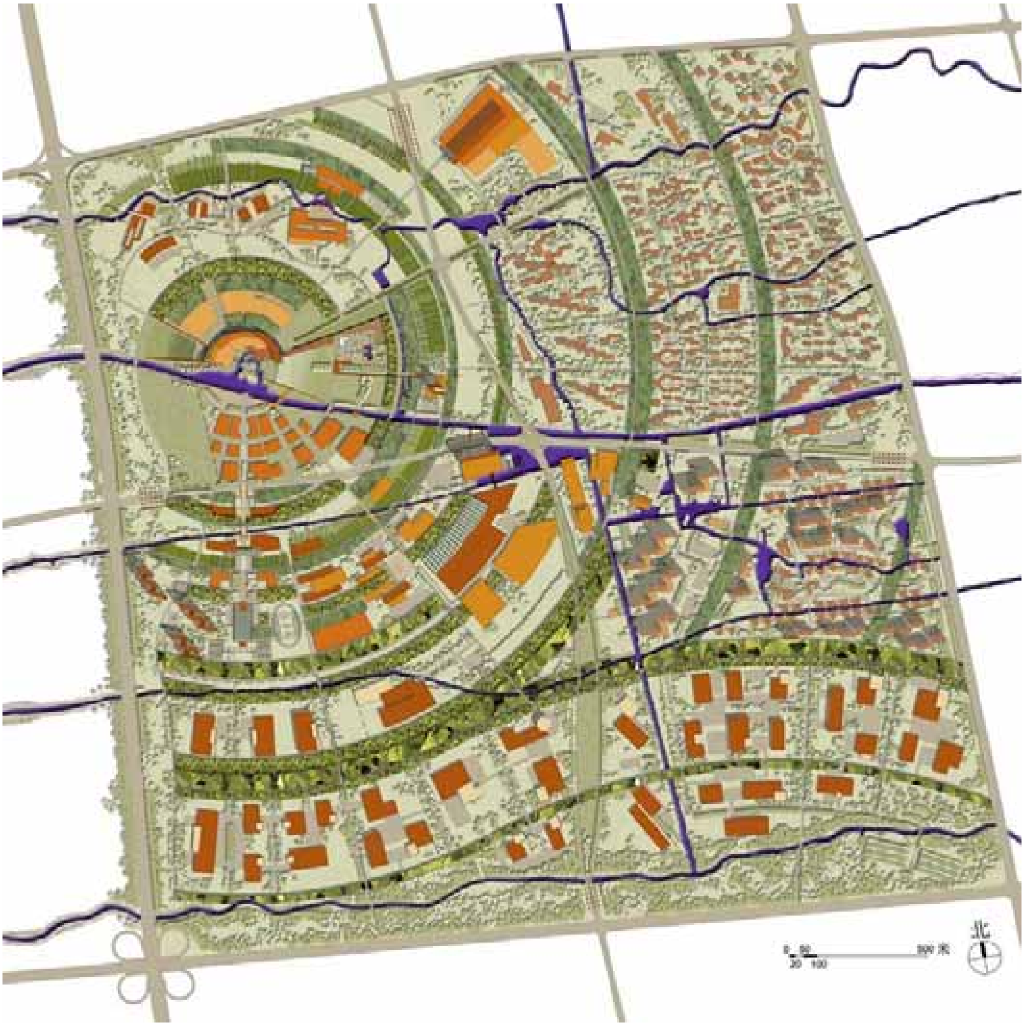

Figure 4 *Shanghai International Medical Zone Site Plan*

construction technology, such as green roofs, that contribute to a healthier environment for those, near or far away, that would be affected by the large building program. With such a large volume of new development, the medical garden can take advantage of large-scale methods of water and energy conservation and efficient use of resources.

Most people who work at SIMZ will come from other parts of Shanghai. A growing number will drive, but many will use mass transit. The circulation plan will accommodate both major modes efficiently and will also have a pleasant and convenient system for pedestrians and bicyclists. The highway network plan is simple and efficient. A major boulevard forms a circulation spine throughout the site from north to south and connects to the three major east-west arterials and to the on-site collector streets that provide access to all major buildings. The boulevard and the collectors will carry most of the traffic.

Figure 5 *Shanghai International Medical Zone South Elevation*

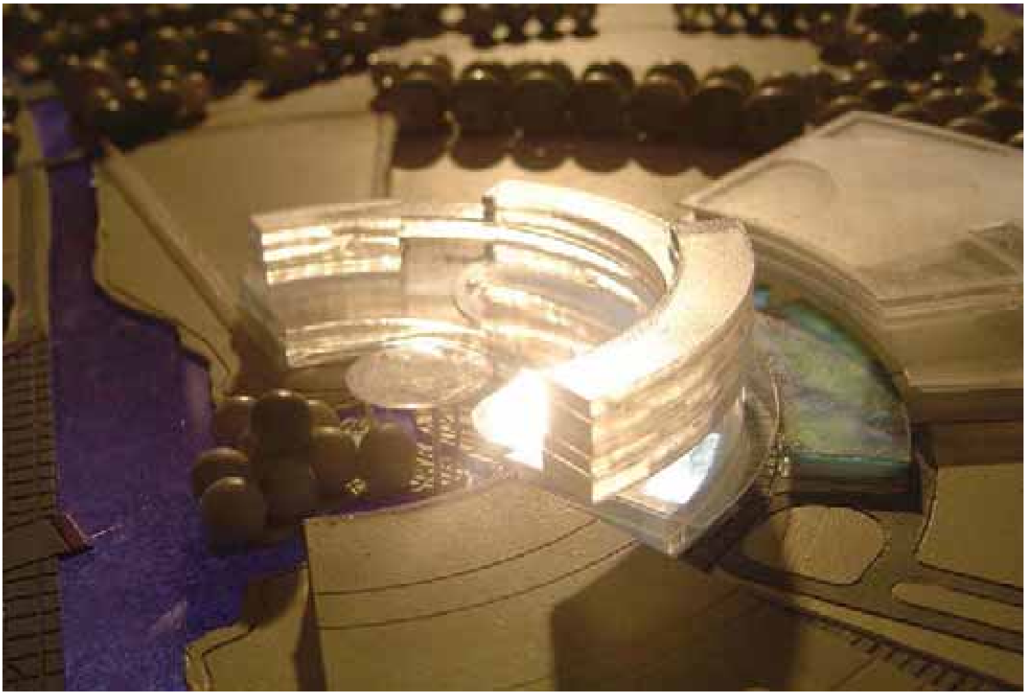

Figure 6 *Shanghai International Medical Zone Model*

A fine grid of local streets supplements the major network to provide access to smaller buildings, including the residential neighbourhoods. The local streets will also accommodate service traffic. They will be smaller in scale and pedestrian-oriented. The curving streets will slow traffic naturally without the need to resort to intrusive traffic-calming measures such as speed bumps.

In addition to regular automobile traffic, a parallel network of dedicated, one-way collectors provides fast and efficient ambulance access to the international hospitals. Helipads provide access to the hospital complexes for emergency helicopters.

Yet another circulation system, the pedestrian and shuttle, will play an important part in on-site circulation. The shuttle will consist of a series of buses connecting to the R3 stations and to major buildings on the site. These vehicles can provide door-to-door service for persons arriving near the site via the regional R3 system and for those traveling between various buildings, such as between the hotel and the hospital, or between the medical school and the hospital.

Then there is the pedestrian and bicycle circulation system. Attractive pedestrian paths are laid out so that most internal trips can be made on foot. The paths connect the major buildings to each other along water features and promenades on the site. Some of these paths may have specially designated bike lanes. Parking will be provided in garages for the hospitals and exhibition centre. On the rest of the site, in areas such as residential neighborhoods and in manufacturing facilities, parking will be at-grade in well-landscaped parking lots.

SIMZ, adjacent to one of the fastest-growing cities in the world, symbolizes how China is facing up to the unfamiliar challenges of modernization. For instance, since antiquity, China's elders were always cared for as part of the extended family. But with many of the younger generation living abroad, seniors are beginning to live independently.

Traditional Chinese medicine links natural ingredients and processes with well-being and recovery from illnesses. In today's stressful world, the benefits of a relaxed green environment have become even more important. SIMZ will point the way to combine this holistic approach with state-of-the-art medical and business practices.

Elderly Care and Green Hospital Design

Chair: Nadia Tobia (Canada)

Health Promotion by Design in Elderly Care

Agneta Morelli, Alan Dilani

The New Green Field Hospital in Ontario

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Health Promotion by Design in Elderly Care

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Objective: The overall purpose of this study was to systematically investigate the requirements of health promotion by design in elderly care and to identify the specific supportive design conditions contributing to the promotion of healthy living and working environments.

Methods: We developed and used a combination approach based on the Future Workshop model whereby a reference group consisting of thirty persons participated in a series of workshops, seminars and field studies. A questionnaire directed to the health care staff included subjective measures of health using the Sense of Coherence Scale, a Health Index Scale and a section of questions developed by the authors regarding the experienced physical environment. The study was carried out at Vårbergs Nursing Home in Stockholm, Sweden during the year 2004.

Results: The results pointed to a correlation between experienced health and sense of coherence among health care staff. The importance of the physical living and working environment for health rated higher compared to existing environmental conditions. Specific and essential design requirements for healthy living and working environments in elderly care were identified and recommended.

Implications: This research demonstrates a much needed development of organizational values and non-pharmacological approaches within elderly care operations. The designed environment must be regarded as the most enduring of these approaches. This requires a deeper understanding of the interaction between the physical environment and the aged person in this particular setting. The preconditions of health among the elderly will most likely be improved through the use of non-pharmacological approaches such as psychosocially supportive environmental design.

Keywords: Elderly care, Health promotion, Environmental Design, Health

Introduction

The population of elderly is significantly and rapidly growing in Sweden, in Europe as well as in North America, increasing the demand of health care services for this segment of the population. Simultaneously, attitudes and perspectives on ageing are changing. A conscious and well-educated generation with new points of reference is emerging. The prosperous western society has created larger economic possibilities for an active and rich life for seniors far into old age. This development poses demands for changes both in health treatment and in the physical environments for the elderly. An additional challenge within elderly care is the high levels of sickness absence among health care employees as well as the shortage of a competent workforce. A well designed environment may provide a supportive psychosocial work environment, attracting well educated staff and encouraging healthy activities among health care staff.

The fundamental principle of this study was to meet the needs for humane living conditions amongst the elderly population by designing supportive elderly care environments which promote health and well-being. These values may be realized through the conscious design of physical environments based on experiences of staff, family members and the elderly residents. The goal included the analysis of health promotion using designed environments for the elderly in future planning. Elderly care facilities provide a living environment for ageing residents and also constitute a workplace for employees. It is therefore important that the improvement of both environments is concurrent. The transformation of Vårberg Nursing Home into a new built environment forms the foundation for this research and development project.

Background

Resources for health services and care for the elderly are at the present time insufficient and strained in Sweden. Therefore, new methods for improving effectiveness and quality control must be developed. A report of current conditions from the Swedish National Board of Health and Welfare (Socialstyrelsen, 2003) described the current situation as problematic. Vast difficulties of recruiting and keeping competent staff are identified and constant high levels of sickness absence are mentioned in this context. The consequences of these conditions are difficult to assess but the National Board of Health and Welfare warn that these changes will affect the elderly with few resources particularly hard. The National Board of Housing and the Swedish National Board of Health and Welfare conclude that there is a significant downsizing of beds in municipal elderly care facilities around the country (Socialstyrelsen, 2004). The report warns for a much too rapid and sometimes poorly planned cut back of elderly care. There may be a relatively large group of elderly for which a prolonged stay in the private home with home-care services are not enough.

Currently Sweden and Italy have the oldest populations in the world. Over 17 percent of the population is sixty five years or older (Statens Folkhälsoinstitut, 2002). At the same rate as the number of really old people increases, the number of elderly with dementia is also growing. Europe faces a great challenge to meet healthcare needs of an ageing population when at the same time the average age of the health care professional is increasing. A large part of the population in Europe is currently over sixty and that number is expected to double within 25 years. In 2050 it is estimated that Europe will be inhabited by more +50 year old individuals than persons under the age of fifty (Socialstyrelsen, 2004).

The basic preconditions for a good life in old age are basically the same as for younger individuals; a secure economy, good health, a functioning social network, meaningful occupation and to be able to control one's own life (SOU 2003:91). However, when working life is left behind, a number of habitual activities are suddenly removed which must be replaced by other stimulating and meaningful engagements.

Throughout the aging process, physical functional losses may be compensated for, muscle mass and bone density decreases gradually with age but may be counteracted by suitable exercise even at a very senior age. Oxygen uptake capacity may be improved considerable through cardio vascular training such as swimming, bicycling and walking. An improved cardio condition offsets tiredness and makes independence more possible with older age. A good over all condition lowers the risk for depression and anxiety (Folkhälsoinstitutet, 1997).

The need for mental and intellectual stimulation is unchanged in old age. The ability to learn and remember needs continuous encouragement to stay intact. The environment we live in is important in this regard. We need varying stimuli daily, requiring us to remember as well as exercise the memory. Intellectual stimulation has good health effects; stress reduction, physiological improvements on pulse and blood pressure and improved rehabilitation after coronary arrest (Norling, 2002). An active social life which includes time with relatives and friends has an impact on overall health.

The experience of social belonging may prevent early mortality, stunt the onset of disease and speed up recovery. Interestingly, social connections may actually function as a biological release mechanism, stimulating the immune system to mobilize defense against various diseases and stress. Social involvement may according to Mendes de Leon, Glass & Berkman (2003) be an important factor in preventing functional loss among the older population.

Research on ageing as a phenomenon has focused primarily on the problems relating to ageing rather than on the description of successful and good ageing. However, there is a growing interest in the health promotion features of the later life cycles as a contrast to the pathogenic preoccupation of ageing. These thoughts have been gathered under the concept of salutogenic ageing.

Figure 1 *Balcony and seating outdoors*

The theory called "Sense of Coherence" developed by Antonovsky (1991), concerns the individual general resistance resource against stress. The theory is based on three main concepts; comprehensibility, manageability and meaningfulness. It explains why some individuals exposed to various forms of stress are able to maintain good health. Sense of Coherence may be generalized to the good ageing which in itself contains good health. A study of seventy year old persons revealed a high correlation between sense of coherence and health which had its origin in the memory of one's life history. The study confirms the importance of earlier experiences and the recollection of these in relation to the sense of coherence and well being in old age (Rennemark & Hagberg, 1997).

Elderly and the Physical Environment

The physical environment has according to Lawton & Nahemow (1973) three main functions; the aesthetic, the objectively functional and the subjectively functional (individual demands and preferences regarding function). Successful ageing according to these authors is a process dependent on the balance between individual abilities and the demands from the surrounding environment. When an individual experiences life as more demanding such as in the state of illness, the ability to manage stress from the surrounding environment is reduced. Various functional losses in connection to ageing may affect the degree of negatively experienced stress. It is therefore important that the surrounding environment is adjusted and improved to fit the remaining abilities of the older person in relation to his or her environment.

The elderly care facility has two main design functions, as a home environment for the residents and as a work environment for the health care staff. These dual functions place complex demands on the character of the physical environment. A home like environment may promote health, increase overall satisfaction and support the remaining abilities of elderly residents. However, the space as a work environment also places specific requirements on the physical environment which may be conflicting with the criteria for an optimal residential environment.

Creating the optimal conditions for health and a good life in old age requires access to the following components developed by the authors: Vita Activa – to be able to work and experience participation in a productive context, to make sure the elderly person is stimulated and encouraged to an active life through occupational therapy, physical activity or taking part in daily chores. Vita Contemplativa – to nourish the inner life through social contacts, to make sure the elderly person is given the possibility to participate in cultural and mental activities such as dancing, singing and discussion groups. Vita Ristorativa – to take care of physical needs for rest and recuperation, to make sure the elderly person has the option of peace and quiet in calm surroundings.

Human understanding of the surroundings is dependent upon human sensory and cognitive abilities. Limited sight, lost memory and impaired concentration usually occurs at some point in the ageing process. Dementia disorders also bring a number of specific difficulties which are related to the physical environment. The sense of space, orientation ability (Gustafsson, 1996; Kaske & Storandt, 1995; Wallin et al, 1994), difficulty processing information from the environment and reduced recognition ability (Bäckman & Herlitz, 1996) are some examples. A lost ability to comprehend and understand the surroundings present a feeling of unsafety which in turn may lead to negative health effects such as stress and depression (Wijk, 2004).

The living environment is fundamental in daily life for the elderly and must be designed to meet their needs as they experience difficulty understanding the environment. The home may be understood as a sphere of integrity and self governing and has a symbolic value in a deeper sense. Furnishings and personal objects are reminders of one's life history anchored in various episodes of life.

During the later years of ageing, remembering is of great value which makes these items even more essential. A relaxing and safe milieu is not only about creating comfort but also a strategy making the most of remaining cognitive abilities of the elderly resident with dementia (Ericsson, 1991). The homelike environment has a therapeutic function aiming to strengthen residents' resources to postpone the degeneration of cognitive abilities (Gaunt & Lantz, 1996). According to Ericsson (1991) the homelike physical environment is important for the elderly with dementia in the following ways; encourage independence, support social belonging, provide safety, arouse recognition, offer physical activity, orientation and stimulation of the senses.

A supportive surrounding gives residents the possibility to use more of their energy for social interactions rather than for orientation. In this way they can become more socially involved (Baksi & Cradock, 1998). A feeling of safety and control in the physical environment is a psychosocial factor which may reduce various stress symptoms. Psychosocially supportive living and working environments may strengthen the individual's ability to manage situations which are often experienced as demanding (Dilani, 2001)

Figure 2 *Spacious private room with personal objects*

Health Promotion by Design in Elderly Care

The residential setting has an important role as a platform for the immediate social environment, a meeting ground where the mealtime is one of many arenas for interaction. The desire for food is clearly influenced by elements in the physical environment, in the social atmosphere and in connection to new relationships (Jansson, 1993).

Figure 3 *Nature contact from kitchen and dining areas*

Outdoor activities promote health contributing to the experience of joy and meaningfulness. The possibility to reflect in nature stimulates senses and cognitive abilities of the elderly. There is also value in viewing the outdoor environment from the inside, especially for the elderly with functional restrictions (Norling, 2002). Creatively active elderly people seem to have a more positive outlook on the remaining years of their lives. This may be due to the sense of being an active creator of one's own life instead of being a passive "victim" of the ageing process according to Smith (1990).

Music may be used actively (to create music) or passively (to listen to music) with the sole purpose of promoting health. Therapeutically, music may reduce stress, anxiety and pain for the elderly (Aldridge, 1993). Music may also be used by health care staff to add a calming element to an agitated situation. Sound and music may also provide a relaxing and comforting function to assist with sleeplessness as a compliment to pharmacological treatment (Lindenmuth et. al, 1992). Music in combination with exercise has proven to have positive cognitive and physical effects for the elderly (Hagen, et. al, 2003).

Color, form and lighting collectively contribute to the overall sense of space. Light is an important aid for the elderly who often have some form of sight impediment (Brunnström, et al, 2004). Perception of color is according to Wijk (2004) well retained in old age including the elderly with dementia. The use of colors in residential environments has been used successfully to support the elderly in daily life and is a tool in compensating for lost abilities.

Most of the cognitive limitation and sight impediments can be compensated for by a more comprehensible visual environment. Pets may have several important functions for the elderly in the residential environment and serve in health promotion. Pets help the elderly maintain an active life style, to quickly recover from disease and help in improving the immunity system according to Bergler (1992). The psychological benefits of pets in the residential setting include improved sleep, reduced depression and anxiety as well as less aggressive behaviors (Fine, 2000).

Method

The method selected for this research study is based on the Future Workshop model including five structured workshops. The model was combined with five field studies, five educational seminars including external presenters and a questionnaire directed to the health care staff. This research also included an extensive literature studies. A reference group consisting of twenty seven individuals involved in the nursing home was selected to participate in the activities. The represented professionals were; nurses aids, licensed practical nurses, registered nurses, head nurses, occupational therapists, physiotherapists, speech pathologist, administrators, family members and representatives from the county council.

The Future Workshop

The Future Workshop is a structured process using experience and knowledge of front line staff consisting of the following five phases; preparation, critique, vision, implementation and follow-up. The preparation phase was started in the beginning of 2004 with a number of seminars regarding life conditions and living environments of the elderly, vis-à-vis the working environment of health care staff in elderly care. The Critique Phase is considered to be a time for problem inventory concerning general working and living conditions. This includes documenting existing qualities of the physical environment which may be experienced as challenging in the daily operations. The next step is to prioritize the most important critique by individual voting. The top-ten results from the critique phase are listed:

1. Inadequate rooms/apartments	**96 p**
2. Too large units	**95 p**
3. Tight bathrooms	**70 p**
4. Long corridors	**53 p**
5. Lighting and ventilation	**33 p**
6. Understaffed units	**29 p**
7. Mixed categories of elderly in the units	**28 p**
8. Limited availability to the outdoors	**25 p**
9. Too many floor levels	**23 p**
10. Colors creating anxiety	**16 p**

The reference group then made study visits to a number of elderly care facilities. All homes relatively newly built in the region of Stockholm and were considered interesting in the planning of a new nursing home. The purpose of the field studies was to inspire and provide a frame of reference regarding various design solutions and environments in elderly care. The field studies supported the transformation from the Critique Phase to the Vision Phase by providing an experience of various qualities of rooms and spaces.

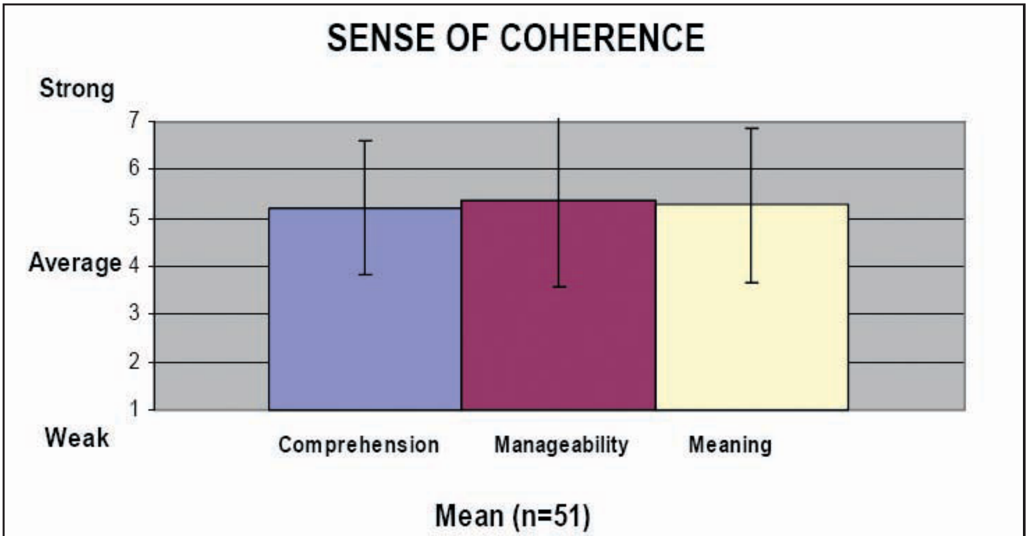

Figure 5 *Sense of Coherence divided into comprehensibility, manageability and meaning illustrated with mean and standard deviation.*

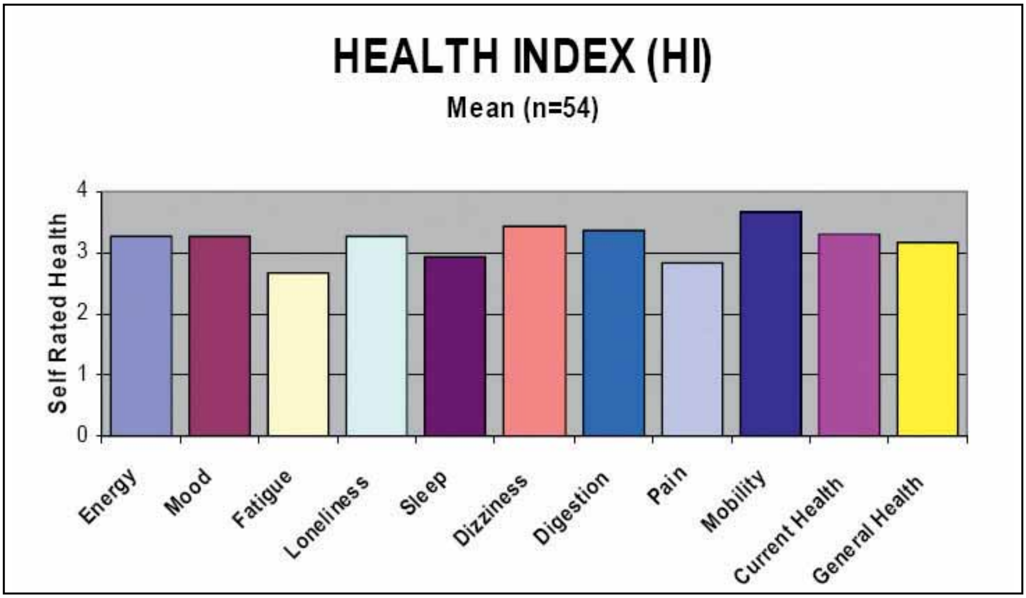

Figure 6 *Self rated Health Index consisting of eleven health factors, illustrated in mean.*

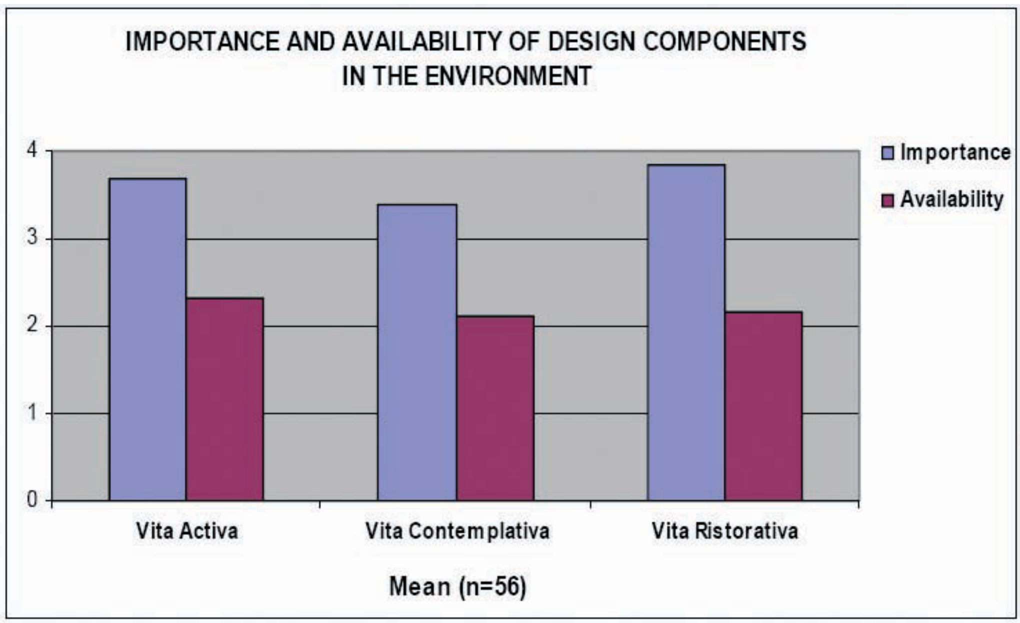

Figure 7 *Importance and availability of Vita Activa, Vita Contemplativa and Vita Ristorativa in the physical environment from an employee perspective, illustrated in mean.*

In the Vision Phase critical thoughts focusing on difficulties and obstacles must be replaced by thoughts of new possibilities and opportunities. The participants are encouraged to imagine situations with endless resources. In this phase it is wise to try and imagine the new spaces to understand what is optimal in the environment and what meets the needs of the organization. At the same time it is also important to note environmental factors affecting emotions and experiences in a positive way. Just like in the Critique Phase, the methods of brain storming and group discussions are used to describe and set concrete the visions. The results of the top-ten list in the Vision Phase are listed below:

1. An inviting entrance	**115 p**
2. The apartments	**73 p**
3. An activity centre	**72 p**
4. The garden/backyard	**53 p**
5. Space, daylight, windows, lighting	**41 p**
6. Spacious bathrooms	**40 p**
7.View	**31 p**
8. Colors and patterns	**28 p**
9. A central kitchen for the entire facility	**25 p**
10. One level building	**25 p**

The purpose of the Implementation Phase is to unite the critique and the visions creating tangible suggestions and action plans. The objective is to realize the visions and to have an agreement in the entire group. Each group presents their plans in front of the large group. The various suggestions are challenged, questioned and commented on by anyone who wishes to do so. This is a way of testing the strength of each plan. A number of themes emerged, themes that later were complemented and concretized. The work continued with in depth discussions and later presentation of proposals and plans after a consensus regarding the most important subjects was made.

The presentations received views, criticism and questions from the other group members. Three areas were chosen for in-depth discussions; 1) an inviting entrance/the courtyard, 2) the units/apartments/bathrooms and 3) an activity center. The groups created lists of concrete and detailed recommendations for each of these design components.

The Questionnaire

The first part of the questionnaire contained the Sense of Coherence Scale originated and developed by Antonovsky in 1991. The original version contained 29 questions and measured the three elements; comprehension, manageability and meaning as a whole. A shortened version of the questionnaire was also constructed by Antonowsky containing 13 questions taken from the larger survey and used in this study.

The Health Index Scale used in the second part of the questionnaire measures general experienced health and includes nine questions regarding the following health factors; energy, mood, tiredness, loneliness, sleep, dizziness, digestion, pain and mobility. Two additional questions measured current health status and general health status. The last question in this section of the questionnaire was semi-structured and concerned the occurrence of any currently experienced health symptoms. Each question was responded to on a four graded “Liker scale” where higher points reflect a higher rating of health for each aspect.The third and final section of the questionnaire was constructed and designed by the authors. This section focused on the experienced physical working environment of health care staff as well as the physical and psychosocial living environment of the elderly.

The emphasis was on the health promotional aspects of design components earlier identified in the reference group. In total, part three contains 21 questions, two of which are semi-structured with options for motivating the experiences of the environment. One open question completes part three and offers a chance to freely express, comment, and suggests anything related to the subject matter.

Results

The number of completed questionnaires were 58 which is a response frequency of 44,6 percent. A total of 92,9 percent were filled in by women and 7,01 percent by men. The internal response frequency on individual questions was generally over 84,4 percent.

The short version of the Sense of Coherence Scale was used in the first part of the questionnaire with the purpose of measuring self rated general resistance maintaining health using Antonovskys' salutogenic model. A high score on the test indicates a strong sense of coherence. The result reflected that the employees on average rated their sense of coherence as somewhat higher than average (m=5, 29). The distribution of the three concepts included in the theory were; comprehensibility (m=5, 21), manageability (m=5, 39) and meaning (m=5, 27). Internal consistency was tested using Cronbach's alpha and indicated good reliability (alpha=, 82).

The second part of the questionnaire measured employee self rated health using Health Index. High scores reflect experienced good health. By adding all eleven health factors, a general indication of the health status was determined (m=3,19) on a four graded scare (1-4). The results reflected experienced health symptoms with the lowest score for fatigue (m=2, 67, SD=0,64) and with the highest score for mobility (m=3,65, SD=0,64). A number of correlations were identified. Current health status and general health status correlated significantly and positively ($p<0,01$). High scores on current health status

Figure 8 *Inviting entrance in two levels*

also indicated high rated general health status. The general health status also correlated significantly to sleep and pain (p<0,01). Low scores for sleep and pain indicated low rated general health status. Individuals who experienced poor sleep and experienced more pain symptoms also rated their general health lower. The last question concerned current health problems or disorders. A total of 38,6 percent of respondents stated that they did experience current health problems. The most common type of symptoms was pain in the back and shoulders followed by difficulties concerning sleeping/fatigue. The third most frequent symptom reported was high blood pressure.

The results regarding the importance of the three health promotion concepts in elderly care, Vita Activa, Vita Contemplativa and Vita Ristorativa indicated that employees valued all of the concepts as somewhat important or very important on a four graded scale (1-4). The average scores were for Vita Activa, (m=3,67, SD=0,47) for Vita Contemplativa, (m=3,38, SD=0,77) and for Vita Ristorativa, (m=3,84, SD=0,37). When all six components constituting each concept were added, the results pointed to a discreancy between the rated importance of each concept and the available conditions for the same concepts (Vita Activa, Vita Contemplativa och Vita Ristorativa). The discrepancy was particularly evident and most significant for Vita Ristorativa. Its qualities were rated very important and the availability of these qualities was at the same time rated the lowest of the three concepts.

Overall satisfaction among employees in the physical work environment (n=56) was rated on average as somewhat good (m=2,84, SD= 0,63). The questions regarding elderly overall satisfaction with the physical living environment from an employees perspective (n=56) yielded on average as somewhat poor (m=2,16, SD=0,71). The reasons stated for overall satisfaction with the physical living environment were compiled and categorized illustrated below:

Satisfaction in the Physical Living Environement	n=	%
Requesting private rooms not shared wards	6	25
Corridors are experienced as a negative design component	5	21
A homelike environement is preferred rather than the experienced hospital like environement	5	21
Personal integrity is limited in existing setting and must be promoted	4	16,5
The physical environment is generally experienced as being too dark	4	16,5

Figure 8

Elderly overall psychosocial satisfaction in the nursing home from employee perspectives (n=54) resulted in an average of somewhat poor (m=2,04, SD=0,8). The motivations to these answers were compiled. In total, 23 persons filled in their motivations which is a response frequency of 40,4 percent. The motivations are illustrated below.

Satisfaction with the Psychosocial Living Environment	n=	%
More activities and stimulation is suggested	8	35
Smaller units are needed to create a more personal atmosphere	6	26
Compromised integrity leads to feelings of fear and insecurity	5	22
Categories of elderly are mixed too much within each unit causing anziety	4	17

Figure 9

Implications

Comprehensive knowledge of how the elderly experience their surroundings is a requirement in planning the design of a new elderly care facility. These care homes make up the dwellings during their last stages of life. It is therefore necessary to have an understanding and awareness of the natural functional losses specific to ageing. Residents in elderly care facilities have the right to feel safe and should be supported and encouraged to live as independently as possible in their environment.

Research regarding the planning and design of elderly care facilities are unusual in Swedish universities today. Sweden has not invested in research and development based on evaluation in spite of large investments made yearly for the construction and renovation of health care buildings. A logical consequence in this context is to view this report as a contribution to staff involvement in the planning of their future work environment. This is motivated by relevant experiences of functional and appropriate spaces among health care professionals. This active participation also contributes to the development of new knowledge and services within elderly care.

The combination of workshops and questionnaire applied in this report is a unique process of making often concealed resources of health care employee knowledge visible. This use of competence must be developed and applied in future work. It is suggested to consider this activity as a production and application of knowledge.

The elderly is not a homogenous group but may be divided into separate categories such as, the elderly with dementia, the elderly with Parkinson's disorder and the elderly with natural functional loss due to the aging process. All these groups and each elerly individual within a group has varying needs regarding the physical environment. The needs and requirements must be analyzed on different levels throughout the building structure and the design levels.

It is the task of architects and designers to unite and interpret translate and shape these criteria in the physical environment in order to satisfy complex and sometimes contradictory requirements from staff and residents.

Evaluations must be developed in accordance with residents' needs and requirements with the sole purpose of contributing to professional competence in elderly care. This could be utilized in an ongoing process to eliminate poor design solution. Continuous evaluations will also guide the organizational decision making processes. New operational strategies, services and environments must be developed concurrently in response to all user' needs for changes in future elderly care.

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Wallin 1999

The New Green Field Hospital in Ontario

Tye S. Farrow

Tye S. Farrow, M.Sc.Arch.

Tye Farrow is a leader in the design of buildings that lift the human spirit by drawing on themes from nature. Working from his firm in Toronto, Tye has designed projects in Canada, the Middle East and the Caribbean. His contribution to health-care design at the Credit Valley Hospital and Thunder Bay Regional Health Sciences Centre in Canada is viewed internationally as setting a new standard in health care architecture. A graduate in architecture of the University of Toronto, Tye also received a Master of Architecture in Urban Design from Harvard University. His award-winning work has been published in such British journals as Architectural Review Magazine and AD Architectural Design.

If the delivery of health care and the creation of architecture share the common goal of improving the quality of life then the role of health care architecture has never been more important. While there are codes that mandate the essentials of fire and life safety, there are few guidelines that capture the qualitative or humanistic aspects of building design. As the maintenance of health is rising to the top of the health care agenda, it is clearly time for a change.

The Thunder Bay Regional Health Sciences Centre[1] , a new 375-bed, 680,000 square foot hospital in Thunder Bay Canada, has positioned itself to do just this. Challenging accepted truisms in health care design, its dramatic use of wood and multiple-height interior spaces flooded with natural light creates a dynamic and innovative space for healing. More than simply a regional hospital, it presents itself as the physical manifestation of a design paradigm that recognizes the benefits of the cohesion between the science and the holistic art of healing.

By using this facility as a case study, this paper will explore: the project objectives; summarize the philosophical and methodological drivers for design; explore methods for the delivery of green field hospitals in the Canadian context; and illustrate how design and material selection and intentional site planning can increase patient well-being, reduce patient and user stress, and still allow a facility to remain fiscally and operationally responsible.

A Starting Point

As the first new green field hospital in Ontario under the province's new restructuring directives, the objectives of the new hospital were fourfold:

1. Meet the client's tight budgetary and scheduling requirements.
2. Respond to the rugged natural context and northern Canadian vernacular;
3. Create a more humanistic environment for health care;
4. Provide a functional building that meets Ministry Standards for operations.

The project began initially with two existing hospitals, one of which was 50 to 75 years old with numerous additions. Through a provincial initiative to restructure the public health care system, the government issued a directive to close one of the hospitals and expand and renovate the other. It was believed by the Hospital Administration that they could get better value for money by building a new hospital in the centre of the community next to the local university and strengthen the teaching component of the hospital, versus renovating the existing. However, a detailed programme analysis conducted by the architect team determined that the money would be better spent if it built one new regional facility rather than renovating its two existing local hospitals.

The government approved the process and began development in May 1999. The Hospital also mandated a rapid turnaround time. Eschewing the traditional lump-sum construction process in favour of the construction management approach -the first of its kind in Ontario for a new hospital- it was delivered in just 4 ½ years versus the traditional 8-10 years. The project was substantially completed in October 2003, with the first patients being transferred in February 2004.

The initial design first evolved out of both an ongoing process of research into the hospital as a typology, fused with an interpretation of Ontario's rugged North West context including the cultural, economic and ecological wealth of the region. Additionally, the client firmly believed that most hospitals were not designed to enhance healing and thus required a rethink. To facilitate this process, the design and Hospital Administration team conducted a study tour of over 40 health facilities throughout Canada, the United States, and Europe to understand and research successful (and not successful) design options.

This resulted in a manuscript by the architect team entitled Humanism in the Art of Healing: Beyond Form Follows Function in Health Care Architecture [2]. As a vehicle to study the history and roots of healing, it sought to develop a context, and outline a number of design principles that would serve as a benchmark decision making for both the architectural and the client's team. The document also served as a parallel document to the functional program by setting the future appearance of the architecture without prescribing an actual scheme.

Figure 1 *Aerial view of the Thunder Bay region*

By laying out a number of design issues against which the final architecture would be measured, it also generated a discourse on ideas surrounding the design including:
- building typology;
- context including the ecological, cultural and economic history of the North West;
- the public role of the hospital as the centre of the community;
- innovation in typical hospital programmatic elements such as nursing areas and cancer radiation bunkers;
- the tectonics of construction;
- materiality as it relates to the North West;
- issues of changing seasonal light.

The result is a comprehensive design that embodies the principles originally set out in the Humanism manuscript but also one that meets the functional and programmatic criteria of the Ministry of Health Functional Program. The project has also been awarded some of the highest awards in Canadian architecture, having received the 2005 Ontario Association of Architects (OAA) Award of Excellence and the 2005 Royal Architectural Institute of Canada (RAIC) Gold Medal for Innovation in Architecture.

A Canadian Vernacular

It goes without saying that the image a hospital projects reflects its identity, history and collective memory. This project is no exception. Thunder Bay is a community of approximately 120,000 in Northwestern Ontario, close to the Manitoba border. Sited on the top end of Lake Superior, the hospital serves a geographic area equal to the size of France.

The city was created approximately 25 years ago out of a forced amalgamation of two adjacent communities, Port Arthur and Fort Williams. Replete with the rugged vernacular of the Canadian north, its history is rooted in local pulp and paper industries and the national railway that helped unify the country.

From a building layout perspective, the building set out in a ‘T’ configuration, orientated north-south to respond to the path of the sun. To the west, the main entrance is located in the crutch of the ‘T’ creating a sheltered civic urban plaza. The edge of the plaza is lined on two sides by the hospital while the other two sides are flanked by an arcade for market activities and an outdoor amphitheater, created by a deliberate grade change. This plaza also frames the horizon view of Mount McKay, a major geographic feature of the City.

Figure 2 *Aerial view of the hospital*

Figure 3 *On-site stromwater retention ponds cleanse rainwater and provide fish habitats*

This resulting urban room now serves as a place of congregation and a significant civic point for the celebration of important events; a space that was previously absent in the community.

The design of the landscaping is thus based on a direct interpretation of the regional landscape characteristics. The site was part of a 60-acre parcel of which close to half was reserved for natural environmental areas comprising of undisturbed bush, and a network of bogs and natural drainage channels leading to the McIntyre River.

Large tracts of exposed Canadian Shield also characterize the area; a fractured rocky geography created from the sheer physical force of nature. It is typified by the plateaus such as Mount McKay, which rise vertically out of the land resulting in cliffs shattered in geometric yet precise natural patterns. Equally inspirational was the linear patterns of black spruce that run deep into the bush, reminiscent of the surveyor cut lines, typical for the region.

A series of ponds and wandering paths form the outback to the building, designed so as to celebrate the local landscape and to invite local species back to the site. Storm water run off is channeled through a series of connected ponds that cleanse and cool the water prior returning it to the McIntyre River. The ponds are also designed as cold-water fish habitat breeding areas to help repopulate the river with native species.

In northern Ontario, wood is the prime raw material that drives the pulp and paper industry and is a major employer of the community. In the past, timber was the major structural element used to build the heroic railway bridges, spanning vast river gorges that formed the link connecting Canada. This image of the curved wood trestle bridges is memorable indeed and is deeply ingrained in the collective memory of the region.

The most salient evidence of this is the main public concourse by its use of wood and its ability to capture and distribute natural light. While the dramatic three-storey wood and glass walkway serves as a main circulation route, it also curves to follow the path of the sun to allow deep penetration of light and enhance the comforting perception of the hospital. Conceived as a path through a forest lined with trees, the wooden concourse symbolizes and fosters a direct connection to nature.

Knowing this, Thunder Bay is the first hospital in Canada to gain approval for the use of wood as a primary structural element. As wood is a combustible material, its structural use is limited.

However, by working directly with Provincial Building Code staff and the local Fire Marshall it was illustrated that wood was indeed an acceptable design and performance equivalent to steel.

The necessary safeguards were achieved by physically separating the wood and steel elements into separate fire zones, undetected though by the public. In total, over 1090 pieces of glue laminated members -some over 65 feet in length- were used. [3]

Wood was also used extensively within the Cancer Radiation Bunkers. Like the main public concourse, it was chosen for its positive and comforting effect on a patients' psyche during what is clearly a stressful and often lengthy procedure. The ability to produce a place that feels familiar, will ultimately increase patient well being, reduce stress and recovery times.

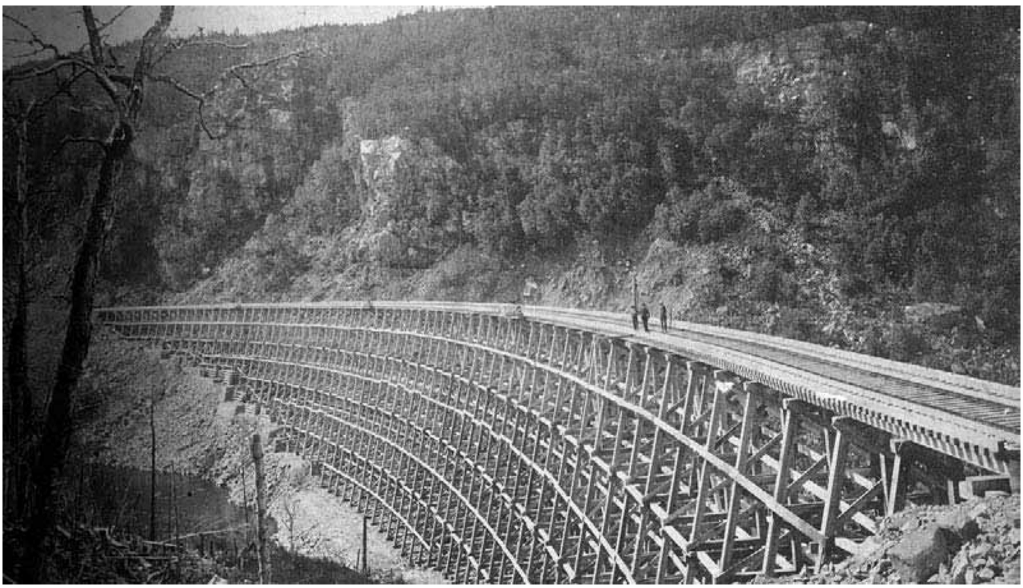

Figure 4 *Historic railway bridges are a symbol of the Canadian north*

The exterior of the building is clad in a mix of cut tindal stone and an aggregate masonry unit made of crushed tindal stone and cement, both in a mix of smooth, bush hammer and a rough surface treatment. The material, native to the region, was chosen so as make reference to the Canadian Shield and while offering a material of quality, versus the typical brick or pre-cast cladding of most southern Ontario Hospitals.

Additionally, the terrazzo flooring of the main corridor is themed as a river through the seasons. Beginning with images of ice breaking up, the pattern progresses to spring flowers, fish in summer and concludes with fall leaves floating on water. Along the river's edge are sitting areas, or camps, equipped with stone fireplaces and hearths. Inexpensive in relation to the overall cost, this was designed to set a theme of comfort. This typology also continues itself throughout the main routes of the hospital creating gathering points.

Figure 5 *Wooden concourses evokes images of the northern vernacular*

Humanism in the Art of Healing

At the root of the project's efforts is a fundamental belief in the necessity to restore Humanism to the process of healthcare. Humanism is based on the idea that concern for human interests, values, and dignity is of the utmost importance to the care of the sick.

The results of this philosophy are environments that have a connection to our social and inner lives; places that evoke images, feelings, meanings, and sentiment. They are also about a complex bouquet of influences that affects all of our senses: like the way sunlight throughout the day, falls across surfaces. Or like the texture of the rock outcrops or bush in fading light or the weathering effects of wind, rain and snow in the north - these are the lines of the faces creating texture to touch; the personality of place in the North.

Humanism thus asks a simple question: what makes every great place unique in its own right? In doing so it looks to understand how it is that the play of light and sound, the very feel of materials is transformed in certain places and can change the ordinary into the mystical thereby changing the way we think, move, and perceive our existence? In the north, this is realized by the direct connection to nature, to the seasons, and most importantly, access to natural light.

The benefits of direct natural light, particularly in the northern region cannot be underestimated and the effective realization of these values is integral to the full expression of Humanism. Harvard biologist E.O. Wilson wrote, in The Biophilia Hypothesis, (Shearwater November 1993) of our deeper attachment to nature that extends far beyond the narrow demand for physical sustenance to include a broader range of intellectual, emotional and spiritual needs.

The Biophilia thesis infers that it is impossible to detach from nature without also compromising human spiritual existence.

Figure 6 *Wood trusses mark the entry to cancer treatment bunkers*

Knowing that daylight hours are limited in the north, and that the connection to outdoors is so strongly rooted in the collective consciousness of the local population, the necessity to make the connection, and to open itself to nature was a first-order priority.

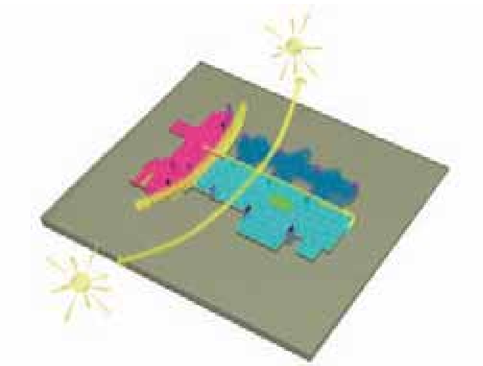

Figure 7 *Building orientation traces the path of the sun*

The carrying cost of people – recruiting, employing and retaining them- is a hundred times as great as the cost of the average building and nowhere is this more significant than in hospitals. Thus the goal was to give the inhabitants of this facility -both staff, patients and visitors- the feeling that they had spent the day outdoors, versus the usual perception in many hospitals that one would not see daylight until the weekend, and specifically in northern climates in which the daylight sun hours are limited.

As such, the main concourse (as well as main public circulation corridors) has been intentionally oriented to maximize light penetration into the building at various seasons while controlling its penetration of light with sunshades.

Using virtually no heating or cooling, it has been designed as one of the first hospitals in the province to use passive solar energy to reduce its mechanical operating costs throughout its life.[4]

Thunder Bay is also the first cancer radiation bunker in Canada, and apparently the sixth in the world, that allows sunlight directly into the heart of the bunkers. While technically challenging in the control of radiation given the obviously strict requirements of Atomic Energy Control Canada, the impact on the psychological well being of the patient and health care workers is enormous.

Figure 8 *Publics corridors have access to views and natural light*

In bunker design, laser lights are focused on pre-painted marks on the body that allow the exact treatment of the radiation to penetrate the body to an exact point. This requires a very low light level so the lasers are visible. As a result, the team began to study art gallery design solutions that allow the penetration of natural light, in focused ways, on paintings that should be viewed in natural light but could be damaged by the same source. Through a number of options, the team devised a solution that would bring the north light straight down along a modeled wall to illuminate a garden below. This way the light would fluctuate in intensity as a cloud passed overhead while keeping the day light focused at the foot of the treatment bed.

Similarly when you enter a radiation treatment room, you move through an entry maze in and look directly at the treatment machine, a potentially overwhelming experience. In this instance, the machine was rotated so upon entering you look past the machine to the sun lit garden beyond, a significant break though in bunker design both for staff and patients.

Natural light is also considered in the patient rooms as well. Each private patient room has a wooden framed inglenook containing a day bed where a member of the patient's family can sleep overnight, which helps in the healing process and the health care delivery by nursing staff.

Clearly the impact of dwindling resources and increasing health delivery costs will have a significant impact on staff moral. As a result, the quality of the environment in its ability to attract and retain staff has never been more important. It is for this reason that the main nursing stations are oriented with direct views to outside through three-storey, mini atriums in each of the inpatient areas.

As much as do patients, all staff need individualized control over comfortable personal environments, access to natural light and views, proximity and visibility to the patients in their care and efficient work paths. A people-centred workplace therefore translates into a perpetually renewing investment in improved patient care and reduced staff stress.

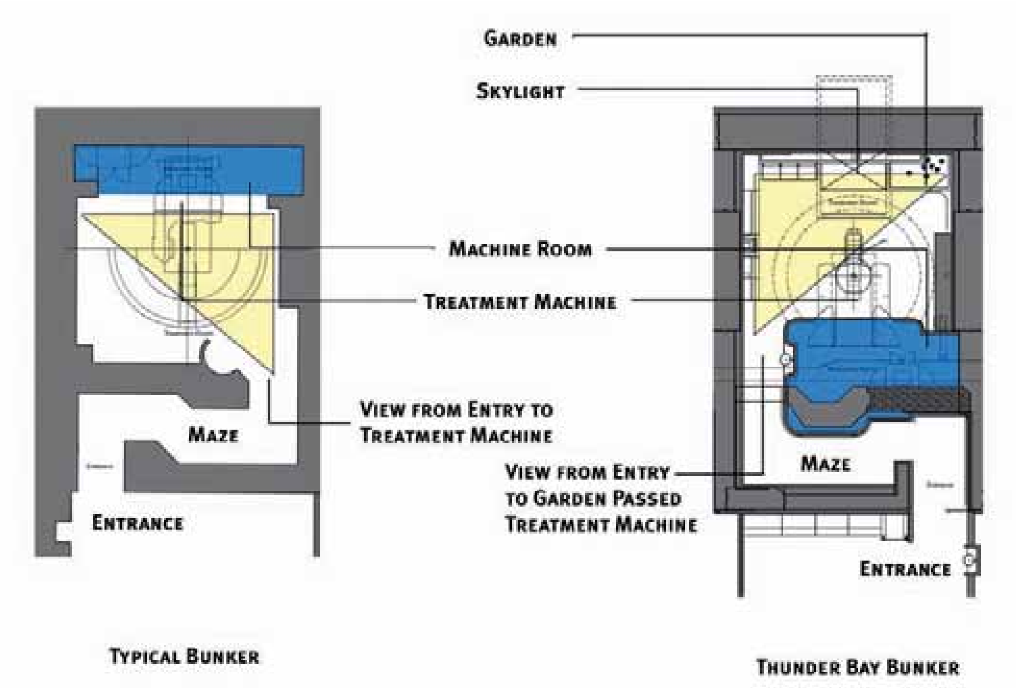

Figure 9 *Contrasting radiation bunker plans*

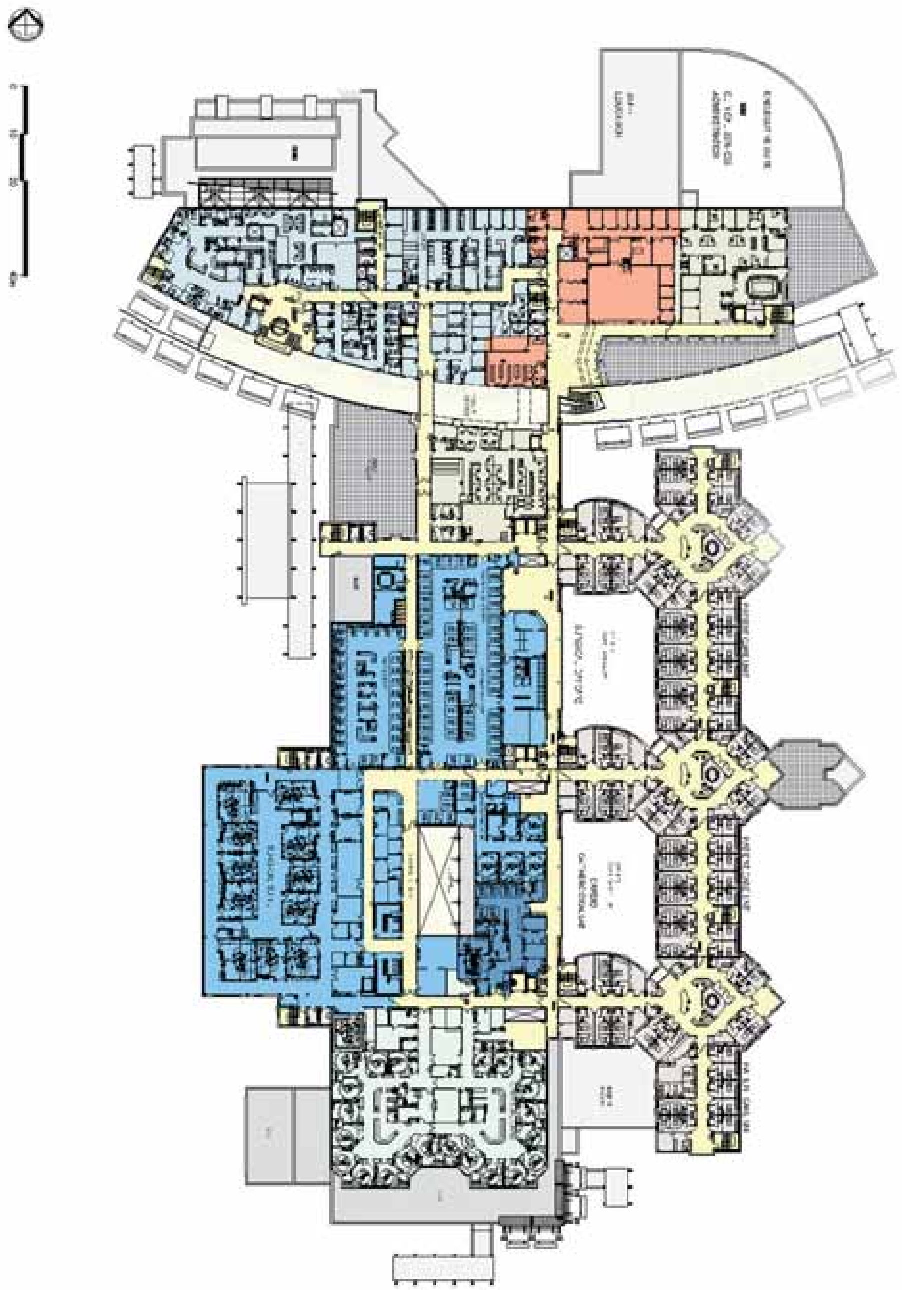

Figure 10 *Floor plan third floor*

Figure 11 *View of the cafe´ bathed in natural light*

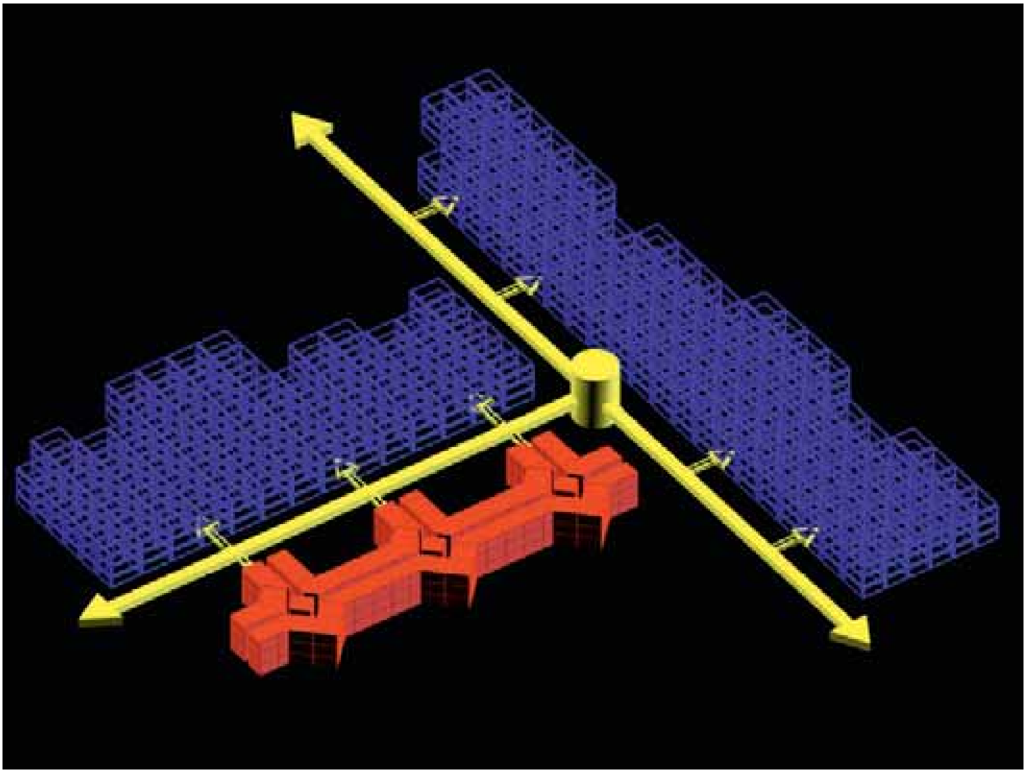

Figure 13 *Basic building composition*

Creating Functional Buildings

Beyond the aspects of Humanism, the hospital was also charged with meeting specific standards of operation as set out in the approved functional program. Thus, the Primary Organization of the hospital was developed as follows:

The building has been designed as a three-storey structure. At its western edge, the building is buried one storey below ground making the second floor the main entrance level.

Separate entrances have been organized for the Emergency, Maternal Child, Mental Health and the Cancer Centre. The entrances are located in relationship to the ends and edges of the "T" shape.

These side doors are advantageous in that they speak to the differences of people undergoing radiation treatment versus those that are giving birth. It is also effective from a SARS control standpoint.

Traditionally, hospitals are designed with the departments such as operating suites and clinics in a podium with the nursing/patient beds placed on top.

Unfortunately, the grid for the podium is different from that of the patient's beds as well as the mechanical and electrical services and shafts, which can create many conflicts. Both the upper and lower portions are compromised and the construction coordination is complex, especially for an accelerated construction schedule.

As a result, the two were separated and placed side by side. This allowed the use of a flexible modular frame of 9m x 12m, which houses clinical departments, to sit on their own and adapt and change over time. The patient beds are attached along side. Following this logic, they can be constructed conceptually as separate buildings. The advantage of the grid is that it can expand or contract easily during design or construction due to changing programme needs, which it did.

Conclusion

Architects often use the word 'spaces' to describe the buildings they design and the physical areas created by them. At Thunder Bay, we first designed places, not spaces; small moments and humanistic vignettes that transcend their efficiency by becoming places where people feel cared. And it is in these places, where the realms of public and private overlap, that provide opportunities to subtly articulate different thresholds, or blend and mix functions to generate different uses and activities for both the patients and staff.

It is the first hospital in Ontario to use wood extensively through the building and has charted new ground in the design of cancer bunkers. It is also the first hospital in the province to use and embrace sustainable environmental design concepts in both the building and site strategies.

But beyond these firsts, the true measure of its success is by the people who use its spaces on a daily basis. Today the hospital commands a staff new-hire waiting list and competes for doctors internationally – a feat unheard of in the Canadian north.

Footnotes

1. The Thunder Bay Regional Health Sciences Centre was completed by Salter Farrow Pilon Architects; Farrow Partnership Architects and Salter Pilon Architects, successors.

2. Humanism in the Art of Healing is a self-published manuscript, authored by Tye Farrow of Farrow Partnership Architects. Copies are available through the author.

3. Interestingly the Construction Manager originally resisted the use of wood because of the uncertainty -as it hadn't been done before- and the perceived expense of the material. Our Construction Managers priced both a wood and steel structure for comparison and found that the wood structure, all in -including fire suppression- to be slightly less expensive than a steel solution yet offered far more value for its qualitative aspects. The building was designed so that the steel structure could be erected on its own, then the wood structure inserted within the steel frame, thereby allowing the two to be constructed independent of each other. This allowed the team time to fine tune the details of the wood structure while the repetitive steel package could be tendered earlier. The wood structure erection lasted approximately 3 months.

4. Interestingly, provincial health officials were originally resistant to the amount of south facing glass, not understanding the operational cost savings it offered through passive solar energy. Both this design and a two-storey space were modeled to quantify the operational costs, and the two were found to be equal from an operational cost perspective. This space, having been open for about a year and a half, uses virtually no energy in the summer or winter.

Figure 5, 6 ,11 Photo Credit: Peter Sellar Klik Photography

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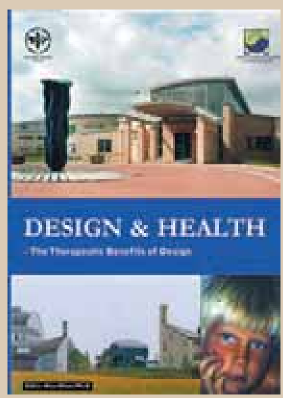

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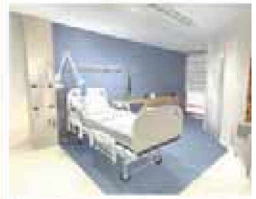

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Topics presented in this book include research on hospital performance, healthy workplace design and patient perception of healthcare environment, design for elderly, the presentation of major new hospital design of the world, the effects of art, music, garden on healthcare outcomes and finally the presentation of several PFI-Build projects in United Kingdom and the impact of Public-Private Partnership on healthcare design in UK.

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