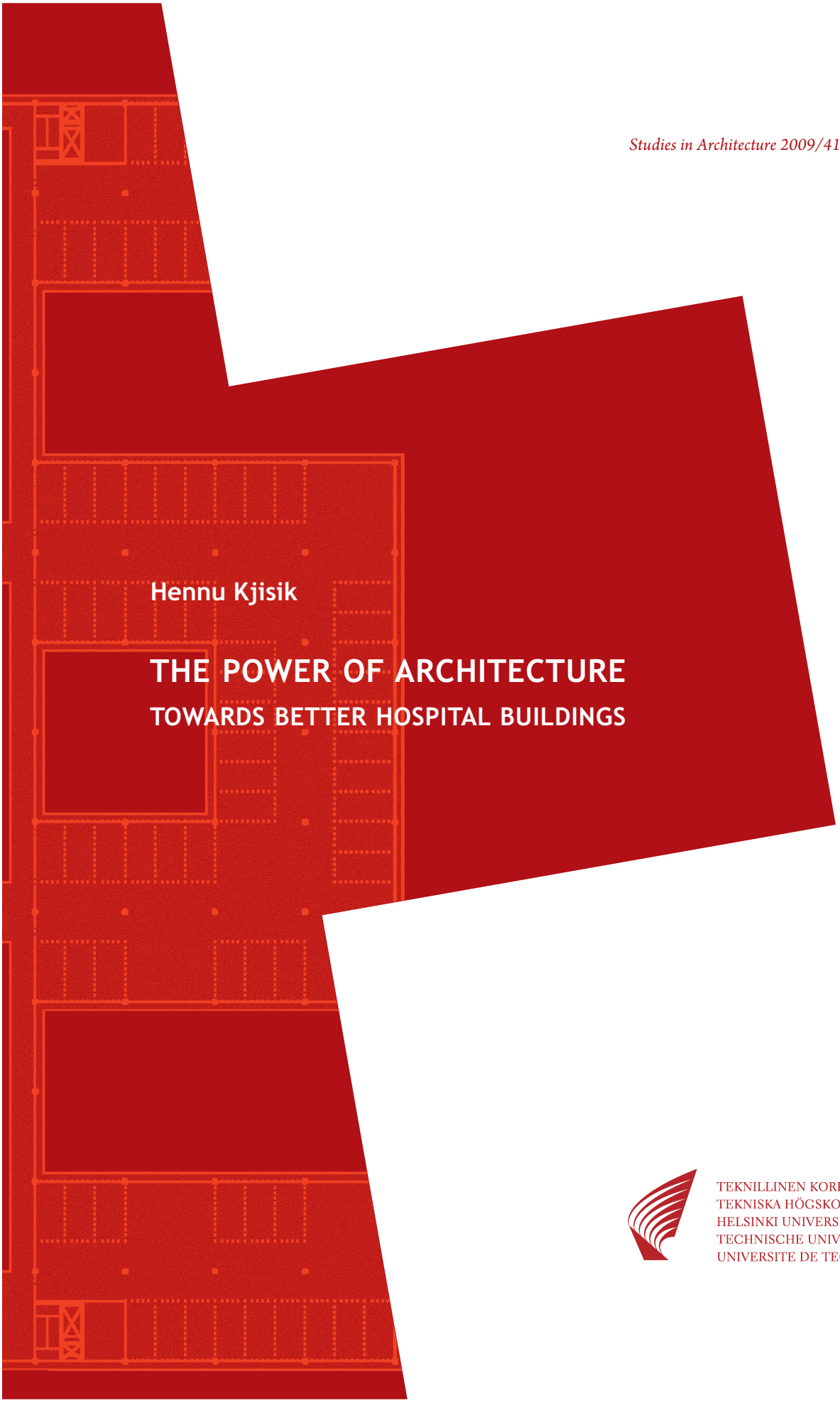
Studies in Architecture 2009/41 Public Building Design



Hennu Kjisik

THE POWER OF ARCHITECTURE

TOWARDS BETTER HOSPITAL BUILDINGS

TEKNILLINEN KORKEAKOULU
TEKNISKA HÖGSKOLAN
HELSINKI UNIVERSITY OF TECHNOLOGY
TECHNISCHE UNIVERSITÄT HELSINKI
UNIVERSITE DE TECHNOLOGIE D'HELSINKI

Hennu Kjisik

THE POWER OF ARCHITECTURE
TOWARDS BETTER HOSPITAL BUILDINGS

DISSERTATION FOR THE DEGREE OF DOCTOR OF SCIENCE IN TECHNOLOGY

to be presented with due permission of the Faculty of Engineering and Architecture, Helsinki University of Technology, for public examination and debate in Auditorium E at Helsinki University of Technology (Espoo, Finland) on the 9th of October, 2009, at 12 noon.

Studies in Architecture 2009/41 Public Building Design

Helsinki University of Technology, Department of Architecture

Distribution:
Helsinki University of Technology
Department of Architecture
P.O. Box 1300
FIN–02015 TKK
tel. +358–(0)9–452 4418
E-mail: a-kirjasto@hut.fi

Graphic design: Helena Sandman

Translations to English of citations in French, German, Finnish, Swedish, and Italian, are all by the author.

ISBN 978–952–248–033–0 (print)
ISBN 978–952–248–034–7 (pdf)
ISSN 1797–3511(print)
ISSN 1797–8343 (pdf)

Helsinki University Print 2009

My senses were oddly acute that time. I wasn't always able to open my eyes to the room's fluorescent glare, but when I could, I saw its contents with remarkable clarity. Every sound on the ward vibrated through me; my nerves were as resonant as a tuning fork. The smell of antiseptic, urine, and hospital food was often so pungent that I hid my nose in the pillow. But at the same time, my body was impossibly heavy; even lifting an arm required a huge effort. It was a curious state. I felt like a turtle hundreds of years old, its soft inner body encased in a stone shell. It was never clear to me if what I saw, heard, smelled, and felt was distorted or if I was merely hypersensitive. At any rate, things were not the same.

Siri Hustvedt, 1995

That's what happens to you when you land in hospital. They take off your clothes, put you in one of those humiliating gowns, and suddenly you stop being yourself. You become the person who inhabits your body, and what you are now is the sum total of that body's failures. To be diminished in such a way is to lose all right to privacy. When the doctors and nurses come in and ask you questions, you have to answer them, and only a person who didn't want to live would give them false answers.

Paul Auster, 2005

ABSTRACT

The physical qualities of a hospital building can in the best case indicate a high level of development and humanity in a given society. The academic purpose of this doctoral dissertation is to articulate the accumulated knowledge and dynamics of these qualities as well as other know-how deemed relevant to the primary quest of improving the current state of our hospitals. Its pragmatic purpose is to facilitate analysis and to assist in the development of conceptual tools meant to improve the design processes and practices, thereby creating conditions more conducive to high quality architecture.

The widely held view is that recent hospital buildings have not responded to modern demands in a satisfactory manner. The hypothesis is made that this view is well-founded, and that the main reason for it is that the architectural quality of the vast majority of these hospitals has not reached the level that should be expected of major public buildings. This study claims, and attempts to show, that the underlying reasons for this lack of quality are the shortcomings in the actual design process and in the way design services are procured, as well as in an excessive emphasis on specialisation.

A historic overview is presented in which the recurring themes of the study are highlighted. Four historic periods are taken up in more detail. These eras are seen by the author to be particularly relevant when creating strategies aimed at producing better buildings for health care. The examples from these past eras are analysed through drawings, old and new photographic material, site visits and discussions with present users.

The study claims that only through combining lessons learnt from the past with a thorough knowledge and insight into the topical discourse can administrators, medical professionals and other user-clients, but above all architects, achieve the design quality that should be expected of our future health care facilities. The present discourse and trends have been examined through research projects and case studies, as well as discussions with major international authorities.

Recommendations are made on how improvements could be achieved. Present best practices are referred to, while some topics prominent in the present discourse are critically analysed. The study concludes with a conceptual physical synthesis that consists of the presentation of two successful entries for major international architectural design competitions for health care facilities of the future. In the latter case the task was to design a city, a health care system for that city, as well as conceptual designs for the buildings serving that system. These competition entries were based on the knowledge accumulated during the process of writing this dissertation as well as experience from previous and concurrent professional practice. They provide models where lessons learnt are combined with the latest ideas on creating health care facilities that could actually become attractive places to use and visit, and would display an architectural quality of the highest order.

TIIVISTELMÄ (abstract in Finnish)

Sairaalarakennuksen fyysiset ominaisuudet ovat usein indikaattoreita jotka voimakkaasti peilaavat ympäröivän yhteiskunnan elämänlaatua ja inhimillistä kehitystä. Tämän väitöskirjan akateemisena tarkoituksena on kartoittaa näistä ominaisuuksista ja niihin liittyvistä laatutekijöistä kerääntynyttä tietoa ja tämän sekä muun relevantin tiedon välistä dynamiikkaa tavalla joka edesauttaisi sairaaloittemme tilan kohentumista. Väitöskirjan pragmaattinen pyrkimys on edesauttaa sellaisten konseptuaalisten työkalujen luomisessa jotka voisivat parantaa suunnitteluun liittyviä prosesseja ja menettelytapoja suuntaan jossa korkealuokkainen arkkitehtuuri nousisi entistä merkittävämmäksi tavoitteeksi.

Yleinen käsitys on että sairaalarakennukset, viime vuosikymmenien aikana, eivät yleensä ole vastanneet aikansa vaatimuksiin ja tarpeisiin tyydyttävällä tavalla. Hypoteesina työssä on ollut että tämä käsitys on oikea, ja että pääasiallinen syy siihen on sairaalarakennusten arkkitehtoninen laatu, joka lähes aina on jäänyt sellaisen tason alle jota on syytä edellyttää merkittävältä julkiselta rakennukselta. Tässä väitetään että tämä on lähinnä johtunut hankinta- ja suunnitteluprosesseihin liittyvistä puutteista sekä liiallisesta erikoistumisen korostamisesta.

Väitöskirjassa esitetään historiallinen analyysi jossa työssä yhä uudelleen esiintyvää tematiikkaa ja sen merkityksiä korostetaan. Suunnitteluprosessin kannalta relevantit seikat on määritelty ja lopputuloksissa on arvioitu uudelleen tämän hetken näkökulmasta. Neljää historiallista vaihetta tutkitaan perusteellisemmin koska, niistä ammennettavissa oleva tieto ja kokemus muodostavat erityisen merkittävän pohjan tulevaisuuden entistä parempia sairaalarakennuksia suunniteltaessa. Materiaalia on tutkittu piirustusten, vanhojen ja uusien valokuvien sekä henkilökohtaisien käyntien kautta kuten myös keskusteluissa nykyisten käyttäjien kanssa.

Sairaaloiden johdon, lääketieteen ammattilaisten ja muiden käyttäjäryhmien sekä ennen kaikkea arkkitehtien ja muiden suunnittelijoiden on kyettävä yhdistämään historiasta ammennettuja opetuksia nykypäivän ajankohtaisen diskurssin täydelliseen hallintaan. Vain näin voidaan taata se taso jota voimme vaatia tulevilta terveydenhuoltoa palvelevilta rakennuksiltamme. Ajankohtainen diskurssi, olemassa oleva kirjallisuus, viimeaikaiset parhaat käytännöt sekä arkkitehtonisesti korkeatasoisimmat uudet projektit, otetaan eläväksi osaksi suunnitteluproblematiikkaa ja - prosessia samalla kuin osia ajankohtaisesta diskurssista analysoidaan kriittisesti. Väitöskirja päättyy konseptuaalisiin synteeseihin joita on menestyksellisesti testattu ja jotka koostuvat kahteen merkittävään kansainväliseen arkkitehtuurikilpailuun tehdyistä palkituista ehdotuksista. Ehdotukset perustuivat siihen tietoon ja kokemukseen joka oli kerääntynyt tämän väitöskirjan tekemisen aikana sekä jo aikaisemmasta ammatinharjoittamiseen liittyvästä toiminnasta. Niissä on luotu malleja joissa historian parhaista esimerkeistä kootut opit on yhdistetty ajankohtaisten eettisten ja esteettisten, kuten myös hallinnollisten ja organisatoristen trendien asettamiin vaatimuksiin tavalla joka edistää pyrkimystä tehdä sairaaloista paikkoja joissa on miellyttävää viettää aikaa ja jotka edustavat korkeinta mahdollista arkkitehtonista laatua.

ACKNOWLEDGEMENTS

This book was made possible by two research institutes at Helsinki University of Technology. The HEMA (Healthcare Engineering, Management, and Architecture) Institute and the SOTERA Institute at the Department of Architecture, were the "homes" of my research activities during the first couple of years of writing. The TePro (Healthcare Processes and Logistics) project funded by TEKES (The Finnish Funding Agency for Technology and Innovation) and two EU-funded Interreg-projects all dealt with the theme "Future Hospital". I thank all the relevant organisations for supporting me which has greatly facilitated my attendance at numerous workshops, seminars and conferences and visits to many of the most interesting new hospitals in Europe, as well as giving me the chance to meet a large number of leading experts from different countries. All these people, too numerous to mention here, deserve my sincerest thanks for their inspiring collaboration and many of them have also become good friends.

At the Department of Architecture, I have to especially thank my supervisor Markku Komonen, Professor of Public Building Design, who has been supportive and inspirational. He has, from the beginning, been very comfortable with the title of this book because he, if anyone, believes in the "Power of Architecture". The one person without whom this work would never have come to fruition is my instructor, Professor Erkki Vauramo, whose powers of persuasion were of vital importance in getting me started on this endeavour. I am eternally grateful to him for having rekindled my interest in hospital design, for having continuously encouraged me, and for sharing his immense expertise. Professors Tuomo Siitonen and Hannu Huttunen have, as directors of SOTERA Institute, played an important role in the proceedings. Professor Aino Niskanen has been extremely helpful all through the process and her wisdom is highly valued. Professor Kimmo Lapintie has provided contributions for which I am very grateful. Key figures at the Institutes referred to above, such as Vesa Kämäräinen, Satu Åkerblom, and Antti Autio, deserve my thanks and warmest appreciation.

Undoubtedly, during the process, my other work has at times suffered. I would thus like to thank my partner, Professor Trevor Harris, and everyone else at the Harris-Kjisik office for their support, patience and understanding. Similarly, Veikko Vasko, Humphrey Kalanje, and Auli Puhakka, my co-teachers at the City in Crisis Studio, deserve my apologies and gratitude for putting up with my frequent absences.

During these last few years I have been fortunate to be involved as a jury member in several design competitions involving buildings for cure and care. This activity has proved extremely useful and given the present work added impetus. For this I am grateful to the City of Espoo, Paul Stradins University Hospital in Riga, the municipalities of Riga and Oulu, as well as SAFA, the Finnish Association of Architects.

The success of the competition entries that form the physical synthesis of this study shows that I have had some excellent collaborators. I am indebted to all those mentioned on the list of authors and assistants of "Cure for Sure" and "Fair care – Care Fair". Two names that have already been mentioned do, however, deserve to be taken up again. Erkki Vauramo's experience, insight, and ability to look at the future without prejudice, proved invaluable, as

did the skill and architectural flair of Trevor Harris, to whom my professional work in general is immensely indebted. An especially important contribution to the winning competition entry of 2007 was made by Marta de Abreu-Hartman, a central member of our office team.

I would like to extend my thanks to the pre-examiners, Professor Ton Venhoeven, Dr Gintaras Stauskis and Dr Martti Teikari for their valuable comments. Helena Sandman's role as the person responsible for the visual appearance of this book cannot be emphasised enough. Otso Helenius and Ulla Kalliomäki have given me invaluable help in various practical matters. The role of my wife Felicity Kjisik as proof-reader and linguistic consultant, who managed the difficult task of keeping my language sufficiently succinct, concise, and economical, has been crucial. She has also been encouraging, patient and understanding throughout.

Lastly, I would like to single out four people whose contributions have perhaps been less tangible but of absolutely crucial importance: Reijo Lahtinen, who first made me aware of the dangers of specialisation in architecture; Jan de Bosch Kemper, from whom I have learnt so much about humanity, both in Africa and elsewhere; my old friend from undergraduate days, Phil Gusack, who like myself came back to healthcare design at a mature age and with whom I have had a series of inspirational conversations on the subject; and finally, Professor Dimitrios Sotiriou, the father of the Modern Asclepieion. Had I not heard of his ideas and met him personally several times, the dramaturgy of this book would have been very different.

CONTENTS

INTRODUCTION

Hospitals are built catastrophes, anonymous institutional complexes run by vast bureaucracies and totally unfit for the purpose they have been designed for. Cor Wagenaar, 2005

About the buildings, old and new

As buildings, hospitals are not, and probably never have been, as remarkably unique and overwhelmingly complex as people involved in the planning and design of them would like us to believe. Only a very small proportion of an average hospital consists of spaces which require truly specialised, fixed and inflexible design solutions. The vast majority of the volume consists of a series of interconnected, more or less open or closed envelopes, just like any other man-made shelter built for whatever purpose. This not only applies to areas used for administration, assembly, waiting, education, recreation etc., but also to parts of the hospital where the focus is on the sick patient, i.e. wards, consultation and treatment areas and even spaces where complex and demanding procedures are performed. Economic realities and the unpredictability of the fast-changing world have led to an ever-increasing demand for more universal, flexible, adaptable, agile and subsequently more sustainable spatial solutions. New designers are called for to tackle the tasks facing us, designers who lack the ballast of narrow expertise and wave the banner of good architecture rather than specialisation.

Nevertheless, the hospital is a facility where paradoxes reign. It should be smaller in order to be more humane and larger in order to make more economic sense. It should be more open to the surrounding community but at the same time more secure. It should be more open in its internal layouts while providing better control against the spread of infections. It should cure patients in an efficient high-tech environment and care for them in surroundings that promote the healing process.

Just as there are no completed cities, there are no completed hospitals. Parts of hospitals are out of date before the building is taken into use. These facts have formed part of the discourse for at least the last four decades, but little has changed. Improvements have, however, occurred concerning the negative effects of the overblown plethora of strict programming norms, regulations and control procedures which, until recently, covered everything apart from the most important aspect, architectural quality.

The majority of the hospital building stock that we possess today is based on a historical model, prevalent during a particular era. Most of this building stock, particularly in the Nordic countries, is no more than about forty years old. Thus these buildings are not old, so giving them a new lease of life should by all accounts make perfect economic sense. Looking at the refurbishment needs and potentials of these buildings, one can see that some archetypes are inherently more flexible and adaptable than others. Some of the less adaptable ones were unfortunately predominant at the time when the bulk of these large complexes were realised. The strict external controls prevailing in many countries, that limited the choices available to designers and users alike, together with insufficient or non-existent forward-looking master planning, led to the situation we have today: a huge collection of large, fairly sound buildings that, if not obsolete already, will become so in the near future.

The non-clinical content of a hospital is, however, on the increase. Buildings now deemed unsuitable for certain clinical functions could in most cases be used for research, teaching, communications and social services. Since a hospital facility possesses strong symbolic values, it is difficult to simply declare the building obsolete and erase it from the map. Hospitals have always been physical expressions of the attitudes towards health and sickness, as well as of the scientific and social trends prevalent during any particular era. Having a deeper understanding of this would help us in the re-use of the old hospitals, important urban symbols as they are, and they could again be taken into relevant and respectful use.

The first wave of conversions and extensions of the early 20th century hospitals, often placed just outside the city core, began already in the years immediately following World War Two. Recently these processes have been accelerating, with the campuses and their buildings presenting a multitude of issues ranging from faulty logistics to demands for conservation. Even hospitals built soon after World War Two, and which are now approaching obsolescence, have been declared urban landmarks. Conservation of the built heritage has become an additional burden for hospital administrators and others concerned. At the same time the discussion goes on about improving the relationship between the hospital and the city, the role of health care facilities as an active part of the urban fabric. Architecture, urbanism and heritage are now truly in the forefront of the international discourse on hospitals.

About evaluation and research

Roughly speaking, there are two ways of evaluating buildings. The first is traditional architectural criticism, a field that has been largely monopolised by the architects themselves and based on trends, fashions and subjective opinions which have, however, usually undergone a kind of self-censorship and a somewhat intuitive "peer review". Very few architectural critics, at least in recent history, have had the power, courage or motivation to manipulate matters so that the consensus among the profession has been dramatically altered. The commonly held belief, particularly among non-architects, that this genre of criticism is always based on purely aesthetic issues is largely false. If one is at all inclined to second Louis Sullivan's manifesto "form follows function" (actually an age old truth practiced by vernacular builders in all cultures), one instinctively takes heed of functional considerations as part of the aesthetic experience. The Venice Architecture Biennale of 2000 had as its motto "Less Aesthetics More Ethics". The emphasis on ethics, the prevalence of social consciousness among architects at any given time in history, has also, at least intermittently, been an important part of the "norm" and thus also of the aesthetic content. The period of the tuberculosis sanatoria and the aesthetically, functionally, technically, and socially innovative buildings it produced, is a pertinent example of such an era.

Post-occupancy evaluation, the supposedly less subjective approach, is primarily based on interviews and the use of questionnaires since that is often the only way to decipher how people react to the buildings they live or work in. There are many books written about relevant methodologies. The "experts'

walkthrough" is often seen as being as valid and pertinent a post-occupancy evaluation method as any other, particularly in hospital buildings. The method is based on a small group of experts of different fields (preferably including an able architectural critic) walking through the facility, having spontaneous conversations with the users, and drawing their own conclusions.

Much of the research on hospital buildings currently carried out in different countries continues to be dominated by questionnaires and interviews. Recently the field has become saturated with research based on comparisons between clinical outcomes and the physical environment. The outcomes of some of these studies are undoubtedly useful but many others are either unconvincing or too glaringly obvious. The priorities often appear ill-conceived, full of cultural ethnocentricity and concentrating on secondary matters rather than the quality of the architecture and the relationship between the buildings and their immediate surroundings.

About this study

A historical resumé of the development of hospitals is given in the first part of this study. Important phases as well as individual buildings are highlighted including several that no longer necessarily carry a particular significance for the future but still form an important link in the totality. The examples that have been included should also not be seen as the "best" hospitals in history, but rather as examples that have played a significant role in the historical continuum. Those global 21st century megatrends that are likely to have an effect on the organisation of health care and subsequently on the physical facilities are analysed, as are those medical developments that may change the face of cure and care. General architectural trends and their capacity to react to these projected changes are also discussed.

In the second part of the study new health service concepts and organisational models that dominate the current discourse are reviewed and their effect on the facilities analysed. A critical look is also taken on the present trends in the research into health care facilities, with particular emphasis on evidence-based design and "healing environment" ideologies.

Beneficial assets and experiences are discussed in the third part. Adaptability and flexibility, aspects which are becoming an essential part of health care design for the future, are introduced under the term "future-proofing". The notion of a wall-less hospital is brought up as well as two related concepts stemming from the 1950s, "mat building" and "open building". This part also includes a discussion on urban metaphors, the relationships between the city and the hospital.

The fourth part of the study, "The way forward", forms a synthesis of the ideas and findings presented earlier. The events and developments that led to the decline of the architectural standards during the last decades of the 20th century, which form the complex legacy that now has to be confronted, are discussed. Improved programming and design processes, the necessity for long-term master planning as well as more recent concepts such as process-based design, are covered under the heading "Improving the design process". The chapter "Other essential remedies", proposes ways to raise the status of hospital design in order to motivate the most skilful and talented members of the architectural profession, and proposes ways to achieve this. A case against inflated specialisation is presented together with a case for the demystification of hospital design. The chapter also presents recent hospital projects that seem to relay signals of an improved climate in the world of hospital design. These examples, from different parts of Europe, all contain features that illustrate some of the points made earlier in this study and form part of the inspiration base for the conceptual and physical synthesis presented in the final part of the study. This synthesis is based on lessons learnt during the preparation of this work and culminates in extracts from two successful open international competition entries prepared in 2004 and 2007. The titles of these competitions were, correspondingly: "Future Hospital – Competitive and Healing" and "Healthcare 2025 – Building(s) for the Future".

The whole study aims at providing an analysis of those aspects and issues that are seen as particularly pertinent for the improvement of our present and future stock of hospital campuses and individual buildings. It argues that a combination of deep knowledge of both the past (historical archetypes and other precedents) and the present (current discourse on trends, new concepts and approaches) is required to achieve successful and real innovation. It attempts to show that some past hospital types, already deemed to extinction, are again relevant, due to a growing diversity and a continuous flux in organisational models, both in existing hospitals and those still on the drawing board.

The study calls for a total overhaul of the internal spatial planning of hospitals, for traditional schedules of accommodation to be replaced by space requirements based on processes rather than individuals or events. It aims at showing that a future-proof approach is necessary to ensure that the next generation does not have to confront the same problems that we face today. Future-proofing should encompass all actions that improve flexibility, agility and elasticity of the built environment. This applies to new buildings as well as refurbishments of old, the latter a task that will in the near future require most of our attention. Master planning is also an important part of future-proofing. The lack of long-term planning, combined with exaggerated specificity and lack of flexibility, has been one of the main reasons for the problematic state of our facilities. Future-proofing also equates with sustainability, which in turn should not be evaluated only from an environmental point of view; socio-cultural and economic sustainability are equally important.

Tailor-made, over-specific solutions ("for me, today") are by definition future-ready, not future-proof, and thus unsustainable. Hospitals in the 21st century will have fewer doors and walls than their predecessors. Room sizes will largely be standardised. The whole

concept of a "room" will be questioned. Very few "rooms", if any, will be named after a position (eg. "chief surgeon") or a piece of equipment. There will be a clearer separation between activities related to cure on one hand and care on the other. The latter will increasingly take place outside hospitals.

The importance of the relationship between the city and hospital is taken up as an important theme in the quest to increase the "normality" factor in both cure and care. The importance of the hospital as an urban landmark will be resurrected, no longer by means of size and exclusion, but through harmonisation and inclusion.

The study also aims at showing what is truly important in hospital design and calls for serious rethinking of the emphasis and priorities of the current research trends. It is essential that these trends be reversed towards the fundamentals of architectural design. The decisive questions will be the relationship between the facility and its surroundings as well as future-proofing strategies and questions of scale, rather than aspects which are essentially cosmetic.

Hospitals, like universities, schools and concert halls, are public buildings, and it is essential that we do our utmost to improve the quality of their architecture. This can be done through increasing the number of open architectural competitions in the field and by improved publicity and visibility in the media at large, including the professional journals. For this to happen we need better buildings, because that is the way the media works. Only through raising its status will the field reach the kind of prestige level it deserves in order to attract the most talented young members of the profession to tackle the demanding tasks that lie ahead. The dominant themes in the present discourse (openness, adaptability, life cycles, ecology etc.) are so well in line with the ongoing general architectural trends that this should not be an impossible task. There are indications that the architectural profession, certainly its younger generation, is already prepared to respond to these challenges. There is also, among the different strata of users and other actors within the health care network, a growing awareness of the need to radically rethink their attitude towards their working environment.

The presumption here is that, even in this era of *laissez-faire* capitalism, the fundamental principles behind the Welfare State will prevail. How future welfare systems will be maintained, remains to be seen. In any case, financing structures have historically had relatively little effect on the physical facilities and the way that they are conceived and realised. During the Cold War decades it could be seen that whatever method the state used to acquire the necessary means for building the best possible hospitals, the outcome was very much the same. The fact that market forces are now playing a stronger role in health care may help de-institutionalise procurement procedures and design processes which in turn may contribute towards an improvement in levels of architectural ambition. So far there is little sign of this, in fact the British Private Finance Initiative programme, the largest input of the private sector into health care buildings in modern day Europe, is taken up in this study because of the discouraging quality of the buildings it has produced so far.

Finally some words of clarification. The word "hospital" here refers to general hospitals, central, regional, larger local and teaching hospitals. It does not cover mental hospitals, nursing homes, hospices, smaller specialist hospitals, health centres or clinics. This study deals primarily with the "industrialised" countries of Europe and North-America, hospitals in the developing world are not discussed. Reference is made, when appropriate, to exceptions, if it is felt that relevant lessons can be learnt from them. Consequently, if this study claims that relatively few hospitals based entirely on standardised type-plans have been realised, this statement does not cover health care projects consisting of the construction of identical facilities financed by the World Bank or other donors in, say, Bangladesh, Sudan or Nicaragua.

These texts thus only deal with privileged people and communities who have a choice or where at least the vast majority of the population has a choice. Choice, in this context, does not refer to being able to choose between public and private healthcare providers, but a choice of whether to turn to organised health care at all when the need arises. Such a choice is not available for the majority of the world's population of which far too many die, not because they have no access to a hospital, but because they are too poor to stay alive.

PART I. THE BACKGROUND

Chapter 1. The relevance of historical archetypes

The challenge for all of us is to look back at history but envision the path ahead. There seems to be no question that our future depends on this vision.
Robin Guenther and Gail Vittori, 2008

One of the primary messages of this study is learning from history. Past mistakes are repeated far too often while there appears to be a lack of awareness of past successes among those involved in hospital planning and design. Benchmarking and best practices are terms that are now used on a daily basis but the relevant historical perspective is sadly absent from the discourse. There is a plethora of innovation, creativity and pure common sense that can be derived from the history of hospital architecture, reinterpreted to comply with the requirements of the future and be presented as true best practices to learn from.

This chapter attempts to give an overview of the important milestones in hospital design from the viewpoint of an architect and town planner. Its function is to introduce some of the main recurring themes of this study through historical precedents while trying to draw parallels between past examples and events and the present discourse.

Many ways of dividing the history of hospital design into different eras have been presented in the literature over the years. The classification used here is inspired by the one used in Verderber & Fine's recent book "Healthcare Architecture in an Era of Radical Transformation" but manipulates it to better comply with the aims and priorities of this study:

1. The Greek Asclepieions
2. The Medieval
3. The Renaissance and the Urban Palaces
4. The Nightingale Era and the advent of the Modern Movement
5. The Era of the Sanatoria
6. The first decades of the Megahospital
7. The Heroic Era
8. Counter reaction and Post-Modernism

The Greek Asclepieions

Health is the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Constitution of the WHO (World Health Organisation), Geneva, 1946

The post-modern era has re-focused our attention on the importance of our individual (personal) and our collective (societal) histories. It has also led to the appreciation of the requirement for a combined (holistic) approach to the fulfillment of human needs.
Dimitrios Sotiriou, 2007

And beyond the walls themselves, Greek cities identified a territory as being under the tutelary protection of appropriate divinities, delimiting a zone or chora auspicious for human life.
Alberto Perez Gomez, 2006

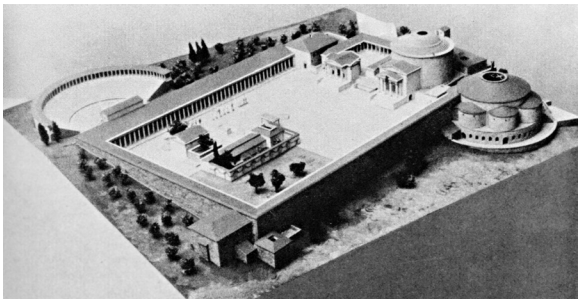
The creation of a myth in the 5th century B.C. that declared allegiance to the god Asclepios led to a new "health and culture movement" which provided a holistic view of man in the context of his total environment. Asclepios was described as the offspring of the god Apollo and the mortal Koronis.

In this way, the necessary divine power for healing and the appropriate human empathy were combined (Sotiriou, 2006). The movement reached its pinnacle in the 4th century B.C. and lasted well into the first centuries of Christianity. Cures were based on the psychological strengthening of the patient's faith in the healing capabilities of Asclepios, and on the application of pharmaceutical treatments practiced at the time. The pursuit of a healthy way of living and the holistic approach which included participation in artistic endeavours and physical exercise formed an important part of the care and the cure.

The Asclepieions present us with a dilemma. After all, therapies were based on priests interpreting patients' dreams and turning them into a curative regimen. But the Asclepieions nevertheless contained many features that could justify calling them hospitals. They were undeniably places for inpatient treatment and the inclusion of different types of therapeutic bathing facilities, as well as the emphasis on exercise, make them forerunners of modern rehabilitation hospitals. The halls for "dreamer-patients" can be seen to have influenced the layout of large medieval wards (Thompson and Golding, 1975). Also, the way these halls were completely closed on three sides and opened up only towards the south may have influenced the designers of the sanatoria of the 20th century (Fig. 1).

An important contribution of the Asclepieions is their holistic view of the human being's endeavours and surroundings. Considering the limited medical knowledge of the time, they provided as therapeutic an environment as could be wished for. Recent research now claims that, in terms of positive distraction, the performing arts have a better effect

Fig. 1



on patients than visual arts (Scher & Senior, 1999). In the Asclapieions this entailed patients taking part in interactive activities, which may have involved relatives, friends, artists in residence and staff. In the Asclepieions art was omnipresent in all its forms because it formed part of the holistic ethos that was used to promote well-being. In fact it was customary for patients to express their gratitude to the institution through the donation of a piece of art. From the point of view of "cure", the Asclepieia probably left a lot to be desired but the evidence shows that the "care" was of a very high level.

The therapeutic effects of cure and care environments have formed a conspicuous part of the discourse concerning contemporary and future hospitals in recent years. The Asclepieion should here be seen as an important precedent. Therapeutic elements were not merely cosmetic but an integral part of the holistic approach. In Greece, efforts are now under way to revive these ideas. The proponents are planning to establish Asclepieion Parks which promote health and culture in an integral and harmonious way through creating "open spaces" within urban environments where various activities that are helpful in achieving both individual and societal aspirations can be brought together (Sotiriou and Boddy, 2006).

Asclepieions existed in ancient Greece for more than eight centuries. At their peak there were over 300 of these healing centres. They provided sequences of internal and external spaces in beautiful natural settings forming classical Greek urban configurations. They made use of all medical knowledge and the tried and tested healing methods that were available at the time. Experimental therapeutic methods were also used and psychosomatic influences were recognised. Water played a major part in the treatment and also as a soothing natural element contributing to the creation of ideal psychological conditions. Many of the physiotherapeutic methods that were used, such as water and mud baths, massage, the use of medical herbs and the application of ointments, are still applicable today (Akurgal, 1985). Healing was seen as a product of harmonious collaboration between nature and man.

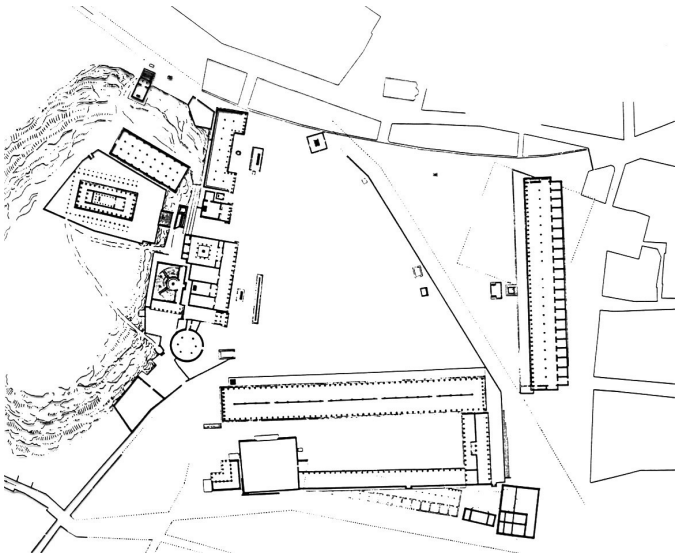


Fig. 2

Facilities for cultural activities and sports usually formed part of the ensemble. Ancient societies placed great emphasis on physical fitness and the general well-being of the "whole person". Many philosophies viewed man as a "wholeness". The myths and the legends of the time were reinforced by stories about great physical feats and great champions were raised as examples and role models for the population to respect and to emulate (Sotiriou & Boddy, 2006). This is why Asclepieions usually included sports stadia where athletics competitions were organised.

All major cities of the ancient world had an Asclepieion. The one in Athens was situated on the slope below the Parthenon (Fig. 2). The Asclepieions had asymmetrical and fragmented plans, the individual buildings usually being shallow-framed and generic in character. Some of the buildings were used for medical assistance and for specific treatments. They could be seen as the equivalents of today's clinics. "Hospitality" or guest houses were provided for the use of itinerant pilgrims, a tradition that was continued with the monastic houses and retreats in medieval times and is still maintained, particularly in Greece. Patients and visitors worshipped in the temples of Asclepios and in other surrounding sacred premises (Pevsner, 1976). There were installations of holy water which were used for ritual cleansing as well as for bathing. Musical and theatrical performances, which were considered a particularly valuable part of the healing process, were held in honour of Asclepios and staged in the theatres that formed an important part of the urban composition. At the Asclepieion at Pergamon the theatre had a capacity of 3 500 spectators.

The Asclepieion at Pergamon, together with those at Epidauros and Kos, was one of the most important therapeutic centres in antiquity. Excavations have shown that it had existed since the fourth century B.C., but experienced its most glorious period in the second century A.D. while Pergamon was a Roman city. The Asclepieion, that lay about 800m from the city, was approached along a monumental colonnaded street. The central open space of the Asclepieion was 130m long and 110m wide (approximately the equivalent of two football pitches), with various buildings on the eastern sides and colonnaded stoas on the other three sides. Within the central space there were buildings and structures including mud-baths and various other pools as well as sleeping-rooms specially used for incubation and auto-suggestion which were the two most important forms of psychiatric treatment. The northern stoa was connected to the entrance of the huge theatre and used, as the other stoas, for certain therapies and rites, meetings and gatherings. The buildings on the eastern side were concerned with religious worship and medical treatment and included the temple of Asclepios, the library and the actual treatment building, a two-storied cylindrical structure with six semi-circular apses (Fig. 3). The area containing the other temples and the sleeping apartments was connected to the treatment building by an 80m-long tunnel (Akurgal, 1985).

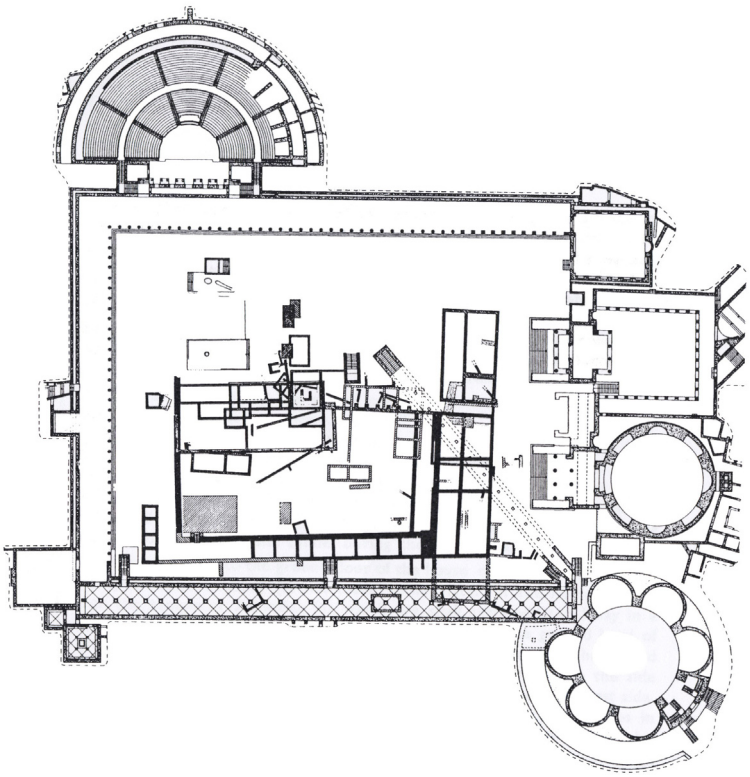


Fig. 3

The Medieval

The main hall in an Asclepieion was usually a "Stoa", a long building with a continuous portico opening in one direction and originally conceived as a shopping arcade. The Asclepieia thus had derived plans, that is, plans that were originally conceived of for other purposes. This was to be the case with hospitals, as with many other building types for centuries to come. The Roman military hospitals were also based on derived plans. Ordinary barracks were converted into nursing use. Derived plans present certain important advantages that are now topical since generality, as part of the future-proofing discourse, is gradually becoming a desirable attribute in hospital design. The plan of Vindonissa Roman military hospital (in what is now Windisch in Switzerland) from the first century A.D. (Fig.4) is derived but also shows a remarkable layering of public, semi-public, semi-private and private space. Claims have been made that Vindonissa was the first real hospital, as the term is used today (Thompson & Goldin, 2006).

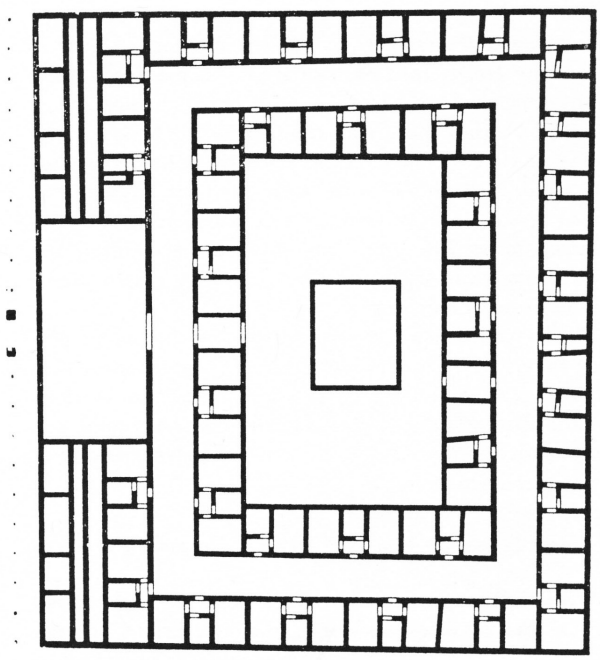


Fig. 4

During the Middle Ages, when Europeans looked upon illness as a condition caused by supernatural forces and thus cured only by actions steeped in religion, other cultures had for centuries also been preoccupied by questions related to health and were quite possibly more advanced in the actual science of medicine. It fortunately falls beyond the scope of this study to show which cultural superpower actually invented the product which can truly be called a hospital. However, it is interesting to note that Byzantium, in the 7th century A.D., can lay some claims to this achievement (Miller, 1997) while the Muslim world frequently claims that the first hospital, in the modern sense of the word, was the one established by Harun-al-Rashid in Baghdad in the beginning of the 9th century A.D. Similar claims can undoubtedly be made in favour of Persia, India, Sri Lanka, China and Syria (The Hospice of Turmanin, A.D. 475). It is, however, known that soldiers taking part in the Crusades (11th – 13th centuries) were impressed by Islamic hospitals, which were specially designed and not generic like their "Western" counterparts. They were "functional, hygienic, generally small rooms grouped around a central space with a fountain" (Guez, 1970, p. 6).

The first hospitals in Europe were guesthouses for pilgrims and places where the most disadvantaged

could get shelter. Responsibilities for the care of the disadvantaged were often taken over by traditional religious orders and monasteries and care was given in the premises that these orders inhabited. Health care services for those able to pay were meanwhile mostly provided in homes. The first hospitals thus served a social mission in society by sheltering the weak members of local communities. They did in fact perform a multitude of functions as names such as hospital, almshouse, asylum, orphanage, foundling home, guest-house and poorhouse, bear witness (Pevsner, 1976). There is however no doubt that hospitals during medieval times were mainly associated with death. They were also built to protect those outside rather than to benefit those housed within their confines (James & Tatton-Brown, 1986).

A common plan form used during the late Middle Ages was the cruciform with the nuns' nursing station in the centre (Fig. 5) and an altar at one end, placed in such a way that all the sick could see it. Medical treatment was indeed inadequate and communication with God was seen as more urgent than that with the "professionals". The first cruciform plan was built at Santa Maria Nuova in Florence in 1334, but the new fashion only took off in earnest about one hundred years later when several new cruciform hospitals were built, particularly in Italy. In today's situation, with pressures to minimise numbers of staff on duty, the cruciform with its single nursing station in the middle, presents a pertinent precedent.

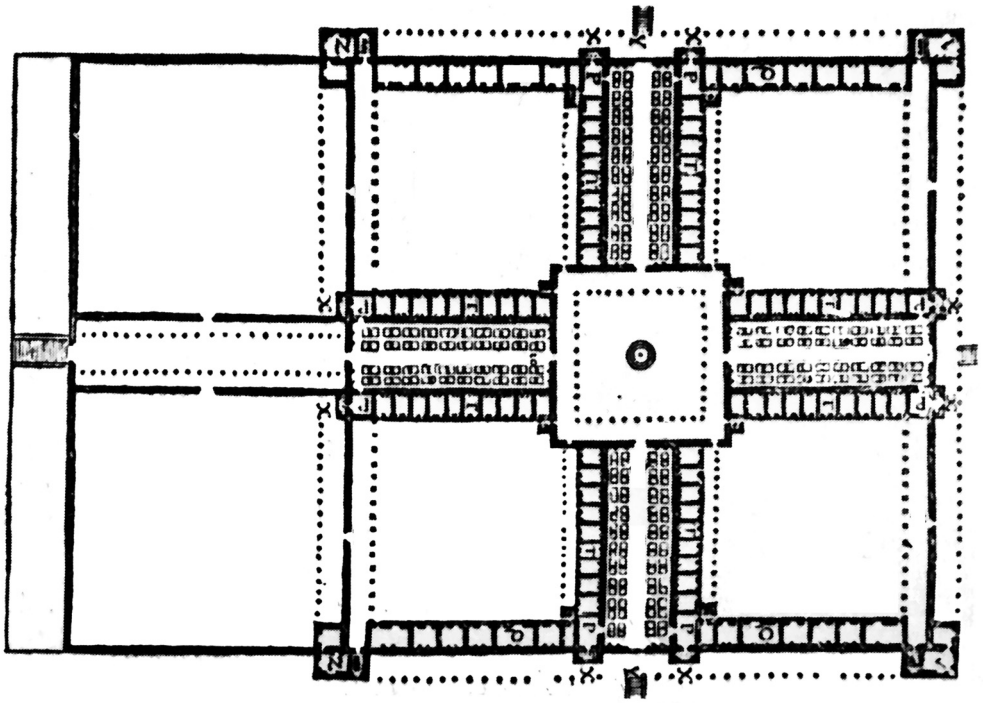


Fig. 5

The best preserved medieval hospitals can be found in France, notably in Angers (late 12th century), Ourscamp (early 13th century) and Tonnerre (late 13th century). Angers and Ourscamp represent the usual high rib-vaulted Gothic-hall type, while Tonnerre (Fig. 6) is covered by a wooden tunnel-vault (Pevsner, 1976). Of all the medieval hospitals that still survive in their original use, the Hôtel-Dieu in Beaune (mid 15th century) is probably the only one so intact that even the original bed covers can still be seen (Figs. 7 & 8).

It is also interesting to note that well known and still existing inner city urban hospitals such as St Bartholomew's in London, Hôtel-Dieu in Paris and Santa Maria Nuova in Florence had all already been founded by the end of the 13th century. The oldest remaining parts of their present building stock are, however, more recent.

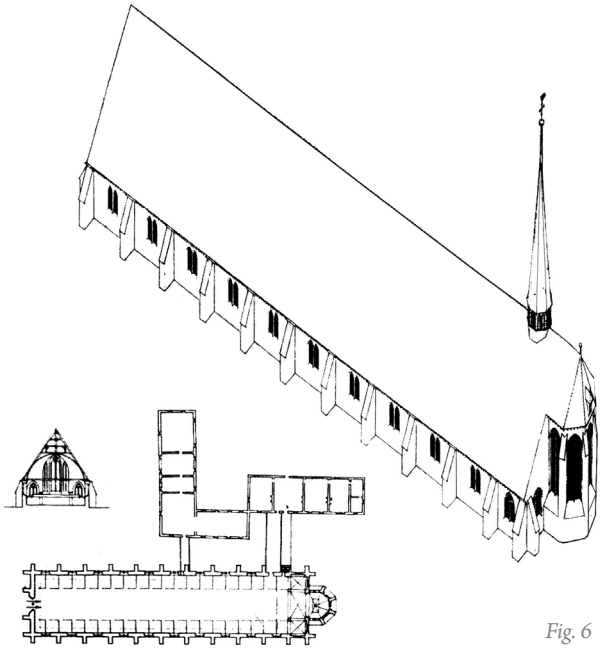


Fig. 6

Fig. 7

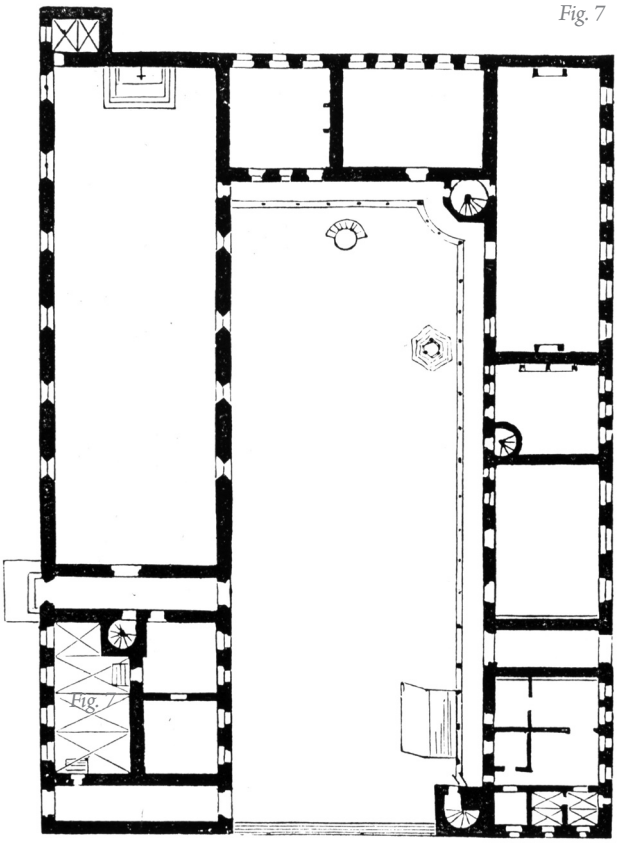


Fig. 8

The Renaissance and the urban palaces

Quadrangles are as old as any of our civilisations, but for hospital architects the iconic image must be Brunelleschi's Ospedale Degli Innocenti (Foundling Hospital). It incorporates a colonnaded single-loaded corridor – a perfect place for a contemplative stroll – which creates the gradient in intimacy between the surrounding building and the central piazzetta.
Phil Gusack, 2006

Architects should not be afraid to look to the past and return to purer, less complicated building lay-outs, taking inspiration from palaces and universities.
Andrew Barnett, 2004

It can safely be said that the first hospital building which has become a lasting architectural masterpiece is Brunelleschi's Ospedale degli Innocenti (finished c. 1445) in Florence. It can still be argued that it was actually a mere orphanage but its name, also in English (Foundling Hospital), carries the key word and, as stated in the previous chapter, the definition

Fig. 9

of a hospital was still, in the early Renaissance period, a fluid one. Brunelleschi's work is also considered the first architectural masterpiece in any category during this epoch. Its arcaded front forms one side of one of the finest squares of that era, Piazza Santissimo Annunziata (Fig. 9).

Another Italian Renaissance leading architect, Filarete, undertook, in 1456, the design of a new, very large hospital in Milan. The typology of the rectangular plan (Fig. 10) is strongly reminiscent of

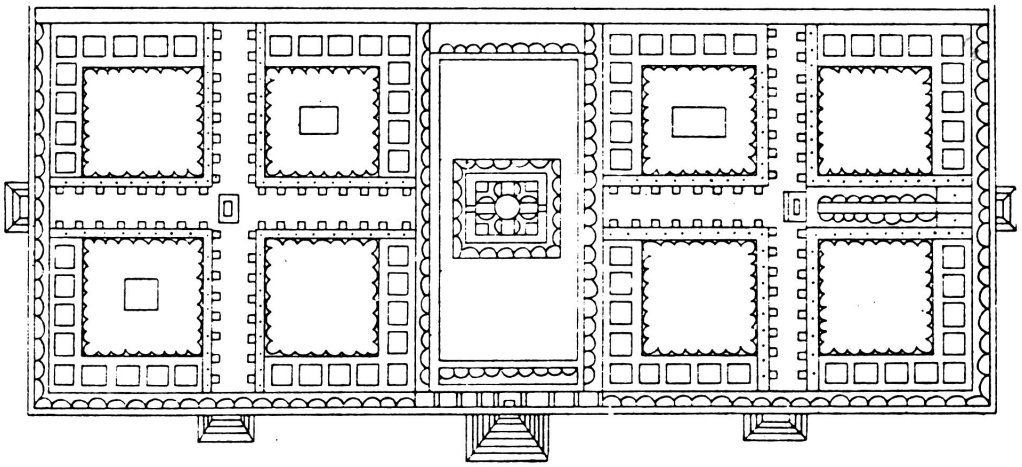


Fig. 10

some of the iconic hospitals designed over 500 years later, in the 1970s. Filarete also included elements that were far ahead of their time, including an early water closet system. Between the beds all along the wards were lavatories with water cisterns above and trapdoors below, flushing into the river. Each bed was provided with a small cupboard, a chest and a flap-table. The original plan for Ospedale Maggiore took centuries to complete and little is left of Filarete's original design, which is nevertheless a fine building and today used for medical teaching and hospital administration (Pevsner, 1976).

According to the book "Hospitals in Changing Europe" hospitals already had a "recognisable medical character" by the 16th century. In spite of this, the same book mentions two quotes from the 1986 edition of the Oxford Dictionary of Quotations concerning hospitals in the 17th century. In 1643 T. Brown said that hospitals were "a place, not to live, but to die in" and in 1682 T. Southerne said that they were refuges for the elderly poor "to rust in peace, or rot in hospitals" (McKee and Healy, 2002, p.15). One might argue that the latter is still, nearly four centuries later, frighteningly true in many places.

Two quotes from over a century later than these English ones, describing two famous hospitals in Paris, are taken up by Pevsner. One by Tenon in 1788 describes the inmates of Salpêtrière: "Old women, old men, raving lunatics, imbeciles, epileptics, paralytics, cripples, the blind and so on" and one by Stieglitz in the 1790s, describes Hôtel-Dieu, "How infinitely cruel is the way they pack four or six unfortunate patients to one bed" (Pevsner, 197, p. 146).

In spite of one of the cornerstones of the Enlightment being *bienfaisance*, the desire to make society more reasonable and humane, the rich still had their servants and were able to command the services of qualified physicians in their homes, whereas the poor were dependant on charity and the kind of institutions that the above quotes describe (Summerson, 1986). In consequence, one can conclude that the large urban European hospitals were, in spite of Filarete's innovations and prevailing philosophical thinking, by the end of the 18th century still suffering from the same shortcomings as their medieval counterparts.

Some other important examples of major hospitals in the centres of large cities should nevertheless be mentioned. La-Pitié-Salpêtrière in Paris was founded in 1656 and designed by Leveau on its present site. At first it dealt with prostitutes and the insane, as well as providing residential care for the poor, and only developed into a tertiary care acute hospital in the 20th century. Its history provides a fascinating example of the growth of a truly urban institution on a site which for centuries has essentially been in the heart of Paris (Fig. 11). The history of St. Bartholomew's Hospital in London is even longer than that of La-Pitié-Salpêtrière. Founded as early as 1123, it was, in 1547, officially named the "House of the Poore in West Smithfield in the suburbs of the City of London of Henry VIII's Foundation". It is the oldest surviving hospital in England and still holds an important role. During its long history some architecturally important buildings have been added to it. The main square was designed by James Gibbs in the 1730s and of the four original blocks three survive, including the block containing the Great Hall and the famous murals by William Hogarth. Gibbs'

ensemble was completed by the East Wing in 1769. St Bartholomew's Hospital has existed on the same site for almost 900 years, surviving both the Great Fire of London and German bombing during the Blitz (Fig. 12).

The stories behind the Hôtel-Dieux in the two largest French cities, Lyons and Paris, are very different. The building of the new Hôtel-Dieu in Lyons was started in the 1740s on the site of an old hospital where Francois Rabelais had been the chief 200 years earlier. The new building took a century to finish but the process was straightforward and unproblematic.

Fig. 11

Fig. 12

Today it is a large, impressive monolithic mass, with a huge dome, a 400m long façade on the river and eight courtyards (Fig. 13) of various size and character. The building was conceived by J-G. Soufflot, known primarily as the designer of the Panthéon in Paris.

Soufflot was also involved in a major debate raging in France in the 1770s. The publication of the book *L'homme machine* (Man a Machine) in 1747, written by the atheist physician and philosopher Julien Offray de Lamettrie, had paved the way for a new kind of rationale concerning man as a physiological being. In an intellectual atmosphere dominated by the major

Fig. 13

figures of the Enlightenment, Diderot and Voltaire, and with the Revolution just around the corner, the term *machine à guérir* (machine for healing) was coined for the first time (by Condorcet, Lavoisier, Tenon et al.) to describe a hospital for the future. The hospital was to be seen as an essential urban public service where internment should be replaced by increased control and openness (Foucault et al., 1995). This way of thinking was strongly linked with the concept of *bienfaisance*, which Summerson (1986, p. 127) describes as a "golden thread in the history of the Enlightenment".

The mortality rate in the old Hôtel-Dieu in Paris was one in four (compared to one in fourteen in Lyon) in the 1750s. This terrible state of affairs gave cause to new revolutionary ideas such as an early "Bismarckian" concept by Chamousset in 1754 when he suggested that an insurance company should be set up, and that people should pay monthly contributions according to their means (Pevsner, 1976). Before anything had been achieved, Hôtel-Dieu had, by 1772, been completely destroyed by two fires. The rebuilding process became a long and tedious one. The discussion was dominated by debates between the proponents of the *machine à guérir* philosophy and those who basically opposed anything that the controversial atheist Lamettrie stood for. The situation was further complicated by the building of the Naval Hospital at Stonehouse in England, finished in 1764 and greatly admired by the *machine à guérir* lobby. The scientist Jean-Baptiste Le Roy produced plans for the rebuilding of Hôtel-Dieu in 1773 in which he incorporated ideas from Stonehouse, and wrote in his report "A ward is, as it were, a machine for treating the sick" (Pevsner, 1976, p. 157).

After decades of debating the location of the new Hôtel-Dieu, the decision was made to stay on the Ile de la Cité. Construction work on the new premises, however, did not start before 1868. In spite of its monolithic outward appearance, it does incorporate pavilions but in a different form to that envisaged by Le Roy. Hôtel-Dieu in Paris, as well as the other examples mentioned above, are nevertheless prime examples of urban landmarks which have, through refurbishment and sensitive replacement of buildings, managed to respond to new challenges (Fig. 14). Because of the difficulties in achieving what at any particular time has been seen as the optimal logistical conditions, this process has often been painful and the temptation to "scrap and grab" and start anew elsewhere must have been almost insurmountable. The generality of these urban palaces has, however, proved to be an asset and their role, as lasting symbols for healthcare, invaluable.

Fig. 14

The period of Renaissance and Baroque hospitals provides us with inspiration on several levels. The relationship between the hospital and the urban environment surrounding it was, during that époque, on a different level to what we have grown accustomed to during the last decades. The position of the hospital as an urban landmark of lasting architectural quality, as well as the adaptability of the modular, essentially generic plans provide valuable lessons.

The Nightingale Era and the advent of the Modern Movement

William Tatton-Brown pointed out many years ago that in the old-fashioned Nightingale ward the nurse is a prima donna, but in the corridors and single rooms of a private hospital she is a bellhop. Colin Davies, 1988

The idea of a pavilion hospital, prevalent during the "Nightingale Era", is again, as a functional and organisational concept, undergoing a renaissance. Looked upon superficially, the new interpretations, such as St. Olavs Hospital in Trondheim, Norway, do not seem to have much in common with the Naval Hospital at Stonehouse near Plymouth on the English south coast, designed by Rowehead and built between 1756 and 1764, and generally considered to be the first pavilion hospital in the world. The central space at Stonehouse was a large open quadrangle which was surrounded by detached ward blocks planned to prevent the spread of infection in the hospital (Fig.15). Not only the *machine a guérir* movement, but also other observers around Europe soon realised its pioneering role.

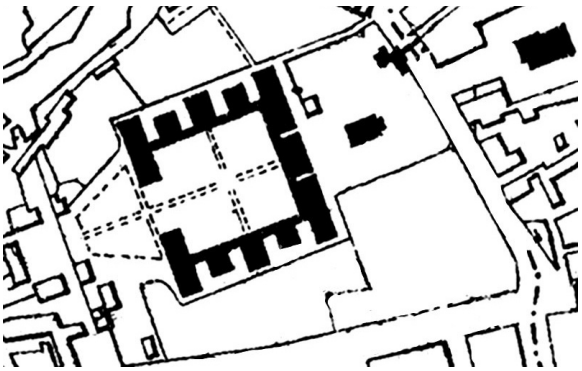


Fig. 15

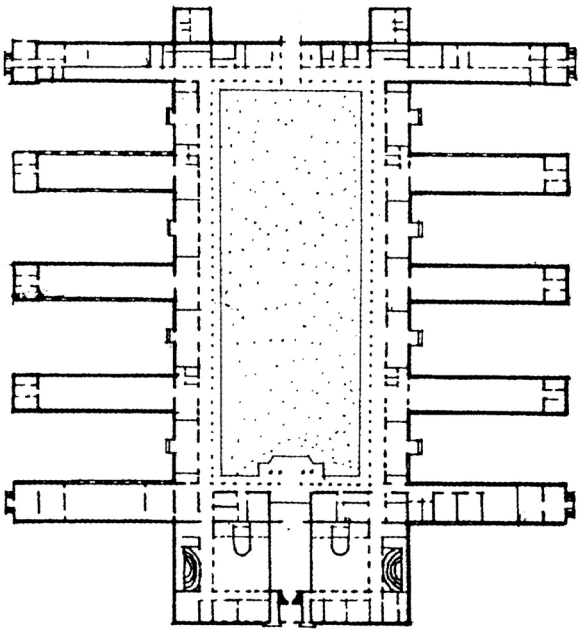


Fig. 16

In spite of this, neo-classical and other revivalist block hospitals continued their domination all over Europe. The final breakthrough for the pavilion model was brought about by the construction of the 900-bed Hôpital Lariboisière in Paris, designed by Martin-Pierre Gautier and finished in 1854. It is widely considered to have created a new epoch in hospital building. Pevsner quotes Husson, "It presents all the conditions of well-being and healthiness which an establishment of this nature can provide" (Pevsner, 1976, p. 154). The hospital was built as a response to a major cholera epidemic that ravaged Paris in 1832 and proved the hospital stock to be incapable of coping with such events. Conveniently, a wealthy childless widow, Countess Elisa de Lariboisière, died in 1851 and left her fortune to be spent on the building of a new hospital in Paris (Fig.16).

Florence Nightingale was born in 1820, became interested in hospitals as a young woman and consequently trained as a nurse. Before her famous trip to Crimea during the war in 1854, she had visited numerous hospitals in Britain and France. She was mostly very critical of what she saw but very impressed with the brand new Lariboisière. She, thus, did not invent the pavilion hospital but became its fiercest proponent. The headline of this chapter is justified by the changes she managed to introduce to the functioning of hospitals, and the fact that no other changes of comparable sustainability occurred until the end of the World War Two. The famous quote, in which she claims that people have a better chance of survival outside a hospital, is shown in BOX 1.

Florence Nightingale's main functional objection to what she had seen was the "lack of direct visual supervision of patients, while her clinical objctions centred on the lack of fresh air and daylight" (Nightingale, M., 1982, p. 48). Her ideas of ward design were based on her general philosophy of nursing. Many of the "assembly line" ideas, identical procedures performed on patient to patient all being supervised from a central position, are still topical today. The fact that some wards designed and built during her lifetime are still in use in Britain is, however, not a very flattering state of affairs.

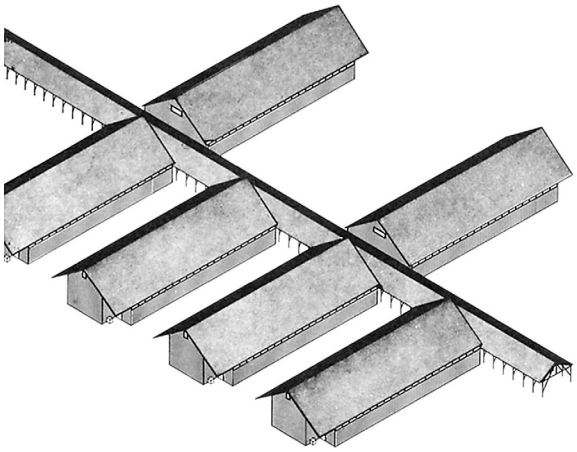
Before Florence Nightingale arrived (1854) at the Barrack Hospital in Scutari, Turkey, soldiers were more likely to die in the hospital than on the battlefield. Through rigorous improvements in the hygienic conditions of the patients, the death rate was cut dramatically from 578 per 1000 patients to 17 (Black, 2006). On her return to England she embarked on her successful campaign to improve conditions in British hospitals. Pavilion hospitals were built in many British cities and the fashion quickly also spread to the United States where the Free City Hospital in Boston (Gridley J. F. Bryant, 1864) and Johns Hopkins in Baltimore (John Rudolph Niemsee with Cabot & Chandler, 1889) are particularly well-known examples.

Isambar Kingdom Brunel, Britain's foremost structural engineer of the Victorian era, designed, in 1855 during the Crimean War, a 1000-bed prefabricated hospital. The parts were manufactured in Britain, shipped to Turkey and assembled, all within ten months (Toppin, 1981). It followed Nightingale's philosophy in its layout and hygiene principles, but was also ahead of its time concerning plumbing and other sanitary features. It is said to be equally important in terms of the history of building technology as Brunel's most famous work, the Crystal Palace. Its influence on much later building systems, such as the Harness in Britain, is clear and it is today as relevant as ever (Fig. 17).

Box 1

It may seem a strange principle to enunciate as the very first requirement in a hospital that it should do the sick no harm. It is quite necessary nevertheless to lay down such a principle, because that actual mortality in hospitals, especially those of the large crowded cities, is very much higher than any calculation founded upon the mortality of the same class of patient treated out of hospital would make one expect.
Florence Nightingale, 1859

Fig. 17



One of the main problems in many pavilion-type complexes all over the world is that many of them were built with inadequate connections between the pavilions. In some, heated corridors or tunnels were added later, but many have had to make do with covered open galleries. Changing clinical practice during the second half of the 20th century led to requirements of closer proximity and integration of different medical services, which was difficult to achieve on many of these sites. Changing architectural styles and fashions in the beginning of the 20th century also meant that pavilion plans were no longer as generic and future-proof as those of Stonehouse, Lariboisière or many other earlier examples. Three prominent European examples are described here in more detail because the problems illustrate a number of issues that administrators, planners and designers have to wrestle with in many of our hospitals today. Some recent innovative reinterpretations of the pavilion archetype will be discussed later in this study.

Some of the best known early 20th century pavilion hospitals were designed by major figures of the architectural scene of that era. Luis Domenech y Montaner designed the Hospital de la Santa Creu I Sant Pau in Barcelona (from 1901 onwards) at the end of a minor diagonal axis that connects it to Gaudi's Sagrada Familia (Fig.18). Domenech's version of Catalan "modernismo" is less steeped in structural and constructional pyrotechnics than that of Gaudi but his delightful free-standing pavilions are nevertheless complex and idiosyncratic buildings (Fig. 19). This superb *Gesamtkunstwerk*, which is now included in the UNESCO World Heritage List, has whimsical shapes and syncopations that occur on both sides of the strictly symmetrical axis in a manner typical of *modernismo*, which has now become as "classical" as ragtime, its contemporary equivalent in music. The "Mudejar-inspired red brick pavilions are adorned with yellow and white bricks, towers, cupolas, sculptures, mosaics, majolica features, pillars, Moorish and European vaults, reliefs, friezes and stained glass" (Ihalainen, 2005, p. 43).

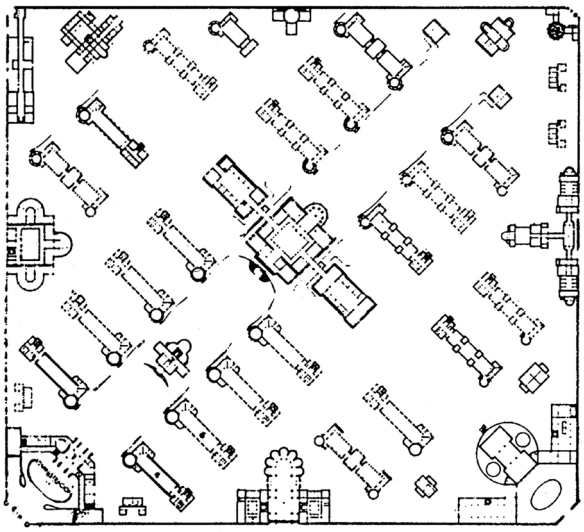


Fig. 18

Fig. 19

Fig. 20

The Sant Pau pavilions are internally inherently inflexible. It is obviously impossible to change the exteriors or add things to them without resorting to artistic rape. Luckily Domenech *père*, during his lifetime, only succeeded in finishing 12 of the pavilions and the master plan was brought to completion by Domenech *fils*, who was not his father's equal as an architect. In the early years of the new millennium, when it had become well-nigh impossible to run the hospital efficiently, it was relatively easy for the authorities to take the decision to demolish most of the son's work and replace it with a new core hospital to house all the main clinical units. The well-known local architects Esteve Bonell and Josep Maria Gil (with no previous hospital design experience) were appointed for the job.

Paul Stradins University Hospital in Riga (1908-12) was designed by the important Latvian architect Reinhold Schmaeling in an eclectic revivalist style with strong Art Nouveau and National Romantic undertones (Fig. 20). The main parts of the pavilion hospital are connected to each other by covered and glazed corridors, but there are many free-standing pavilions with no heated connections at all. It can be a harrowing experience to see patients being wheeled along the sleety and bumpy pathways, in sub-zero temperatures, from the wards to the operation blocks and back again. The situation is further complicated by two large monoblock hospital buildings that were built during the Soviet era without a master plan, with no internal connections to the older buildings and with virtually no consideration of future expansion needs. These are now common and recurring problems on many pavilion hospital sites and not only in the old Warsaw Pact countries. At Stradins Hospital the future is uncertain but an architectural competition that has been held indicates a better future.

In 1909 the visionary French architect Tony Garnier, together with his friend and patron Edouard Herriot, Mayor of Lyon, created a new concept for a modern pavilion hospital. Between 1913 and 1933, 32 pavilions were built on a site just outside the historical centre of Lyon. The pavilions contain traces of the Arts and Crafts movement but also of early Modernism. They are somewhat "domestic" both in their internal arrangements and their scale (Fig. 21). They include a fair amount of repetitive elements but that is where any possible flexibility ends. The tunnels connecting the pavilions to each other were originally planned to serve the central heating network with small trains carrying coal from building to building.

Fig. 21

The tunnels are too narrow to satisfy today's needs and they also contain inconvenient level changes as a result of an artificial hill that was constructed for the pavilions housing the tuberculosis patients to give them the benefit of maximal intake of fresh air. Many of the pavilions have, during recent decades, been changed rather radically (Stauskis et al., 2005).

Although the pavilion model as a concept is again arousing attention today it has to be said that the Lariboisière and Nightingale inspired hospitals of the second half of the 19th century and early 20th century, including those in inner city areas, tended to become walled compounds, bastions of health care, which from the outside gave signals of extreme severity and secrecy, comparable to military barracks or prisons. The contact between the hospital and its urban surroundings was not as relaxed and natural as in the Urban Palace model.

In addition to Nightingale's innovations and the acceptance of the pavilion model, the second half of the 19th century had brought about some major developments that were to have lasting effects on health care and also on the future development of the premises in which it was delivered. The notion that hospitals were about life rather than death was reinforced by the discovery of anaesthetics in 1846. Lister's carbolic sprays (late 1860s) radically reduced infections and reduced post-operative fatalities. In 1886, von Bergman developed aseptic techniques to sterilize instruments and in 1895 Röntgen innovated the use of X-rays as a diagnostic method (James & Tatton-Brown, 1986).

Apart from these medical developments, there were also important socio-political changes. Chancellor Otto von Bismarck, who has often been seen as the father of the welfare state, created a national insurance system in 1883 which guaranteed health care for each and every German citizen. Later, during the 1930s, a network of general hospitals with 6-7 beds for every 1000 inhabitants was developed in Germany. A kind of nursing home structure was also provided in the form of *kurhaus*- and *badeanstalt*-type institutions which were financed under separate systems. The hierarchical accommodation schedules that were created for the Prussian military hospitals of World War One have been very influential and are still in use in wards in Germany, the Baltic States, Russia, Finland, and to an extent also in the rest of Scandinavia (Johansson et al., 2006).

After the period of pavilion complexes that had become increasingly idiosyncratic in style and functional interpretation, came the advent of the Modern Movement. As described in BOX 2, the philosophies behind the new movement were seen as being particularly appropriate and applicable in hospital buildings. The tuberculosis sanatorium was the genre of hospitals that the most talented architects found particularly attractive and

Box 2

By the time the Modern Movement broke, the hospital had become a bastion of scientific control, defending its occupants against the invasion and chaos of unreason and disease. It was the perfect modern building. The purity and abstraction of the Modernist architectural language quickly became synonymous with health and hygiene, and the hospital has remained the building type for which this kind of architecture seems most fully appropriate. The cool rationality of the grid spells order and control — no mysterious darkness or dirty corners — and the geometry of the cubic masses registers timeless perfection. Intense lighting stands for clarity of understanding, avoiding shadows of doubt. Bright impervious surfaces in plaster, white paint, vitreous enamel, glass or stainless steel are not just cleanable but seen to be clean. Peter Blundell-Jones, 2002

challenging. The two iconic examples are Zonnestraal in Hilversum, The Netherlands, by Johannes Duiker and Bernard Bijvoet, completed in 1931, and Paimio, Finland, by Alvar Aalto, completed in 1933, but there are numerous others in Europe, particularly in France, that merit much closer scrutiny and will be discussed in the next section.

Duiker, Bijvoet and Aalto were all "one-off" health care designers. Other well known masters of the early modernist era, most notably the German-born Erich Mendelsohn, were involved in the branch on a more regular basis. During the 1930s, after establishing an office in Jerusalem during the time of the British Palestinian Protectorate, he designed several notable early "monobloc" hospitals where his expressionist roots are intermingled with a utilitarian starkness (Fig. 22).

Another modernist pioneer, the Russian émigré Berthold Lubetkin, founder of the Tecton design group, was the designer of Finsbury Health Centre in London. It is, strictly speaking, not a hospital as defined in the introduction to this study, but deserves to be included because of its pioneering character and huge influence on future generations of designers.

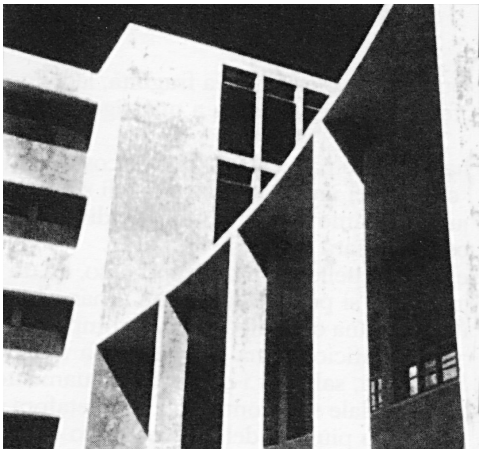
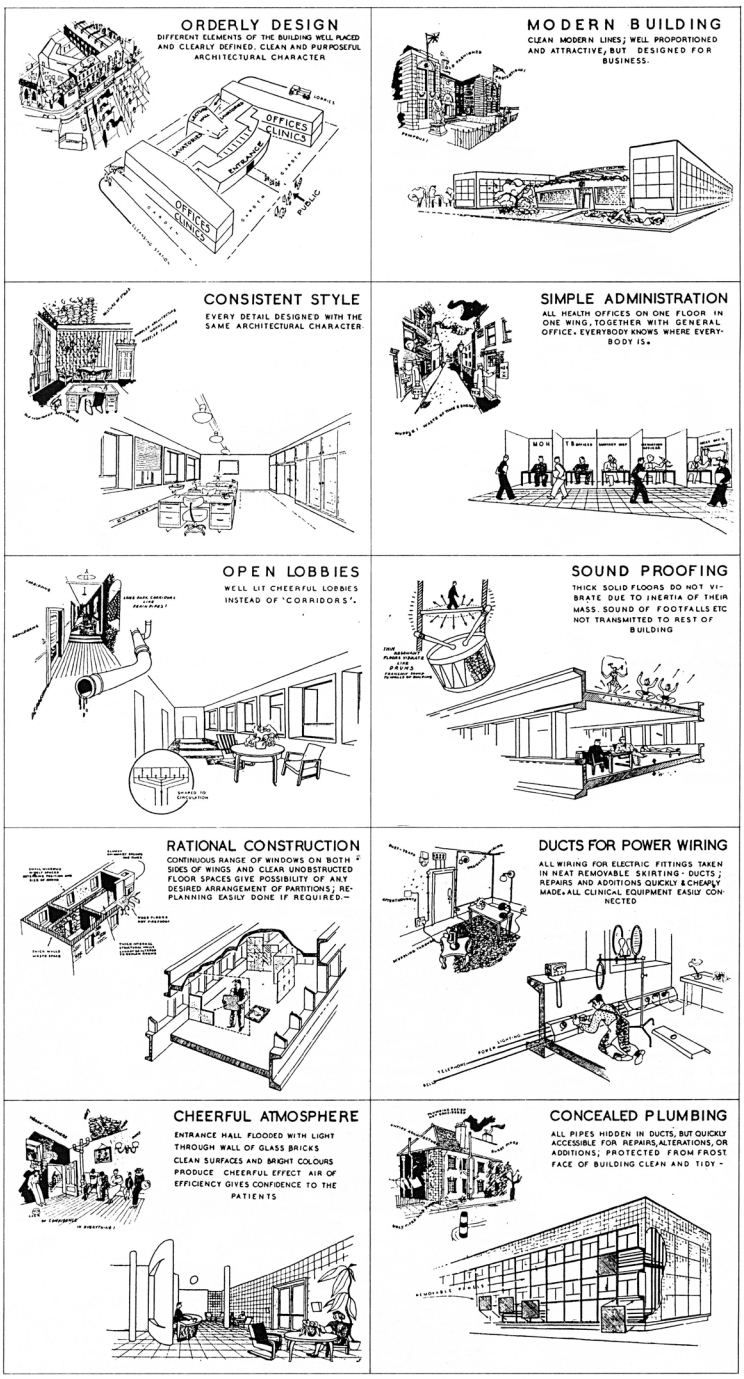


Fig. 22

The manifesto of Finsbury, expressed in cartoon-like sketches (Fig. 23), embodies the Modernist agenda, takes heed and further elaborates on all contemporary technological advances as expressed by Duiker and Bijvoet and others. Lubetkin chose as his consultant Ove Arup, a Danish structural engineer whose practice was to develop into a world-wide empire. Arup's rise to prominence, and particularly his firm's continuing involvement in health care planning and design, thus had its roots in the Finsbury project.

Fig. 23


ORDERLY DESIGN
DIFFERENT ELEMENTS OF THE BUILDING WELL PLACED AND CLEARLY DEFINED. CLEAN AND PURPOSEFUL ARCHITECTURAL CHARACTER
OFFICES
CLINICS
ENTRANCE
PUBLIC
MODERN BUILDING
CLEAN MODERN LINES; WELL PROPORTIONED AND ATTRACTIVE, BUT DESIGNED FOR BUSINESS.
CONSISTENT STYLE
EVERY DETAIL DESIGNED WITH THE SAME ARCHITECTURAL CHARACTER.
SIMPLE ADMINISTRATION
ALL HEALTH OFFICES ON ONE FLOOR IN ONE WING, TOGETHER WITH GENERAL OFFICE. EVERYBODY KNOWS WHERE EVERYBODY IS.
OPEN LOBBIES
WELL LIT CHEERFUL LOBBIES INSTEAD OF 'CORRIDORS'.
SOUND PROOFING
THICK SOLID FLOORS DO NOT VIBRATE DUE TO INERTIA OF THEIR MASS. SOUND OF FOOTFALLS ETC NOT TRANSMITTED TO REST OF BUILDING
RATIONAL CONSTRUCTION
CONTINUOUS RANGE OF WINDOWS ON BOTH SIDES OF WINGS AND CLEAR UNOBSTRUCTED FLOOR SPACES GIVE POSSIBILITY OF ANY DESIRED ARRANGEMENT OF PARTITIONS; RE-PLANNING EASILY DONE IF REQUIRED.—
DUCTS FOR POWER WIRING
ALL WIRING FOR ELECTRIC FITTINGS TAKEN IN NEAT REMOVABLE SKIRTING-DUCTS; REPAIRS AND ADDITIONS QUICKLY & CHEAPLY MADE. ALL CLINICAL EQUIPMENT EASILY CONNECTED
CHEERFUL ATMOSPHERE
ENTRANCE HALL FLOODED WITH LIGHT THROUGH WALL OF GLASS BRICKS
CLEAN SURFACES AND BRIGHT COLOURS PRODUCE CHEERFUL EFFECT AIR OF EFFICIENCY GIVES CONFIDENCE TO THE PATIENTS
CONCEALED PLUMBING
ALL PIPES HIDDEN IN DUCTS, BUT QUICKLY ACCESSIBLE FOR REPAIRS, ALTERATIONS, OR ADDITIONS; PROTECTED FROM FROST. FACE OF BUILDING CLEAN AND TIDY.

Many of the key statements in the Finsbury manifesto are in the forefront of the discussion today. "Clearly defined, clean and purposeful architecture", "rational construction", "replanning easily done if required" are all aspects that have again attained major importance. "Well-lit cheerful lobbies instead of corridors" and, "air of efficiency gives confidence to the patients" are statements that architects in health care design deal with on a daily basis today, 70 years later, and also form important cornerstones for the present study.

The Architect's Journal later described Finsbury as "a triumph of rational thought over poverty and ignorance that itself becomes a teaching and social device" (Allen, 2003, p.2). Just before the outbreak of the World War Two, Finsbury had become one of the symbols for the Welfare State and the National Health Service, both still in their embryonic stage. The development in Britain culminated in the social insurance system first outlined by William Henry Beveridge in 1942. In 1945, after World War Two, Clement Attlee included it in the Labour party election programme and the proposed ideas were realised in 1945-48. The term Welfare State came into use.

The Era of the Sanatoria

When success is entirely dependant on the healing powers of the building, the architect becomes the doctor. Julius Posener, 1934

Like the airport and the transmitter tower, the sanatorium was an emblematic instance of the modern. Frédéric Migayrou and Concetta Collura, 2008

Tuberculosis was a disease exacerbated by the growth of the cities which was accelerated by the industrial revolution and resulted in polluted air. The only cure was fresh air and sunshine. This provided a tremendous opportunity for the young generation of architects who were looking for ways to fulfill the ambitions of their Modernist agenda. "In the age before antibiotics, the bacillus was most effectively killed by sunlight, providing the most literal justification for the Modernist obsession with light and air" (Blundell-Jones, 2002, p. 42). Julius Posener's statement that the architect becomes the doctor due to the healing powers of his building will probably never be as relevant and truthful again. It is difficult to imagine a situation in the future where the physical *gestalt* of the hospital itself would again provide the key to the healing process.

Innovations at the beginning of the century were very much on the level of plan and section alone. Stylistically these buildings were still revivalist and eclectic, the innovations involved having their roots purely in the functional requirements. There was a clear, generally accepted way of providing cure and care based on moving patients between their bedrooms and the communal open or semi-open balconies. This presented certain logistic challenges

which these new innovative plans addressed. They were narrow-framed, usually symmetrical buildings because men and women were kept strictly apart, and thus a case could be made for this somewhat schizophrenic symmetry, which was, in fact, still steeped in the classical tradition.

Some decades later, when the architects of the Modern Movement got seriously involved in the field, they derided the historicist and regionalist features of the early examples. Much of the "form follows function" innovation had, however, already been achieved by the earlier pioneers. The speed of building sanatoria at a time when the Modern Movement was just reaching its early zenith was stunning. For instance in France, between 1933 and 1946, 39 132 beds in a total of 236 sanatoria were established (Cremnitzer, 2005).

The period between the two world wars had in most European countries produced a new generation of architects that was particularly ambitious. Much of their passion was linked with the new social engagement which formed an important part of the agenda of the Modern Movement. In terms of the sanatoria which dominated the hospital scene during those years, internationally important models were produced at least in Switzerland, Germany, France, Holland and Finland (not only in Paimio). In these years the exchange of ideas was particularly strong, architectural journals having become increasingly international by publishing projects from different European countries. New developments in black and white photography were particularly suited to illustrate new ideas in sanatorium design where sun and shade played such a big part in the healing process (Cremnitzer, 2005). Also CIAM (*Congrès International d'Architecture Moderne*) meetings were frequent and study tours had become an important part of any architect's agenda. Zonnestraal and Paimio had appeared in every conceivable journal but so had for instance Plateau d'Assy (1930-33) (Fig. 24) and other projects in the extraordinary, sometimes truly futuristic body of work realised by Pol Abraham and Henry-Jacques Le Même in France.

There were nevertheless differences in the schools of thought. The Dosquet system based on large sash ("guillotine") window-walls was preferred by the Germans and particularly the architect Richard Döcker, who designed the influential sanatorium in Waiblingen, Germany, in 1929 (Fig. 25). The continuous balconies were connected to the dormitory-type internal spaces by the continuous window walls. This was quite different from, for example, Alvar Aalto's Paimio where the communal cure balconies were located in their own separate wings.

Single rooms gradually took over, largely for the same reasons that the advocates of single rooms today give as their primary arguments. The trendy *existenzminimum* and *neue sachlichkeit* themes fitted the task on hand perfectly, and the ergonomically

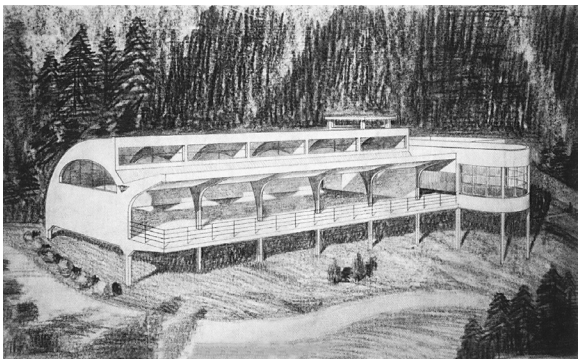


Fig. 24

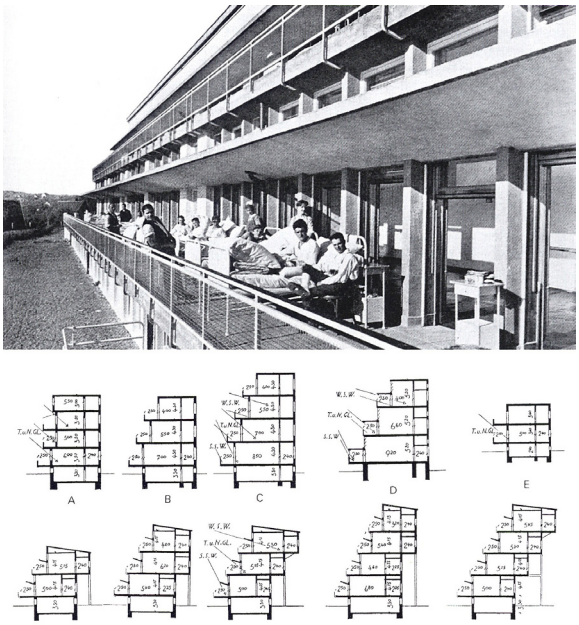
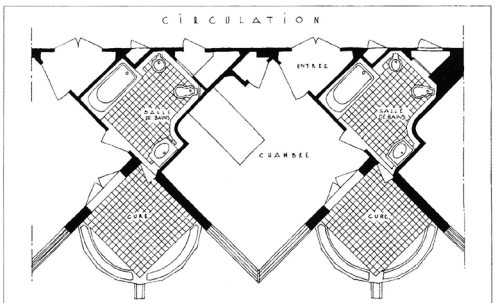


Fig. 25

designed "cells", including their own individual cure balconies, such as those in Plateau d'Assy (Fig. 26), still provide relevant precedents.

Zonnestraal, in Hilversum, the Netherlands, by Johannes Duiker and Bernard Bijvoet (completed in 1931) takes to the extreme the idea of transparency and the disappearance of the limit between inside and outside. Like the architect of the present restoration project Hubert Jan Henket says (private communication, 2006), Duiker always talked about the "necessity to break the psychological barriers created by walls" – a principle very topical today and one of the themes of the present study. The engineer Jan Gerko Wiebenga, who was actively involved in the design process from the start, created a structure which for its time is astonishing in its

Fig. 26



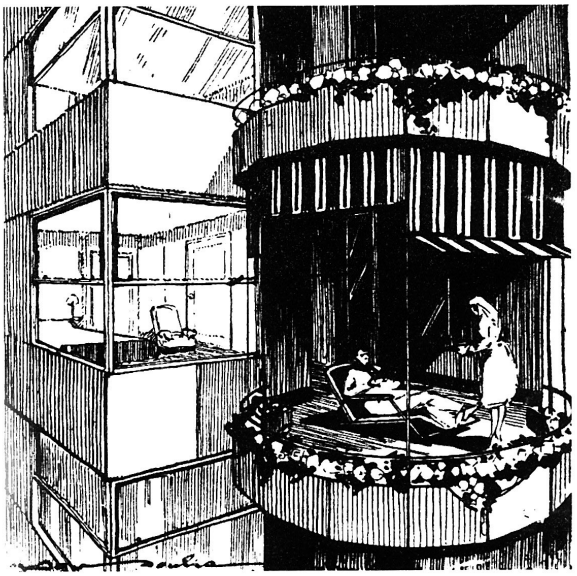


Fig. 27

dimensioning and clarity. Everything is based on a 3m modular frame. The intermediate floor slab is 8cm thick and other structural members follow the same kind of minimalist virtuosity (Fig. 27). Some of the structural concrete members are so slim and elegant that the buildings appear almost weightless (Fig. 28).

An important part of the cure and care at Zonnestraal, designed for the Dutch Diamond Workers' Union (ANDB), was the occupational therapy given to recuperating patients in small cabins in the woods just outside the hospital itself. This provided the patients with regular exercise, therapeutic work, partial independence and eventual rehabilitation (Overy, 2007), all familiar subjects of discussion today and cornerstones of the present breed of community rehabilitation hospitals. Duiker and Bijvoet's buildings at Zonnestraal fell into different degrees of decay during the decades after the virtual eradication of tuberculosis. Hubert Jan Henket says that the main building, which is now finished, should now be looked upon purely as a piece of art (private communication, 2006). It will be used for small scale functions and meetings but it will never again perform a role as part of the health care service. The old ward buildings, which will essentially be rebuilt, will form part of a "wellness complex".

Alvar Aalto's Paimio Sanatorium (Fig. 29) was taken into use in 1933, two years after the completion of Zonnestraal, which Aalto had visited before he embarked on his design work. With its bright white walls and shiny steel balustrades, it became one of the central symbols for the new modern Finland and a "stylistic and ideological crystallisation of Functionalism" (Saarikangas, 2002, p. 92). Aalto was aware of the fact that patients spent considerable

Fig. 28

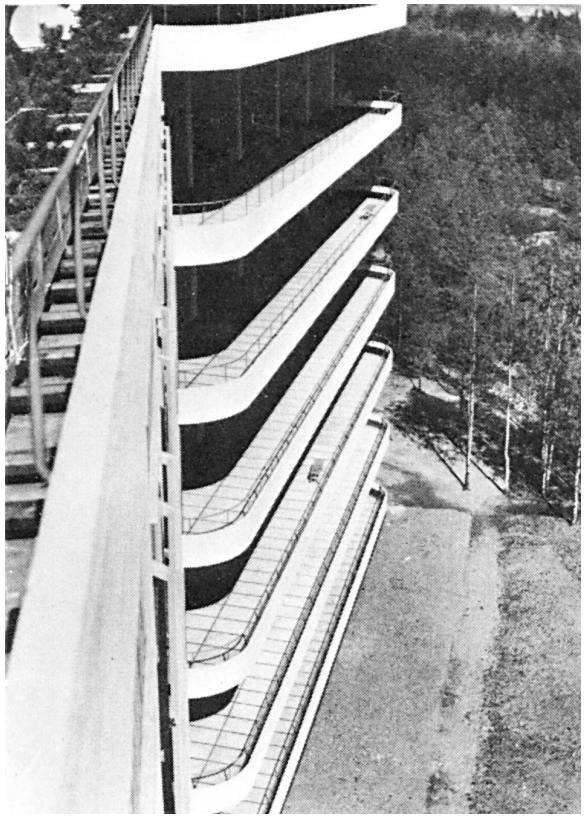


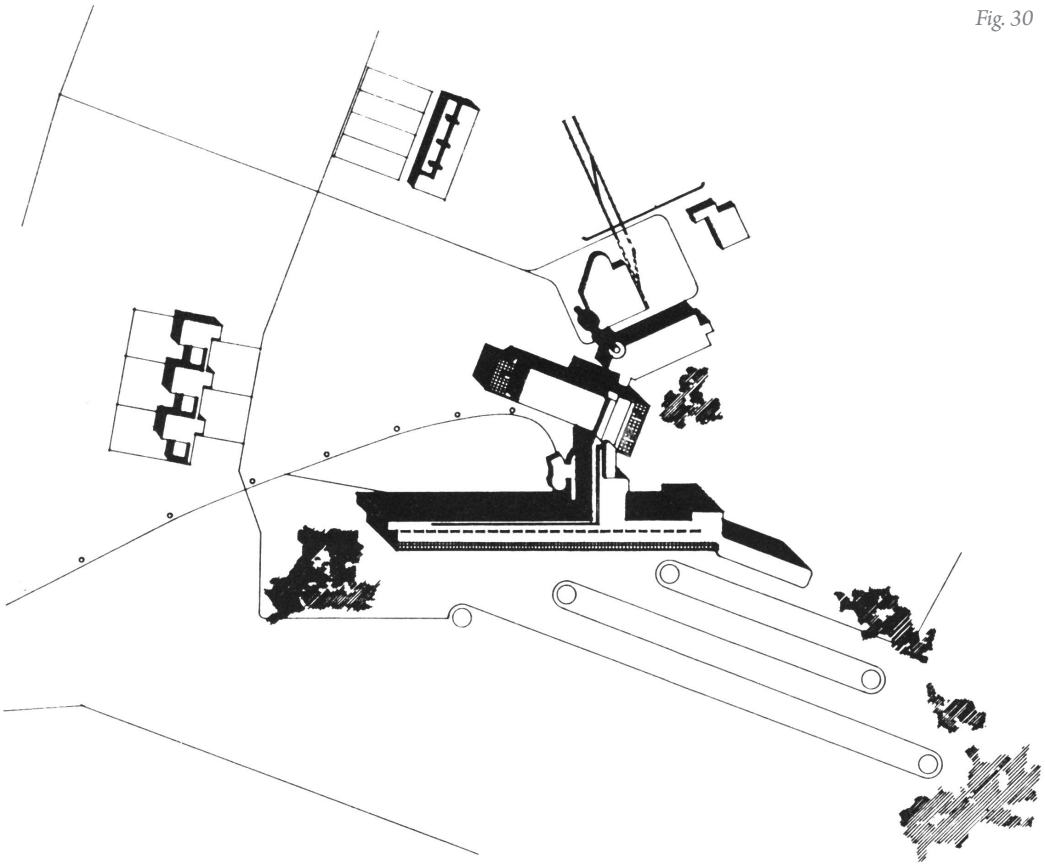
Fig. 29

periods of time at the sanatorium and all his design decisions were based on what today would be described as patient-centred approaches. He emphasised those qualities in a ward room that might have a conducive effect on the healing process by, for example, designing the light fittings so that the light source was outside the range of vision of recumbent patients and creating special washbasins "with particular attention being paid to eliminating noise in use" (Aalto, 1933, p. 5).

Paimio (Fig. 30), like many of the other sanatoria, is dimensioned in such a way that requirements for optimal efficiency of clinical areas of a modern hospital have been difficult to introduce. It has nevertheless found a new lease of life after certain interventions that purists have disapproved of. As in the case of many other architectural masterpieces threatened by obsolescence, good sense has prevailed and the uniqueness of the building makes it an inspirational place to inhabit, in spite of some logistic shortcomings.

Richard Döcker, meanwhile, did a lot of work on finding the correct gradient for the terraced solutions to maximise the intake of sunshine on

Fig. 30



each level. The French and the Swiss also produced many variations of the terrace model, work that had already been started by Tony Garnier in his French-American sanatorium in Lyon in 1917 (part of his *Cité Industrielle* project) and Henri Sauvage in his housing projects. Abraham and Le Même's stepped balconies and the expressive force they conveyed emphasised the importance of the roof as the fifth façade. It turned the building towards the sun and sky, in a similar way to that of the patients also being turned towards the sun and sky for their healing (Migayrou & Collura, 2008).

The literature on the subject is teeming with variations of these themes illustrated by cleverly presented section drawings. The terrace experimentation reached almost ludicrous levels in the project by the Italian Nicolas Visontai in the Italian Alps for a sanatorium for 1250 patients (Fig. 31). The building was 32 storeys high with a series of sloping lift shafts between the rooms/galleries and the mountainside. Individual rooms and communal cure galleries alternated by floor which made the logistics of moving the patients around somewhat problematic.

The most incredible manifestations of the strong belief in the preferred therapy, i.e. sunshine, and also the willingness to invest in technical innovations, are the revolving solaria developed by the French doctor Jean Saidman. These were based on the science known as actinology, which means the selecting, filtering and concentrating of the sun's rays in a way which gave maximal therapeutic benefits (Cremnitzer, 2005). The first machine (and one of the very few ever realised) was built by Saidman in 1928 in Aix-les-Bains. It looks like a strange windmill

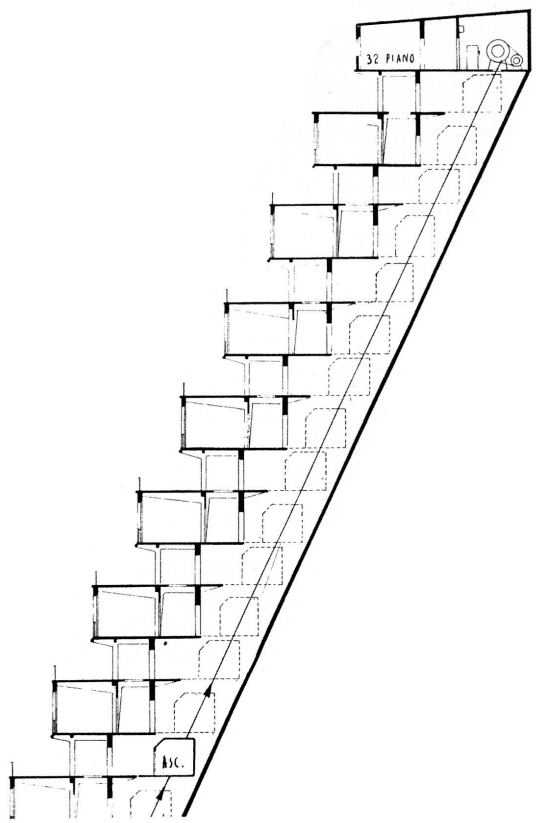


Fig. 31

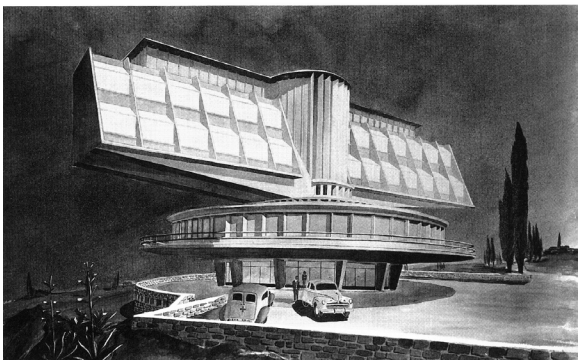


Fig. 32

with a small row of rooms placed on the sole "wing" which turns in order to optimise the orientation of the rooms towards the sun's rays. Many others were designed but never built (Fig. 32). It is clear that these contraptions were the inspiration for later projects such as Richard Buckminster Fuller's Dymaxion House and E. Fagiuoli's Villa Girasole in Marcellise, Italy, as well as the work of some of the Heroic Era futurists, such as E. Todd Wheeler.

The historically unique character of the era of the sanatoria can be illustrated by the fact that when the development of effective drug therapy in the 1940s allowed tuberculosis to be managed on an outpatient basis it led to the more or less immediate closure of nearly 30 000 hospital beds in the United Kingdom alone, and the elimination of an entire class of hospital. There are numerous examples of the architecture of sanatoria influencing other building types, which makes this era unique. Ideas expressed in hospital design permeated into other aspects of architecture, certainly hotels, but also the Outdoor School by Duiker in Amsterdam 1930, as well as housing projects, even Le Corbusier's *Ville Radieuse*.

Tuberculosis as such, and particularly through the buildings that were created to combat it, had a strong effect on architecture and town planning. It affected zoning principles in cities and the opening up of urban space. New hygienic considerations contributed to the increased specialisation of space, even in people's homes (Saarikangas, 2002). Forms that emphasised the importance of sunlight quickly became a prominent part of the Modernist aesthetic and architectural vocabulary. It is very difficult to find, during any other time in history, comparable examples of buildings designed for health care acting as an inspiration for other buildings. It can be argued that the qualities of the architecture of sanatoria have not been sufficiently appreciated by hospital designers of the past few decades. This may be because of the difficulties involved in refurbishing some of these buildings to satisfy the needs of modern general hospitals. Most sanatoria have, however, found a new lease of life in the service of health care as rehabilitation centres and facilities for elderly care, or alternatively as hotels and recreation centres of various kinds. The lessons to be learnt from the best sanatoria far outweigh the shortcomings in their future-proofing qualities.

The first decades of the Megahospital

The boom in hospital construction in the United States had started immediately after World War Two through the Hill-Burton Act (Hospital Construction Act of 1946). The "muscular expressiveness" (Verderber & Fine, 2000, p. 26) of Modernism had been seen as a perfect answer to the requirements of the building of new hospitals. Up to the beginning of the 1960s, the American "monobloc" hospitals were based on central corridors. Gradually double corridor, so-called "race-track" hospitals, started to gain ground. The first one of these was St. Joseph's Hospital in Burbank, California, designed by Welton & Beckett. The plan of the slightly later (1964) Archbishop Bergan Merchy Hospital in Omaha, Nebraska (Fig. 33) can be seen as the ultimate racetrack, the prototype for so many hospitals all over the world. It is interesting to note that after a period in the doldrums, the race-track also seems to be now experiencing a renaissance. It has been seen as a good model for the "monospace" approach, a future-proofing strategy applied to some new hospitals, particularly in Canada and France.

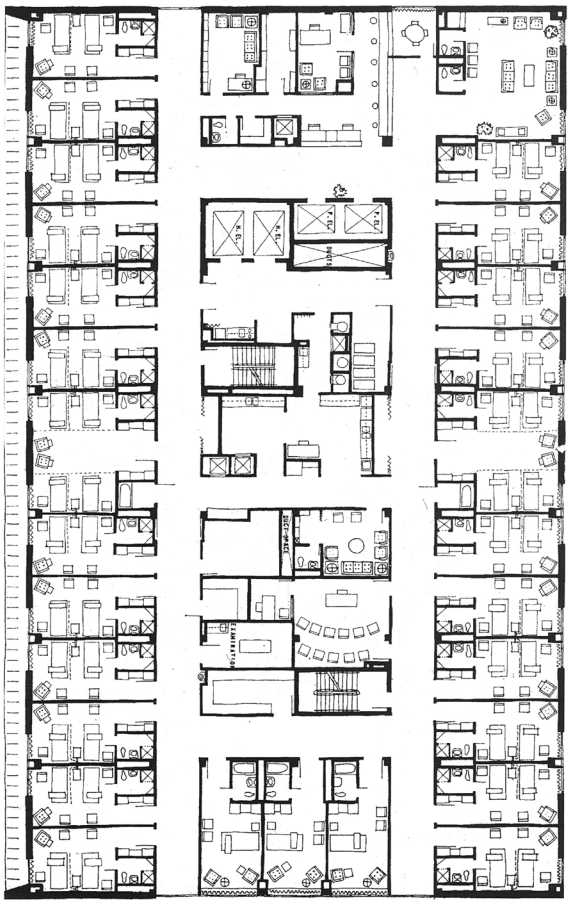


Fig. 33

The first British example of a "race-track" hospital, quite possibly also the first one in Europe, was Bellshill Maternity Hospital in Scotland by Gillespie, Kidd and Coia (Andy MacMillan and Isi Metzstein), finished in 1962. This was the first hospital project by this highly respected Scottish practice and shows a crucial difference from its contemporary American counterparts by including internal light wells that provide daylight into the middle sections of the plan and also make orientation easier. The glazed "floors" of these light wells form roof lights to lower level working areas situated in the centre of the frame (Rodger, 2008). The juxtaposition of the plan of a typical floor at Archbishop Bergan Merchy and at Bellshill (Fig. 34) illustrates the difference between American and European hospitals in their approach to daylight penetration, a difference that still has repercussions on the discourse today. Through its design, and not only the daylight aspect, Bellshill strongly advocated the need for the deinstitutionalisation of the working environment (Fig. 35).

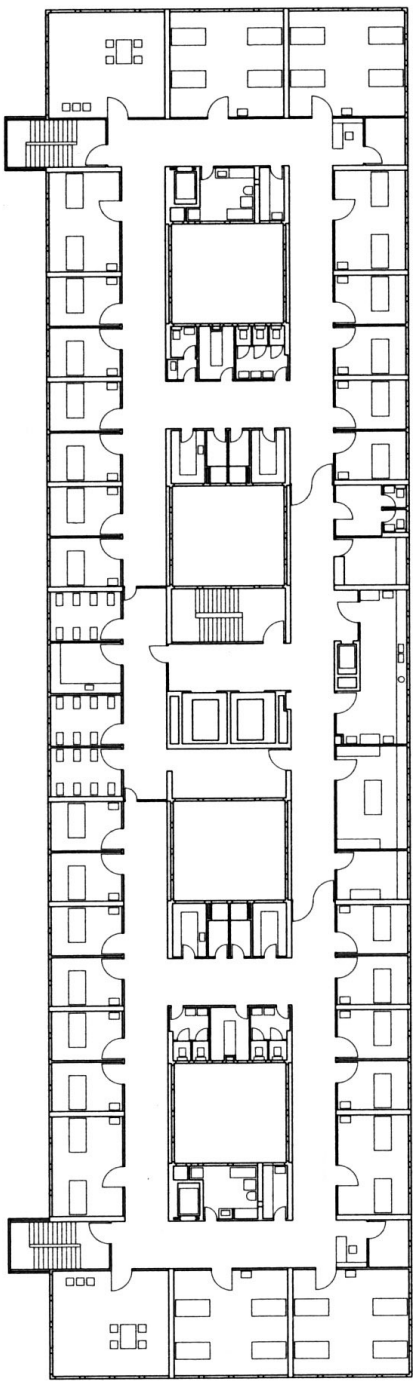


Fig. 34

During the 1960s many squared-plan hospitals were also built. These "cube" hospitals were largely based on the idea that patients needed conditions where daylight prevailed whereas the staff could do without it (Verderber & Fine, 2000). Bellevue Hospital in New York City (Fig. 36) was an early example of this type and further illustrates the difference referred to above.

The great majority of the early models were pure "monoblocs", high monolithic masses which were reminiscent of the first wave of Modernist hospitals built between the two world wars. The growing demand for space for diagnostics and clinical procedures led to an increase in the importance of the plinth section of the building. Very soon the "tower on a plinth" model became the norm, the veritable prototype of the minimalist megahospital. This model has many names, from "base tower" and "matchbox on a muffin" to "Breitfuss-model", a name used in central Europe and used in this study because of its relative linguistic and symbolic neutrality.

Strong claims have been made that the France United States Memorial Hospital of Saint Lô, completed in 1948, is the first Breitfuss-hospital (*hôpital socle tour*) anywhere (Fig. 37). Paul Nelson, an American-born disciple of Auguste Perret, who had already created some imaginative projects for sanatoria before World War Two, received the architectural commission as a symbol of the links between France and the United States.

Nelson emphasised a patient-centred approach. All patients' rooms faced south (sanatorium tradition retained), had lively colour schemes and views over the countryside, thus aiming at maximising the therapeutic effects. The most important

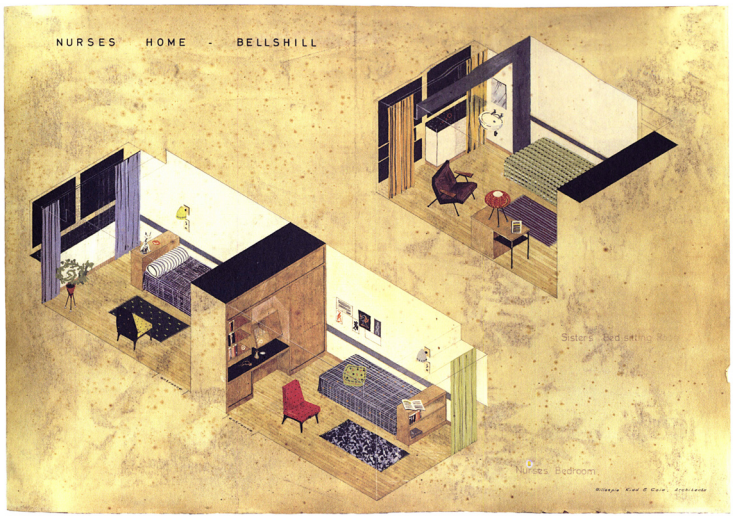

NURSES HOME - BELLSHILL
Sisters Bedroom
Nurses Bedroom

Fig. 35

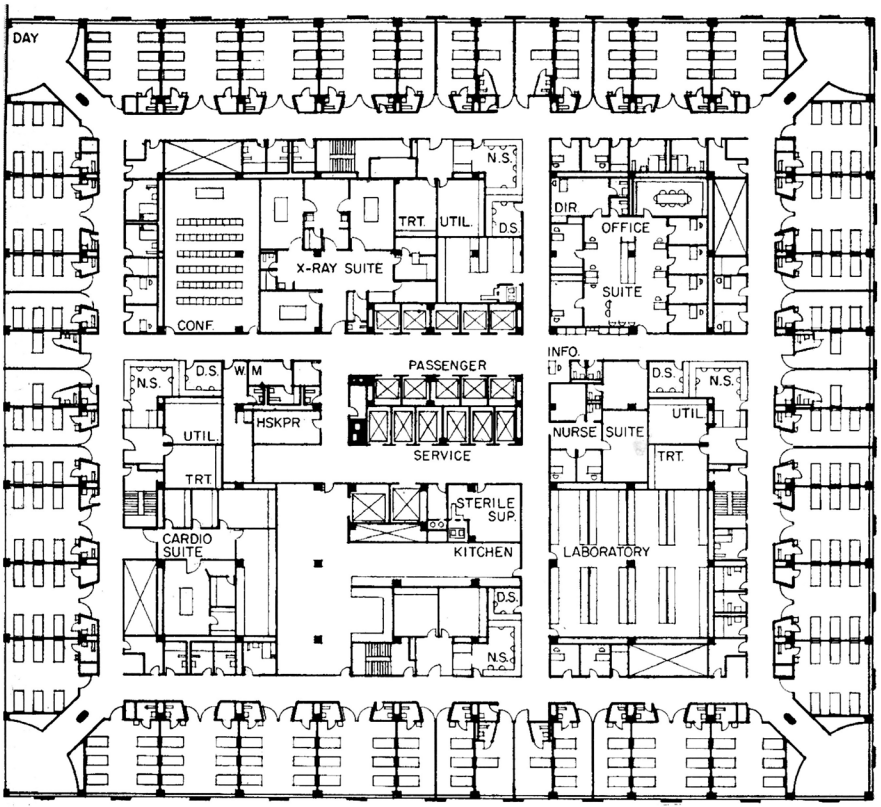

DAY
N.S.
TRT.
UTIL.
D.S.
X-RAY SUITE
CONF.
DIR.
OFFICE
SUITE
INFO.
D.S.
N.S.
UTIL.
NURSE SUITE
TRT.
PASSENGER
SERVICE
W.M.
D.S.
N.S.
UTIL.
HSKPR
TRT.
STERILE SUP.
KITCHEN
CARDIO SUITE
LABORATORY
D.S.
N.S.

Fig. 36

Fig. 37

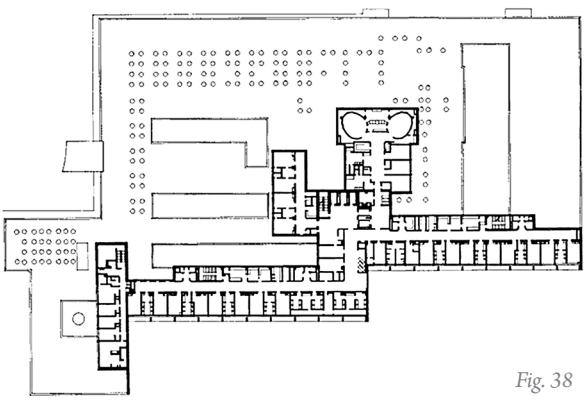


Fig. 38

innovation, however, was to spread out the diagnosis and treatment areas with critical interconnection requirements, and create a low plinth on which the patient tower stood (Beisson, 2004). One remarkable aspect is that the plinth is scattered with courtyards and extensive rooflighting (Fig. 38), features that all but disappeared from later deep-plan North-American Breitfuss-hospitals. While aiming at building the most modern hospital in Europe and at the same time introducing many features that are still relevant, did Nelson actually create one of the most important archetypes in the history of hospital design?

At the end of the 1950s, the WHO (World Health Organisation) recommended a system of regional responsibility. Special care should be concentrated in specified hospitals in such a way that each region of one million inhabitants would have three hospitals with 1 000 bed spaces in each. European countries reacted to the WHO recommendations in different ways. The UK soon started to actively pursue them. France adopted the aims in 1972, around the same time that the hospital building boom in the Nordic Countries, begun already in the 1960s, started to gain new speed. Regional equality led to a growing number of hospitals. The importance of clinical laboratories grew as a result of developments in clinical physiology, microbiology and chemistry. The development in imaging contributed to an increase in surgical procedures. Intensive care units were created. The importance of the procedural units within a hospital started to increase, as well as the role of specialisation. Meanwhile the growing emphasis on Primary Care created a whole new genre of buildings.

The first heart transplants were performed in the early 1970s while the development of CT scans and ultrasound imaging paved the way to new diagnostic practices. The degree of sophistication in surgery and the domination of procedural units kept growing. Information systems became part of everyday life in laboratory diagnostics. Is it any wonder that under these optimistic circumstances President Richard Nixon promised that the problems of cancer would be solved by 1974 (Verderber & Fine, 2000).

University hospitals gradually became segregated from ordinary acute hospitals. In German-speaking Europe, however, the Prussian, clinic-centered, pavilion-based military hospital model remained the norm for wards for a long time to come. The number of specialised care bed-spaces per inhabitant was in those days, and largely still is today, twice the WHO recommendation (Johansson et al. 2006). The first Breitfuss-hospitals in Germany were thus really large. The Freie Universität Krankenhaus in Berlin (Davis & Mocken, 1970) had over 1 400 beds and the Göttingen University Hospital (Neue Heimat, 1971) as many as 1 920 (Verderber & Fine, 2000).

Fig. 39

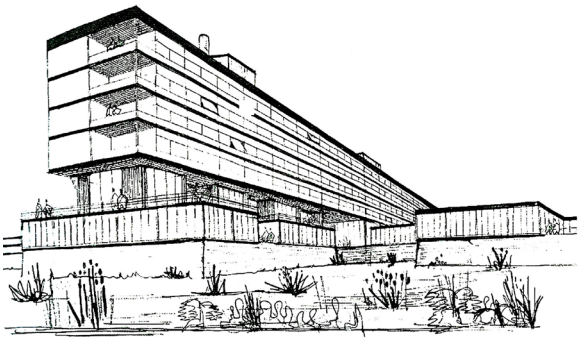
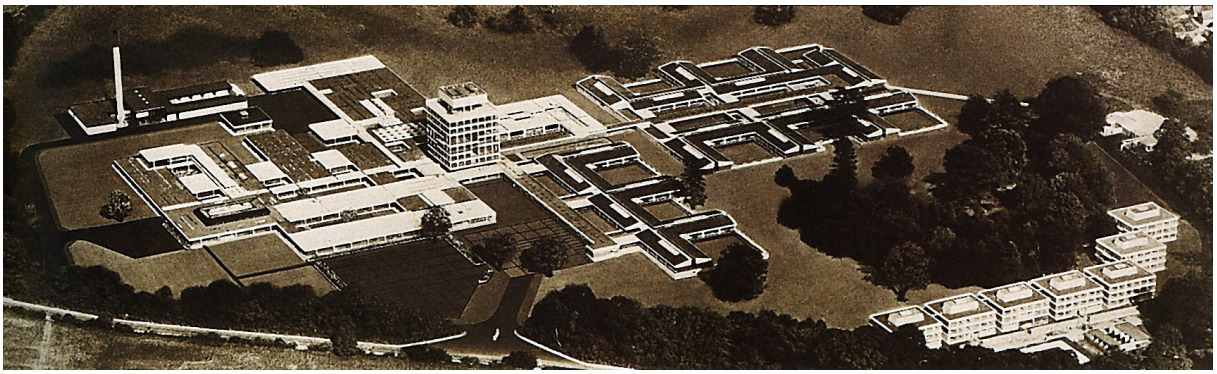


Fig. 40



The British National Health Service had been founded by the Labour Party in 1947. Hospital construction was overseen by the progressive Nuffield Trust, led by the architects Richard Llewellyn-Davies and John Weeks. They appointed the young office of Powell & Moya, who had no previous experience of hospital design, as architects for four early projects. These four hospitals, finished between 1959 and 1983, Princess Margaret in Swindon (Fig. 39), Wexham Park in Slough (Fig. 40),

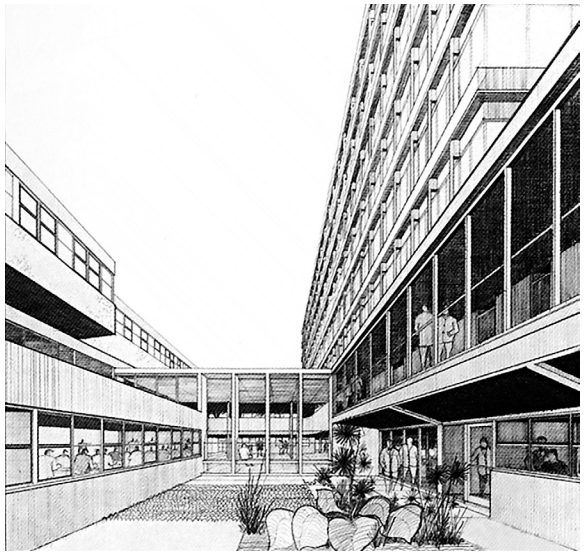


Fig. 41

Wycombe General in High Wycombe (Fig. 41), and Wythenshaw District General), differ markedly from each other but form an interesting body of work. The influence of the Breitfuss-model is in evidence but for instance Slough represents a totally different, single-storey, Nightingale-influenced, "village-type" solution (Monk, 2004).

One interesting project of this period was Venice Hospital (1964-70) by Le Corbusier and his closest collaborator and *chef d'atelier*, the Chilean Guillermo Jullian de la Fuente. The latter continued with the design after Le Corbusier's death in 1965 but unfortunately the project never came to fruition. It was essentially an extension of the city along Canareggio canal, next to the railway station, seemingly floating over the lagoon and consisting of a series of streets, squares and hanging gardens (Fig. 42).

The International Style (Modernism, Functionalism etc.) had certainly broken through on a global level. Its "sub-species", Brutalism, which was based on repetitive, in-situ sculptural concrete elements, became particularly popular in hospital architecture because it was seen as something particularly universal and contemporary as well as symbolizing the latest advances in technology (Verderber & Fine, 2000). A major Brutalist figure in the United States was Bertrand Goldberg, whose best known building is probably the apartment complex Marina Towers in the centre of Chicago. He applied similar ideas to the Prentiss Hospital for Women at the North-Western University Medical Centre in Chicago (Fig. 43). Brutalist Breitfuss-hospitals were built in such culturally diverse environments as Israel (Tirat Hacarmal, Haifa, 1971), India (Chandigarh Central Hospital, 1970) and Mauritania (Hôpital National de Nouakchott, 1970), just to mention a few better known examples (Verderber &

Fig. 42

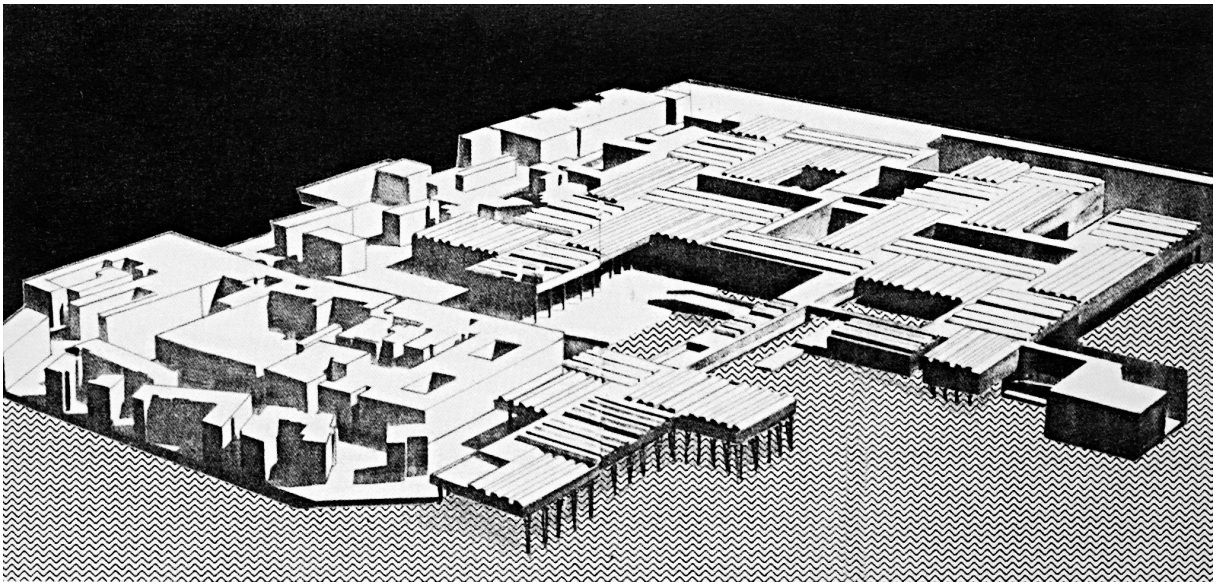


Fig. 43

Fine, 2000). The colonial stronghold reigned supreme over the newly independent countries, particularly in Africa, and versions of this archetype can be found in most of their capital cities.

In the European countries that were then occupied by the Soviet Union international Modernism was dominated by an eclectic trend of "Socialist Realism" that prevailed till the late 1960s. Hospitals were planned as regular complexes with symmetric axis, designed as groups of big blocks, connected by corridors and galleries with plenty of free space left around. This tradition continued in ever-increasing volumes with some stylistic modifications towards the "international style" and stayed dominant until the fall of the Soviet Union. Building blocks became bigger and higher and usually the hospital was located in either in one single Breitfuss block or a small number of free-standing blocks connected to each other by covered walkways. In big cities hospitals were planned on specially designated areas as health campuses, which were included in master plans of big cities particularly during the 1960s. By the early 1970s new hospitals had been established on many large city sites, e.g. Vilnius University Santariškių hospital (1976) and Gailezers hospital in Riga (Purvins, Bivina, Bivins and Kardikovs, completed in 1982) (Fig. 44). The sites were located in quiet city areas with good transport access and spacious plots. The sites were planned quite rationally; functional zoning and site planning are logical and comfortable for the users. The architecture is now solidly rooted in the "international style", sometimes with Brutalist undertones with a certain local pomposity thrown in. The structural system of the hospital blocks of this period is mainly based on prefabricated concrete frame structures and non-load-bearing prefabricated

Fig. 44

panel external walls. This system certainly still gives reasonable scope for modifications within the existing building body. The best of the Soviet-era hospitals are more future-proof than they are generally given credit for, partly because the so-called "SNIP" norms that were created in Moscow and had to be adhered to everywhere, were fairly generous in their dimensioning of space. On the other hand, plenty of attention was given to small details in these norms, whereas broader, strategic aspects were lacking in depth. Floor areas of the different departments were very strictly regulated, but the planning of medical and other processes left a lot to be desired (Johansson et al., 2006).

Not all the megahospitals built between 1960 and 1980 were of the Breitfuss-type. Horizontal comb-models (which should be seen as a sub-genre of the pavilion type) were also fairly general and there were "monoliths" too. Huddinge Hospital outside Stockholm (Hellman, Lindblom, Löfström & Sandberg Arkitekturkontor, 1970) is an excellent example of a comb-model (Fig. 45). It has proven relatively future-proof and is looked upon as a major asset, as opposed to many hospitals built at this time. Recently, small extensions have appeared on the large planted internal courtyards of Huddinge. These structures, known locally as "rucksacks" will not, according to recent decisions made by the hospital administration, be duplicated. From now on, extensions will be built in a way that respects the original architectural and logistical ideas of the building (Hällström & Sandow, 2004). One of the advantages of the comb-model, when compared to the Breitfuss-type, is indeed that the extension possibilities have been taken into account from the start.

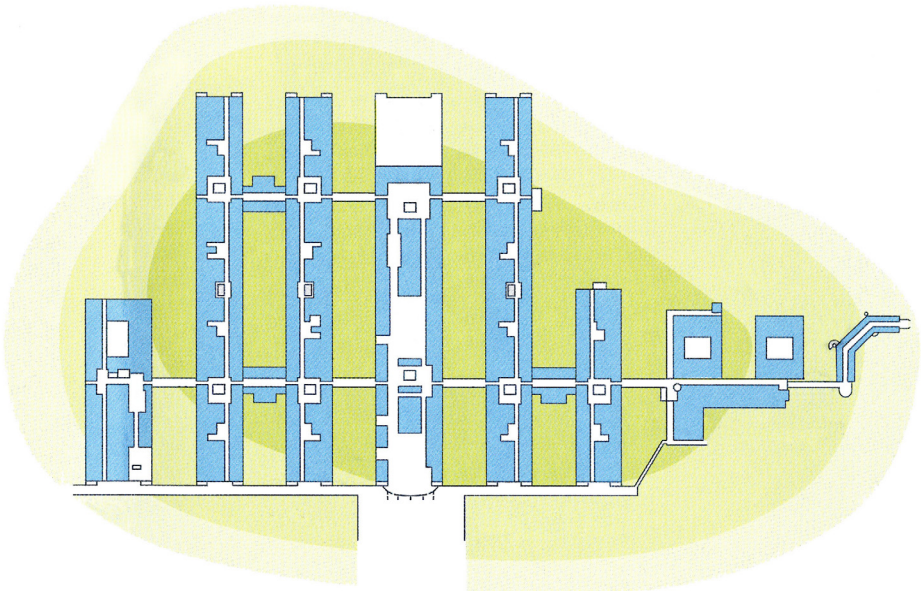


Fig. 45

Another expression of the comb-model, one that probably more consciously than any earlier hospital took future requirements into account as one of the primary driving forces in the design, was Northwick Park Hospital in London, completed in 1966, and designed by Richard Llewellyn-Davies and John Weeks. As key figures in the Nuffield Trust, they were in the privileged position of being able to closely follow the development of the field for a considerable length of time. As a result they had produced their theory of indeterminacy that claimed that buildings should be able to "grow with order and change with calm" (James & Tatton-Brown, 1986, p. 5). Northwick Park consists of a "hospital street" with blocks along it, capable of expanding at right angles (Fig. 46). Like many other comb-models it was essentially a contemporary reinterpretation of the pavilion hospital, or at least it owed a lot to that historical model.

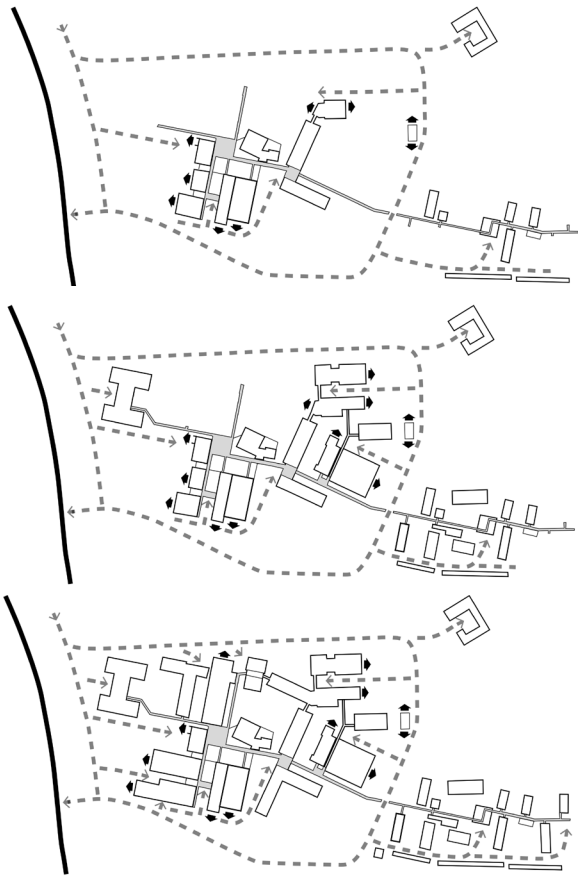
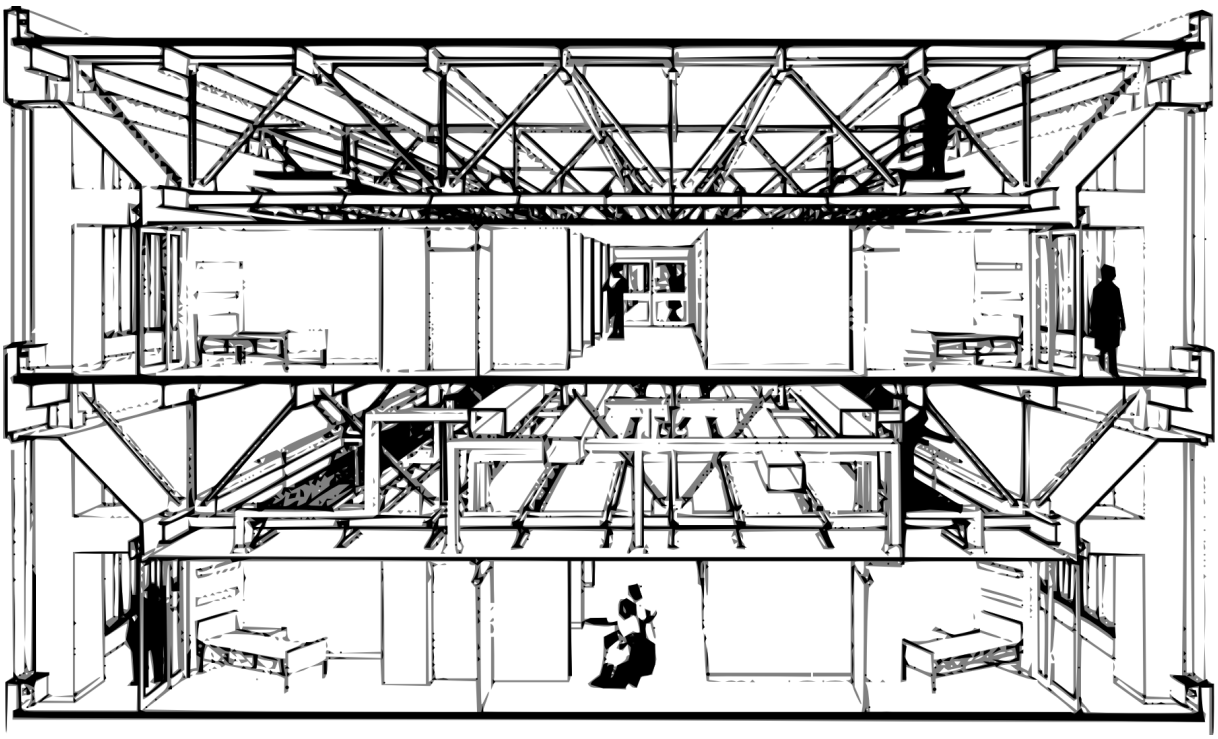


Fig. 46

The kind of open-endedness that was required for a hospital to expand the way the designers of Northwick Park intended was obviously seen as problematic on more urban sites. To combat this problem the Hospital Building Division at the UK Department of Health embarked on their ground-breaking "universal space" project (undoubtedly an inspiration for the present "monospace" approach in France), which eventually produced the new 800-bed Greenwich Hospital, finished in 1972. It took phasing into account, it provided an economical and effective circulation system, and had the capacity to be extended with a minimum of disturbance to the existing hospital. The construction was revolutionary - all lateral engineering services were contained in a two-metre high "interstitial space" between floor and ceiling of each pair of floors (Fig. 47). This allowed repairs and maintenance work to be carried out with no disruption to the routines of the hospital (James & Tatton-Brown, 1986). The building was thus intended to be future-proof, although that particular term was not used at the time. For various, largely organisational and territorial reasons it turned out to be unsustainable and was closed down and demolished in 2001. In any case, Huddinge, Northwick Park and Greenwich were all auguring the advent of a new era.

Fig. 47



The Heroic Era

A concern for maximising flexibility continues to be achieved by modularity, full or partial interstitial spaces, and the separation of functions. American Institute of Architects, 2001

The period of innovation and experimentation that characterised much of the hospital design through the 1970s has been described by the German professor and hospital designer Robert Wischer, as "The Heroic Era" of health care architecture. This very appropriate term will be used in this study to describe what was indeed an exceptionally invigorating and stimulating period in the field. The idea of a hospital as high-tech machinery, a "machine for healing" strengthened during the 1970s. To what extent the vocabulary used was inspired by Le Roy's 19th century *machine a guérir* and to what extent by Corbusier's "machine for living", remains open to speculation. Processes and logistical systems were nevertheless studied, interstitial space and other integrated solutions were taken into use. The first "clip on – plug in" ideas were created in the United States as early as in 1972. Around this time hospital consultants started to take over from the architects as the main orchestrators of hospital projects, which led to several high-profile architectural practices losing interest in the field (Verderber & Fine, 2000). In spite of this, the new ideas left behind a large number of technical and functional innovations and also major architectural achievements.

Apart from the "machine for healing" theories and the active experimentation that took place during the Heroic Era, which for the purposes of this study is defined to have started in the late 1960s and continued until the end of the 1970s, the period was also characterised by a certain megalomania. The new Vienna Allgemeine Krankenhaus was a continuous web of 242m x 147m in which all zones could grow along two axes. Theoretically the concept included an extension capacity of "at least 100%". From the vast plinth grew two 22-storey towers containing 2 200 beds. A new hospital which was planned for Gothenburg was in the end never built, but was supposed to house 3 600 beds! Themes of today, such as "generality", "modularity", and "flexibility" were, however, used on a daily basis. Also, a serious discourse on the problems involved in combining increased efficiency with a more human approach was initiated. One could argue that more meaningful progress was made during this decade than in the 25 years that followed.

New types of actors entered the scene. A Canadian hospital planner, Gordon Friesen, was known for introducing a new "service delivery system" every year. He developed prototype systems of patient rooms, intensive care units, or materials transport systems, and proceeded to market them "with the intensity of an automobile manufacturer with a new model" (Verderber & Fine, 2000, p. 64). His exploits were extremely successful and his influence grew so that by the early 1970s he was involved in most hospital projects in North America. Friesen had also, in the 1960s, presented an early plea for single rooms and "boldly proclaimed that the time had come for every patient to have a private room" (Verderber & Fine, 2000, p.196).

Friesen's inventions played an important part in the reinforcement of the atmosphere of innovation that reigned at the time, as did the projects of the Archigram group in England with which the "plug-in" concept is particularly associated. Many of the experiments of the 1970s remained on the drawing board. Different types of patient capsules were developed, particularly in Japan. Some of them were tried out in practice but remained short-lived.
The American architectural practice of Perkins and Will, and particularly one of its partners, E. Todd Wheeler, produced a large number of visionary projects that were never realised and probably were never even meant to be. They included tent hospitals, underwater hospitals, upturned pyramid hospitals (Fig. 48), and many variations of a container hospital. Of these, for instance, the "Tree Hospital" (Fig. 49) displayed characteristics which now, over three decades later, seem utterly contemporary. All these fantasies undoubtedly contributed to the general excitement in the United States at the time and also merit further study in today's situation.

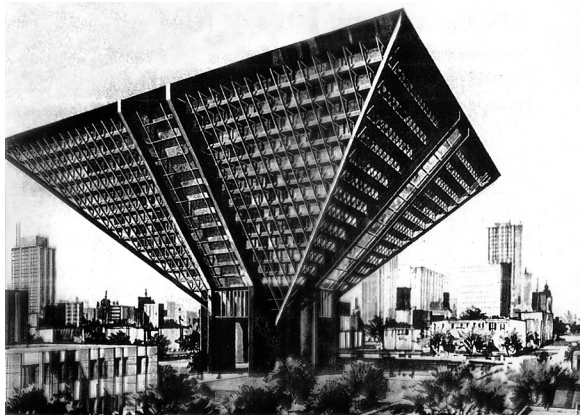


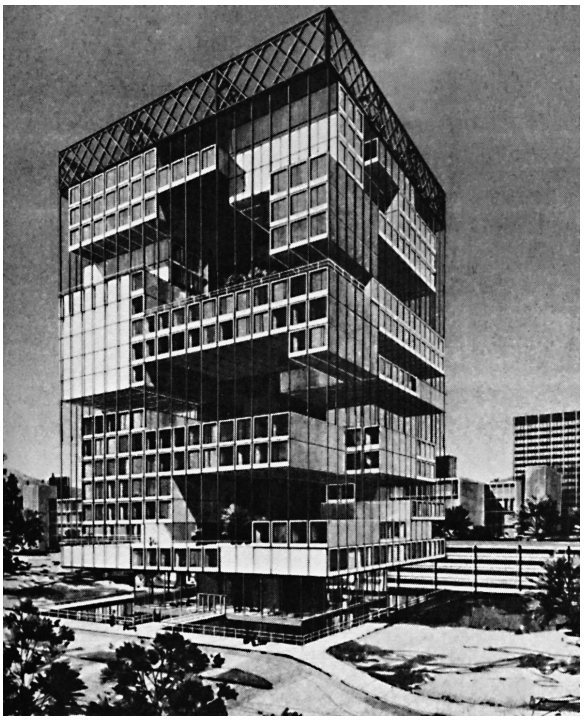
Fig. 48

In Britain lessons were learnt from the successes of the post-war school building programmes that used standardisation, industrialisation and modularisation. The particularly successful and widely published Hertfordshire County Council's schools programme had been directed by William Hatton Brown, who later became chief architect at the Ministry of Health and ran the Hospital Programme between 1959 and 1971.

In the sixties "the everyday practice of architects was enriched by debates about high-rise and low-rise; racetrack wards and peripheral bed areas; interstitial service floors, and automated supply systems etc., few of which they had ever seen in operation" (Francis et al., 2006, p. 42). On the academic front there was also unprecedented activity. The Medical Architecture Research Unit (MARU) at the Polytechnic of North London (later London South Bank University) was established in 1965 and at the Bartlett School of Architecture in University College, London, health care architecture was given a boost through Llewellyn Davies and John Weeks moving there from the Nuffield Trust. That is where they started to develop their analogies between hospital design, village and town planning and the importance of the street, coining the term "Indeterminate Architecture". All this gradually led to an exciting series of experiments in largely prefabricated modularised hospital building systems, such as the Oxford Method, the Harness system and eventually the Nucleus system. All these will be discussed later in this study because of the exceptionally strong future-proofing content that permeated this philosophy.

In spite of the increasingly strong influence of hospital consultants in North America there were architects who were not deterred. Some high profile

Fig. 49



practices were determined to keep the architect in the driving seat, notably the Canadian firm of Craig, Zeidler and Strong (later Zeidler and Roberts). With Eberhard Zeidler as the figurehead they designed the McMaster University Health Sciences Centre (MHSC), in Hamilton, Ontario, completed in 1972. It was the first integrated patient-care, educational and research complex to incorporate interstitial space with an incremental mechanical system. A "servo-system" concept, integrating structural and mechanical systems, separates permanent and changeable building elements for ease and economy of inevitable future change and growth (Fig. 50). "Called obsolescence-proof by the World Hospital Congress" (Zeidler, 1974), it was completed the same year as Greenwich (1972). McMaster, however,

has survived and is not only flourishing but remains an icon of the "plug-in machine" modern hospital. MHSC was designed to provide an infinitely flexible space to combat premature obsolescence and was deliberately designed never to be finished. During the design and construction process, it was possible to leave the final decision on which equipment to install to the very end, thus securing that the latest state-of-the-art equipment could be procured (James and Tatton-Brown, 1986). Zeidler's modular structure separated each part of the building into permanent and non-permanent elements. The permanent frame was integrated with the primary electrical and mechanical services into which various functions could be plugged. Zeidler incorporated interstitial spaces throughout the entire complex. Apart from organisational and structural intentions this was also seen to reduce refurbishment costs that are often, in the long run, higher than the original cost of the building. At McMaster the operating suites have,

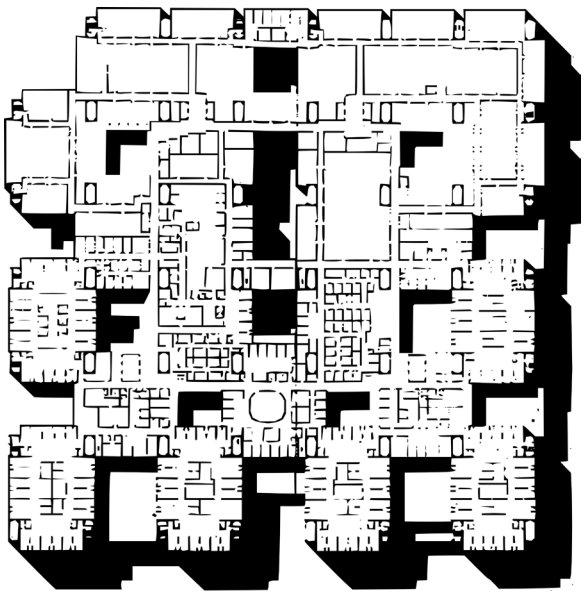


Fig. 50

since 1972, been renovated on average every 7.5 years without major disruptions to the functioning of the hospital (Verderber & Fine, 2000).

This utopian vision, over 120 000m^2 (with an additional 60 000m^2 of underground parking) of ever-changing architectural form, is demonstrated clearly in the overall design and gestalt of McMaster. Some critics rejected the high-tech mechanical image of the hospital, but many others understood Zeidler's intentions and appreciated his achievement. "Even today, 30 years after the building was completed, its presence is powerful" (Putievsky Pilosof, 2005, p. 2) (Fig. 51).

Zeidler's next major hospital was the Walter C. Mackenzie Health Science Centre, University of Alberta, Edmonton, Canada (Hood & Gardener and Grover Hodgson Palenstein with Zeidler Roberts Partnership, design from 1975, completed in 1986). According to the American Institute of Architects, it is "the first seriously built example of the idea that stimulating architecture can speed recovery" (AIA, 2001, p. 21). The building consists of only five actual floors, but the full-height interstitial spaces, and a large mechanical "penthouse", make the huge atrium reach a height equivalent to an 11-storey building. The atrium is dominated by a glass vault, a white space frame, walkways, galleries and terraces, pergolas, vines, fountains, bridges, windows, window boxes, stairs and elevators. The atrium is the first one of its kind in a hospital and it also contains fully visible ducts, pipes and other technical installations (Fig. 52).

Zeidler himself called it "humanist high-tech" (Freeman, 1987), while it could just as well be called "high-tech romanticism" (Verderber and Fine, 2000) (Fig. 53). "All through the day and into the

Fig. 51

Fig. 52

Fig. 53

evening, patients sit on balconies and terraces, alone in contemplation or in small groups. In addition to the architecture, they can watch fellow patients wheeled on stretchers from operating rooms across distant bridges or follow the path of sunlight as it rakes one side of a long space and then the other. It is a stimulating, sociable environment, and, Zeidler believes, curative" (Freeman, 1987, p. 54).

Studies have been made that show that the building has had positive effects on patients, including reduced recovery times. It is not too difficult to believe these studies. After all, in this case the trigger for the positive effects on patients is the architecture itself, not cosmetic decoration applied as an afterthought. These Canadian super-hospitals differ from the majority of their US counterparts in the treatment of daylight. Zeidler buildings are always generously sprinkled with courtyards, as are other "Romantic high-tech" structures such as Aachen. Whether these courtyards are intended to be deliberately therapeutic or not, they certainly make them into better buildings.

Fig. 54

The Medical Centre of Aachen Technical University (Jürgen Kunz, Paul Tröger and Wolfgang Weber / Weber Brand & Partner, designed in the early 1970s, taken into use in 1984) is a classic, familiar to all involved in hospital architecture. It is the ultimate expression of "machine for healing" and one of the masterpieces of the Heroic Era. It was described as "one of the most awe-inspiring high-tech monuments of the decade" (de Gravelaine, 1988, p. 3) and is, by now, also one of the best preserved examples of the architectural era it represents (Fig. 54). Aachen was opened in 1984 after a lengthy design and construction process. Its philosophy, both functionally and aesthetically, dates back to the late 1960s. The strength of the 1960s imagery is now seen as an asset by the decision-makers and the users. The yellowy green, an almost fluorescent and slightly unnatural colour, is everywhere, because it is religiously kept as a theme also when refurbishing the facilities. Mezzanine floors on the ground floor (height 5.4m) are made of lightweight steel structures that resemble scaffolding and give the impression of an interior that is in constant flux. The corridors are straight and very long but daylight seems to be omnipresent. The

amount of daylight increases the closer to the patient one gets, the external walls of the ward rooms being entirely glazed. The internal courtyards are green, spacious, and appealing, and extensively used by the patients (Kjisik, 2008) (Fig. 55).

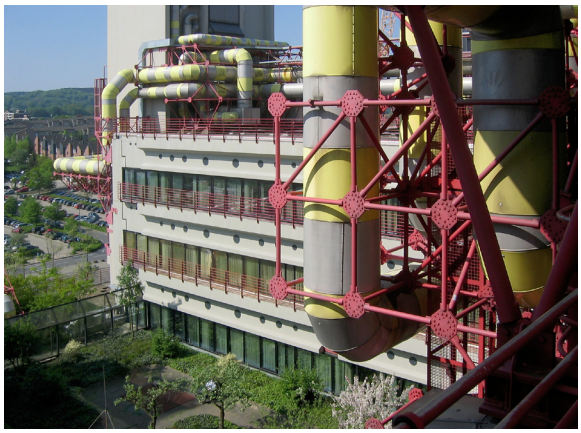
The building was well received by contemporary critics. The Japanese journal *Architecture and Urbanism* wrote that the effect of the towers is "just as dramatic as the dynastic towers of Tuscany" and that "the brilliant composition of the actual mass and volume even in the interplay of the smallest details never ceases to impress" (Amsoneit, 1986, p. 64). Peter Buchanan quoted Bruno Zevi in the *Architectural Review* as follows: "There is no monotony, no oppressiveness, no meagreness of form in this fabulous and stupefying mechanism", and himself concludes that it provides "a much more humane environment than is generally associated with a building of this size, consistency and ruthless exposure of parts and services" (Buchanan, 1986, p. 100). A Finnish group of architects and doctors who visited the building a few years after its completion stated in their report that "Aachen mirrors the society around it, a society which is in harmony with modern natural sciences. Its architecture particularly emphasises the interplay between medicine and technology. The unyielding construction exhibits itself unashamedly with bright, clear eyes" (Pesola, 1991, p. 12).

Aachen is a new dramatic interpretation of the Breitfuss-model, having no less than 24 towers rising from a gigantic plinth. Apart from the towers, the dominating elements of the massive structure are the ventilation channels and shafts that cover up the facades. This "San Gimignano and Centre

Fig. 55

Fig. 56

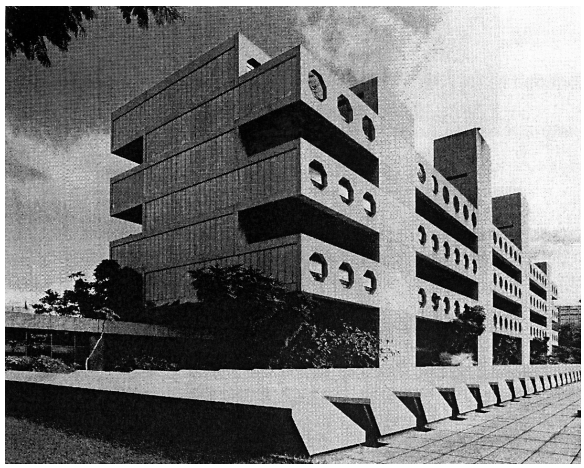
Fig. 57



Pompidou of European hospitals" has proved future-proof and is today perhaps more relevant than ever (Figs. 56 & 57).

Joao de Gama Filgueras Lima, generally known as Lelé, has designed a series of fine hospitals for the Sarah Network in Brazil. The first one of them was the Sarah Kubitschek Hospital in Brasilia, completed in 1981 (Fig. 58). It is included here as an example from the Southern hemisphere, to show that in spite of perfectly justifiable and appropriate regional variations that occur, the ideas of the Heroic Age exerted global influence. The Sarah Kubitschek Hospital displays spatial flexibility through industrial components that make extensions easy and flexible installations that minimise disturbance to patients. The green areas, courtyards and patios provide plenty of daylight and are extensively used for relaxation and exercising (Ribeiro, 2001). The later hospitals of the Sarah Network at Salvador, Sao Luis, Belo Horizonte, Fortaleza and Rio de Janeiro (1984-2002), all by Lelé, are particularly important in terms of their approach to ecological sustainability. All spaces in the buildings are designed for natural ventilation. Additional passive strategies, such as shade structures and abundant vegetation are used, while thermo-acoustic roof tiles and insulative air gaps between roof layers mitigate heat build-up (Guenther & Vittori, 2008). The philosophy of the network is in many ways exemplary and supports many of the arguments presented in the present study. It emphasises the importance of simple and logical floor plans and technical systems, in fact it sees simplification as the perfect critical synthesis of all complex systems and processes (The Sarah Network, 2007).

Fig. 58



Fabrizio Carola's General Hospital in Kaëdi, Mauritania (designed in the late 1970s and financed by the EU), is included here because it shows that the Heroic Era ideas are not limited to one particular architectural language. Modular innovation does not need to have rectilinear roots but it can also be based on vernacular, organic tradition (Fig. 59). The constellations of circular brick modules (Fig. 60) are joined together by arched elements that form semi-open corridors, thus making natural ventilation possible in most parts of the hospital. The project is a contemporary interpretation of local traditions but at the same time an important contribution to the global discourse as a completely novel way of designing a health care facility in a hot climate (Kjisik, 1984). "It is a breath of fresh air in the world of hospital architecture, a field that tends to be more imitative and impersonal than innovative and intimate" (Smith, 2003, p. 36). The project belatedly, but deservedly, received the Aga Khan Award for Architecture in 1995.

Fig. 59

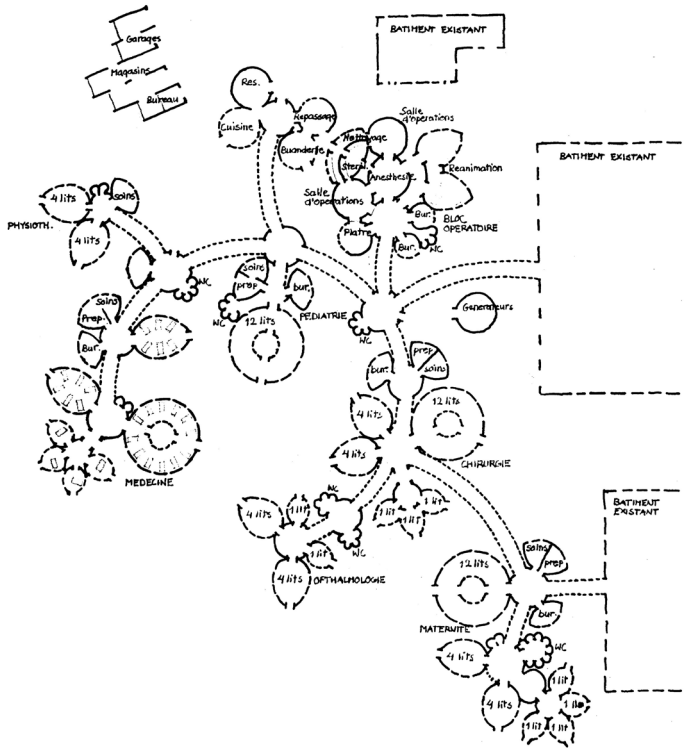

BATIMENT EXISTANT
Garages
Magasins
Bureau
Res.
Cuisine
Repassage
Buanderie
Salle d'operations
Nettoyage
Sterel
Anesthesie
Reanimation
Salle d'operations
Platre
Bur.
BLOC OPERATOIRE
WC
BATIMENT EXISTANT
4 lits
Soins
PHYSIOTH.
4 lits
Soins
Prep.
Bur.
WC
Soins
prep.
Bur.
WC
12 lits
PEDIATRIE
Generateurs
WC
prep.
soins
Bur.
12 lits
4 lits
4 lits
CHIRURGIE
MEDECINE
4 lits
1 lit
1 lit
1 lit
WC
4 lits
OPHTALMOLOGIE
BATIMENT EXISTANT
Salle prep.
12 lits
Bur.
MATERNITE
WC
4 lits
1 lit
1 lit
4 lits
1 lit
1 lit

Fig. 60

Another justification for including Kaëdi Hospital in the present study is that it serves as an example of the fact that even in development cooperation projects, this period deserves to be called "heroic". Innovative thinking was flourishing all over the "Third World" and donor organisations were involved in experimentation based on re-engineering of vernacular techniques and providing facilities which exploited local resources in an optimal and appropriate fashion in order to respond to real local needs. Nothing comparable has happened in the field since the early 1980s.

The plan of Kaëdi is essentially an exercise in modular inventiveness, albeit a particularly original and "exotic" one. A lot of the design research that was performed during the last years of the Heroic Era was in fact preoccupied with similar concerns, finding new inventive shapes and configurations for floor plans of patient wards. Numerous layout prototypes were designed, by no means all of them were tried out in practice, but they form a fascinating body of useful work that merits further study. Towards the end of the period, approaching the early 1980s, flexibility has started to attract less attention, and the emphasis was on plans that applied more complex interpretations of modularity, using plenty of 45 degree angles and circular forms. The inventiveness of the plan solution seemed to matter the most, and this is what the publications at the time, both in Europe and the United States, also largely concentrated on.

The Kreiskrankenhaus in Ulm, Germany, was a competition win in 1982 by Kubanek Muller Röder and Fukerider Architects. The plan studies (Fig. 61) show an almost "brunelleschian" obsession with superimposed grids, octagons and circles. Scottsdale Memorial Hospital (completed in 1983 by the NBBJ Group) in Arizona, expressedly "expandable" (Baumeister 2/1985), aimed at perfecting the rationality of a triangular ward model consisting entirely of single rooms (Fig. 62). Advantages

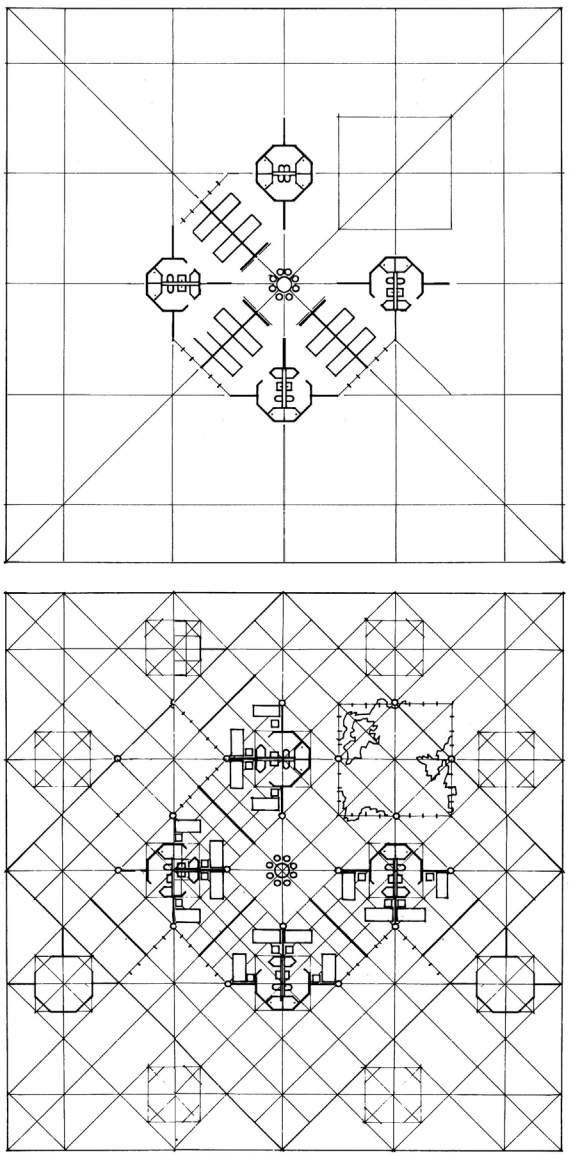


Fig. 61

associated with triangular wards (less staff required for observation) are not particularly apparent here, but the placing of all the private bathrooms on the external wall allows for a softer and more intimate interface between patient-room and corridor, an argument which has been frequently put forward also in recent years.

Lexington Memorial Hospital in North Carolina, by Freeman-White Associates, 1979, tried to do to the circle what Scottsdale tried to do to the triangle. The highly developed geometry and symmetry of the plan leads to the ward blocks appearing like stuck-on satellites on the overall ground floor plan (Fig. 63). The apparent rationality is probably slightly false. Finding the right patient's room after entering via the main door probably requires extensive signage and personal guidance.

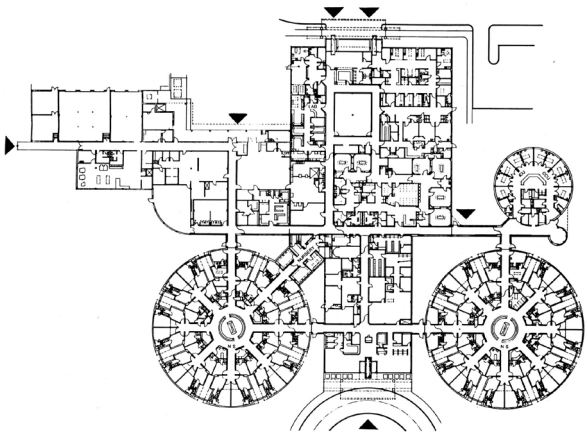


Fig. 63

One of the leading practices in Switzerland during the post-war decades, Atelier 15, also designed a number of hospitals during this time. Asyl Gottesgnad (designed in 1984) was conceived as a small 120-bed hospital and the configuration of its 1-4 bed rooms became influential. The 45 degree angle had been a common feature in concrete buildings since the heyday of "Brutalism", and as far as hospitals are concerned, Asyl Gottesgnad took it to new heights (Fig. 64). Many hospitals that were built during the following decade were, consciously or subconsciously, influenced by this ward model.

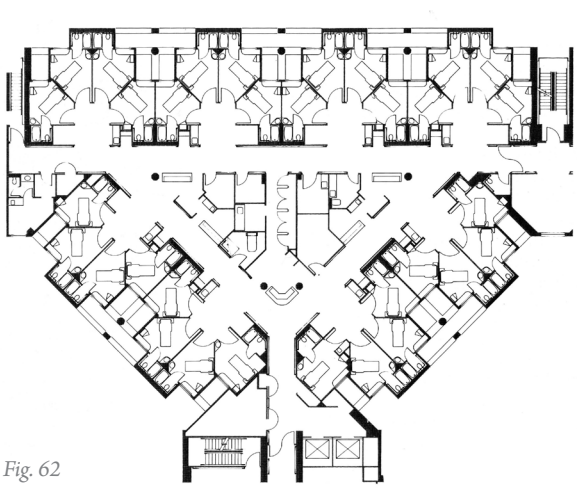


Fig. 62

These examples show a continuing preoccupation with systematisation. These buildings were generally intended to be extendable and in spite of their somewhat over-elaborated character, their future-proofing qualities were generally better than in the generation of hospitals that followed. That is why they deserve to be mentioned as examples of the dying convulsions of the Heroic Era.

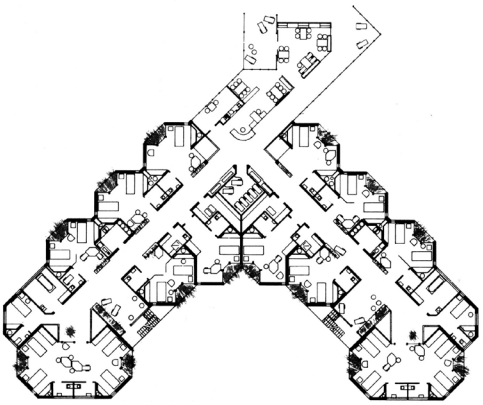


Fig. 64

In spite of the encouraging atmosphere that prevailed in the 1970s, the "limitations of a heritage based on a largely prosaic and limited interpretation of functionalism" (Francis et al., 1999, p. 56) prevailed in the design of a lot of the health care buildings around the world. The prevalence of the mediocre unfortunately led to a situation where it became increasingly difficult, especially for non-architects, to make meaningful value judgements. The good buildings of the 1970s were thus seen as part and parcel of something that had to be eliminated. All this inevitably had to lead to changes and sadly these changes rarely proved to be improvements.

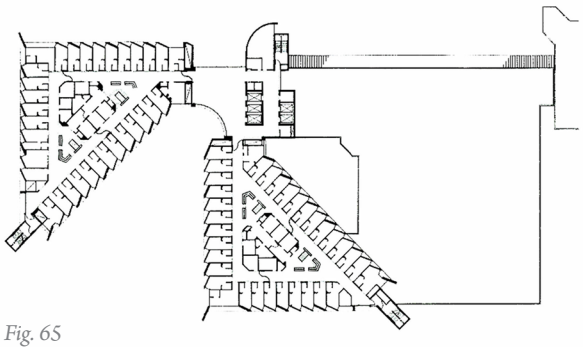


Fig. 65

Counter-reaction and Post-Modernism

The first hospice (St. Christopher's Hospice) was opened in London as early as 1967. Gradually the architecture of hospices started to affect the way people thought about health care buildings. A general appreciation of a "home-like" atmosphere, small scale and diversity of form started to manifest itself. In 1977, the American architect Herbert McLaughlin started repeatedly to criticize the Breitfuss-model (the term "Matchbox on a Muffin" was coined by him), and the minimalist megahospital in general, in many magazine and newspaper articles. He claimed that these hospitals were incapable of addition and demolition (Verderber & Fine, 2000) and went on to design one of the most important new wave hospitals, the St. Vincent Hospital in Santa Fe, New Mexico, in 1980 (Kaplan, McLaughlin and Diaz, 1977). It is based on strong horizontality, closeness to nature and clearly underlined regional characteristics (Fig. 65).

This development was strongly supported by the international critique of Modernism which led to the advent of Post-Modernism. Whether Post-Modernism should now be seen as a style, a periodizing concept or merely as a commercialisation and domestication of Modernism is debatable (Harvey, 1991). In any case, by the early 1980s, Modernism was by many seen as a thing of the past and there was a younger generation of architects who longed for "an architecture of communication" (Boyer, 2006, p. 54). The underlying philosophical and social principles of Modernism were also threatened. Individualism was gaining ground whereas solidarity and equality, cornerstones of the pioneers of international Modernism, were falling out

of fashion. As a result, buildings were built in which content, context, history and regionalism became key elements. The building was to be an expression of its cultural environment, as opposed to the "minimalist" megahospitals, which were the same all over the world. Even ornamentation was, once again, permissible (Johansson et al. 2006).

The development of acute hospitals continued during the 1980s and 90s. New imaging systems (CT, MRI, DSA) were taken into use in all acute hospitals. Non-invasive surgical procedures made day surgery possible. At the same time, polyclinics and procedural units kept growing. The demands for spacious work environments increased the floor area of surgical and intensive care units. There was further specialisation and concentration of know-how. A new level of specialised care, highly specialised care, was formed. University hospitals become their own urban entities with 200 000–300 000m^2 of floor area. Information technology became routine but its use was still complicated by ever-changing systems. The financing crisis was beginning to become a reality.

In hospital design, this led to increasingly tailor-made solutions. Even if the new buildings in principle were horizontal and had inbuilt extension possibilities, problems would occur later. Continuous ground level extending is, after all, rarely possible. These over-tailored plans have often caused difficulties concerning internal changes. The systematic clarity and logic, based on repetition and modularity, which had become characteristic of the minimalist megahospital, generally gave a better starting point for later adaptation and change (Johansson et al., 2006).

International Post-Modernism remained rather short-lived. In some countries like Finland, it had practically no impact at all. By the mid 1990s the whole concept had become blurred and the general diversification of styles made any kind of classification more difficult. Post-Modernism certainly contributed by bringing a more patient-centred thinking to the forefront of health care design. Post-modernist thinking coincided with the need to change the image of a hospital. A special set of articles in *L'Architecture d'Aujourd'hui* in April 1988 was headlined "Hospitals change their image". It dealt with many of the themes that are still part of the discourse today, such as patient-centredness, the relationship with the surrounding community, and bringing the city into the hospital (de Gravelaine, 1988). The belief that instead of better architecture, all can be cured through the addition of superficial decoration, a pinch of regionalism, better furniture, open fireplaces and other such irrelevancies has, however, been a persistent one. However, a few noteworthy hospital buildings did still emerge in the 1980s.

At the Ospedale Santa Santissima Giovanni e Paolo in Venice, the architects Semerani, Tamaro and Cosimini designed, in 1981, some skilful infill on a highly historical site, one of the oldest functioning hospitals in Europe. The new buildings show the kind of sensitivity to their surroundings that the Post-Modernist period at its best could offer (Fig. 66). Sadly, this did not happen very often.

In 1978 the Assistance Publique de Paris launched its first competition for a hospital that was open to "non-specialist" architects. This was because more and more people had become aware of the fact that

Fig. 66

it is unhealthy to let public edifices systematically ignore architectural quality. One of the main culprits was seen to be the "specialised hospital architect". The French had lacked what the Canadians had in Zeidler, the Germans in Weber & Brand and the British in Powell and Moya. Practically all French hospitals of the Heroic Era consisted of "thousands of beds stacked on top of each other, functional to varying degrees, in huge suitcases devoid of social graces" (de Gravelaine, 1988, p. 3). The winner of the competition for Hôpital pediatrique–maternité Robert-Debré was Pierre Riboulet, an architect with no previous hospital design experience.

It became, at its completion in 1988, the first major new hospital in Europe based on the idea of a "hospital street". It was considered important, particularly in a children's hospital, to provide a "soft landing" for the patients. Thus there are absolutely no clinical functions along the street, only shops and other normal "fun" places. The street is clearly narrower than in some later variations of the same theme, but the continuing curve adds extra tension. The central square about half way along is a real hub of activity, as well as being spatially impressive (Fig. 67). The post-modern features are played down, but the ensemble still clearly represents its own time. The site is very complicated. The slope is steep and even the very basic planning paradigms (vertical connections, sufficient daylight etc.) must have caused headaches. The result is a minor masterpiece in spite of its present logistical shortcomings, some dreary departments and a basic lack of flexibility. It succeeds in its quest to socially improve a neighbourhood through its determined urban approach, which is indeed a unique achievement by a hospital project designed in the 1980s.

Fig. 67

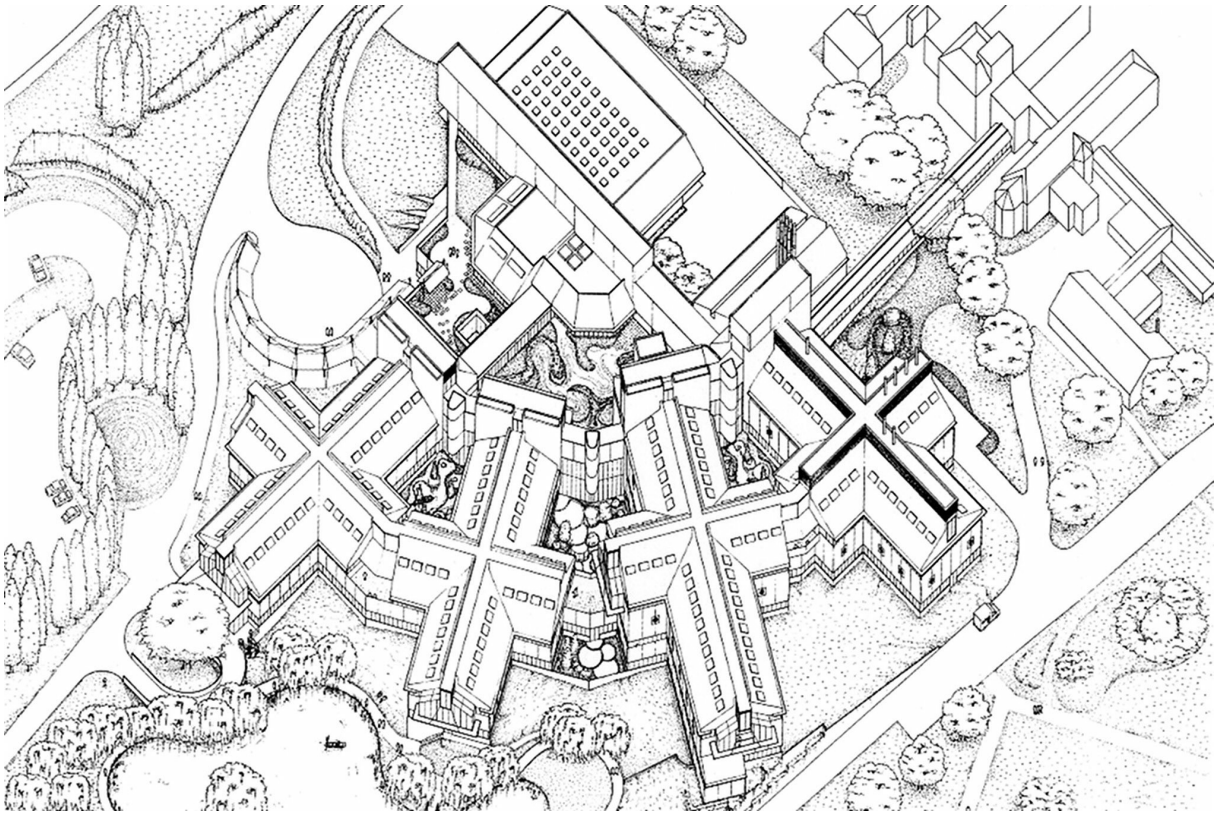


Fig. 68

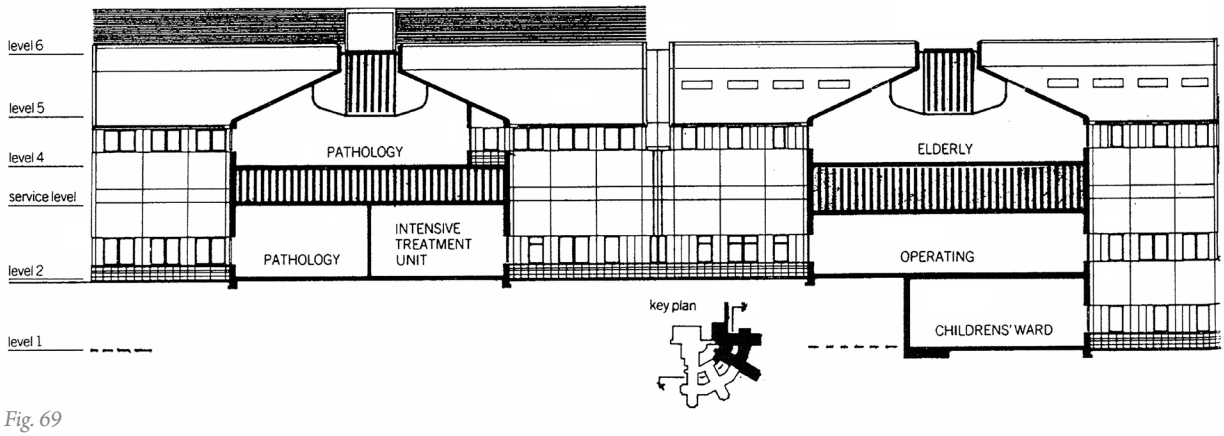

level 6
level 5
level 4
service level
level 2
level 1
PATHOLOGY
PATHOLOGY
INTENSIVE TREATMENT UNIT
ELDERLY
OPERATING
CHILDRENS' WARD
key plan

Fig. 69

The British architectural practice Ahrends, Burton and Koralek designed St. Mary's Hospital in Newport on the Isle of Wight in 1991. The building represents a "bent comb" model with its roots in the pavilion era (Fig. 68). It contains an array of idiosyncratic contemporary and futuristic ideas, managing to combine post-modern vernacular with ecological high-tech (Fig. 69). The architects had no previous hospital design experience and managed to produce a facility that is now, by most observers, considered as iconic. According to Burton it used nearly 50% less energy than a comparable hospital of the time. It has sophisticated heat recovery systems, interstitial floors and rather narrow bodies in the wings in order to make natural ventilation possible (Burton, 2004). The design process incorporated the arts and landscape from a very early stage. Peter Davey wrote in the *Architectural Review*, "St Mary's promises to be a civilised and uninstitutional place, in which the care lavished on provision of a richly layered and integrated environment should bear rewards in a happier life for patients and staff alike" (Davey, 1991, p. 31).

The field of health care design was diversified in the 1990s by the proliferation of smaller scale clinics, the increased role of the private sector, the growing need for extensions of existing facilities and the gradual preparation for the baby-boomers reaching retirement age. This, combined with a certain stylistic liberalisation and a decrease of control by public authorities led, towards the end of the decade, to many renowned architects (such as Richard Meier and Robert Stern in the US, Wiel Arets and Jo Coenen in Holland, Arata Isozaki, Shin Takamatsu and Itsuko Hasegawa in Japan, Herzog & de Meuron in Switzerland etc.) again being involved in commissions for health care related projects. The Maggie's Centres in Scotland had as their first designers Richard Murphy, Page & Park and Frank Gehry, with Zaha Hadid, Daniel Libeskind and Richard Rogers, among others, now lined up for forthcoming projects. These cancer patients' centres are not hospitals as such, but have "elements of a day-care center and hospice, as well as some functions already being absorbed into large hospitals – for instance, the therapeutic role of art and collective expression" (Jencks, 2006, p. 455).

Above all, the reason for the selection of these particular architects for the Maggie's Centres is that the client body believes that only the best architecture is good enough for the patients. This is an attitude one wishes were more widespread, particularly since in the projects for large hospitals of the kind that this study primarily covers, the iron grip of the "specialists" is not getting any weaker. If anything, the small group of architectural practices that has monopolised the field for many decades has, as a result of international mergers, become even smaller, and in consequence the practices that are getting the commissions even bigger. The situation is now threatening to deteriorate even further due to phenomena such as the British PFI (Private Finance Initiative) programme where only giants are allowed on the playing field. Nevertheless, some very interesting projects, the most important ones being on a par with the the very best achievements of the "Heroic Era" have emerged during the early years of the new millennium.

Chapter 2. Inevitable trends

Global megatrends

The programmes for hospital complexes have been in a state of constant flux everywhere since the beginning of the new millennium. This has had less to do with changing ideas about what a hospital should look like than a multitude of transition factors that are changing the way health care is organised and consequently are also having an impact on the way our hospitals are designed. These factors are driven primarily by changes in society but also by scientific developments. They are partially global and generic, but it is important to stress that they are "global" only as far as the "developed", industrialised part of the world is concerned. A variety of ways to assemble these factors can be found in literature. The EU Interreg IIIC programme "Network for Future Regional Health Care", after lengthy deliberations, agreed on the following list (Johansson et al., 2006, p. 18):

- demographic change towards a rapidly ageing society
- developments in biotechnology and medical technology
- wide-spread use of information technology
- changing work processes and work environments
- growing consumer awareness and empowerment
- diversification in health care provision
- shortage of qualified personnel

Of all these points, the first one, the demographic shift towards a rapidly ageing society, has dominated the discussion already for several years. Hardly a single seminar or conference is held anywhere in Western Europe, the United Staes or Japan, where the first speaker does not take up the problems related to all the baby-boomers that will retire *en masse* and live for much longer than their pensioned predecessors.

Even if one considers the baby-boomers as a one-off occurrence, the population in Europe will undoubtedly continue to age. The proportion of Europeans older than 65 years is expected to grow from 16.1% in 2000 to 27.5% in 2050, while the population aged over 80 years (3.6% in 2000) is expected to reach 10% by 2050 (Kekomäki et al,. 2006). A higher percentage of older people puts greater demands on health services, and the increase in life expectancy leads to more people living with chronic health conditions (Francis & Glanville, 2001).

The argument that these demographic trends will increase both health care costs and the demand for hospital care has been politicised and used to support the view that the welfare state will no longer be affordable. The crucial factor, however, is not how long one lives but how long one takes to die. The last year of life is usually the most expensive. This is, however, not the case only with the elderly, in fact there is research that shows that the most costly patients are those that die young (McKee&Healy, 2002). The elderly of the future will probably benefit from a lifetime of better nutrition, education, general awareness levels and social conditions. They will have a higher income and probably better health status than previous generations of old people, which in turn will lead to increased consumer awareness, influence consumption habits, and escalate the demand for more variety in forms of elderly care services and levels of accommodation (Kekomäki et al, 2006).

A major change in the provision of residential facilities for the elderly has already taken place in many countries (Sweden, Denmark, The Netherlands, etc.). The sight of bedridden long-term geriatric patients gradually fading away in the decapacitating and inhumane wards of local hospitals and health centres will fortunately soon be history. A lot of work still remains to be done to achieve this, for instance in Finland. Elderly living, in its various forms, will provide major challenges for architects in the years to come. Acute care hospitals may be the section of the health care network that will undergo the most dramatic physical changes but the need for innovations in the field of elderly living is just as great.

Other kinds of demographic shifts, such as growing and shrinking populations as well as increasing mobility within the EU and the whole world, are factors that will have a major effect on health care delivery. For a while, the most recent EU member countries as well as those in line for membership, will have low birth rates, which together with high mortality rates will lead to shrinking populations. Immigration from outside Europe will accelerate in parallel with improved living conditions. Predicted fertility rates are going down in some countries, particularly predominantly Catholic countries with traditionally high birth rates. Immigration does, however, maintain the population level in most of the richest member countries, at least until the newer arrivals have assimilated to such an extent that their birth rates approach those of the indigenous population. Poverty among the indigenous population, still common in many new EU member states, works as a deterrent for immigrants from the very poorest countries, and will do for some time (Kekomäki et al., 2006).

Ethnic diversity and multiculturalism are increasing as a result of immigration. EU immigration policies are becoming homogenised and in the future the flow of people from the poorest countries will be spread more evenly than before. The make-up of the workforce will also be significantly affected by continuous immigration into Europe. For the moment the movement of qualified personnel from the low-income EU countries to the most affluent has led to a dramatic shortage of qualified personnel, for instance in the Baltic countries. Immigration from the developing world will not be able to combat this significantly under the present circumstances. The shortage of staff is strongly felt even in many "mid-table" European countries. At the same time some developing countries are devising means to stop their own "brain drain". South-Africa, the most developed sub-Saharan African country, has decided to lower the level of the education of their nurses in order to prevent them from passing examinations that are required to work in the United Kingdom.

Multiculturalism will have an effect on hospital design. There will, on the one hand, be more pressure to create more private areas and clearer gender separation, but on the other, there will be a need to plan circulation and waiting areas, as well as semi-public and semi-private spaces in such a way that larger groups of relatives and friends than what is the norm today can be accommodated. The hospital will become a more social place but problems could also be caused by certain aspects of human life that are considered taboo in some cultures. In more open hospital environments the question of personal space also becomes more critical because it varies greatly from culture to culture. Reasonable proximity in one is seen as intrusion in another (Hall, 1966).

The paradox of striving towards increased openness on the one hand, and the need for "cocooning" on the other, is one of the main future challenges taken up in this book. Multiculturalism will clearly give this discussion yet another dimension.

Christian monoculturalism will give way to value pluralism in all EU countries before very long. As is already happening in the European countries with the largest immigration populations today, Christian symbols and ways of treating space are giving way to neutral or completely flexible areas where people can meditate, worship or mourn. Dedicated prayer rooms or communal "meditation" spaces will also be part of future schedules of accommodation in hospitals.

Increased cultural diversity will put more pressure on health workers at all levels. Apart from the fact that migrant populations often have a different disease profile from that prevalent in the recipient country, the staff must also be made aware of a multitude of behavioural idiosyncrasies. Hospitals must become increasingly accommodating when facing different beliefs, including attitudes to death, which some cultures view as more "natural" than others. Ethnic diversity and value pluralism will undoubtedly, in the end, reduce ethnocentricity and positively affect communication between care givers and patients and all others involved. This will also have an effect on the physical facilities, or at least on the way they are used and adapted to different cultural scenarios.

The time-scale and degree to which different sections of the migrant population assimilate and change their traditional ways of life varies greatly. Those sections that are seen by their "western" counterparts as the most "successful", i.e. those that seem to assimilate easily, at least in terms of acquired affluence, will soon join the ranks of the indigenous population in having increasing expectations and demands, thus showing growing consumer awareness and empowerment. Consumer movements and the availability of information through the internet and otherwise, will generally lead to a rise in public expectations as to how care is delivered and also to the architectural quality of the buildings in which this care is received.

Many countries are introducing reforms intended to create more competition and an open healthcare market. Demographic changes, particularly the ageing population, will affect the cost of healthcare. The retirement of the baby-boomers will reduce tax revenue all over Europe. Political conditions and economic dynamics are, however, probably more difficult to predict now than ever before. Few would have believed that Ireland, traditionally a country with a very high level of emigration, by nearly trebling its GDP within ten years, would become a major recipient of educated workforce from the new EU member states. Very recent developments, however, indicate that this may have been a temporary state of affairs.

In the same way, it is also possible that the "competitiveness" criteria by which different countries used to be evaluated will be reviewed as a result of recent setbacks to the neo-liberal, uncontrolled capitalist thinking. Already at the beginning of the 1990s, the UNDP (United Nations Development Programme) created a new concept, the "Human Development Index", which included indicators based on health and education on a par with economic ones, in order to rank the development levels of different countries. When

health and education indicators also become part of the evaluation of the "competitiveness" of a country, paying less or more income tax may no longer be seen as such a major issue as it has been in the prevailing political climate. Free, high quality health care and education for your children may be seen as an essential selling-point when high earning, well-educated young people choose their country of residence. High public spending could again be seen as a sign of a civilised, well-ordered society based on solidarity and equality.

Tax revenue will probably decrease in any case, even if the above scenario materializes. As a result of this, and other economic realities, outsourcing and sound public private partnerships will evolve further. The health care system will concentrate on its core tasks and main areas of competence, i.e. preventive services, diagnostics of pre-clinical diseases, clinical services and rehabilitation. Laundry services, book-keeping, janitorial and security services, technical maintenance, and storekeeping do not form part of the core skills of a health care organisation and thus these services will be produced outside the hospitals by various forms of public-private partnerships. This development will have a major impact on the way hospitals of the future will be designed. Major elements, traditionally seen as integral parts of a hospital complex, will no longer necessarily be found anywhere near the premises where the core functions are performed.

Life-cycle costing approaches will be used in the design and realisation of facilities. This will be a positive development particularly if its application raises the awareness that the initial capital investment costs, and particularly design costs, are only a small part of the general picture. It will be less positive if it is primarily connected to profit-making mechanisms for the private sector, as has often been the case until now. Life-cycle costing has also so far not been seen as being particularly applicable to refurbishment projects. This is a major shortcoming since refurbishment of the 1960-1980s hospital stock is underway everywhere and remains one of the principal challenges ahead. It has been estimated that one tenth of the present hospital facilities within the EU is continually under some kind of refurbishment (Kekomäki et al., 2006).

Technical innovation is generally slower in the world of medicine than in many other fields. This is due to the fact that the innovation process is particularly long and complex involving multidisciplinary groups and facing exceptionally stringent regulatory safety requirements. The initial investments are often so elevated that smaller enterprises are unable to face the risks involved. The medical device industry is heavily based on research and development and it combines knowledge from various sciences, engineering and medicine to solve the problems it is tackling. Its products must be clinically validated, proven in terms of medical progress and also be affordable given the present constraints. Thus it is not enough to produce what is technically possible but whatever is produced must also be an affordable solution that makes a positive contribution to the world of medicine (Pallikarakis, 2006). The general impression among experts has until recently, however, been that most technological innovations increase costs more than they increase effectiveness (Kekomäki, 2006a).

Life-extending technologies have nevertheless led to many previously untreatable diseases now becoming treatable. These technologies produce added expenditure in any case, and even more so since the years of prolonged life are usually the most expensive. A longer life with reduced risks and discomfort is, however, such a compelling argument that some hospital administrators and doctors seem to regard the hospital building as simply an envelope for all the required technology. To those whose quest it is to improve the architectural quality of hospitals, this is very unfortunate since, considering the excessive cost of all the life-saving technologies, this envelope is too often seen as a necessary evil which should be executed as cheaply as possible.

In the final report of Interreg IIIC "Network on Future Regional Health Care", the chapter on Trends in Medical Technology" states that future health care in thirty years time will be produced differently from today but "the way it will affect the citizen's quality of life will strongly depend on political and financial issues as well as adaptability to disease management, rather than scientific and technological potential" (Pallikarakis, 2006, p. 90).

Megatrends with a medical source

It's the hospital war on terrorism, in which MRSA is the Al-Qaeda of bacteria. At over 20 MRSA deaths per million population the evidence proves you are safer without a flak-jacket in a back-alley in Basra than you are in a British hospital bed. Phil Gusack, 2006

Universal design issues – circulation, legibility, space, light – are still of paramount importance. Technological and environmental requirements are simply components in the age-old architectural discipline of marrying function to form.
Susan Francis and Rosemary Glanville, 2001

Concepts such as "care pathways" and "seamless service chains" will probably change the health infrastructure and the appearance of our hospitals more dramatically than technological innovations. The borderlines between primary, secondary, and tertiary care will become blurred or disappear altogether. The organisational cultures and work methods will change rapidly. The differences in the facilities at different levels of the care hierarchy will be accentuated, with hospital care being reserved only for patients who require short–term intensive specialist or emergency care. Continuing and long-term care will be provided in smaller units in the community, which in turn will lead to the development of new types of care units. The inherently different characteristics of "cure" and "care" will play a more important role in the design of the various facilities.

BOX 3 describes the current situation in Northern Ireland, but is applicable to almost any rich country today. It lists a multitude of typical current problems

Box 3

An ever increasing demand for services

A major surge in the number of emergency medical admissions leading to postponement of elective work

Bed-blocking in acute hospitals by elderly patients due to insufficient community places for them to be transferred to

Large number of hospital beds occupied by patients with chronic diseases who tend to be admitted periodically to stabilize their condition

Long waiting lists for General Practitioner referrals for hospital outpatient appointments, diagnostics and elective surgery or other treatments.

Difficulty in clinical and nursing staff recruitment

High quality complex care increasingly unsustainable in smaller units due to lack of consultant cover

Overcrowded accident and emergency departments frequently due to self-referrals

Limited effective integrated working between primary and acute sectors and services

The large majority of available capital investment focused on the acute sector to the disadvantage of the community sector

Pressures on affordability

John Cole, 2006.

that should be alleviated by the adoption of smoother care pathways and improved service chains. Maybe the most visible symbol for this changing structure of cure and care is the dramatic reduction in the number of hospital bed spaces in the old EU countries, as well as in the rest of the industrialised world. Cost pressures and increased competitiveness, the closing down of smaller hospitals, the elimination of duplication of activities, and the moving out of psychiatric and long-term geriatric patients, as well as increased out-patient activities and rehabilitation outside the hospitals, are all factors that have contributed to the elimination of thousands of beds. The average inpatient length of stay in the UK was 49.3 days in 1949, 37.6 in 1959, 25.6 in 1969, 19.8 in 1979, and 9.9 in 1995 (McKee & Healy, 2002). In 2006 it was on average 5 days in the EU member states, not including the new members of 2004.

The British National Health Service (NHS) has set the target that 80% of planned surgery will be undertaken as day procedures within the next few years. This signifies another major shift away from overnight stays (Francis, 2006). Paradoxically, an increasing proportion of day patients actually increases the average length of stay since a large number of these day patients would previously have stayed for one night, thus lowering the total average (McKee & Healy, 2002).

These trends, as pan-European as they seem, are not yet a reality everywhere. Much can be learnt from the experience of others but every dominating trend or policy cannot unequivocally be applied everywhere. Even within the present EU member countries there are still differences. In some of the new member countries, the social context is still critical in this

respect. Many of them lack the kind of support mechanisms (well equipped homes, home care and other social services) that are more or less taken for granted in more affluent circumstances. People cannot be sent home from hospital too early, so the length of stay and thus the need for beds, will remain higher for a while to come.

The domination of the ward block as the symbol of a hospital will thus become a thing of the past. The wards that remain will take a secondary role in the ensemble and be standardised and extremely flexible. On the other hand, large teaching hospitals that deal with tertiary and highly specialised care seem to be growing ever larger. Centralisation of certain highly sophisticated elements of the care chain leads to a growth where economies of scale become a major issue. A multitude of studies shows that central hospitals with more than 300 but less than 600 beds are the most scale-efficient. They also show conclusively that large hospitals with more than 620 beds are scale-inefficient (McKee & Healy, 2002).

Whatever the size of the hospital, the recruitment of sufficient and qualified personnel in care work will become more difficult in the future. Thus, new thinking in the design of both functional and attractive spaces, plus furnishings and work stations that seamlessly support the work processes, will be an increasingly important factor in the competition for workforce. The volume and expertise of the staffing will, however, correspond more closely to the actual clinical needs of the patients. This will range from a simple one-man janitorial service in a patient hotel to full, highly-trained professional manning of an intensive care unit (Kekomäki et al., 2006).

Hospitals have been built in suburbs, or at least on the outskirts of the urban core, since the 19th century cholera epidemics in the overpopulated cities of the industrial revolution convinced the decision-makers that the right place to be cured was closer to nature. The period of the sanatoria moved them even further out to the countryside. Existing suburban road networks, ease of parking, and sites with capacity for extension have kept them there but now there are strong trends towards reversing this development and returning the hospitals their status as urban landmarks.

Wherever hospitals are or will be located, there now seems to be a growing agreement that the building and renovation of health care facilities requires innovative thinking and new flexible solutions. These must incorporate new ideas about the organisation and structure of care, as well as unforeseen technological developments into the processes and physical structures of the facilities.

Changing disease patterns will have an effect on the planning of hospitals and provide an additional argument for ever more flexible and adaptable solutions. The group aged 80+ is growing steadily in both relative and absolute terms. This will cause the incidence of age-related illnesses to increase. Dementia, a severely debilitating disease, is the most familiar example and also one that offers specific challenges to those designing facilities for patients suffering from it. Many older people also suffer from more than one chronic disease, such as high blood pressure, heart failure, eye diseases, diabetes and arthritis. The health of the world's population is being transformed due to changes in lifestyles, increased prosperity and climate change. Modified eating habits are the primary cause for the steadily

rising incidence of obesity in the industrialised world. Obesity leads to a range of illnesses, such as diabetes and accelerated deterioration of joints. There are signs that the incidence of psychiatric disorders may be increasing. Finally, climate change may cause the appearance or reappearance in Europe of diseases that have been considered exclusively tropical. Patient profiles could soon be very different and this again will affect the programming and design. Some of the developments are culturally, socially and genetically unpredictable and difficult to pinpoint. Statistics and trends at the moment show, for instance, that the need for thoracic surgical facilities will decline in Finland but increase in Portugal. There are also many risk factors, such as an increase in smoking among teenagers, that will only show effects decades later (McKee & Healy, 2002).

There are now about 800 000 different types of infections that patients can catch in hospital (Meuser & Schirmer, 2006). In both the United Kingdom and France they now kill more people annually than road accidents. The battle against hospital acquired infections will be one of the main themes in hospital design in the coming years. In spite of this being a "trend", it goes without saying that nosocomial infections have always existed. In fact it has been estimated that by the beginning of the 20th century, for the first time in history, the risks of going to hospital were less than receiving treatment elsewhere, and this was primarily because hospital infections were being brought under some control (McKee & Healy, 2002). Air-conditioning systems now play a key role, but if the problem could be solved by technological means alone, the task ahead would appear less daunting. There is now plenty of evidence (Lawson & Phiri, 2004; Ulrich et al., 2004; Dowdeswell et al., 2004) that a gradual move towards single rooms in patient wards will improve the situation. A consistent provision of alcohol-rub hand hygiene dispensers at strategic points all over the hospital is a relatively small and inexpensive way to combat these infections. A lot of work needs to be done, and architects, engineers and industrial designers will play a key role.

The combination of the technology push by the manufacturers and the demand pull by the users will continue to bring new medical technologies, both devices and pharmaceuticals, to the health care market. Increasing demands "on proven cost-effectiveness will put a certain harness on this development but the pace of introducing new technologies is unlikely to slow" (Johansson et al., 2006, p. 18). The effect that these new technologies will have on the physical environment remains, in most cases, unpredictable.

There is no indication that genetic technologies (genetic mapping and testing as well as actual gene therapy) would have a direct influence on the design of facilities for health. Nevertheless, the understanding of the interplay between genetic predispositions and environmental factors will help in the prevention and treatment of a number of diseases (Johansson et al., 2006) and will thus have a potential effect on disease patterns, which in turn could indirectly influence prioritisation of spatial arrangements. The impact of the increased use of regenerative medicine (repairing or replacing injured tissue and organs with engineered tissue based on the patient's own cells or tissues rather than artificial implanted prostheses) is equally unpredictable but since these techniques greatly improve

biocompatibility (Pallikarakis, 2006), it is likely that also in these cases disease patterns will be affected.

In any case, many of the new scientific innovations in this field will remain at the disposal of only the very richest countries and individuals, representing only a very marginal answer to the major challenges in health care world-wide. In the end, ethical and moral debates (particularly concerning genetic technologies) will continue to play an important role in determining future practices (Francis et al., 1999). Advances in imaging and laboratories are topics that will doubtless also have a major impact on the facilities of the future health care network. Magnetic Resonance Imaging (MRI) and Computed Tomography (CT), as well as the most extensively used recent imaging technology, ultrasonography, have revolutionised diagnostic imaging in recent decades. New technologies such as electron-beam computed tomography (EBCT), high-resolution positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) have been developed. The costs involved are high and there is still no certainty that they will lead to significant improvements in patient outcomes. Some of these techniques are, at least for the moment, far too costly to be used extensively at central hospital level (Johansson et al., 2006).

Clinical equipment in general is certainly getting smaller, more automated, and more mobile. One of the cornerstones of a patient-centred approach, the doctor coming to the patient rather than the other way around, will be reinforced through the development of more mobile equipment. Micro-essay test kits and small automated pathology testing equipment offer possibilities for on-the-spot screening and diagnostics, thus greatly facilitating near-patient testing. It will also be possible to perform the majority of common laboratory analyses with small mobile multi-channel analysers which are connected directly to information networks. As a result of these developments, much of the basic diagnostic testing will in the future be housed in primary and community settings. Highly-specialised analyses, on the other hand, will be performed in centralised laboratories, even across national borders. All this will lead to the gradual disappearance of large scale laboratories from the prime "hot" sections of large hospitals. This will assist in simplifying the internal logistics of new hospital buildings, and pave the way for less cluttered and more flexible floor plans.

Minimally invasive procedures (miniaturised devices, digitised imaging, and endoscopic and catheter techniques in surgery, cardiology and interventional radiology) will provide easier access inside the body and consequently shorten the recovery times as well as reduce the trauma experienced by the patients during treatment (Johansson et al., 2006). The new techniques will have an effect on the detailed design of operating departments and other work space designated for treatment procedures. The shorter hospitalisation times, in turn, will contribute to the reduction of the average length of stay and thus the size of the wards in general hospitals.

The developing minimally invasive microsensors are implantation devices that can perform analyses "in situ" without the need to visit a traditional laboratory. Already existing applications such as blood glucose monitors and insulin pumps actually perform therapeutic functions and thus an extreme vision of the hospital of the future could be "a chip under

your skin". Moving from "micro" to "nano" scale is a new development and we still do not know when the technology involved will have matured sufficiently to be applied in practice. It is nevertheless likely that the use of nanotechnology with its devices, tools and techniques will revolutionise many diagnostic and treatment procedures within the next 30 years (Pallikarakis, 2006).

The use of information technology will increase. It will help reduce queuing times and assist in building up credible care pathways and seamless service chains. In the Nordic countries, the same patient database can, in the near future, be simultaneously used by primary care physicians and specialists. This will allow for electronic consultation and considerably reduce the number of visits to hospitals. At the eHealth 2005 Conference in Athens organised by the Interreg IIIC Network for Future Regional Health Care, the conclusion was that information technology will indeed make it possible to reorganise the patient processes, but that a meaningful analysis of these processes is still ongoing. In due course, when the work is at a more advanced stage, we can gradually expect to benefit from this development, in terms of both patient satisfaction and financial gains (Johansson et al., 2006).

Telemedicine, as a field of telematics, is already in rather extensive use. Remote and continuous monitoring of patients on a routine basis, with data transmitted via telecommunications or internet links, offers new means for "remote medical care, enabling doctors in remote locations to consult, in real time, with centres of excellence – at their own convenience and without delays" (Pallikarakis, 2006, p. 90).

Some of the new technologies described above will probably not have a particularly significant direct effect on the use of space and the programming of future health care facilities. The most important indirect effects will probably be related to the continuing decrease in hospitalisation times. Some of the others, particularly those related to miniaturised and movable diagnostic equipment, centralised specialised laboratories, the growing use of minimally invasive procedures will, however, gradually lead to new ways of conceptualising the spatial, functional and logistical aspects of some of the core departments in acute care hospitals. The relative uncertainty of the speed of development will undoubtedly lead to escalating demands for improved flexibility and adaptability of the facilities, i.e. calls for better future-proofing.

Architectural megatrends

Architecture is not a vehicle or a symbol for things that do not belong to its essence. In a society that celebrates the inessential, architecture can put up a resistance, counteract the waste of forms and meanings, and speak its own language. Peter Zumthor, 2005

Minimalism, a contemporary trend that is often quoted as having its roots in 1980s Catalonia, leans heavily on the early Modernist pioneers, such as J. J. P. Oud and Adolf Loos, and at its best represents a continuum of the traditions of international Modernism. The term is here used rather broadly in order to make a distinction between primarily rectilinear and unfussy artefacts and those displaying more flamboyant, expressive features. An ever-increasing openness, flexibility and transparency are characteristics of Minimalist Modernism of the new millennium. These attributes are in no conflict with the present trends in hospital design, in fact quite to the contrary.

The first phase of the extension to Hospital Sant Pau in Barcelona by Bonell and Rius is a true Catalan minimalist building with entirely white monochrome interiors which are full of sunlight, easy elegance and well proportioned spaces (Fig. 70). Without any "therapeutic" colour schemes or paraphernalia meant to give it a "domestic" feel, this hospital is as appropriate an environment for cure and care as any. Sant Pau is not the only example. Very good architects are now producing fine, more-or-less Minimalist hospitals, for example in Austria, Switzerland, France and the Netherlands. Minimalism does not, contrary to the way it is often perceived by non-architects, result in dreary clinical and institutional interiors.

Fig. 70

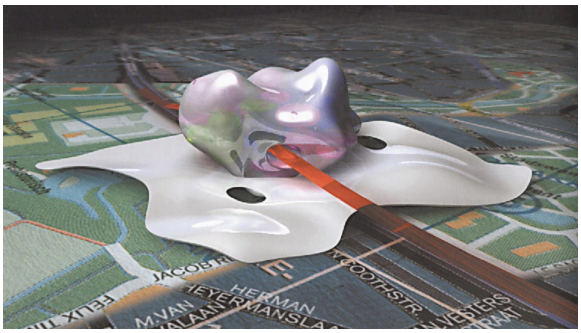
The "wow factor" has become a talking point among architects as well as the general public. Buildings that cannot leave anyone indifferent because of their surprising, unusual or even shocking appearance, possess the "wow factor". The new CAD drawing programmes and their applications have made it possible to design (and make) almost anything. The majority of recent major buildings that possess a particularly marked "wow factor" consist of freely flowing, organic forms with few right angles or straight lines. "Blobism" can be interpreted as a genre of neo-expressionism and the Potsdam Tower

(Fig. 71), built in 1924 by Erich Mendelsohn (who later designed several fully-fledged minimalist megahospitals), can be seen as the original "blob". Architectural theorists and critics are slow in the creation of nomenclature for new styles and movements. Thus we are left with somewhat flippant descriptions, such as those used here. One of the most influential architectural theorists of the latter half of the 20th century, the American Robert Venturi, is best known for having categorised all buildings under two headings: "ducks" and "decorated sheds". Unfortunately there are many hospitals that have been built in the last few years that are best described using Venturi's terminology. They are basically "decorated sheds" with a "duck" glued on. The "decorated shed" is the actual hospital, designed to be a logistical dream. The "duck" is the meek and clumsy "wow factor" that marks the entrance to the "health mall". Venturi would probably agree that the main reason for these buildings looking the way they do is that "Post-Modernism in architecture and urban design tends to be shamelessly market-oriented because that is the primary language of communication in our society" (Harvey, 1991, p. 77).

Fig. 71

Market-oriented or not, major "blobs" have not yet been seen in hospital architecture. The competition "Future Hospital – competitive and healing", organised in 2004 by the Netherlands Board for Hospital Facilities, did, however, yield some entries strongly inspired by "blobism" (Fig. 72). The "wow factor", if looked upon with some artistic licence, can be said to be nothing new in hospital design. The Renaissance and Baroque palace hospitals, in big city centres, provided plenty through their sheer size and pomp. The early Modernist sanatoria were certainly also "wow" buildings of their own era, many of them still having that effect on people today.

Fig. 72



”Paradoxically there is a need for isolation, cocooning almost, in perfectly controlled conditions, but also for a healing paradise with lots of people and life around” (Molenaar, 2006, p. 377). This quote presents one of the main dilemmas of hospital design today but is also inspirational. The word “cocoon” conjures up “blob”-like images, so we might imagine a situation where the two opposing approaches or “styles” meet. This could result in a “minimalist” flexible and adaptable basic structure that incorporates “blobistic” cocoons whenever appropriate. In fact, the “father of the Breitfuss-model”, the inspirational and mysteriously underrated French-American architect Paul Nelson, already experimented with cocoon-like operation theatres in the 1940s (Fig. 73) and he incorporated a variation of these ideas in his hospital at Saint Lo. In the near future it is conceivable that minimally invasive procedures, new imaging technologies and intensive care units could best be served, both ergonomically and in terms of elegant and functional integration of all the technology, by free-form “blobs”.

“Mat building” is a concept coined by Team 10, a group of architects disillusioned by the inflexibility of the Modern Movement in the 1950s. Its inherent philosophy is gaining popularity today particularly in connection with the design of buildings such as airports and shopping centres. It has perhaps not been used consciously by hospital designers up to now but clear parallels can be identified between “mats” of the past decades and some good new hospital buildings. The “building within a building”, or “room within a room” approach has become a topical theme in architecture in general. In new hospitals in Spain and elsewhere this has manifested itself in the shape

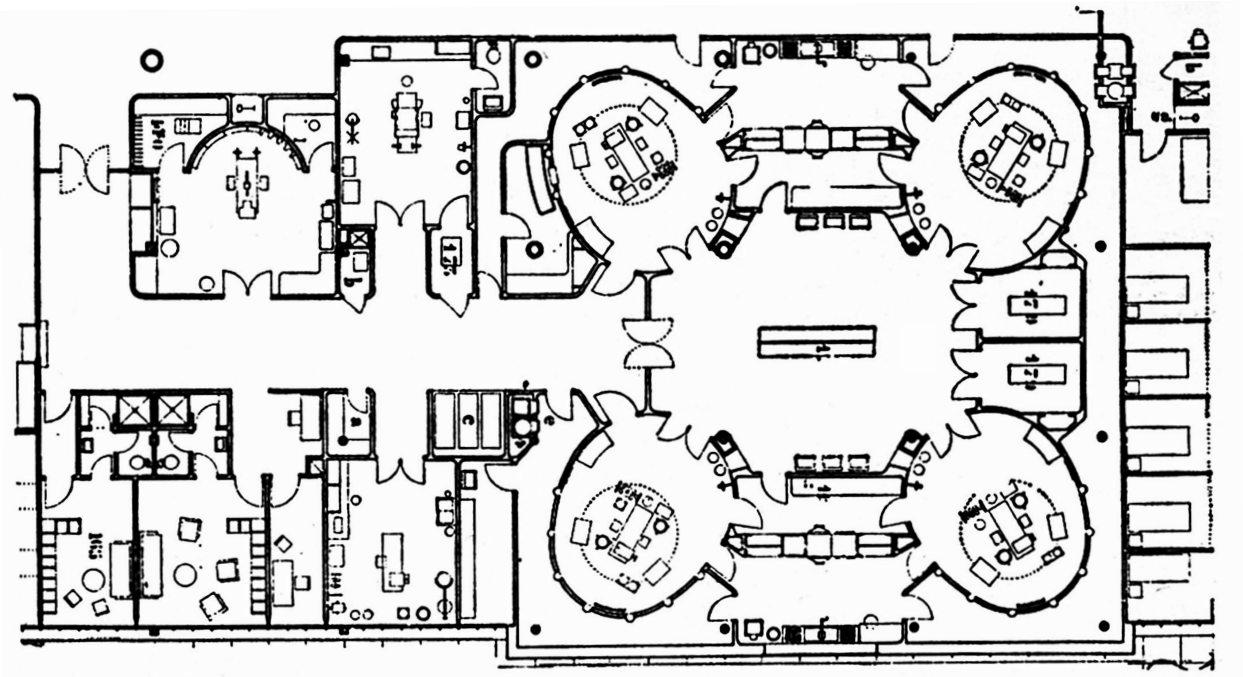


Fig. 73

of clusters of standardised consultation or treatment rooms forming free-standing "buildings" surrounded by more public activities. A "mat" is basically a building that can extend freely in different directions, thus resembling the way many hospital campuses have been conceived in the past. But a "mat" can also be a structure where the corners are fixed from the start, and where flexibility is provided by the "room within a room" principle. Since there is no reason why these "rooms" cannot be "blobs", we are back with the ideas inspired by the "cocoon".

Transparency and openness are words that appear frequently today in the descriptions by architects of their own buildings. The word "transparency" can be used to describe either the fact that the building is "see-through" or that it represents an institution that has nothing to hide. In the latter case policies reign, rather than the actual physical attributes. Hospitals should have nothing to hide but, on the other hand, everything in a hospital cannot be "see-through". This dilemma is again related to the "cocoon" discussion.

Today's architects like physical transparency. Nowadays it is easy to convince public clients, as well as big corporations, of its appropriacy since transparency as a concept is seen as being politically desirable. A good contemporary example of a transparent "blob" is the Greater London Authority building by Norman Foster, completed in 2000 (Fig. 74), in which the basic concept encourages stronger public involvement with the procedures of political decision-making. Supposing that hospitals would also want to be more transparent, both conceptually and tangibly, the related problems would be purely technical. Different kinds of computerised blinds and shading systems are becoming

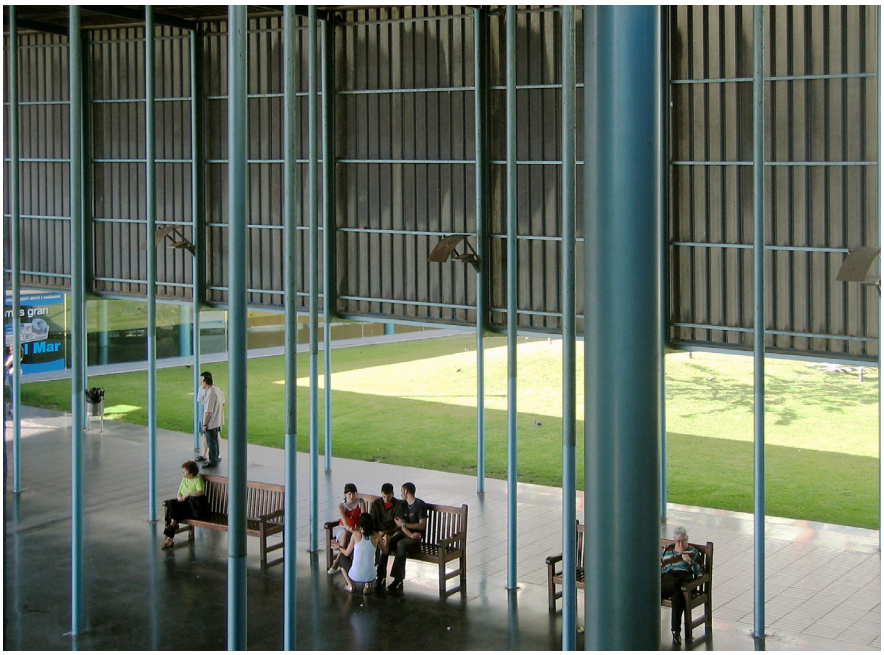
Fig. 74

commonplace. Glass that can be made opaque by turning a switch is available and becoming cheaper. There are now concert halls with glass walls, which means that airborne noise is no problem either. There is no technical reason (or reason related to privacy) why a whole hospital could not be built entirely of glass.

It is a fashionable architectural trend to create 'outside-inside' experiences through different means in order to obscure the borderline between the interior and the exterior. Blurring the boundaries is a trick used by many of the best architects today. This happens through the use of double facade systems, shading devices, movable walls and roofs, etc. An internal atrium or garden can seem like an internal space at one time and an external one at another. In the case of the external waiting area in Barcelona's Hospital Del Mar (Brullet & de Pineda, 1992), it is indeed difficult to define the boundaries (Fig. 75 & 76). Apart from forming a multi-faceted but lucid and tranquil space, it helps to create coherence between the different development phases of the complex. As for creating therapeutic spatial sequences in hospitals, making sure that these boundaries perform the function they were intended for (i.e. assuring that patients, visitors, and personnel can freely use

Fig. 75

Fig. 76

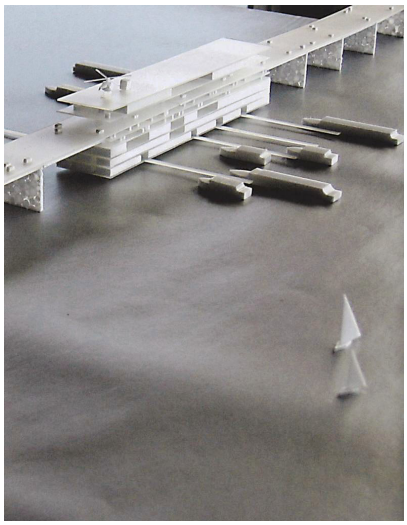


the courtyards, gardens etc.), would be much more important than some of the interior paraphernalia that is often provided for the sake of "therapeutic effect".

Moving parts are used more and more in prestigious new buildings. These may be parts of the boundaries, as described above, but they may also be much more conspicuous elements, which, when they move, change the appearance of the building dramatically. The Spanish architect and engineer Santiago Calatrava is particularly well known for these kinds of solutions. Similar effects are probably difficult to justify in health care buildings which, on the other hand, have a long history of developing mobile solutions. The concept of mobile clinics is a fascinating one with examples ranging from a UNESCO sponsored "camel clinic" for use in the desert (a health post designed to be fixed on a camel's hump) to barge clinics, a variation of which was presented as an entry for the "Future Hospital – Competitive and Healing" competition in 2004 (Fig. 77).

Mobile parts in hospitals, apart from those that are directly connected to the flexibility of the spatial layout, are mainly equipment oriented. Some expensive equipment is shared by a network of hospitals and plugged into different buildings according to a certain schedule. This applies particularly to diagnostic imaging equipment but also to operating suites, etc. It is possible that with ever more sophisticated and expensive machinery, these arrangements will become more common. "In mobile solutions the need for appropriate buildings is less pronounced and, depending on the platform used, specialised spaces may not be needed at all" (Nazarenko, 2006, p. 69).

Fig. 77



Having robots in the service of logistics in hospitals is now becoming the rule rather than the exception. Robots are still developing but it is clear that they will become a prominent feature of hospitals and complete revolutionise the approaches to storage and transport of equipment, pharmaceuticals, linen, laundry, and food.

There has hardly been a single major construction project during the 21st century in which flexibility and adaptability have not been high up on the agenda. These aspects are today more essential in hospitals than in perhaps any other building type. This study emphasises the importance of flexible solutions in several different chapters and sections and makes references to the history of adaptable architecture. Most of the points covered earlier in this section also reinforce the relevance of future-proofing and show that the prevailing architectural trends are not in conflict with the quest for better hospital architecture.

PART II. THE CURRENT DISCOURSE

Chapter 3. New concepts

Disease management and the seamless service chain

Health care systems in most countries are still today dominated by hospitals which function according to traditional and frequently inflexible management structures. The performance level of these institutions is evaluated through figures such as number of visits or performed procedures rather than the true effectiveness of the clinical outcomes. The need to reduce variations in practice, as well as duplication of work, has led to more emphasis being given to process orientation and networking. Quality of care is improved by monitoring both processes and outcomes. Adherence to protocols and clinical guidelines is supplemented by computerised follow-up and evaluation of the level of performance.

Disease management tries, from the point of view of all stakeholders, to find an optimal balance between the quality and costs of health care. The idea is that it will combat the present fragmentation of care, the predominance of acute care over preventive care, and the unsatisfactory results of the care of chronic illnesses. The key factors in disease management are "1) an integrated health service system where the implementation of care and the involved parties integrate seamlessly; 2) information systems that support the management of a disease, i.e., provide knowledge of its natural course, evidence-based management and treatment options; 3) quality management systems based on care protocols and continuous evaluation of care results" (Johansson et al., 2006, p. 21).

Disease management is particularly applicable to well-known long-term diseases (diabetes, asthma, coronary artery disease, certain types of cancer, depression, HIV/AIDS etc.) where plenty of evidence is available in order to establish the care protocols and specify the expected results. Care is seen as a continuous process rather than as a series of separate episodes, which traditionally has been the case. Disease management relies heavily on the exploitation of networking and data bases. This highly information-intensive concept will, through its very nature, lead to the dissolution of many artificial organisational borders and intensification of team work between different groups of care professionals.

The concept of disease management often implies changes in job descriptions among the professional groups involved. The resistance to these changes is the main reason for the slowness of the adoption of this concept in most European countries. A more concrete barrier that causes inertia is the separation of the management of funding of primary care and specialised care. Many countries are now thinking of ways in which to eliminate these organisational borders. For example Finland is combining the two separate legislatures that cover primary care and specialised care respectively (Johansson et al., 2006).

These changes could have major implications for the design of physical facilities in the future. What has been known in most of Europe as the "health centre", that is to say the bastion of local level primary health care, is likely to become more of a multi-purpose wellness centre, a place where the presence of social services is also strongly felt. Chronic disease management may have a stronger role in the agenda of these places than used to be the case in the old health centres, but at the same time the general advisory and preventive functions will also play

Fig. 78

SETTING	FACILITY	SERVICES
Home	Home Nursing homes Pharmacy Cyber café Health kiosk	Self care Monitoring Automated treatment Information and advice
Health and social care centres Up to 10k population Close to home	Surgeries Drop in centres Healthy living centres	Social care Primary care Outreach care Information and advice
Community care centres 100k population Heart of the community	Resource centres Community hospitals	Basic diagnostic services Day interventions Minor injuries Nurse led inpatient care Intensive rehabilitation Chronic care management
Specialist care centres 250k, 500k, 1000k population On central city sites	Diagnostic and treatment centres Secondary care Tertiary care	Planned interventions Emergency care Complex diagnostic treatment & inpatient care

an ever-increasing role. The hospitals in turn will continue to deal with specialised care but no more in a "specialised care vacuum", but as a part of the holistic chain that manages the patients' wellbeing. The only thing that can be said for certain concerning the required changes in the facilities is that the flexibility and adaptability of the buildings will be more important than ever. Short-term tailor-made solutions will not provide sustainable answers.

Improved disease management leans on an improved seamless service chain, and vice versa. Modern, customer-oriented service provision is generally seen as requiring the cooperation of care providers across different care levels. Clinical networks based on care pathways link the patient's route from primary, community and specialist care and improve the quality of care. The seamless service chain also includes settings closer to people's homes and in their actual homes. New technologies (video conferences, audio recordings etc.) can be used to minimise unnecessary journeys to health care facilities. MARU (Medical Architecture Research Unit) at the South Bank University, London, has developed a model for the Nuffield Trust (Fig. 78), which presents four settings for health care: the home, health and social care centres, community care centres and specialist care centres. All the centres are electronically networked to provide communications systems for patient records, appointments and basic diagnostic testing (Francis & Glanville, 2001, p. 51). The development of the home, not only as a part of the seamless service chain, but as an increasingly important setting in the provision of health care, will attract more attention from architects and other designers during the coming years. Homes of the future will be equipped for a life-cycle approach, i.e, they will be flexible in a variety of ways that will support and encourage self care and reduce the need for institutional care. Long-term home care

will include remote monitoring which provides information about the patient's condition and also takes account of possible accidents.

According to the MARU model, health and social care centres would provide a variety of services. In addition to primary health care and basic social care they would encompass information and advice activities including the availability of peer groups and various other support systems. Community care centres in turn would provide basic diagnostic services, day interventions and nurse-led inpatient care as well as intensive rehabilitation. The setting of these centres would be at the heart of local communities and they could also include mental health resource centres, day centres for older people, nursing homes and palliative care centres.

Skåne Region in Sweden with its "Nearby Health Care" (NHC) concept has provided another model, similar to the one conceived by MARU. It aims at minimising the patients' need to travel to reach the different services through better integration of working methods. Like the MARU model, it widens the traditional scope of primary care units by also providing services in a significant part of internal medicine, psychiatry, rehabilitation, geriatric care, palliative care and domiciliary care. Minor surgical operations in connection with an outpatient appointment can also be performed, the first port of call in all cases being the family general practitioner (Westrin, 2006).

In both models, as well as in other current views, the acute care hospitals will still have the responsibility for the most highly specialised services. They will thus contain the most sophisticated technology and consequently also continue to consume the bulk of the health care resources. These specialist care centres will increasingly separate the patients into elective and emergency patient streams. Care could be divided, for example, into three elements: "1) accidents and emergencies, with observation and assessment of emergency admissions; 2) one-stop shop consulting and diagnosis, planned interventions, day and short stay (1-3 days); 3) complex care, diagnosis and treatment, requiring complex equipment and skills, critical inpatient care" (Johansson et al., 2006, p. 23). Many of the support functions would not have to be located at the centres but could, often more efficiently, be provided off site thus serving a number of specialist centres as well as other facilities. The specialist care centres would provide a narrower spectrum of services than the current generation of hospitals and might thus eventually become physically smaller than the post-war megahospitals, many of which, although rarely exceeding 150 000m^2 before the 1970s, have now grown to twice that size.

University hospitals perform very rare processes which require population bases of up to 5 million inhabitants in order to make economic sense. This is beginning to lead to a separation of "highly specialised care" which may increasingly form its own sphere within acute care. The new organisation at Karolinska Hospital in Stockholm is already based on the idea that the campus at Solna, where a new building is planned, will focus strongly on "highly specialised care" and narrow specialisations, whereas the 1960s complex at Huddinge will deal with the rest of the acute patient flow. Similar solutions are now being planned in many other university hospitals.

These developments give scope for interesting new challenges from the point of view of future designers. If highly specialised care is to be concentrated in very few university hospitals it may mean that the traditional acute hospital network gradually moves towards the "core hospital" principle. This could lead to the demand for a whole new "kit of parts", a series of flexible and elastic units of varying sizes to provide for both the local community level services (as indicated by MARU and Skåne Region among others) as well as the "core hospitals".

Two strong paradoxical trends have been evident in health care systems and the construction of facilities for quite some time. They are the continual and accelerating concentration of expertise in large university hospital complexes on the one hand, and the demand for smaller, more humane, hospital units on the other. The effects of the trends mentioned here are destined to provide relief from the effects of this paradox since they would generally lead to a reduced average hospital size. These trends will also be assisted by present communication technology which will make cooperation possible for care units that are quite far apart.

Patient-centred care

Nothing is too good for ordinary people.
Berthold Lubetkin, 1938

Patient-focused or patient-centred care can be interpreted as a "management driven approach which aims to improve the patient experience by rationalising logistical processes by claiming to be more efficient and to put the patient to the least disruption" (Francis et al., 2006). One of the pioneering innovations was the provision of "LDRP" (labour, delivery, recovery, postpartum) rooms for maternity wards. The patient was not moved during her stay at the hospital, which provided more dignity and privacy and started what has now become a widely accepted aim; doctors should come to the patients rather than the other way around. This aim certainly has repercussions on the spatial arrangements of hospitals but is as yet far from being achieved.

The Planetree organisation in the United States, and its 13-bed medical/surgical unit built in the early 1980s, is often sometimes cited as having started the patient-centred care "revolution". Planetree's philosophy is based on the self empowerment of patients and an increased role of the experience of all the actors involved (Malkin, 2006).

In Orbis Medical Park in Sittard, The Netherlands, the front-line staff undergoes retraining at a college for hotels and tourism. This makes them more aware of how to handle the wishes and complaints of the public and provides more dignified circumstances for the communication between the service providers and what the administration calls their "guests". The wards consist entirely of single rooms, although in practice they are doubles since the presence of a relative or friend is strongly encouraged. Orbis calls this the "coach" concept. The hospital claims greater privacy for patients, more clinical flexibility, more flexibility in patient throughput and shorter lengths of stay as results of this policy (Erskine, 2006).

Care pathways also form part of the patient-centred approach. When electronic patient records are fully

used, the staff will know where the patient is on the care pathway, what has been done and what should be done next. Patients will also, in the near future, be able to consult their own patient records. This will eliminate a lot of frustrating occurrences which are certainly not conducive to healing, such as continuous repetition of information and answering the same questions. It also has an effect on spatial planning.

The seamless service chain falls under the same category of concepts. The Interreg IIIC final report describes this as a thread passing through a series of knots with other threads partially passing through the same knots, or taking an entirely different route through the net. The important thing, however, is that each of these routes is designed to serve the best interest of the patient. A network that functions in this way epitomises a patient-centred health care system (Kekomäki et al., 2006).

Ideally, patient-centredness also reduces admission and throughput times as well as improving information supply and interactive information-sharing between patients and care professionals. This leads to improved transparency in products, better quality and more reliable results and produces an environment that better suits the patients' circumstances, preferably also providing care closer to home. The patient is a client, the processes are demand driven and the work environments more inspiring (Meuser&Schirmer, 2006).

In line with traditions of Scandinavian organisational democracy, the hospital planning process at St Olavs Hospital in Trondheim, Norway, has involved extensive staff participation. A first for the Trondheim project, however, is the scale of patient participation that has been used. About 140 patient organisations have come together, and the members have, according to relevant experience and qualifications, participated in the planning and design on most levels of the process (Helsebygg Midt-Norge, 2006). At Orbis Medical Park in Sittard, the Netherlands, patient groups were also involved in the form of a patient board that reviewed and commented on all the plans.

Organisational models

The opportunity should not be lost of taking advantage of the significant planning concept that design can be a catalyst for organisational change.
Susan Francis and Rosemary Glanville, 2001

The Netherlands Board for Hospital Facilities has analysed the different organisational models that are currently in use in hospital buildings. Three organisational models were considered in a report published in 2002. The way these three models would logically sub-divide into departments, building blocks, or parts of an existing hospital, is shown in BOX 4.

The report also compares different hospital archetypes and discusses their ability to adapt to the diverse requirements presented by the different organisational models. The care process based model (C), has been in general use for a long time and is now finding new interpretations which take into account the optimal dimensioning for the facilities for each process, thus producing campus-type models of a new kind. An example of this is the new hospital in Arras, France, which will be referred to later in this study. Two examples of the model based on clinical entities (model A) are described here.

Box 4

A. Organisation according to target groups and clinical entities

1. Brain and sensory organs
2. Oncology
3. Immune system, metabolism and ageing
4. Acute care and musculoskeletal system
5. Heart and vascular
6. Growth, development and reproduction

B. Organisation based on patient flows

1. Acute care
2. Urgent care
3. Elective care
4. Chronic care

C. Organisation based on the care process

1. Screening and diagnostics centre
2. Consultation and appointments centre
3. Treatment centre
4. Nursing centre
5. Logistics centre
6. Knowledge and expertise centre

Netherlands Board for Hospital Facilities, 2002

The new parts of Trondheim's University Hospital, St Olavs Hospital, are organised as seven clinical centres, each in its own building. Improved resource utilisation and shorter hospital stays are the aims of this model. The centres are currently named Neuro-Centre, Women's and Children's Centre, Abdominal Centre (including oncology), Mobility Centre, and Heart-Lung Centre (including an Emergency Centre wing). There are also interdisciplinary centres: Laboratory Centre, Supplies Centre (technical infrastructure for the entire hospital) and Knowledge Centre (including medical library and auditoria). The patient hotel provides an important supplement to traditional hospital beds. The fact that service functions such as anaesthesia, X-ray and imaging diagnostics are decentralised has provoked controversy among medical professionals. Obviously it will initially be more expensive to provide these services in each centre, but this is supposed be offset by gains from a generally more effective organisation of the hospital as a whole (Helsebygg Midt-Norge, 2006).

In the Erasmus University Medical Centre in Rotterdam, the Netherlands (still under construction in 2008), medical departments have been grouped under six themes: the brain and the senses, oncology and immunology, metabolism and aging, emergency care and mobility, circulation and growth, development and reproduction. Outpatient, clinical, diagnostic and treatment facilities of each theme are organised around one central, clearly articulated space. The definition of the themes is based on the existing communication practices and co-operation between departments. The grouping is also based on social developments in the fields of disease and health. Physically, each theme will have its own facility, but this does not lead into a collection of "small hospitals" – the themes merge into one another at the edges (Fig. 79) (Johansson et al., 2006, p.27).

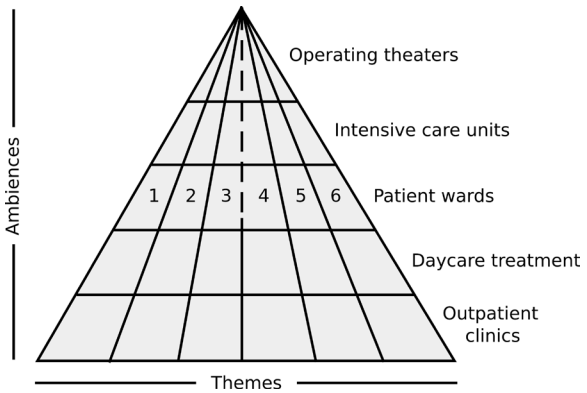


Fig. 79

The proponents of the "centre model" also claim that it is particularly suitable for patient-centred approaches. As the architect of the Erasmus Medical Centre, Bas Molenaar (2006, p. 379) writes: "By clustering the medical expertise around the patient, his or her specific disease, and the care he or she needs, all the contacts between doctors and researchers arising during treatment can be facilitated by the various fields of expertise involved, thus stimulating the interaction between fundamental science, patient-focused research, and patient-focused care".

Reinterpretations of archetypes

Of the more than 100 projects published in Meuser & Schirmer's impressive overview of new (since reunification) German hospital buildings, 70% are classified as a "horizontal" type, 5% as a "vertical" type and the remaining 25% as a "mixed" type (Meuser & Schirmer, 2005). This clear trend has dominated European hospitals for the last couple of decades. It could be reversed through new logistic ideas and inventions and a growing emphasis on urban hospitals.

It is likely that new ideas will appear which again render more "vertical" buildings as logistically and economically attractive. It is also likely that the synergy between hospitals and the urban environment will increasingly be seen as an asset. This will lead to a situation where we have an unprecedented number of archetypes to choose from, all of them appropriate to certain circumstances. The hospital "village" model, fashionable in the United States since the 1980s is certainly not finished yet in spite of its dependence on large, essentially non-urban sites. The "core hospital" philosophy (see next chapter) seems to lend itself particularly well to extremely compact "monoblock" type solutions that on some levels take us back to the 1950s and 1960s. The pavilion model is returning as a result of growing popularity of the "centre model" (organisation based on clinical entities). Different kinds of "campus" models are talked about, often in connection with various "wellness complex" ideas where healthcare services are supplemented with activities, connected to the promotion of healthy living, sometimes even including cultural activities thus echoing the heritage of the Greek Asclepieions.

In 2002, the French architectural journal *Techniques et Architecture* presented, in a special issue on health care facilities the new term "polybloc" as a present trend in hospital typology. This is a variation of the Breitfuss-type, but here the plinth part is dominated by a glass-covered internal street and the number and height of towers varies. The towers no longer necessarily contain only wards (because the proportionate role of wards in hospitals is in any case declining) but also administration, laboratories, research activities, and different knowledge centre-type units. This model has not yet achieved the dominating status that the journal predicted but it has the potential to survive in a variety of locations and under most of the organisational models currently in use.

The 2002 report by the Netherlands Board for Hospital Facilities ("The General Hospital – Building Guidelines for New Facilities") analyses some current models in comparison with the organisational models discussed in the previous section. Five hospital types are included:

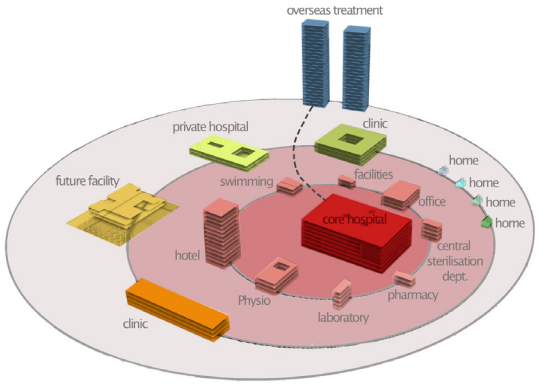
- Linear models ("star", "branch" etc., horizontal "village" models)
- Arcade model (high central atrium or internal street)
- Comb model (single or double, type Huddinge)
- Plinth and Tower (essentially Breitfuss)
- Pavilion Hospital (sentenced to death over half a century ago)

The report compares the different hospital types and discusses their ability to adapt to the diverse requirements presented by the different organisational models. The result is somewhat surprising. The linear models, the arcade and the comb model are suitable for all the organisational models. The Breitfuss-model is not ideal for model A (clinical entities) for which the pavilion model, on the other hand, is particularly well suited. This shows that much of what has been done before can be applied, developed, readapted and reinterpreted, which does not mean that there is no space or market for completely new ideas.

The Core Hospital and the Core Functions

In 2004 Bouwcollege launched an open international architectural competition, "Future Hospital – Competitive and Healing" to find these new ideas. The winning entry, "Core Hospital", by Ton Venhoeven and Thomas Gutknecht, had separated the core functions from most of the other functions traditionally present in central hospitals to form a "Core Hospital". This was placed in the centre of Rotterdam with all the other functions and units provided for elsewhere (Fig. 80). The term "core hospital" (or "hot hospital", in its purest form

Fig. 80



comprising just emergency, surgery, intensive care and imaging) will undoubtedly become one of the important themes in future years. The other important theme that was introduced in the entry was the relationship between the hospital and the urban milieu surrounding it.

The "core hospital", based on the principle of decentralisation of services, by definition leads to smaller hospital buildings. The massive size of hospitals has, for a long time, been seen as one of the biggest drawbacks and one of the main obstacles for achieving humane, high quality environments. Cor Wagenaar in his introductory text for *Architecture of Hospitals*, also brings up the concept of "thinning" as a way of achieving radical changes (Wagenaar, 2005). The Orbis Medical Park project in Sittard also applies the "thinning" principle. Departments dealing with logistics, distribution, and human resources are physically placed separate from the core business (van Laarhoven, lecture in Sittard, 2007). In spite of this, the use of floor area for public and semi-public activities is extremely generous.

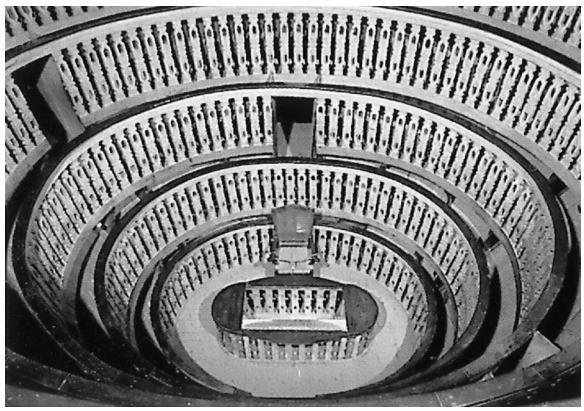
"Core hospitals" are gaining ground, particularly as extensions of existing facilities. Many 1960-1980s

hospitals are now undergoing major refurbishment, an activity that will long remain at least as important as the building of new facilities. The biggest problems that these hospitals suffer from are usually connected to insufficient dimensioning, both vertically and horizontally, of either the lower floors of "monoblock" hospitals or the plinth section of "Breitfuss" hospitals, in other words the portions of the building where the "hot" activities are located. The only remedy is often to build a new extension which houses these "hot" functions and where structural modules and spans and consequently dimensions of different functions can be optimised. These additions are essentially "core hospitals" with the decentralisation aspect (as well as the urban link) often missing since the old parts of the hospital also have to be used for something.

The core unit incorporates all the hospital functions that require the highest levels of technology. The risks of nosocomial infections are also the highest in the "hot" parts of the hospital. In France they account for more than 10 000 deaths per year, which is higher than the number for road accidents. Of these infections 20% are airborne, and the remaining 80% are due to human contact. The appropriate choice of materials and the strategic provision of wash-hand basins and alcohol rub dispensers are relatively easy solutions. Better air-conditioning systems are constantly being developed but the discussions around spatial organisation continue as actively as before. The opinions tend to be based on unnecessarily dogmatic ideas on hygiene (Fermand, 1999).

The first room specifically designed for planned operations on the human body was in Padua University in 1594. It was the original Anatomical

Fig. 81

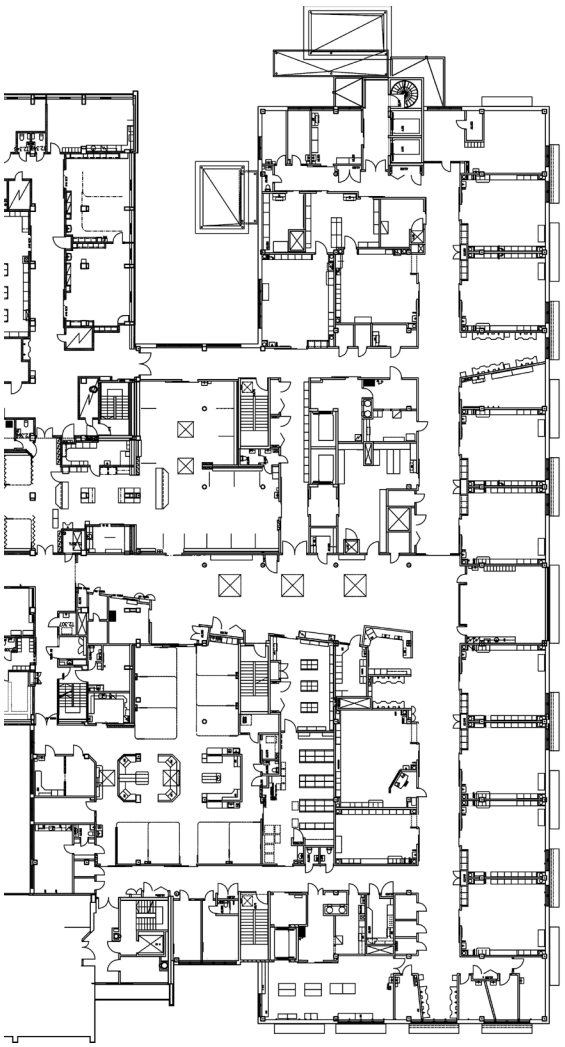


Theatre which became a model for nearly three centuries (Fig. 81). Daylight used to play a major role in the design. Large areas of glass on the facades signified operating theatres, particularly in hospitals built at the beginning of the 20th century and especially in Germany. The "theatre" idea, the importance of being able to observe operations, had largely been abandoned by the 1960s. Development of artificial light, the deepening of plans due to increased emphasis on overall logistics, as well as an increased emphasis on physical separation of space and classification of space according to the degree of cleanliness of the air, led to theatres gradually moving deeper into the building body. In recent years, the changes in thinking about hygienic requirements have again led to weaker sealing off of the surgical area, and the gradual simplification and elimination of complex air and spatial sluice systems. The AIA Guidelines of 2001 in the United States only called for the "avoidance of pedestrian through-traffic" in operating departments, whereas the Robert Koch Institute in Germany in 2000 had recommended a sub-division into zones as opposed to individual rooms while also reducing the demands for purity of the air in certain areas (Meuser & Schirmer, 2005).

There is a famous quote from a surgeon who noted, during the Napoleonic wars, that going through surgery meant you were "exposed to more chances of death than an English soldier on the field of Waterloo". In 1847 the Austro-Hungarian doctor Ignaz Semmelweis discovered that death rates in Vienna General Hospital dropped dramatically when medical students started washing their hands between attending autopsies and looking after patients in the obstetric ward. Hand washing was seen as such a revolutionary idea that Semmelweis had to move to Budapest. Only relatively recently, some 150 years after Semmelweis's discovery, has hand washing finally achieved the status it deserves. From an architectural point of view, this has made life a lot easier because small wall-mounted alcohol dispensers have essentially replaced complex systems of sluices and lengths of "clean" and "dirty" corridor. The spatial and architectural quality of the operation departments can be greatly enhanced through these developments.

Single circuit solutions (no separation between "dirty" and "clean" areas) seem thus to be gaining ground, even in the last double-circuit strongholds in German-speaking Europe. It has been observed that "dirty" corridors are in reality often less "polluted" than the communal parts of the areas classified as "clean", the assumption being that the double circuit creates a false sense of security and leads to generally more lax hygienic procedures (Fermand, 1999). A double circuit usually adds at least 10% to the floor area, thus adding to the costs significantly. Architecturally, the single circuit is far preferable. It eliminates sluices, dark corridors and a considerable number of doors. It also makes it easier to bring back daylight and good views into ORs. The possible conflict with the fact that

Fig. 82



monitors of different kinds are increasingly used in ORs can be solved through various adjustable blinds and screening mechanisms which in any case, with increasingly multi-purpose ORs, should be provided. A relatively early example of a single circuit solution is the rebuilt operation department at Helsinki University Central Hospital in Finland (Reino Koivula Architects, 2001) (Fig. 82).

The gradual disappearance of maze-like surgical departments has greatly facilitated the planning and improved the flexibility and future-proofing qualities of hospitals. Furthermore, it will reinforce the "core hospital" philosophy since the spatial and technical requirements of radiological diagnostic and therapy rooms, rooms for computer and PET tomography, nuclear medicine, endoscopes and heart catheters will gradually adopt features of operating rooms. Surgical departments, up to now the most revered and untouchable part of the hospital, will in the future be integrated into a succession of technologically intensive treatment rooms. New standards in the quality of minimally invasive surgery and microtherapy may lead to a new definition of the operating theatre as an intensive treatment room (Meuser & Schirmer, 2005).

Apart from minimally invasive surgery, which will require ergonomic locations for video monitors and electronic equipment in the OR, as well as improved ability to control lighting, there are also other current and anticipated surgical techniques that will have an effect on the design of operating rooms. Image-guided and computer-aided surgery use portable imaging systems which require "parking spaces" in or adjacent to the OR. The two components of robotic-assisted surgery, the surgeon's console and a robotic arm above the patient table, will change the way an OR looks and create new challenges for improved ergonomic solutions (Mathur, 2005).

Whatever the changes will be in the detailed design of ORs, stripping the operation department of its various hygiene-based straightjackets is somehow symbolic of the development of the entire hospital towards a more adaptable and flexible entity. In particular, it signifies the potential of a "core hospital" to become a new kind of "machine for healing", but one that is open, transparent and welcoming, rather than mysterious and daunting like its predecessors. The "openness" question was also emphasised when planning the new emergency department at Karolinska Hospital in Stockholm, which was taken into use in 2006. The design process was long, thorough and highly participatory. One of the main discussions concerned the conflict between patient privacy and the ease of safe supervision of patients. Indeed this is one of the major challenges facing designers of new emergency departments in the coming years. The majority of the staff preferred the "privacy" solution where the patients were placed in small private rooms along corridors. However, the questionnaires showed clearly that severely ill patients preferred the open plan solution, wanting to be constantly observed by a nurse (Engqvist, 2006). The result was a compromise, with about one third of the beds being placed around two nursing stations in an open plan arrangement, and the rest in private cubicles. In the most recent central and southern European hospitals the "privacy" solution is applied. The individual "boxes" are usually equipped with sliding glass walls that give maximum visibility but also provide privacy when desired.

The number of "channels" used in an emergency department has an even stronger effect on the physical planning of the spaces than the way the observation of patients is organised. The traditional way has been to separate the "bloody" trauma patients from those requiring conservative care. In larger units there will, in the future, be 4-6 separate channels for different specialties including internal medicine, cardiovascular, neurology, paediatrics

etc. Primary care patients will also have their own channel, often combined with psychiatric and social 24h services (already widely the case in, e.g., Sweden and France). This arrangement leads to a "hospital within a hospital" situation with observation facilities approaching intensive care standards and capacity for sophisticated 24h imaging diagnostics. Because of its very nature, the emergency department has always had and always will have a decisive effect on the total logistics of a hospital complex. The characteristics of future ERs will therefore have a major impact when hospitals are built, renovated, modernised and extended (Johansson et al., 2006).

New models and changing schedules of accommodation

Local general hospitals often lack the critical mass required to maintain desired levels of excellence. This has led to the removal of special care and highly specialised care from these institutions to regional acute centres or regional tertiary care centres. Concurrent with this, a new type of specialised care is being developed that works towards rapid "deinstitutionalisation" of patients. This is done in community rehabilitation hospitals which are rapidly gaining in popularity. The units include specialties such as rehabilitation, physiotherapy, geriatrics, cardiology and psycho-geriatrics. It may also include elective orthopaedic, or other surgery (Johansson et. al., 2006).

Building up a network of community rehabilitation hospitals leads to the decentralisation of less specialised activities from the larger acute centres to community-based facilities. This will improve accessibility to earlier diagnosis and preventive therapies. Out-patients appointments could be moved from the acute centres to these hospitals which would also provide improved outreach services to the community at large. An important activity would be chronic disease management that prevents inappropriate acute hospital referrals. The length of stay for the great majority of patients would be between 7 and 30 days. Ideally the community hospitals are thus placed in the same location as shopping, transport hubs etc. The vicinity to normal everyday life and the possibility to take part in a variety of activities as the patient's condition gradually improves is of crucial importance. This is often not sufficiently understood.

Community hospitals are an interesting mix of "cure" and "care", with nevertheless more emphasis on the latter. They are, after all, primarily places for recovery and thus a more hotel-like character is called for. Hotels and hospitals have for centuries been considered opposites. One you choose to go to, the other you are forced into by unfortunate circumstances. The community rehabilitation hospital blurs these old distinctions. The hotel-hospitals, apart from providing all kinds of services and recreation in the immediate vicinity, will also become "wellness centres" which respond to the ancient Asclepieion philosophy as well as to the "Surgeon and Safari" holiday concept (combining medical treatment with leisure) that is now becoming increasingly popular in many countries. Community rehabilitation hospitals could contribute successfully to "the zeitgeist which is an expression of a leisure society that no longer wants to be ill" (Meuser & Schirmer, 2005, p. 19).

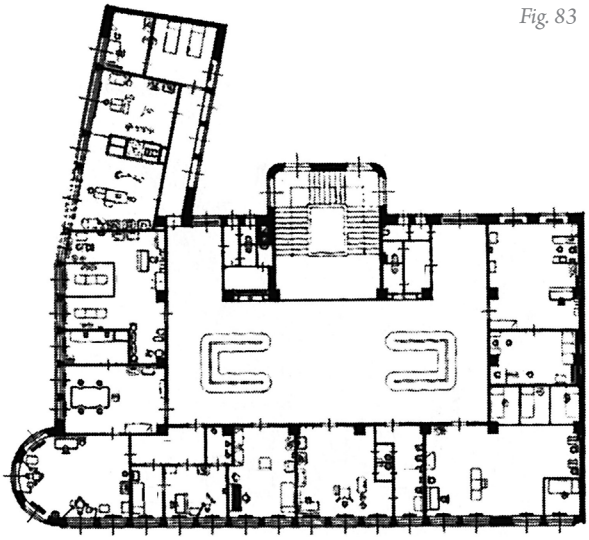
Out-patient departments are in many European languages known as "ambulatory" areas. The term comes from the Latin word "ambulans" (moving, going around) and signifies the areas of the hospital that are meant for moving patients, as opposed to the bedridden. Out-patient departments started to appear as parts of hospitals as late as in the 1920s. One of the earliest out-patient (or ambulatory) departments was situated in an office building, the *Arbeiterkrankenkasse* in Vienna (Judtmann & Riss Architects, 1926). It had ordinary office rooms used by doctors and their patients, two operating rooms and a recovery room, but no other nursing facilities (Meuser & Schirmer, 2005) (Fig. 83). This is an interesting comparison to today's situation where there is a clear tendency to treat out-patient areas increasingly like office buildings with flexible, standardised space. The Netherlands Board for Hospital Facilities has classified hospital functions in different categories and they group out-patient departments with administrative functions (Bouwcollege, 2006).

Concurrent with this development there is a tendency to provide broader services on an ambulatory basis in the form of conservative day hospitals. As day surgery is becoming commonplace in European hospitals and is expected to take on an increasing percentage of all surgical procedures when developed to its full potential, equivalent activities on the conservative side are following suit. It has been claimed that a conservative day hospital (or out-patient treatment centre) might be able to replace up to two-thirds of the present bed spaces (Vauramo et al., 2005).

The lay-out of hospital clinics will be simplified. Polyclinic patients can, in the majority of cases, walk straight from the reception to a consultation with the doctor. Those needing treatment (whatever the specialty) go to the polyclinic treatment centre which includes facilities for resting, observation by nurses, taking of medicines, minor examinations, taking of laboratory samples, cytostatic treatment etc. Applications of these ideas are already widely in use, particularly in Southern Europe (Johansson et al., 2006).

Hierarchical accommodation schedules in hospitals have led to a situation where there are rooms of different shapes and sizes for more or less identical functions. In the future, rooms will be more standardised, both in size as well as in the provision of furniture, fittings and equipment. Work stations that are more ergonomic, adaptable and flexible can

Fig. 83



be created in this way. The recruitment of sufficient and qualified personnel for care work will become increasingly difficult. New thinking in the design of spaces that are both functional and attractive as well as the provision of appropriate furniture and fittings which support the work processes in an optimal fashion will be essential factors in the competition for workforce. The physical structures of health care facilities will be characterised by modularity, multi-purpose functions and convertibility (Johansson et al., 2006).

More standardised solutions for work stations and the spaces they inhabit will be an overall trend encompassing all sections of our new hospitals. This trend will be particularly evident in out-patient departments and related staff working areas. As an example of this development the recent establishment of knowledge centres in several Central European hospitals can be cited. These have been included in the accommodation schedules of new hospitals and also incorporated in existing facilities. Knowledge centres generally consist of an open plan office landscape with a cafeteria, library, recreational space and working space for a large number of doctors. The presumption is that this would facilitate consultations between experts, assist in handing down experience and expertise from generation to generation and generally help in making the hospital environment more conducive to cooperation and effectiveness (Vauramo, 2004). The knowledge centres of Orbis Medical Park in Sittard, The Netherlands, have often been quoted as a model. There the centres are organised in a split-level arrangement with both levels having easy contact to the out-patients' consultation rooms, which in turn are situated along the main internal street of the hospital complex (Fig. 84). An interesting example

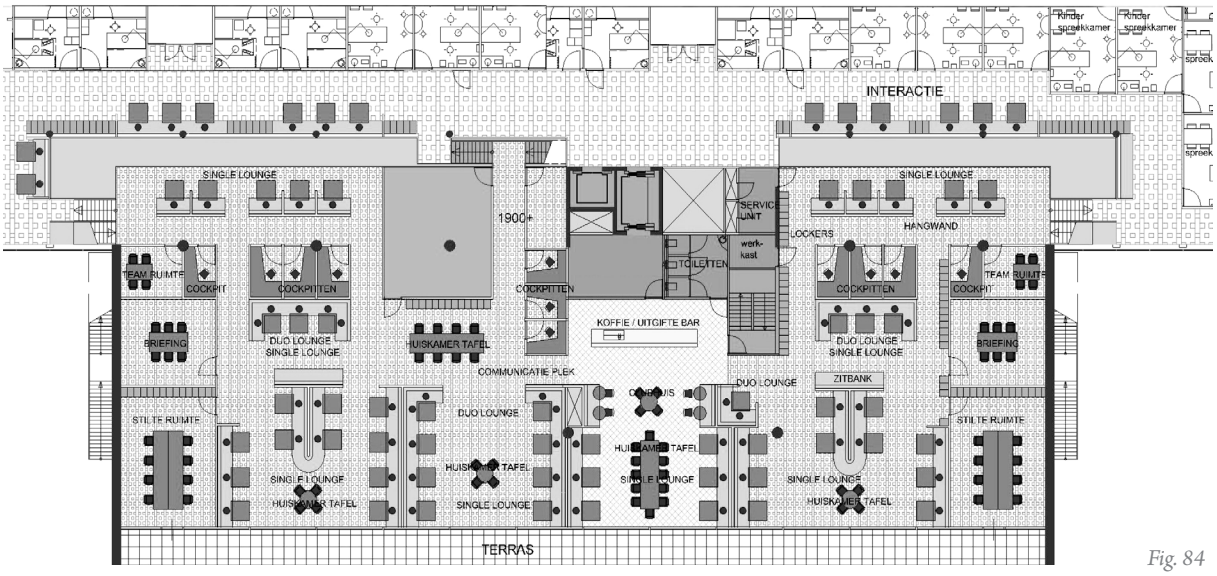


Fig. 84

of integrating a new knowledge centre with existing buildings can be found at the Onze Liewe Vrouwe Hospital in Amsterdam (EGM Architects/Bas Molenaar) where the new addition is placed on top of the wings of the comb-like arrangement of the existing building dating from the 1990s.

There will undoubtedly be a lot of opposition to the idea of the staff working in an "open plan" situation. Instead of using individual offices the doctors and nurses will be able to utilise individual work units (known as "cockpits" in Sittard) with their own "microclimate", a kind of "aedicular space", a term discussed in more detail in the chapter on future-proofing. The advantages of these configurations will gradually be appreciated by the users since there will be more spontaneous sharing of knowledge, which in turn will improve the quality of care. The elimination of long administrative, institutional corridors with doors leading to small individual rooms, will clearly have a positive effect on the overall clarity of hospital plans.

The pressure to cut running costs and rationalise functions, as well as developments in treatment practices, has led to shorter inpatient periods. Thus the traditional dominating role of the wards is gradually becoming more subsidiary with the diagnostic and treatment services constituting the core of the building (Johansson et al., 2006). This new situation calls for generalised wards which will have to be extremely flexible so that they can be used, according to demand, as pre-interventional hotels (for patients not able to arrive in the morning for a procedure), hotels with electronic observation (e.g. cardiac patients), observed care (with one nurse), normal wards with self-service buffets to encourage mobility, intermediate care, critical care, and so on (Wendt, 2006). Generally wards will become more standardised as regards furniture, fittings and equipment. Special items will be required only in mother-and-child, paediatric and geriatric wards. Wards will thus no longer be classified according to specialty but more by the degree of surveillance and care required. On the one hand, some ward functions maybe become part of the "core hospital" (not just traditional ICUs but also "critical care" units etc.) and on the other, a major portion will be part of patient hotels with a low availability of clinical services. The proportion of conventional, specialised wards will thus be dramatically reduced.

Corridors will be seen as living areas rather than cramped and dark, storage-ridden circulation spaces and there will be "activity areas" which will include self-directed physiotherapy possibilities, socialising and cooking, as part of the wards. At Orbis Medical Park in Sittard, these areas are placed at the ends of the corridors in the great central space of the hospital (Fig. 85). The provision of more pleasant and generously dimensioned public areas in the wards is further accentuated by the fact that inpatients increasingly want to be accompanied and receive more visitors (Fermand, 1999). This trend will grow with the increasing multi-culturalisation of all western societies and will also apply to day hospital and day surgery situations.

The benefits of single rooms have been widely discussed in recent years. The tendency is demonstrated by the fact that many new hospitals are today built with a majority of the ward rooms being private. There are still notable exceptions to this. In the Martini Teaching Hospital in Groningen, Netherlands

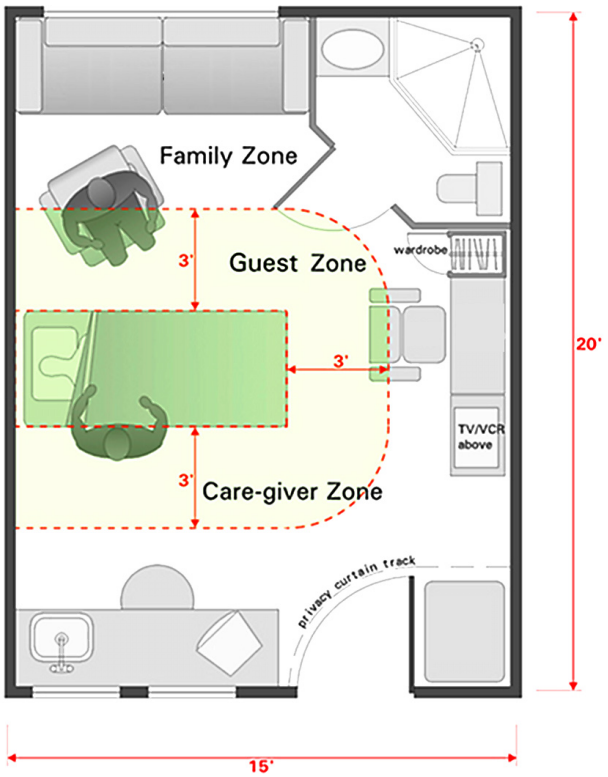
Fig. 85

(Burger & Grunstra Architects, 2007) the ratio of single rooms to the rest (2 and 4 beds) is one to four. Single rooms are only offered to patients when deemed medically necessary (Thiadens et al., 2006).

There is plenty of evidence (see Roger Ulrich and others) to show that single rooms reduce errors by staff and the number of patients falling over. Keeping nosocomial and other infections in check has been shown to be easier in wards consisting of single rooms. Single rooms make it possible for family members or friends to stay overnight and also, "Economical conditions today force patients to partially settle their business work from the hospital bed" (Meuser & Schirmer, 2005).

In order to maximise the benefits related to fewer errors and accidents the rooms also should be completely standardised. This means that even mirror-image plans that possess other advantages (conduits and ducts for appliances can be concentrated on one wall serving two rooms) are not recommended. With the new knowledge now widely taken as a starting point, there is again work ongoing that resembles the *existenzminimum* studies of the Heroic Era. Single rooms are analysed and broken up into different zones for the patient, staff and visitors (Fig. 86). An interesting cultural difference appears in the illustrated example from the United States. The dimensioning of the sanitary space does not allow for wheelchair use, a situation that would be unthinkable in Northern European hospitals.

Fig. 86



Placing the bathroom on the external wall, as can be seen in the example, can offer advantages, depending on how the interface between the room and the corridor is handled. The example shows no particular gains but this arrangement can give scope for more open contact between room and corridor (glass walls with adjustable blinds or curtains, glazed sliding doors etc.), thus facilitating surveillance. It also gives the patient a choice between privacy or participation in the multi-purpose activity areas along the corridor. There already exist good examples of this approach and many more are on the drawing board.

The quantifiable facts (errors, falls, infections etc.) that support the single room argument cannot be questioned. Social, cultural and psychological issues are much harder to evaluate. In an ideal situation it should still be possible to make exceptions to the single room principle. This can best be done through innovative design that aims at maximum flexibility. It is the public areas, entrance halls, hospital streets, courtyards and atria that have recently changed more than other parts of the hospital. Nowadays they often resemble busy marketplaces, hotel lobbies or corporate headquarter entrances. This development will continue and evolve because future health care facilities will be integrated, as far as possible, with the general community structure, as service centres alongside other public and commercial services. Nevertheless, there are aspects such as security which may impede easy access to these facilities. Good urban planners and architects are once again called upon to overcome these potential problems.

Entrance areas should greet and welcome, orientate and inform, in an atmosphere that gives a feeling of security and confidence. There is indeed a tendency to no longer hide information desks behind sliding glass or blinds, a development that will continue in spite of the apparent security risks. These risks can be greatly reduced by intelligent and innovative design and planning. Actual physical barriers are not the only answer. Good examples of open free-standing information desks can be found for instance at the Wilhelmina Children's hospital in Utrecht (EGM Architects/ Bas Molenaar) (Fig. 87) and at the refurbished Kennemer Zuid Hospital in Haarlem, The Netherlands (EGM Architects/Victor de Leeuw, 2006) (Fig. 88). For a hospital to become an open and truly public asset, a certain "dedramatisation" is needed (Fermand, 1999). This has to include a normal, civil way of receiving visitors, as well as intuitive wayfinding brought about by a legible system of circulation and clear articulation of the building parts.

When smart buildings (or intelligent buildings) were first discussed a couple of decades ago, the term signified two things in particular. A smart building was one that "looked after itself", i.e. had inbuilt mechanisms for saving energy. Not only a smart hospital but a smart building in general was one that could also respond to the growing demands of a computerised working environment. It was also supposed to be "paperless" and "wireless". Ecology and information technology were the key words for "smartness". Ecological solutions are still in the foreground and again gaining speed. The fact that a building is adaptable enough to react to future developments in information technology can no longer be seen as a sign of particular "smartness".

Fig. 87

Fig. 88

What then makes a smart building? Smartness is certainly about adaptability, but it is also about interfaces and filters, as well as transparency and openness. It is about having fewer walls and doors. In the final reckoning, the smartest hospitals will be those that are well designed and display architectural quality of the highest order.

A modern hospital is, however, increasingly dependent on information technology. Electronic patient records and management systems for the purchase and storage of material and goods are becoming commonplace. A variety of networks are in use in laboratories, radiology departments, operation rooms and intensive care units. Automatised electronic data recording and storing systems assist different parties in optimising the efficiency of the service chain and the databases improve the quality of follow-up of care results and facilitate flexible changes in service provision.

Networking over national borders, an increasingly relevant aspect due to growing mobility of the population, requires solutions for patient-authorised access to personal health data independent of the location of the care provider. Questions concerning responsibility, continuity and remuneration are complicated and remain largely unresolved. On the other hand, the division of global citizens into digitally literate and illiterate factions will also remain with us for many years to come. There will probably always be a share of the population that will not have the ability, desire or means to use information technology services (Johansson et al., 2006).

How does information technology with all its applications affect the architecture of hospitals? Does it make the hospitals "smarter", and if so, how does it manifest itself? Up to now, there is very little evidence of IT having had recognisable effects on the physical facilities. The relationship between spatial solutions and IT has hardly been touched upon. Well-designed

logistic systems have also traditionally been seen as a sign of "smartness". There is, however, no standard solution for hospital logistics since every establishment is unique and has to devise its own optimal solutions. Robot-based storage and delivery systems (first tried in the 1970s) are gradually becoming common. With a renewed interest in interstitial space and integrated vertical service packages, the time seems ripe for solutions that combine all services, including IT and logistic installations, in a fashion that paves the way for maximum flexibility and elasticity in hospital buildings. This development is highly reminiscent of what was happening during the Heroic Era of the 1970s.

Rather than looking purely at technology as the clue to "smartness" we should perhaps also consider other aspects, particularly from the point of view of the design process. Two organisations, Orbis Medical Park in the Netherlands and the European Health Property Network, have recently defined three key issues in the quest for better hospital buildings. At Orbis Medical Park in Sittard these issues were defined in the beginning of the design process and formed the essential parts of the care chain and the principle of patient-centred care. They were:
1) interdependence of information technology,
2) process oriented work organisation and
3) architectural solutions
(van Laarhoven, lecture in Sittard, 2007).
The European Health Property Network in turn created Lifecycle Economy Models (LCE) for hospitals. Its three key issues, central for creating an effective LCE model, were: 1) integrated capital and revenue profiling, 2) work process systemisation and 3) adaptable design strategies (Dowdeswell and Erskine, 2006).

This, in a nutshell, gives a good picture of the focus of the discussion in the next few years. It covers simultaneously the "hard" issues (costs, both initial and running) and the "soft" ones (patient-centredness and design). It is positive that the design aspect appears on both these short and succinct lists. If we presume that the use of IT will soon be considered so self-evident that it is no longer worth stressing, we arrive at the following recipe for designing a "smart" hospital:

- Lifecycle costing
- Process-centred design
- Adaptable architecture

The hospital design world is undoubtedly undergoing interesting and inspiring times. The new concepts and developments that affect the spatial layouts are generally conducive to increasingly open and flexible solutions. On a global level there is no particular organisational or architectural model that dominates to an extent that would limit the creativity of the designers involved. The current discourse is sufficiently general to give scope for a multitude of interpretations. There is no strong consensus on which way the health care infrastructure will be organised in the coming years. Will there be smaller acute-care core hospitals decentralising the services and supported by even more localised specialised clinics and health posts, or will the centralised tertiary hospitals grow even larger and be surrounded by a network of smaller health care units? The seamless service chain will blur the traditional borders between primary, secondary and tertiary care and the buildings will have to respond to this change. However this is done, the tendency will be to design more open multi-purpose public buildings that have

the ability to respond to change. Smartness will be about adaptability, but also about interfaces and filters, as well as transparency and openness. It will be about having fewer walls and doors. In the final reckoning, the smartest hospitals will be those that are well designed and display architectural quality of the highest order. This may lead us to an era where the demystification of hospital design as a bastion for the initiated will commence in earnest.

Chapter 4. Problematic approaches

A plan of a building should read like a harmony of spaces in light… .Each space must be defined by its structure and the character of its light"
Louis Kahn 1969

Two aspects that represent opposing ends of the spectrum of the discourse are often taken up during debates on the future of our hospitals. At the "soft" end we have concerns about the physical environment of our facilities. It is generally seen as repellent and non-conducive to successful cure or care. At the "hard" end there are worries related to the common presumption that the welfare state, whether taxation or insurance-based, will find it increasingly difficult to finance its infrastructure.

People in the hospital world who are aware of the current situation may feel able to suggest quick remedies on both scores. They claim that the physical side can be dealt with successfully by simply adhering to "healing environment" principles, now amply substantiated by a vast "evidence base". The fiscal headaches can be solved by applying one of the models of financing through public private partnerships in which the markets dominate and the private sector deals with the risks.

This chapter is a critique of these "quick fixes". The aim is to point out their weaknesses and inherent dangers in the hope that local decision-makers or hospital administrators facing the task of refurbishing or building a hospital, will not fall into the trap of adopting them unequivocally and uncritically.

The main aim of this study is to promote architectural quality in hospitals and to promote the status of hospital design as a desirable challenge for the most talented members of the architectural profession. This writer claims that "evidence-based design" and "public private partnerships" have, up to now, tended to achieve the opposite.

The "healing environment" (later "evidence-based design") discourse has now continued for more than 20 years, but has accelerated recently because new hospitals are being built at a greater pace than earlier. Most of the "evidence" has precious little to do with architectural quality *per se*. A lot of the research deals with materials, colours, finishes, furniture, fittings, appliances and decoration, all of them cosmetic aspects that have a lifecycle of a few years at most. This tends to detract from the real issues, such as the aesthetic and cultural sustainability of the building itself, and create a belief in instant "stick on" remedies. On the other hand, the research related to single rooms in patient wards and standardisation of rooms in general has had a major impact and will, in time, indirectly also contribute to an improved architectural quality through increasingly clear and uncluttered floor plans.

Up to now, the only major hospital building programme which uses a form of "public private partnership" procurement methodology, and from which we also now have some evidence, is the "Private Finance Initiative" (PFI) in England. It is thus taken up in this chapter as a case study, an example of what can happen when high quality architecture is not given top priority on the agenda. "Public private partnerships" are obviously not permanently deemed to failure. On the contrary, the shortcomings of the English experiment are likely to offer valuable lessons for the future.

Healing environment and evidence-based design

If a scientist tells you that two particular colours are dissonant, make a note of these colours and use them whenever you can. John Ruskin, 1879

It is essential to an architect to know how to see; I mean to see in such a way that the vision is not overpowered by rational analysis. Luis Barragan, 1980

Good design is in itself healing. Bas Molenaar, 2005

The "healing environment" is a concept that in the last ten years has established itself as an important part of hospital design discourse. Early on, the proponents of the concept tended to concentrate on the effects of the environment on a person's primary senses, such as sight, hearing and touch. Colour theories played an important role, as did external views, plants, and miscellaneous interior design features. From a North-European vantage point, this "movement" seems ethnocentric, in other words it has shown scant regard for the cultural dimension. The American view of what is "cosy" and "healing" can not be seen as a universal truth. This might be one reason for the kind of scepticism expressed in Europe in comments such as the following by Bas Molenaar, "However fashionable such a term as 'healing environment' may have become, its actual impact is often based on wishful thinking rather than hard fact" (Molenaar, 2005, p. 376). As it is, each culture develops its own modes of expression, as it does its own hospitals.

Many doctors have been critical of the concept "healing environment", pointing out that a physical environment can never itself be healing (with the possible historical exception of the tuberculosis sanatoria). At its best it can have a conducive effect on the process of healing. Partially because of this, and also as a result of the widespread scepticism, the concept "evidence based design" has now widely been taken into use. There is now more stress on the importance of daylight, on ergonomic studies that show benefits achieved through the standardisation of rooms, and especially on the growing evidence of the superiority of single rooms in patient wards. The "healing environment" lobby, so dominant in the discussion on physical facilities for healthcare, is now primarily bringing forward arguments based on quantifiable research data (Johansson et al., 2006).

The Academy of Architecture for Health is an organisation founded by the American Institute of Architects (AIA) that distributes annual awards for the best health care projects in the United States. In 2004 the top criteria was, for the first time, "to be therapeutic and healthful", and potential "healing" qualities were placed above criteria such as efficiency, effectiveness and "patient, family and staff satisfaction".

The British National Health Service also pays tribute to the "healing environment" by giving the concept a lot of attention. On the NHS website, it is seen as being based on the effects of a whole range of environmental factors such as lighting, colour, aroma, views, art, scale, proportion, sound, texture and materials. Primary senses are emphasised with sight in particular being seen as the most important. What we can see can be relaxing, reassuring and stimulating, and this can all have a positive effect on the healing process. Without light the effects of sight are obviously limited (NHS, 2003). As early as 1860,

Florence Nightingale said her famous line, "Second only to fresh air… I should be inclined to rank light in importance for the sick. Direct sunlight, not only daylight, is necessary for a speedy recovery".

Florence Nightingale's statement is of course still full of relevance. Those people who live in northern latitudes know of the hormone melatonin which, when there is a lack of natural light, depresses mental functions and tells the body to 'log off'. A condition called Seasonal Affective Disorder (SAD) can be caused by this phenomenon. This may have contributed to the fact that the excessively deep hospital plans, so common in the United States until recently, were never adopted in most central and northern European countries. Roger Ulrich's study of 1984 showed that patients with a view of gardens were discharged earlier after surgery (as a result of fewer complaints, adverse observations and complications in general) than those with a view of a brick wall (Ulrich, 1984). Even if many European hospitals in the 1970s and 1980s did also have what we now see as excessively deep plans and far from ideal daylight conditions, patients' rooms facing brick walls were then, as they always have been, a rarity. A choice between "gardens" and "brick walls" was never a real one, and thus the question of the usefulness of Ulrich's study remains irrelevant from a Northern European vantage point.

The specificity of many of these research results has not been sufficiently emphasised. In order for a research result such as "Prolonged exposure to natural views not only helps to calm patients, but can also have positive effects on other health outcomes and shorten recovery periods" (Ulrich et al., 1993), to be genuinely helpful, we need to know which "natural views" we are talking about and what we are comparing them with. Taking such evidence literally can be risky because it can lead to narrow-minded interpretation that "nature" is always preferable to anything else, regardless of the climatic, geographic, cultural or social context.

Providing the best possible daylight conditions is one of the cornerstones in the teaching of architectural design. Le Corbusier famously talks about architecture being the magnificent play of forms in light. This is known by architectural students everywhere. Using available views in an optimal way is another fundamental principle of good design. It is slightly absurd that a whole new "evidence-base" is now needed for specialist hospital architects to relearn the basics of their trade.

There is an abundance of different colour theories and a vast amount of research exists on the effects of different colours on the human psyche. Colour psychologists have also been very active in the healing environment and evidence-based design discourse. There is research that shows that some colours can induce epileptic fits whereas others can reduce pain in rheumatism and arthritis. Some colours are better than others for the purpose of calming aggressive patients in emergency departments. When used in patients' bedrooms some colours have been seen to be detrimental to REM sleep (NHS, 2003).

There are some familiar rules regarding colour that are frequently applied and seem to make sense, at least in Western cultures. The chromatic scale, for instance, classifies the "emotional loads" of colours – intensive, joyful, oppressive and so on. Warm

colours appear to create confidence and safety. Colours can also certainly be useful as tools for the definition and organisation of space. Reflecting colours are often essential as support for lighting solutions. However, claims such as "contrasting colours are better than monochrome variations of the same colour" (NHS, 2003) are much more difficult to substantiate in spite of the "evidence". According to Harald Arnkil (2007), it is impossible to say anything definite and final about the effect of colour on human behaviour or health. Studying colour as a separate entity without considering the wider context - space and form, lighting conditions and so on - is generally futile because every situation and spatial framework is unique. Many architects nevertheless do make use of colour theories and the findings of colour psychologists when designing hospital interiors. This is unlikely to be harmful, but applying these approaches in buildings already suffering from insufficient natural light or mazelike floor plans often manifests itself merely as an unsuccessful effort to cover up inherent inadequacies.

Of all the visible and dominating elements in buildings, particularly of the interiors, colour is generally the one with the shortest life expectancy. Getting the colour scheme "right" is thus low down on the list of priorities when considering the whole lifecycle of a facility. Evidence of the superiority of one colour over another in a particular circumstance can, be adhered to without great risk, since rectifying the situation, i.e. repainting, in response to a new piece of "evidence", is usually a very cheap remedy. Colour is heavily steeped in fashion and trends, particularly in today's visually conscious and fast-changing society. Our increasingly multicultural societies will complicate matters further since colours have different connotations for people of different cultural backgrounds.

Arnkil has done substantial comparative studies on the subject of the therapeutic effect of colour. He claims that the textbooks and research studies show that effects often claimed to be physical are in fact psychosomatic, and that the psychological effects have less to do with the colour itself than a multitude of other factors. He also argues that the basic colour vocabulary and terminology has, in many research studies, been inexact or incorrect, which also leads to confused and essentially meaningless results. The fact that lighting conditions during experiments have not been sufficiently controlled, as well as a lack of distinction between cognitive and emotional reactions, are also factors that have led to mistakes. Above all Arnkil concludes that it is extremely difficult to study individual colours or colour combinations as separate entities without reference to a wider context (Arnkil, 2007).

Colour only becomes a meaningful issue when it is such an integral part of the architectural entity that any change in the colour scheme automatically detracts from the artistic quality of the building. In the aforementioned hospital at Aachen, now a listed building, the decision has been made to retain the original lime green colour that dominates in the public areas, as well as all other parts of the original colour scheme. It would be interesting to discover whether the Aachen colour scheme, apart from being the epitome of 1970s fashion, has also proved to be "therapeutic" and if so, according to which colour theory. It is more likely that it is simply the quality of the architecture that has prevailed. Arvid Ottar, one

of the designers of the new Rikshopitalet in Oslo, told the audience at a conference in Groningen in 2004 that the design team could have chosen between any number of colour theories for their project but ended up using the one that best suited their architectural concept and ambitions. This pragmatic and logical approach is also followed by many other architects with good results.

In conclusion, we can follow the advice of Josef Albers, "Good use of colour can be compared to good cooking. However good the recipe, the food needs to be tasted continually. In the end it is the good taste of the cook that decides" (in Arnkil, 2007, p. 134).

In terms of positive distraction, the performing arts may have a better effect on patients than the visual arts. To benefit from this would entail patients taking part in interactive activities with relatives, staff and even artists in residence (Scher & Senior, 1999). These ideas, so familiar from the Greek Asclepieions, are pursued in some hospitals but are obviously more relevant to future "care" situations rather than "cure" situations. Bringing hospitals back to truly urban locations would obviously facilitate the pursuit of such distractions.

Most of the evidence-based design discourse on art in hospitals relates to the visual arts. The provision of artworks as a therapeutic ingredient in hospitals is seen as having major significance. Two fundamental questions arise: whether artwork intended to be therapeutic is real art and whether artwork made specifically to go in or on a building is, in fact, not art but decoration (Gusack, 2006). Artists do their best work when they do what they want and not what we want. Architects have similar tendencies and often produce their worst work when they do exactly as they are told. This is perhaps the most poignant single explanation for the low architectural quality of the majority of recent hospitals.

Good art is not always benign. According to the NHS (2005) art should "impart and evoke messages of hope, joy, love, dignity, peace, tranquility, energy, comfort, security, safety, growth and life". These are all attributes that should be present in a good health care environment. But to what extent art can actually contribute is debatable, since, as Simon Schama (2006, p. 6) writes, "Great art has dreadful manners … ..the hushed reverence of the gallery can fool you into believing masterpieces are polite things, visions that soothe, charm, and beguile, but actually they are thugs". Should we therefore make sure that we do not use masterpieces? How low down the scale do we have to go to identify the "harmless" pieces, those that really do "soothe, charm, and beguile"? Being surrounded by mediocrity is not likely to have a therapeutic effect, at least not on the art lover.

There are obvious problems involved in the emphasis that has been put on art as an EBD tool. Art that irritates or revolts some people is loved by others. On the other hand, just as in any other civilised institutions, hospitals too should be well endowed with works of art. Art played a major role in the design philosophy of the Greek Asclepieions, as well as in the Renaissance hospitals. In many countries today, a certain percentage of the total budget is put aside for artworks. Hospitals are also public buildings, so placing art in them is perfectly normal. If, however, art is used as decorative "wallpaper" it can only have "healing" effects on the cracks in the wall, not on the patients.

Apart from providing a hospital with elements of the normal civilised public realm, art can help in wayfinding. Strategically placed works can create a strong identity to key places and provide landmarks that help navigation in a large building. Good wayfinding can dramatically improve the therapeutic qualities of a hospital.

The EDB movement has also kept better wayfinding at the top of its agenda. The conference on "Designing the 21st Century Hospital" in Washington DC in June 2004 was organised by the Robert Wood Johnson Foundation, an influential actor in the ongoing discourse. The conference concluded: "Good wayfinding systems include mail-out maps and written directions, you-are-here maps, directional signage at decision points, reassurance signs for long paths and clear identification of rooms" (Robert Wood Johnson Foundation, Conference paper 2004, p. 8). Is this not exactly what has been practiced during recent decades? The way forward should be towards intuitive wayfinding, towards buildings where all those listed mechanisms can be eliminated and rendered obsolete. Even if total elimination of signage can probably never be achieved we should aim at minimising the dependence on it. The essential tool for reaching this aim and providing less confusing hospital interiors is, again, better architecture.

There have been many books published in recent years about the interior design of hospitals, in fact probably more than those that deal with the actual architecture of hospitals. Most of them pay scant attention to the physical, cultural or social context within which the hospital in question operates. This is an indication of the prioritisation among many of those involved in the health care design business. The interior design lobby focuses on patient-centredness and aims to provide greater comfort through "a rather superficial massaging of the interior décor so that it resembles hotels instead of stark unfriendly utilitarian modernism" (Francis & Glanville, 2001, p. 73).

It is important here to make a clear distinction between the "cure" and "care" situations. In any long-term care situation it is of utmost importance that the patient can, within his or her own territory, be in possession of a physical environment that recreates the feeling of individual domesticity that the patient prefers. Any force-feeding by bureaucrats or designers can, in these contexts, be considered repressive. In a "care" situation, particularly with the elderly, it is crucial that the facility provides enough alternatives and space in order to avoid a situation where going to bed during the day is the only comfortable option. This is much more important to the old person's continuing well-being than the chosen palette of colours and materials in the interior décor.

In "cure" situations, such as those in acute hospitals where the average length of stay is constantly decreasing, the situation is completely different. There "the supposed domesticity is questionable… it dilutes the reality of domesticity, turning it into a banal generality, a shallow symbol of comfort that can hardly convince" (Blundell-Jones, 2002, p. 43). However, transferring the pseudo-domestic vocabulary that is widely used in hotels to hospitals seems to be the main theme of many of the books referred to above.

The covering and camouflaging of hospital equipment is another recurring theme, again in the name of domesticity. If this equipment is covered up because of its "ugliness", it would be more productive to spend that energy on creating more beautiful machinery, "medical equivalents of consumer electronics like the coffee machine" (Molenaar, 2006, p. 378). It is perfectly valid to argue that it is reassuring to many people to be constantly aware that the well-trained personnel in uniforms who use the latest technological devices are looking after you. After all, an acute care hospital is not a hotel pretending to be a home, with high-tech appliances hidden away in mock mahogany wardrobes.

The accumulated base of evidence related to the design of hospitals is vast. Research performed at Texas A&M University and Georgia Institute of Technology (Ulrich et al., 2004) identified 650 relevant scientific studies that link quality of care with design issues. They show that the physical environment has major effects on patient health and safety, efficiency of care and performance of staff. The results now form a valuable checklist for many aspects of hospital design.

One problem that may have contributed to the sceptical response of architects is that a lot of the evidence, particularly earlier on, had little to do with architecture, but was still presented at architectural fori. Some results were highly questionable in their ethnocentricity, such as the one proving that pregnant mothers listening to Mozart or Vivaldi suffered from less foetal kicking than those listening to "rock music" (Gaynor, 1999). Other studies (Ulrich, 1997, etc.) concentrated on details such as the importance of personally controllable lights, high-tech music and other entertainment devices. These are all certainly valuable aspects in the improvement of patient comfort, but they remain questions of programming, prioritisation, and resources rather than architecture or design.

Another problem, strongly related to the one mentioned above, is that a vast majority of the EBD research has occurred in private, for-profit hospitals in the United States, a country where the healthcare system is "on the verge of collapse" (Verderber, 2006, p. 85). Even those EBD results that could be more universally useful are not likely to improve the situation of the nearly 50 million Americans who lack comprehensive health insurance.

The most important decisions in the physical design of a hospital, as in any other building, are made very early on in the design process. The choice of the site, the urban context, the relationship with the surrounding buildings, structures and landscape, the orientation, the traffic arrangements, the massing of the building parts, the articulation of solids and voids, the interface between the exterior and the interior, the spatial qualities of the interior – are all fundamental aspects that define a good building and determine its potential lifecycle. These fundamental questions have largely been ignored by EDB research. The studies referred to tend to deal with matters that are subordinate to others that are more essential. These more essential issues are admittedly difficult to quantify, and happily I would claim. Any evidence base that would nail down the absolute truth about architectural quality would be fatal to the

development of our culture. If mankind had always based its design decisions on existing evidence only, we would still be living in caves.

In many of the research studies that are frequently referred to, the concept of "taste", plays a major part. This is probably the reason why Martti Teikari correctly concludes in his study on staff satisfaction in Finnish hospitals that it cannot be proved that visual and aesthetic aspects hold an independent role concerning satisfaction with the working environment (Teikari, 1995). He was later criticized by Alan Dilani who looked to Jain Malkin's work as proof to the contrary (Dilani, 1996). The problem with Malkin's research results is that they are often based on the opinion of one particular group of people in one particular locality and at one particular moment in time. This makes them unreliable on at least three counts (social, cultural, historical), which means that they are of little universal value.

It is easy to "prove", as Ulrich writes (1984), that a room with a view is more therapeutic than one without. It is much harder to prove that the architectural qualities of the space also contribute to its therapeutic effect. Many scientists and psychologists involved in the field are aware of the fact that many architects actually believe that good design is in itself healing and have started to characterise designers as "faith healers", but as Francis, Grenville, Noble and Scher (1999, p.61) write: "It is, however, an imperative of any creative process for the creator to believe that the proposal will be of positive benefit. Implicit in this material are notions about quality of design that have the effect of blurring the boundaries between therapeutic issues and aesthetics".

It has been argued that architects who do not take the presented evidence seriously are as criminal as doctors who ignore arguments presented by evidence based medicine (Kirk Hamilton, Groningen conference 2005, and others). This undoubtedly well-meant but essentially fundamentalist attitude is worrying for many of the reasons outlined above. Some of the evidence provides useful tools but no politicians or administrators and their designers should be allowed to justify their mediocre hospital buildings by saying: "but we used the evidence base". The cultural ethnocentricity which is evident in so much of the EDB research makes any such justifications questionable. As Stephen Verderber writes, "EDB may be difficult to blithely cross-culturally transfer from American case studies to universal health coverage system case studies, unless cross-cultural, political, economic, legal, and regulatory differences are taken into consideration" (Verderber, 2006, p. 85-86).

Adherence to any amount of evidence does not, in any case, guarantee a good building. But we can reverse the question: is it possible to faithfully pay heed to an entire evidence base and still design a building of high architectural quality? The answer is affirmative, for the reason that most of the evidence concerns matters that have little to do with architecture itself. The evidence that is relevant, such as daylight (the relationship between solids and voids in the massing) and views (context and relationship to the surroundings), is fundamental, and if these issues are not well solved, no amount of adherence to the rest of the evidence base will help.

An early contribution to the healing environment discussion was provided in 1979 by the French architect René Gutton. Many of his thoughts are refreshingly relevant today. He claimed that in two weeks one can transform a critically ill patient into a vegetable, or alternatively bring him back to life, and that this is not dependent on medical techniques but on the conception of space. He saw the *raison d'être* of a hospital as recreating the autonomy of a human being. In order to achieve the desired therapeutic effect there should be a network of spaces where a number of functions, listed in BOX 5, could take place (Gutton, 1979). Today Gutton's approach appears particularly meaningful since he talks about normal human functions in relation to the fundamentals of architecture rather than soft piano music, harmless landscape paintings, covered up appliances, and other trivialities that have dominated the discourse on therapeutic environments for too long.

…meet, live, love, be greeted, celebrate, dream, inhabit, move, sleep, look, communicate, be recognised, place oneself, cure oneself, participate, work, act, eat and drink, create, develop one's faculties, be integrated, contemplate, walk around, admire, feel useful, learn…
René Gutton, 1979

Box 5

Procurement practices – case PFI

The internal market in health care introduced financial incentives to, and competition between the new hospital trusts, concepts that were alien to the original spirit and purpose of the NHS. It was expected that competition would generate innovations in the provision and design of new hospital facilities. There is little evidence of this as yet and the government's currently preferred method of funding capital projects, the PFI, is unlikely to encourage new thinking unless it is to the guaranteed benefit of private finance. Susan Francis et al., 1999

The ownership and management of hospitals can be divided into the following groups: 1) Government owned and managed hospitals, 2) Public-sector autonomous hospitals, 3) Geographically defined health boards, 4) State-owned enterprises, 5) Public not-for-profit hospitals, 6) Joint stock hospitals, 7) Private management of publicly owned hospitals, 8) Public management of privately owned hospitals, 9) Private for-profit hospitals (McKee and Healy, 2002, pp. 122-123).

Until recently there has been little evidence that hospital ownership or procurement models affect either the process or the quality of planning, architecture or design. The Bismarck model (national insurance), the Nordic Welfare State model (taxation) or the Dutch model in which 90% of all the hospitals have developed as private and independent non-profit institutions, have all produced their share of very good, mediocre and poor hospitals. The higher standard of furniture, fittings and equipment that might be found in private for-profit hospitals in some countries is not relevant because it has little to do with architectural quality.

However, one model of procurement and ownership that has emerged as a major player in the last few years is public management of privately owned hospitals. In the United Kingdom this is known as the Private Finance Initiative (PFI). The PFI was initially introduced by the Conservative Party but was later adopted by the new Labour government and is so far unique in Europe. The Portuguese experiment, with which it has been compared, differs in that the hospitals in question in Portugal are publicly owned and privately managed. The British system is dealt with here in some detail because of its architectural implications and because it is indeed a highly topical and unique phenomenon. The attractions of PFI, from the State point of view, are obvious. The private sector provides money up front and the risks involved in the design, construction and maintenance of the facilities are also transferred to the private operator. Thus both parties, in theory, are dealing with their core business.

The system has, however, been described by critics as a "Giant national credit card – buy now, pay later" (Gusack, 2006). There have been many studies, which question the financial sense of the programme. It has been claimed that PFI schemes are costing more than traditional public funding of capital developments because the public sector, due to its size and its ability to bear risks, can borrow money more cheaply than the private sector (Ball et al., 2000). The European Investment Bank has also acknowledged that PFI is a more expensive form of hospital provision than traditional procurement because the private sector needs to make a proper return on capital. The trade unions have been critics of PFI because they see the lack of expertise in human resource policy and practice in the consortia running the projects as a threat to the tradition of cooperative employment relations (Bing Li et al., 2005).

Commentators warned very early on about the existence of credible marketplaces since the variety and number of PFI schemes in the pipeline could be so great that competition would be eroded, with projects chasing consortia and not the other way around. This in turn could lead to the private sector dictating the public sector upon the conditions under which it contracts (Owen & Merna, 1997). There is now evidence that the market is becoming increasingly selective and is only bidding for good projects. In fact there have been cases where there has been one single bidder (Dowdeswell & Erskine, 2006). Service provision is thus now made on the basis of economic viability rather than need, but also without real competition, which is ironic considering that the system was designed to satisfy the very essence of competitive market economies.

Investment is needed to combat the process of constantly adapting existing health facilities to new circumstances, particularly in the UK where many hospitals still operate in 19th century Victorian buildings with open, mixed-sex, Nightingale wards. Constant refurbishment is often seen as both inappropriate and more expensive in the long run than building new facilities, and redundant locations can always be transferred to the concessionaire and subsequently sold for commercial purposes (Thompson & McKee, 2004). The "cherry picking" situation that now exists, due to failings in the PFI system, has led to an increased disinterest in renovation and refurbishment of existing facilities among the bidders. Most of the current schemes are concentrating their activities on commercially

more interesting greenfield or brownfield sites, thus creating yet another wave of hospitals built outside city centres and away from where people live, work and spend their leisure time.

Monk quotes a British Government early post-operational evaluation of a new PFI building (Treasury Taskforce Technical Note no 5. "How to Construct a Public Sector Comparator?, 1995) where the only question related to architectural quality was formulated thus, "Does the client team think that the completed results show that it looks sensible and robust?" (Monk, 2002, p. 23). What would Vitruvius have thought about that?

Efficiency, long term durability, reduced running costs, energy conservation and sustainability are aspects that are strongly encouraged and pursued by the PFI process. However, the way the system is organised, these aspects also automatically generate benefits for the investors. Even worse is the fact that the PFI system in itself does not "contain any direct incentive or result in any obvious financial return in exchange for producing high quality design" (Monk, 2002, p. 23).

Consortia have responded to the risk transfer by adopting tried and tested solutions. Several studies (Pollock et al., 2001, Asenova et al., 2003, Dixon et al., 2005) have argued that low standards of physical facilities have generally been provided and that the expressed expectations involving innovation have proved unrealistic. The UK government's architectural "watchdog" CABE (Commission for Architecture and the Built Environment), has raised concerns about the quality of design in PFI schemes. These concerns show that the government's aims in PFIs to encourage innovation and improve quality are mot being met. Generally, there is a growing suspicion that the design of some PFI projects has more to do with private sector interest than real public need (Lonsdale, 2005). CABE has also claimed that the hospitals that are currently being built under the PFI system will be obsolete in 20 years (Bushby, 2002).

It has been claimed that National Health Service Trusts that embark on new PFI schemes do not possess sufficient experience, either commercially or with regard to hospital design, to meaningfully argue their points with consortia and the few design teams that move from project to project. The projects have also been widely criticized for a lack of flexibility: "Although companies engaged in PFI project submissions and their NHS counterparts say that adaptability and flexibility are part of the process there is little empirical evidence to support this" (Dowdeswell & Erskine, 2006, p. 13).

One of the principal reasons for the increasing lack of interest among bidders, and also the small number of design offices involved, is the high entry cost, which limits the players to those who have very substantial financial resources. Bidding organisations are expected to submit highly detailed design plans, as well as details of financial and legal arrangements involving costs to designers, lawyers and consultants. The negotiations involved are usually complex and lengthy. Many bidders complain that in addition to the time problem (procurement process and the time taken to begin the construction) the costs become prohibitive (Owen & Merna, 1997). The fact that the high transaction and bidding costs deter large numbers of competitors is hardly surprising. It has now been shown that the PFI bidding process is

undoubtedly more expensive under PFI than with traditional procurement, with total costs for all bidders reaching 3 % of total project costs in some cases (Thompson & McKee, 2004).

The disappointing architectural quality of the PFI building stock up to date is largely explained by the same reasons. The present procurement process favours the big and the powerful. Very few architectural firms, whose core business is the production of high quality architecture, are capable of taking the required financial risks which may lead to losses of a magnitude completely prohibitive to a vast majority of practices. Many of the firms that are involved in the PFI process are multi-national giants with little to show for themselves in terms of successes in major design competitions or being published in the top architectural journals. This leads to a polarisation and monopolisation that in turns means that no talented new architects can get involved in hospital design because of the sheer impossibility of entering the field. The situation is further worsened by the lack of inspiration provided by projects produced by those involved. Some architects who have worked in PFI projects criticise the system because "designers are responsible to contractors from day one, and not necessarily given the opportunity to interact with the client in any deep way" (Finch, 2005, p. 54). Even those who are less critical of the PFI system see the simple lack of public money as its main driving force and very few, if any real "evidence-based" advantages can be shown as yet. It has simply been seen as the only way to achieve the British Government's target of building 100 new hospitals by 2010.

The adoption of systems of this kind will seem very appealing to some of the new EU Member States for three reasons. Firstly, the condition of their hospital stock is generally poor and in urgent need of a quick fix. Secondly, their governments generally do not posses the means to finance the necessary investments. Thirdly, as a result of decades of top-down dictation from central authorities, there is a lack of expertise that is needed to rebuild the health care networks. It is thus likely that the British PFI system will, in some form, spread to these countries. It is important that this does not happen in an uncontrolled way and that the worst mistakes of the British experience are avoided.

PART III. THE PRIMARY CHALLENGE — FUTURE-PROOFING

Chapter 5. Future-proofing

The greatest fault of medical architecture is to give a lasting form to quarters destined to be altered.
Paul Nelson, 1933

The real requirement is to design a building that will inhibit change least, and not one that will fit specific function best. John Weeks, 1973

Flexibility, adaptability, agility, elasticity, versatility, generality, repeatability, changeability, convertibility, and modularity are some of attributes that a hospital of the future should possess. A term borrowed from the IT world – "future-proofing" – brings all of them together. As a result of the common understanding that a hospital can never be "ready", designing "future proof – not future ready" facilities also became one of the guidelines for the vast NHS hospital building programme undertaken in Britain at the turn of the millennium (Hutchison, 2004). However, in the buildings so far finished there is little sign of this. This is also true of the majority of current projects in other countries. In fact, it was reported at a conference on PFI Hospitals in the UK in June 2006 (Wilmington 28.6) that not one person at the conference said they were actually working on projects that were future-proof (Gusack, 2006).

The emphasis in the research in the field has not been on fundamental issues such as the quality of architecture and the development of the design and construction process, but rather on matters that from a holistic architectural viewpoint can be considered to be secondary. The design process has also for long been based on distributing square metres according to pre-set hierarchically-based formulae to satisfy all those concerned. The introduction of radically different ways of approaching projects will take a long while to be accepted, however good and generally accepted the underlying principles are. This is in spite of the fact that some people, such as Paul Nelson, understood them more than half a century ago.

Flexibility

In light of built environment's organic patterns of growth and change, the transformational behaviour of its forms, it appears to act very much as a living whole.
N. J. Habraken, 1998

As has been discussed, classical architecture, from antiquity to the revivalist era, is inherently flexibile. However, generic plans are different from those that are actually designed for change. It is therefore safe to say that flexibility, as a conscious architectural tool, was the invention of Modernism. Louis Sullivan pioneered it in his office buildings and, on a smaller scale, Gerrit Rietveld in his Schröder House in Utrecht and Pierre Chareau and Bernard Bijvoet in their Maison de Verre in Paris. In health buildings, the French-based American Paul Nelson developed, as early as in the 1930s, an exterior wall system that consisted of a metal frame with interchangeable opaque, translucent and transparent panels, placed inside the structural frame, which greatly facilitated the use of flexible internal partitions.

Later on, particularly in England and in the United States, there were many experiments in flexibility in school buildings. This included programming multipurpose spaces and flexible clusters of classrooms with movable partitions, all based on rapidly changing pedagogical ideas (group work, learning by doing etc.), and efforts at breaking up

the traditional hierarchical classroom situation. This was also happening in Finland in the early 1970s. The schools were provided with movable partitions, large sliding doors and other devices designed to facilitate the adaptation of the spaces to suit different learning processes and methodologies. To claim that such walls were rarely moved is not a great exaggeration.

Viewing your place of work, a building designed for specific functions, as a flexible set of building blocks that you yourself can, and should, adapt to new situations, is not something that happens overnight. It often takes a whole new generation of teachers (or doctors and nurses) for attitudes to change. Meanwhile, ideas of flexibility and adaptability can conveniently be forgotten and "tailor-made" solutions can again be allowed to flourish. In school design, during the last ten years or so, the ideas of the 1970s have resurfaced. They are now based on a combination of old and new pedagogical thinking, but the difference is that the new generation of teachers is finally responsive to the ideas, and prepared to treat their building as a musical instrument that needs constant tuning. The same way of thinking can now be expected to accelerate among the staff in our hospitals.

The catalysts for demands for flexibility in hospitals were the rapidly changing needs and developments in clinical procedures, just as changing pedagogical philosophies had been for schools. Flexibility remained one of the key words throughout the Heroic Era. Northwick Park, McMaster and Aachen were all classic examples of hospitals that embodied early future-proofing ideologies. What they all have in common is the realisation that a hospital is not of a fixed size but contains elements with pressures for growth which vary and are difficult to predict. The designers of these hospitals were also among the first to realise that obsolescence was a threat to be faced from the start of the programming and design processes, and that any ideal but static design solution was destined to be unsustainable.

In the sixties the discourse on flexibility also extended to avant-garde movements spearheaded by groups like Archigram in England, who introduced ideas such as pneumatic structures, plug-in cities and even walking cities. These groups idealized nomadic lifestyles and took the architectural world by storm with their impressive graphic representations of new kinds of super-flexible structures occupied by a spectacular array of human activity and endeavour. Flexibility became the "aestheticization of rebellion and anarchy" (Sarkis, 2001, p. 84).

The reason this deserves to be taken up here is that mainstream architecture was simultaneously wrestling with similar ideas. Some of the *chef d'oeuvres* of the Heroic Era of hospital design were on the drawing board, introducing interstitial floors and plug-in elements such as prefabricated sanitary units, as well as experimenting with futuristic theoretical models. Architectural practices that were respected members of the professional establishment, such as Perkins and Will in the United States, produced some quite outrageous hospital schemes, with a fun content comparable to the works of the aforementioned "rebels". E. Todd Wheeler of Perkins and Will also produced a text, printed in BOX 6, in which he compared a hospital with the human body. The Japanese were making patient transport capsules (Fig. 89) reminiscent of the pneumatic structures of Archigram (Fig. 90) and others. The relevance of

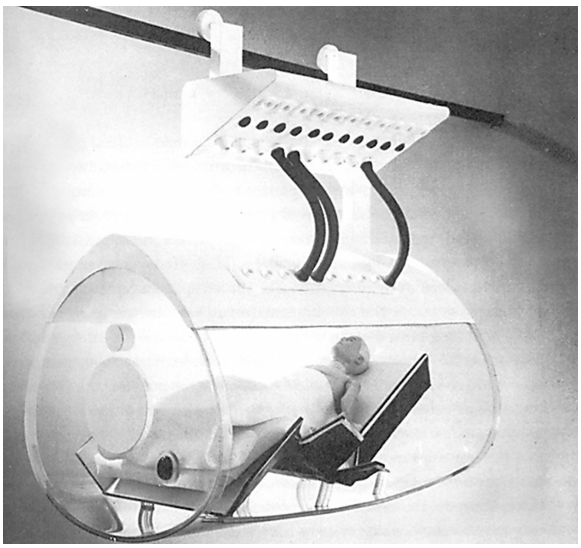


Fig. 89

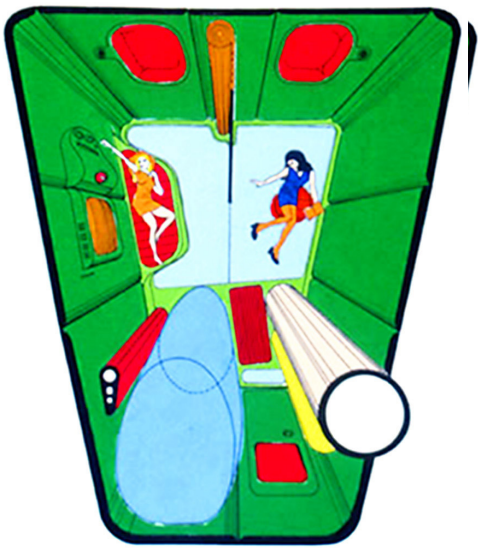


Fig. 90

these in today's situation is twofold. "Blobism", as an architectural trend, appears to have come to stay. It is clear that the pneumatic structures of the sixties have been one source of inspiration for today's "blobs". The need for "cocooning" will become an important theme in the discourse related to increased openness in hospital plans. Here too lessons can be learnt from the avant-garde work of the Heroic Era.

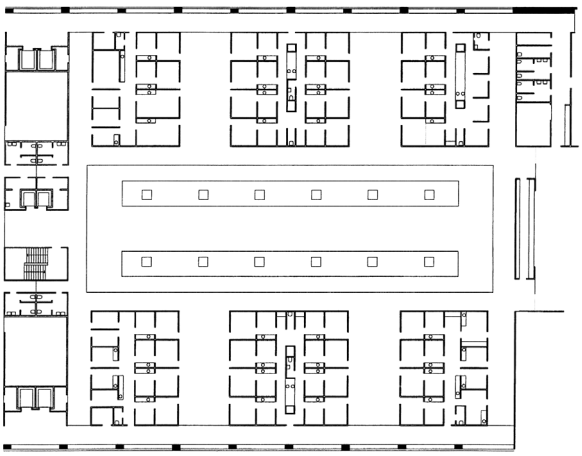
The growing scale of shopping centres, airports, schools and hospitals has led to a revival of mat thinking. Architects and planners are looking for ways to provide buildings that act as "flexible frameworks, rather than rigid containers" (Sarkis, 2001, p. 14). These frameworks usually consist of a systematic repetition of simple elements. In some hospitals built in Central and Southern Europe recently, layouts

All hospitals have structure: a skeleton is clothed with walls, roof, windows, and doors as a skin. The piping systems resemble the cardiovascular and gastrointestinal systems, the ventilating system is a building's respiratory system, and wiring its nerves and brain. Even today the hospital can be said to be organic in an analytical sense, but the parallel is not complete. It fails at the degree of variability to be found in all the elements and their renewability. The desire for a flexible hospital is really a wish to have the hospital renewable in its working parts even as the body components renew themselves. Such renewal is possible only in part, but the objective of renewal suggests ways in which a hospital might be made more organic than it is.
E. Todd Wheeler, 1979

Box 6

can be seen that are more open than those of their predecessors. Smaller individual rooms (private offices, consultation rooms and small treatment units) are often standardised in size and collected as flexible clusters in the middle of the building body (room within a room). Plenty of internal courtyards are used in deeper plan models with the principle of providing the best daylight conditions for the areas where people spend most of their time. Corridors, foyers, waiting areas and open-plan offices are thus situated along the external walls. Administrative areas, as well as doctors' work areas, increasingly form part of open plan layouts. Flexibility, as well as the potential therapeutic quality, is greatly enhanced since rows of hierarchically dimensioned small rooms no longer monopolise the prime locations on the external walls. These principles can be seen for instance in recent Catalan examples, such as Hospital Mataro (Montaner & Teixidor, 2000) (Fig. 91) and the new buildings of Hospital del Mar (Brullet & de Pineda) (Fig. 92) and Hospital Sant Pau in Barcelona (Bonell & Gil, 2005).

Fig. 91



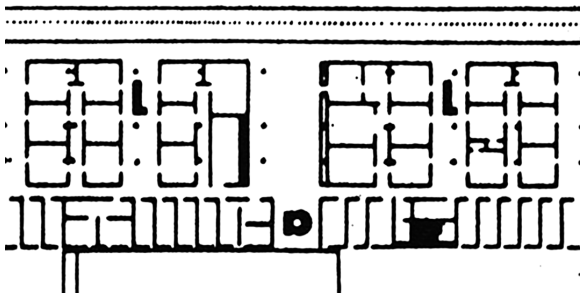


Fig. 92

There are fewer "tailor-made" rooms to be seen in these new hospitals. Rooms are no longer hierarchically dimensioned for a certain rank of doctor or nurse, or piece of equipment. This could be seen as a first step from traditional accommodation schedules towards process-based design. The comparison between the processes that take place at an airport to those that happen in hospitals can be fruitful since, as in airports, "hospitals process people, they manage passengers and wheeled traffic, they treat them decently in both large and small spaces, they deal with sequential waiting areas" (Nield, 2003, p.8). Airports are also increasingly becoming archetypal "mat buildings". The same can be said of shopping centres (see BOX 7). When will hospitals follow suit?

Martti Teikari's research (1995) is relevant to the present discussion. He studied the level of staff satisfaction with operating, radiology and emergency departments in seven Finnish central hospitals built in the 1970s and 1980s. The highest scores were achieved by North Carelia Central Hospital (Veijo Martikainen Architects, extension finished in 1989) (95% satisfaction level for the operating department) and Mikkeli Central Hospital (Marja

Box 7

There's no doubt that Evidence-Based Design research is increasingly popular. Perhaps it fills the intellectual vacuum that has existed since adaptability, building systems, long-life loose-fit low-energy and modular standardisation were thrown on Thatcher's bonfire. Moreover many hospital architects in the UK are far too comfortable within the confines of their parochial specialism. My proposition is that there's a lot to learn about planning, design and construction and fitting-out big adaptable shell-and core superstructures from commercial projects. Technical evolution in the private sector has been spontaneous, is well-researched and delivers the 'wow' factor under time and cost controls as rigorous as any UK hospital project, with or without PFI rules of engagement. Undress Bluewater Shopping Centre, for example, and you'll find a regimented cost-efficient column grid, 5.5 or 6.00m floor to floor heights that enables all electro-mechanical systems to support every conceivable user need in any location. Do any of the PFI hospitals offer similar adaptability? Phil Gusack, 2006

and Erkki Wirta Architects, extension finished in 1985) (80 % satisfaction level for radiology). These two departments have plans which strongly resemble the recent European examples mentioned above, as well as the plans that were prevalent a couple of decades earlier, during the Heroic Era. Teikari analysed the basic spatial configuration that seemed to provide the winning formula, and argued that, in both cases, it consists of three elements; concentric form, grid-structure and functional zoning (Fig. 93). All three terms are pertinent and the formula provides a useful tool when analysing and developing adaptable, flexible, agile, future-proof and even potentially therapeutic environments. However, the eye-opening factor is that, when comparing the radiology departments, Mikkeli (Fig. 94), which had the highest satisfaction score, has the greatest total corridor length and also the longest measured walking distances of all the six examples studied. Nevertheless, "the staff in Mikkeli is absolutely the least stressed about the distances" (Teikari, 1995, p. 128). Very similar conclusions could be drawn concerning the operating department at North Carelia (Fig. 95). Most architects would agree with the importance of Teikari's three essential elements and, as a result, would instinctively pick the right

Fig. 93

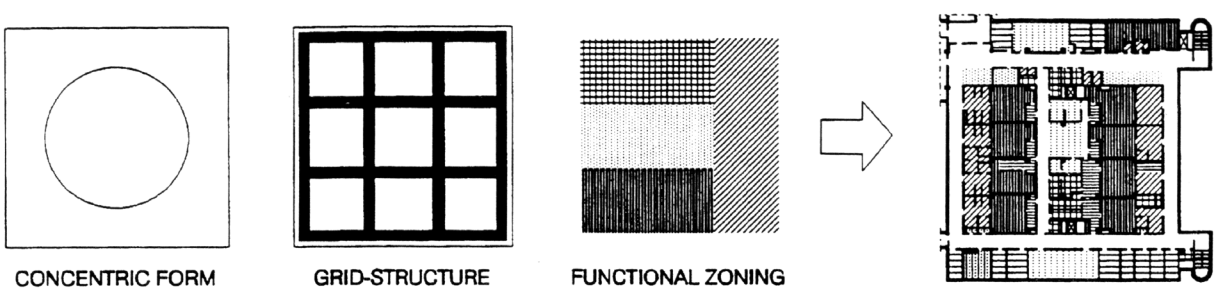
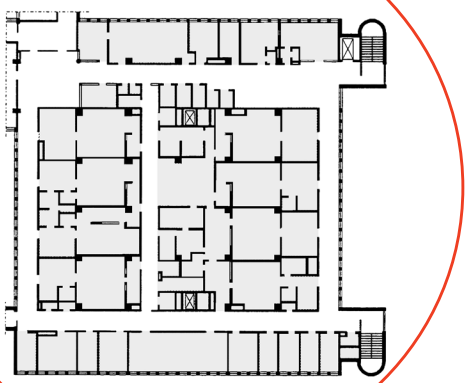
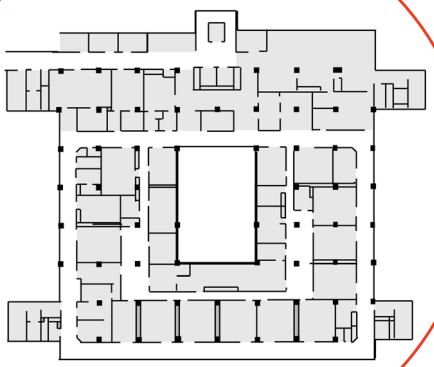


Fig. 94

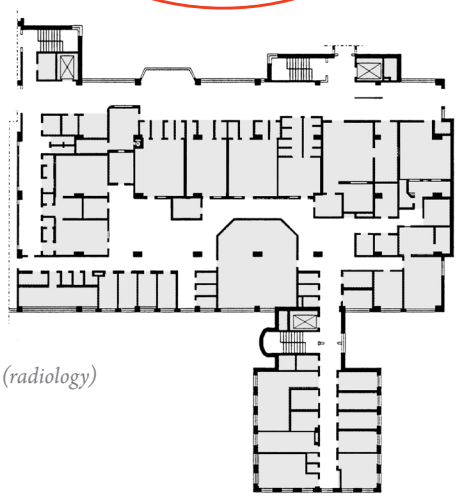


Mikkeli (radiology)

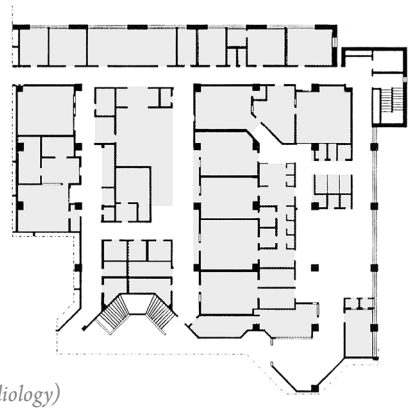
Fig. 95



North Carelia (operating)

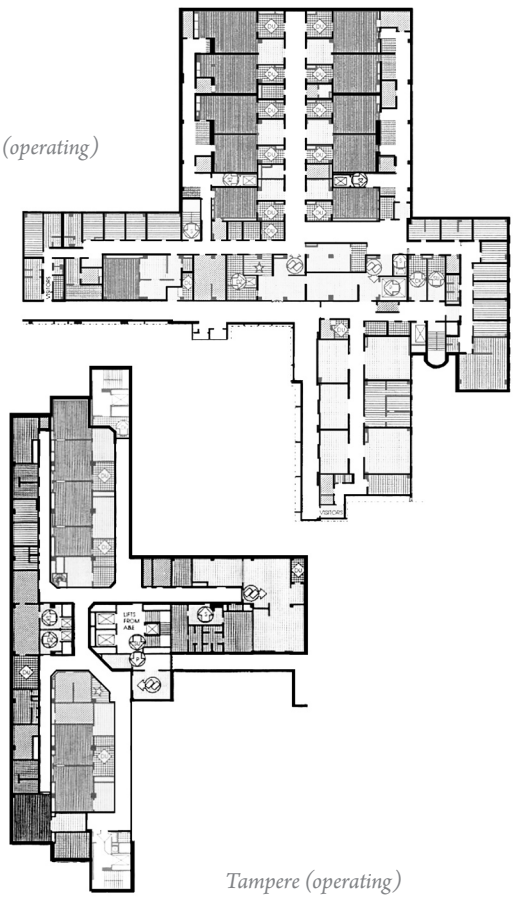


Kuopio (radiology)



Jyväskylä (radiology)

Kuopio (operating)



Tampere (operating)

"winners". These evidence-based findings would indicate that the most "beautiful" plans also work the best thus creating an intriguing comparison with Jullian's far from scientific conclusion during the design process of Venice Hospital: "the best plan plays the best tune" (Allard, 2001, p.33).

In the light of Teikari's evidence we could argue that general good design based on simplicity and clarity of layout, sufficient provision of daylight to the right places, as well as logical functional zoning, is more important than many measurable and quantifiable aspects such as accumulated walking distances or adjacencies.

Modularity, standardisation and systems

The best architects used nothing but quadrangular and rectangular forms. Leon Battista Alberti, 1450

I always start with the square. Louis Kahn, 1969

The Baroque hospitals in France, the urban palaces known as Hôtel Dieu, are direct descendants of Brunelleschi's *chef d'oeuvre* and form part of the same classical tradition as Ospedale degli Innocenti. The genre as a whole is characterised by a succession of arcades, galleries and courtyards often strongly modular in character. Brunelleschi himself later developed his modular systems to a level of sophistication that has scarcely been surpassed. In urban projects in Florence, such as the churches of San Lorenzo and Santo Spirito, and finally his last major work, the Pazzi Chapel, completed in the 1460s in the compound of Santa Croce, he successively took his obsessions to further and further heights. At Pazzi Chapel virtually every dimension, both horizontally and vertically, relates to another, and every single one is a fraction or a sum of some other dimension. Modularity is certainly not a 20th century invention.

In this building type, the urban palace, hospital functions were inserted into an architectural form often originally designed for some other purpose or just as generic space. The overall image followed the fashions of any given time (Teikari, 1995). Because the plans were basically generic they offered plenty of scope for flexibility and changes of use and thus formed a better long-term starting point than many of the later "tailor-made" hospitals. These buildings were far less dependent on walls and doors than those we are used to now. Generic and unspecific spaces are inherently future-proof.

The Oxford Method was a product of the adventurous and inspiring atmosphere that reigned at the British Ministry of Health and its Hospital Programme in the 1960s. It was the first modular prefabricated building system in the world that used integrated engineering systems and standard details and specifications. The programme had first been published as early as 1963, and by 1969, 13 projects had been completed, 14 were under construction and 5 major schemes were on the drawing board. These were mainly smaller units such as district, community and psychiatric hospitals. The system was also exported to Italy where two larger hospitals (in Brescia and Cremona) were built. However, by 1969 the Department of Health's Hospital Planning Division was already "developing a new system in an attempt to obtain a synthesis of the best current ideas in hospital policies, planning, building technology, environmental services design and dimensional coordination" (Francis et al., 1999). This came to be known as the Harness system.

The Harness system was based on a planning grid (module) that produced 15m clear spans. The grid had interspersed courtyards to provide sufficient daylight. The floor to floor height was 4.5m and the height of the building was limited to four storeys (Fig. 96). As much as possible was standardised, such as internal subdivisions, suspended ceilings, storage units, sanitary units and installations. The "plug-in" communication and energy network was like an electrical harness in a car. It provided flexible links between interchangeable components which could be installed or replaced in order to quickly respond to technological developments and changes (James & Tatton-Brown, 1995). Future-proofing elements thus played an important role in the development of the system. The idea was that any project team with a functional programme and a site could take part in a workshop organised by the Department. With the help of the Harness system several alternative plans could be produced and a preferred one selected within two days. The team could then go home "confident in the knowledge that their hospital could then be built to a very high standard in terms of both design and construction and with known costs" (Francis et al., 1999, p. 34). Whether the system really was as good as was claimed is difficult to say in hindsight since, out of 70 major hospitals that were on the Harness list, only two were built due to the recession that followed the oil crisis in 1973.

The American equivalent to Harness, and one that would turn out to be infinitely more successful and long lasting, was devised by George Agron of Stone, Marraccini, and Patterson Architects for the Veterans' Administration of the United States. The prototype hospital, Loma Linda in California, was opened in 1977. As opposed to its British counterpart, the

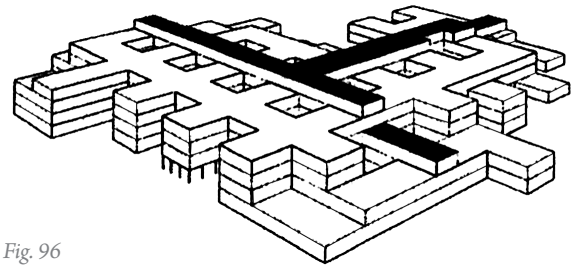


Fig. 96

VAHBS (Veterans' Administration Hospital Building System) hospitals did include interstitial floors, pioneered in Greenwich in 1972 (James & Tatton-Brown, 1995). Three "Medical Centers" ("hospital" had been an undesirable word in the US since the late 70s) that were built between 1987 and 1994 underwent a post-occupancy evaluation in 2005. When studying the dimensioning of these hospitals (all originally built for around 1000 beds) one can observe that the VAHBS really was a "system" (Fig. 97) and not a set of standardised hospital plans.

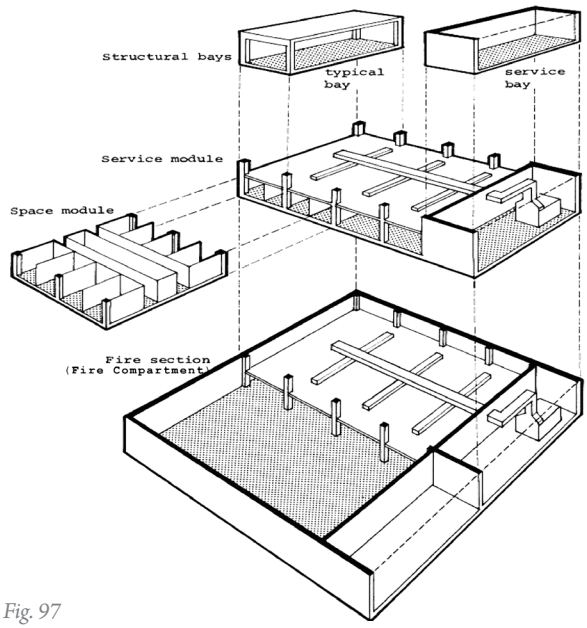


Fig. 97

Of the evaluated hospitals Hospital A had a grid of 11.2m, Hospital B of 8.2m and Hospital C of 6.8m. The floor to floor height varied accordingly; Hospital A 5.8m all over, Hospital B 5.7m throughout and Hospital C 6.2m in the clinical areas and 5.9m in the wards. These heights are far greater than what became the norm after the Heroic Era. However, interviews with users showed that vacated nursing units had been easily converted into other functions. The availability of interstitial space had thus facilitated conversion and remodelling and greatly reduced impacts on occupied functional space. It had also greatly helped in maintenance work, which had mostly been done with no disruption of functions. Even in the worst cases only one floor, not two, had to be shut down (Nelson et al., 2005). This was an impressive outcome considering that, for instance in Hospital A, the number of inpatient beds had been reduced from over one thousand to about 500 in about 15 years, whereas the number of outpatient visits had grown from 120 000 to over 800 000.

In 2007 it was reported that, for the sixth year in a row, VA Hospitals scored higher (83%) than private facilities (71%) on the University of Michigan's American Customer Satisfaction Index (Waller, 2007). To what extent this is due to the architecture of the facilities and their high future-proofing level is open to debate, but it is still no wonder that Progressive Architecture (no3/1992) proclaimed: "Veterans' Hospitals are the General Motors of health care".

In spite of the success of the VA Hospitals there is a general reluctancy to develop new similar systems. However, there is a renewed interest in using standardised plans and full or partial prefabrication for certain elements of a hospital. The design of individual spaces may, according to the MARU model (Medical Architecture Research Unit at London South Bank University) be classified into three types: unique, repeatable and modular. Unique spaces include, for example, public spaces where special attributes can be expressed in design. Repeatable spaces can be replicated within and across projects using standard plans and layouts. Bathrooms, toilets and stores are obvious examples, but this could extend to include clinical rooms such as those for consultation and treatment. Modular design may be devised for operating theatres, diagnostic suites, intensive care suites, and other highly serviced spaces with precise specifications based on firm and quantifiable data. The use of pre-assembled modular units would facilitate economical replacement and upgrading with minimal disruption to service continuity (Francis & Glanville, 2001).

The "room sheet" is a tool that has been used extensively for several decades. It could be described as the "pattern book" of hospital architecture. These standardised "room sheets" were prepared for every conceivable room type, from cleaner's store to operating theatre, and at their worst they had a straightjacket effect on hospital design. At their best they functioned as checklists for what should be provided for each room, according to the thinking of that particular time and place, the problem being that the way of thinking was changing at accelerating intervals.

One of the many problems with designs based on standardised room types was that they did not respond to a specific context. Every individual room was seen as a unit to be studied from its own individual starting points, leading to every unit being of a slightly different size. This caused a lot of time-wasting during the

design process when the architect tried to fit these "perfectly solved" heterogeneous little units together in a sensible way. This has been one of the reasons for the failures of the designs of the last quarter of the 20th century and has certainly slowed down the development of future-proofing. Standardisation as such can be a useful tool for better future-proofing when used in the right way. However, it should not be a straightjacket, in fact it should provide tools for improved innovation and creativity.

It is debatable to what extent rooms are repeatable or modular, or both at the same time. The MARU classification into unique, repeatable and modular includes the very important aspect that both unique and less unique spaces are required in a hospital and that, for optimised quality and sustainability, it should thus include both standardised and customised elements.

The treatment of the standardised elements presents certain questions. MARU defines repeatable rooms as "specific functions that have reached design optimisation" (Francis & Glanville, 2001, p. 45). The latter seems in itself a contradiction in terms. How can one ever be certain that something has reached "design optimisation"? Will this approach not lead to "future ready", rather than "future proof" solutions? If so, there is a danger of falling into the same trap that has caused most of the problems we are now trying to combat. Modular thinking should still preferably be seen as a design tool, rather than a process of bringing repeatable and optimal, "ready-made" and forever sustainable units to the building site. Modularity and standardisation do not help us much if they do not serve flexibility, adaptability and future-proofing. Furthermore, in the long run, plug-in systems only work if the process of "plug-in, plug-out, replug-in" is easier and more sustainable, both environmentally and economically, than demolition and starting again from the beginning.

The relationship between standardisation and architecture is a troubled one. Even in the 1980s when "room sheets" ruled, there were relatively few attempts to apply this thinking to entire hospital plans. Site specificity is one of the cornerstones of architectural design, and any deviation from this is seen by architects as almost sacrilegious. Thus, architects would tend to claim that there can never be standard plans for hospitals apart from under totalitarian regimes. It is true that the "VA" hospital building system in the United States did not aim at producing identical hospitals whereas the "Nucleus" in the United Kingdom did. The fact remains that even in the totalitarian Soviet Union, where a large variety of standard plans for whole hospitals were certainly planned, few were in fact built. Site specific considerations tended to surface at some point during the design process.

"Pattern-book architecture" has, in some form or other, existed since classical times. "Pattern books" reached their peak during the eclectic revivalist movements of the 19th century when the books helped politicians, builders and designers to make architectural choices. This has undoubtedly also contributed to the bad name of standardised architectural solutions. However, a "pattern" can be seen as more than just a standard solution. It can be interpreted as a recipe for a certain outcome. In this case it should not be confused with a "system" which allows far greater freedom to make any configuration desired. In the context of this study, "systems" should

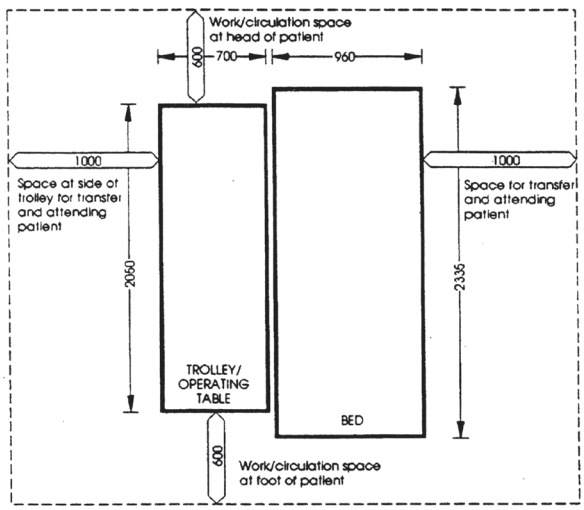
thus be seen as tools that can provide an infinite variety of solutions and not as constraints that impose limits on creativity.

Standardisation and modularisation, in other words "systems", have been part and parcel of human place-making forever. Even if this is often difficult to perceive, most man-made environments that we admire are based on "kits-of-parts", limited numbers of variations on one theme. These lead at their best to coherent entities in which control and diversity co-exist in perfect harmony. Traditional Muslim towns (the "organised casbah" syndrome) can said to be an example of this. Even if Western observers for centuries found them chaotic, they are now admired for their unique and powerful unity, their "clearly recognisable structure and thematic use of a handful of typical elements" (Habraken, 1998, p. 114).

As long as hospitals have existed, the size of the human body has changed very little, in fact one could safely say that it has reached "design optimisation". Plenty of ergonomic research exists on the optimal dimensioning of workplaces of different kinds, including hospitals. The basic design module can still be seen as a person in a recumbent position being wheeled around by two carers. This can be illustrated by one simple graphic presentation (Fig. 98) which shows, on plan, how much space is needed to move a patient from one bed (or trolley) to another. This plan also functions as a good indicator for the dimensioning of circulation routes, amongst other things.

In today's situation, there is one genre of modularisation and standardisation that appears to offer opportunities for hospital designers. It is one based on clusters of rooms of standardised sizes,

Fig. 98



dimensioned so that their use can vary (within reason) when the requirements change. A large number of the rooms in a hospital can be dealt with in this way, thereby providing opportunities for different kinds of modularised suites and clusters which at their best are interchangeable and within which partitions are flexible and easy to transform. Signs of this kind of an approach are evident in some of the recent hospitals that have been mentioned earlier in this study. These developments are encouraged by the standardisation and systemisation of work processes and care programmes in order to reduce overall complexity. 80% of the work is now increasingly being seen as "business as usual", and when this is suitably reinforced by appropriately innovative spatial design there will be more time left to focus on the 20% non-standard, complex medical issues (van Laarhoven, lecture at Sittard, 2007).

Mass-production, in its crudest forms, has probably contributed to the declining standard of design and led to what Habraken (1998) refers to as a gradual

disappearance of a silent understanding of the qualitative aspects of the built environment. Parallels could be drawn here to an overly rational approach to housing which has led to spatial qualities and the building frame being looked upon as two separate elements with the rationality of the frame gaining the upper hand in the case of conflict (Krokfors, 2005). However, the kind of rationality we need for our future hospitals is not one that creates technocratic and economic straightjackets, but one that positively encourages versatility and diversity in spatial articulation. This will only happen when the field of hospital design is actively opened up to the most talented members of the profession.

Wall-lessness

Space should be used as a resource, not as territory.
Lawrence Nield, 2003

Functions are temporary, they have a limited life span. Buildings can never be derived from functions alone. The task for governments, property owners and designers is to create and build structures in which time itself may play a role. Buildings should allow free (ab)use and be fit for 'squatting' by successive generations; in a way, they should be 'intelligent ruins'.
Gert Driessen, 2005

Indeed, space defined by forms of enclosure may be most powerful when the form leaves part of that volume undefined. The walled compound open to the sky, the roof held aloft without walls, or even a group of freestanding pillars – each is a configuration that may give us a readings of space more evocative than the fully enclosed room or building. N. J. Habraken, 1998

Walls and doors in hospitals are simply "in the way" (Nield, 2003). Open plan solutions are increasingly used in laboratories, administrative areas and "knowledge centres" where the staff share the same open work space. The latest developments in laminar flow techniques which control air changes and air flows now even make it possible to design open plan operation suites. The first time this was tried was in the early 1970s when the architect Lawrence Nield and Dr. David Hodgson planned a new, totally open-plan surgical department at Radcliffe Hospital in Oxford. In the end, the plan was never realised (Nield, 2003).

Up to now there are very few examples of open-plan surgical departments. Different sources refer to the Wilhelm Schultess Klinik in Zurich and a theatre in Rummelsberg, Germany, as the pioneers. In Great Britain, a specialist orthopaedic hospital in Shropshire (the Robert Jones and Agnes Hunt NHS Trust) developed a "barn" design which enclosed four operating theatres within a single room. These theatres were suspended cabins enclosed by sliding glass walls. A more open version was taken into use at Broadgreen Hospital in Liverpool in 2006, also for orthopaedic surgery.

The time should be ripe for "barn" theatres; sterility can be guaranteed through laminar flows (or quasi laminar in procedure areas). Air-conditioning actually provides better sterility than walls, and privacy can be achieved through moveable glass screens. Several improvements can be envisaged – a reduction in the number of ancillary rooms, fewer doors, easier monitoring and access to imaging equipment, easier use of robotics and easier cleaning.

Like Nield said, walls have a tendency to get in the way. They freeze operational patterns, reinforce hierarchies and stifle social interaction. They serve "functions", not "events", and should be replaced by mobile elements, screens, glass walls (which can be made opaque) and other such devices. Services can be in floors (power poles or pedestals) or ceilings ("umbilicals"). The workflow, not the structure or services, should provide the planning principles.

The ever-increasing information technology installations have been seen as a major new challenge to hospital design. It is clear that new technologies will change the functional planning of hospitals, but in terms of layouts, the outcome will probably be increased openness. Even with wireless applications becoming more common, it is not likely that space allotted to technical installations will decrease. This means that increasingly rational solutions, including reinterpretations of the interstitial principles, will have to be developed. Information technology has not changed any of the fundamental principles involved but, if anything, they have further underlined the importance of finding more adaptable and flexible solutions. Louis Kahn, in two of his buildings of the early 1960s (Salk Institute of Biological Studies, La Jolla, Ca. and Richards Medical Research Laboratory, Philadelphia, Penn.) placed all vertical installations in the same "package" with the structural frame. Lawrence Nield has promoted power poles or pedestals that would form part of "aedicular architecture" (term coined originally by Sir John Summerson), a kind of small-scale, largely movable micro-environment within the large flexible envelope of the building (Nield, 2003). These posts or pedestals would naturally also house the necessary information technology installations and be a contemporary, agile reinterpretation of Kahn's "packages". The four-poster bed could be seen as a familiar historical example of "aedicular architecture". It is not only a bed, a piece of furniture placed in a private space (a "bedroom"), but it is also a means to create private territory within a larger space (Habraken, 1998).

An article appeared in the Finnish Architectural Review (1/1971) as long as 35 years ago that could be interpreted as an early call for "aedicular architecture" in hospital design: "It feels as if rooms should be planned to be lightweight multi-purpose spaces where walls and other elements can be moved around easily. I would like to see open-plan laboratories in hospitals. I have seen polyclinics, radiology units and even administrative departments which have largely been of an open-plan character. Great adaptability, and also apparently low costs, are advantages of lightweight structures" (Vauramo, 1971, p.23).

BOX 8 lists the most important reasons for a hospital to have walls, or "space dividers", a term more fitting in a discussion about wall-lessness. In each case, the validity of the argument for space dividers is evaluated, as well as whether the problems involved can be solved, and if so, how. Note that "planning" here refers to programming and architectural design, whereas "design" refers primarily to industrial design and product development. The list at the bottom of the box indicates categories of flexibility in space dividers and their adaptability to the tasks that these dividers are expected to perform. It is clear that the future-proofing of hospitals could be greatly enhanced by a much more widespread use of flexible partitioning systems. It is important that these

NOISE (airborne and impact): VALID, SOLVABLE (TECHNOLOGY, DESIGN)
disturbing, distracting, lack of privacy, intimacy, confidentiality

HYGIENE: VALID, SOLVABLE (TECHNOLOGY, PLANNING)
spread of hospital infections, external sources

AIR CONDITIONING: VALID, SOLVABLE (TECHNOLOGY, PLANNING)
varying requirements, temperature control, compartmentalisation

BUILDING REGULATIONS: VALID, SOLVABLE (PLANNING, DESIGN)
fire control (compartmentalisation)

TERRITORIAL REASONS: RARELY VALID, SOLVABLE (ADMINISTRATIVE MEASURES)
hierarchy, distribution of costs and revenue, privacy

VISUAL BARRIER: OFTEN VALID, SOLVABLE (TECHNOLOGY, DESIGN)
privacy,"healing environment"

RADIATION: VALID, NOT SOLVABLE (YET!)
imaging technology

SECURITY: VALID, MOSTLY SOLVABLE (TECHNOLOGY, PLANNING, DESIGN)

TRADITION AND CULTURE: VALID, SOLVABLE (PLANNING, DESIGN)
terrorism, crime, anti-social behaviour, belief in "rooms", cultural factors

LOGISTICS:mRARELY VALID, SOLVABLE (PLANNING)
wayfinding, departmentalisation

PRIVACY: LARGELY VALID, SOLVABLE (TECHNOLOGY, DESIGN)
visual and oral, work efficiency, concentration, cultural factors

ARCHITECTURE: VALID, SOLVABLE (TECHNOLOGY, PLANNING, DESIGN)
articulation of space, lighting conditions, functional "order"

CATEGORIES OF SPACE DIVIDER:	
Keeps out radiation	1
Keeps out noise	1-2
Controls airborne noise (absorbation)	3-4
Lowers noise levels	4-5
Keeps out viruses and bacteria	3
Prevents trespassing	3-5
Prevents fire	1-2
Controls temperature	2-3
Helps in wayfinding	5
Blocks out light (natural and artificial)	2-3
Lets in natural light	5
Provides articulation and order	5
Provides a visual barrier	5
Provides privacy	3-5
Integrates technical installations	2-5

CATEGORIES OF FLEXIBILITY IN SPACE DIVIDER:	
"traditional", heavy-weight, solid, inflexible	1
"traditional", light-weight, solid, some flexibilty (movable monthly)	2
light-weight, flexible,"airtight" (movable weekly)	3
light-weight, very flexible, movable with ease (movable daily)	4
very light-weight and flexible,"nomadic" (movable hourly)	5

Hennu Kjisik, 2006

space dividers can be moved with ease. Hospital staff should not find the moving of these elements any more of a burden than pushing a trolley. In the best case, the ability to constantly manipulate one's working environment to best suit the activity on hand should give back the nursing staff the "feeling of being prima donnas".

To achieve increased wall-lessness there is an obvious and urgent need for industrial designers to get more strongly involved in developing and innovating products which could greatly improve the agility and adaptability of hospital environments. Industrial designers are already closely linked to the development of many products, from the most sophisticated X-ray machines to the simplest toilets and sinks. Architects and industrial designers should speed up their co-operation in the areas of lighting and sounds, climate control, storage, and particularly the waiting areas in hospitals. Adaptable space dividers, power posts and pedestals and, in fact, the entire "aedicular" environment with all the elements that this might encompass, would form an important part of this cooperation.

The debate about open-plan offices has been raging ever since Frank Lloyd Wright's Johnson Wax headquarters were built in Racine, Wisconsin in 1936 (Fig. 99). They have actually existed for much longer, in fact since the days of Giorgio Vasari's Uffizi building in Florence (1560) which contained group offices with thirteen employees in each (van Uffelen, 2007). As often happens, good architecture and design prevails. Johnson Wax is flourishing, the employees are proud of it and love working there, whereas innumerable mediocre open-plan office buildings have been demolished or changed into

Fig. 99

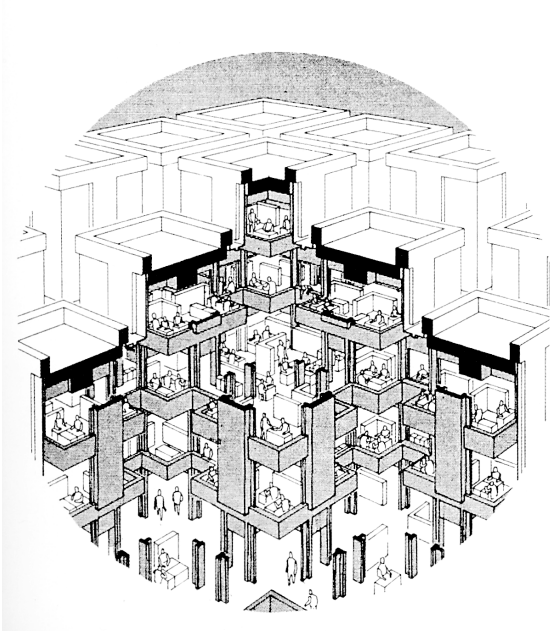
individual offices. Very little real innovation has gone into office design. Apart from a few brilliant exceptions, notably Herman Hertzberger's Centraal Beheer in Apeldoorn, The Netherlands (1977) (Fig. 100), the choice has been between open or closed, although the combi office, of which Central Beheer is a variant, has gained ground in the last few decades. The hospital provides particular challenges in this respect. It is no longer a sustainable solution to provide individual rooms with daylight and decent views for all the staff members who in principle would want one and "have the right" to have one. Most of these rooms are not used for long enough periods during the day to justify it and above all, the more there are of them, the more difficult it is to provide patients and visitors with well-lit public areas, which provide views to the outside and help wayfinding within the complex.

There is now a strong movement towards open-plan offices for staff in hospitals. These communal areas, referred to as "knowledge centres", are now also

being added onto existing buildings. Different ways are explored, variations of the "combi" theme, as in any office building, for staff members to control their own personalized territory. An added challenge is that patients would also benefit from the possibility of creating their personal space during slightly longer waiting periods. The development and innovation of "aedicular cubicle" systems that could be applied in different situations for all user groups in a hospital would be another pertinent subject of study and cooperation between architects, interior designers and industrial designers.

Corridors should no longer be seen as mere circulation routes but as assets, areas to be used creatively and for the purpose of enhancing the physical and architectural qualities of the facility. They should play a major part in creating an uninstitutional and activating environment. A more generous dimensioning (say 3.6m) of "corridors" would allow them to become homes for "aedicular" architecture including cubicles to be used by staff, patients, and visitors, acting as small private reading spaces, booths for individual physiotherapy, private discussions or talking on the mobile phone. What is

Fig. 100



important again to remember in this context is that, according to the best principles of patient-centred care, the patient will no longer be moved around to see doctors and nurses but the reverse will be the case. This will have major effects on the qualitative requirements concerning waiting areas and other more public spaces within the hospital.

There are some promising developments concerning new types of space dividers, particularly in the field of soundscapes, which is indeed a key element in a "wall-less" environment. Sound showers have been developed that allow a person standing within them to hear other (presumably more pleasant) noises than those otherwise prevalent in the area. These products are at a fairly early stage of development and will obviously still be greatly improved. The sound curtain developed at the Georgia Tech research laboratories is, however, particularly promising, probably because it was developed specifically for health care use and thus has an immediate advantage. It is also a real space divider in that its different applications are usually stiff yet flexible (Chow et al., 2004). These elements have noise dampening properties capable of reducing the noise level by seven decibels and they are very adaptable.

Chapter 6. Lessons from Team 10

In the late 1920s the major leading figures of Modernism created the CIAM organisation (*Congrès International d'Architecture Moderne*, 1928-1956). At its last meeting some of the founding fathers, together with younger colleagues, began to criticize some of the fundamentals of the modern movement. The "close form" of Modernism was seen as not being adaptable to the inevitable needs for change in the future. The new movement, "Structuralism", has widely been seen as the inspiration for the "open building" principles that emphasise the need to separate different levels within the design and construction processes. The element of time becomes the key factor. The principle is that the design and construction processes are divided into three different levels, all with different scales and different change speeds. This method has mostly been used in housing, particularly in Sweden and in Holland, even if "the building systems used in nonresidential building offer far better provisions for implementing open building than systems in housing construction" (Tiuri & Hedman, 1998, p. 6).

Team 10 was formed in the early 1950s as a splinter group from CIAM. The last CIAM meeting was held at Otterlo where Team 10 effectively took over, having rejected the rationalism of the old guard. They wanted to introduce social and cultural factors into the thinking. Team 10 brought "Mat building" to the architectural discourse in the early 1960s in order to challenge the separation of architecture and urbanism and also to promote social interaction in both. Leading members were Alison and Peter Smithson, Giancarlo De Carlo, Jakob Bakema, Aldo van Eyck, George Candilis and Shadrach Woods. Other influential figures who participated on a less regular basis included José Goderch, Piet Blom, Reima Pietilä, Ralph Erskine, Guillermo Jullian de la Fuente, Pancho Guedes, Kisho Kurokawa (representing the Japanese metabolists), as well as Herman Hertzberger and other Dutch structuralists.

Mat building

The mat is both city and building, both public and private, both structure and infrastructure.
Hashim Sarkis, 2001

Mat buildings can also be called fields, carpets, matrices. Today it could be seen as a counter force of sculptural form. It is helpful for flexibility in building use and mixed use programmes. It expresses the organic relationship that exists between architecture and the city and landscape. In this respect it is highly relevant to discussions concerning the generic "Urban Palace" and the city-hospital metaphor. "The mat answers the recurring calls for efficiency in land use, indeterminacy in size and shape, flexibility in building use, and mixture in program. It expresses architecture's increasing encroachment on both city and landscape and the open exchange between structure (building) and infrastructure (context) that this encroachment signals" (Sarkis, 2001, p. 13). Team 10 and the "mat builders" remained, in most ways, rooted in the Modernist tradition. They were obsessed by patterns, standard components and formal types. They were fascinated by Herzberger's use of endlessly repeating elements, but did not see themselves as structuralists (Scalbert, 2006).

Mats in themselves no longer need to adhere to any particular architectural *gestalt* or "style". As Hashim Sarkis (2001, p. 14) points out, architectures as

different as "Kazuyo Sejima's ethereality and Rafael Moneo's compactness" can be classified as mats today. In the same connection Sarkis claims that Alison Smithson, one of the early activists, in 1974, said that mats are "still developing". What more apt approach to a hospital, a building that should be "future-proof" but not "future-ready".

Aldo van Eyck often used Mondrian's famous saying, "The culture of particular form is approaching its end. The culture of determined relations has begun" (Mumford, 2001, p. 50). This quote could aptly be used to illustrate the move from a "room card"-based hospital design method, to one based on processes. Van Eyck considered his Amsterdam Municipal Orphanage of 1960 (Fig. 101) to be a synthesis of three traditions: the classical, based on geometry; the modern, based on movement and change; and

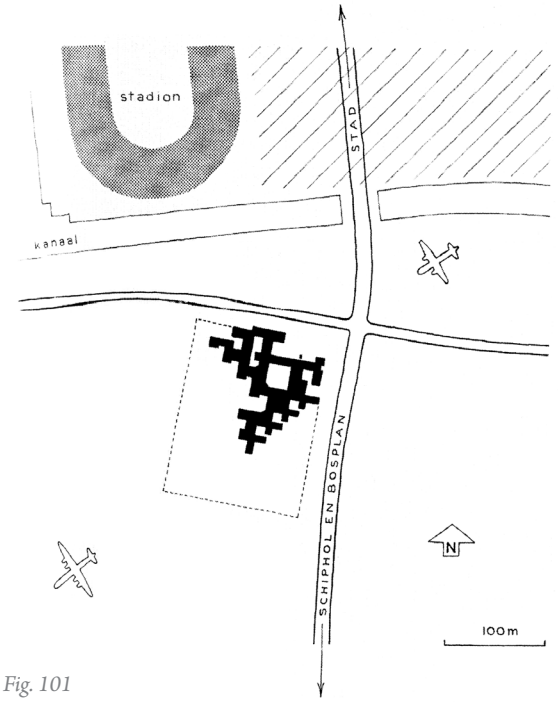
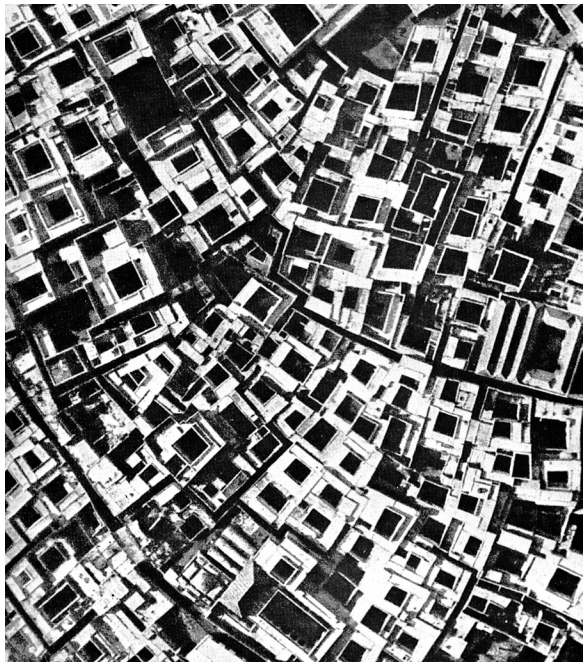


Fig. 101

Fig. 102



the vernacular tradition of spontaneous building such as he had seen in North Africa. This synthesis is fundamental in its clarity and encompasses the basics that any designer should comprehend, including hospital designers. Mumford writes, "The completed building has an open-ended quality, suggesting the possibility of future growth and change using the same basic architectural order. In its creation of complexity within a strict and potentially extendable modular system, the orphanage introduced a new design method that would have a major influence in the Netherlands. It is arguably the first mat building" (Mumford, 2001, p. 56). The influence of the vernacular is particularly relevant and pertinent. What Van Eyck and Piet Blom called the "organised casbah" is something that can be found in traditional building all over the world, a seeming chaos which nevertheless is governed by strict geometries,

repeated forms and masses and an overall order (Fig. 102), again also providing valuable lessons to hospital designers. In fact Piet Blom's "Village of Children" competition entry in 1963 (published in Le Carré Bleu 2 1963) (Fig. 103) could act as a model for a hospital with the "cure" elements in the middle encircled by the "care" elements, all parts being basically open-ended and extendable.

Apart from Van Eyck's Orphanage and Corbusier's Venice Hospital, the Berlin Free University by Candilis, Josic and Woods (1964) has become the most iconic of the "original" crop of mat buildings in the 1960s. In this competition winning project, the architects, founder members of Team 10, were able to put into practice all the ideas that had been accumulated by the group during the past few years (Fig. 104). The structural system and façade

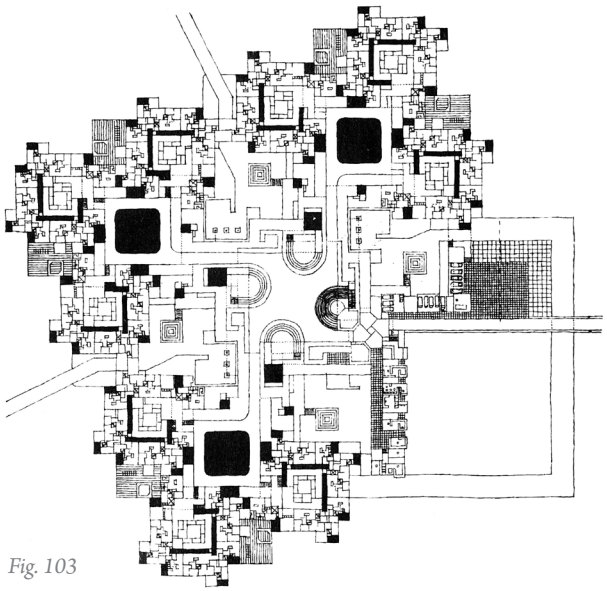
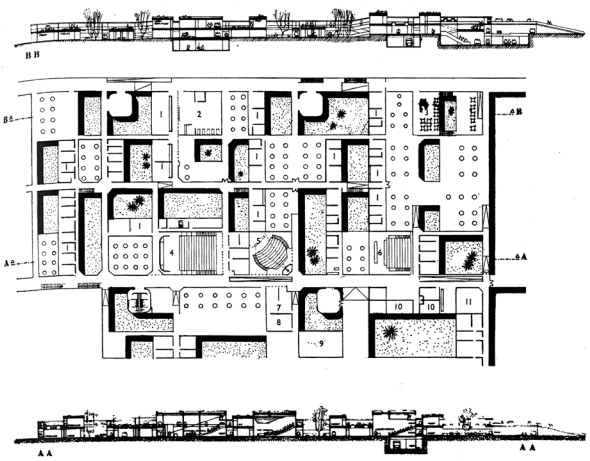


Fig. 103

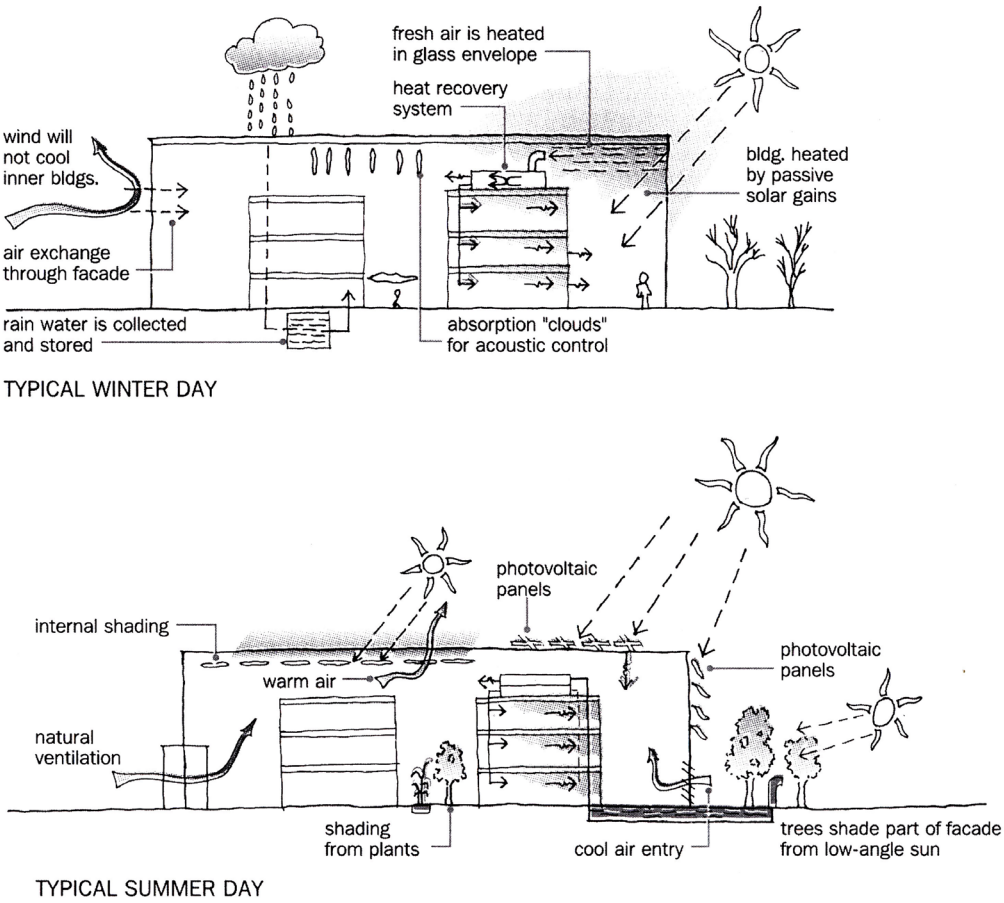
Fig. 104



elements, designed by Jean Prouvé, took account of all topical ideas about extendability and flexibility. In fact, the need for changes has proved less than anticipated (Addington et.al., 2001), something that is unlikely to happen in a hospital building.

The Berlin Free University illustrates the essentials of mat building. It provides a flexible shell to house a variety of functions. It does not contain function-specific enclosed territories which can only accommodate certain predetermined activities. It has a "plug-in" capacity so that new spaces and functions can be added. In fact it almost begs for this to happen, as time has been included from the start as an important design element. The time factor is perhaps not as actively present as it is in the case of the "open building" philosophy, where its role could be seen as almost too determinant. For a life-cycle cost analysis, it would, however, provide an interesting early example for study.

Fig. 105



The Mont-Cenis Academy, Herne (1999), by French architects Francoise Jourda and Gilles Perraudin (Fig. 105) passes as a mat building despite having a clearly defined outer envelope which is obviously not meant to be extended in all possible directions. It does, however, provide another possible hospital design archetype that has not yet been tried, at least not in real life, although E. Todd Wheeler's Tent Hospital, one of Perkins+Will's fantasies, provides a closely related concept (Fig. 106). The term "hospital within a hospital" has been used in this text to describe certain programmatic and functional solutions, but the Mont-Cenis model (in itself not unique as such) could give these concepts a clear physical manifestation (boxes within boxes). The glass envelope, which basically could be of any size, and certainly be made extendable as well, could contain any number of free-standing or connected building elements within an ecologically controlled micro-climate.

Fig. 106

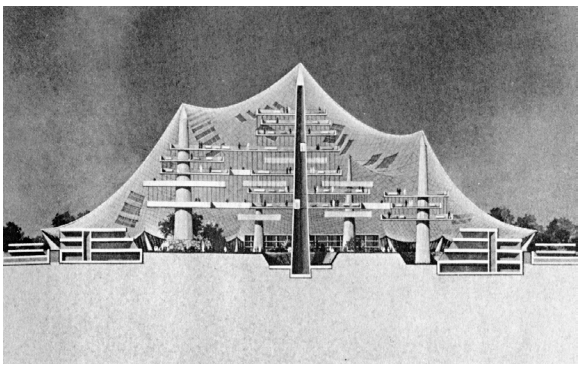
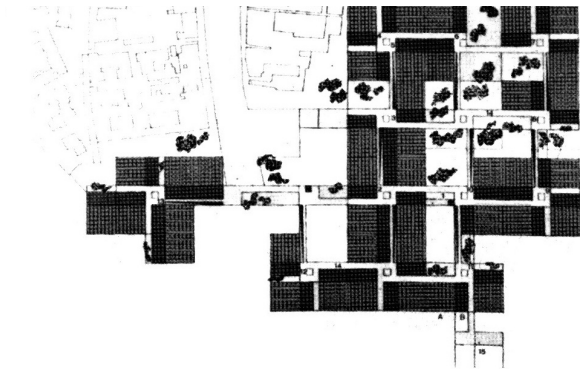


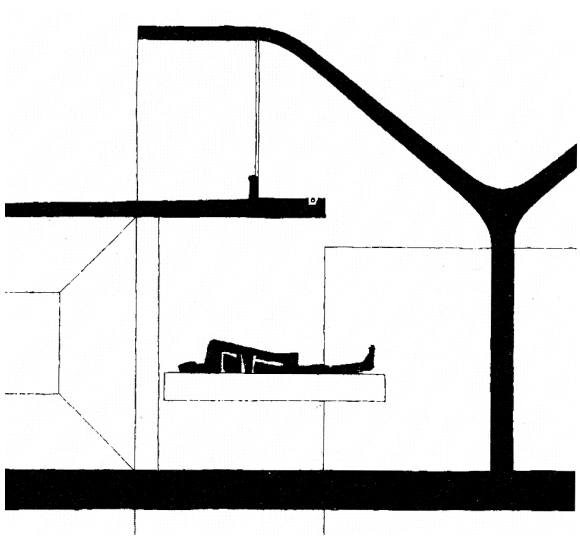
Fig. 107



Venice Hospital (1964-70) was designed by Le Corbusier and the Chilean project architect Guillermo Jullian de la Fuente, who continued with the project after Le Corbusier's death in 1965. It is an extension of the city with a strictly modular concept (Fig. 107), the dimensions of the modules being derived from the surrounding city. Some ideas that appeared in the programming of the hospital are still relevant today. Innovations included a fast-track diagnostic service (cf. triage) with a radiology station, a hotel for recovering patients and their visitors, and a series of shops and restaurants on the ground level internal streets. The building was also conceived in such a way that technical services could be integrated into the structure, either as vertical shafts or horizontal in the form of suspended ceilings or installation floors, according to the specific requirements of their location (Allard, 2001).

Corbusier and Jullian claimed that functions within the different modules could be interchanged without disturbing the daily routines of the hospital. The project also separated the critically ill patients from the short-stay ones. The latter were placed on street level to be as close to normal urban life as possible, whereas the former were housed on the third floor in cells where all possible external disturbances, including direct light, were eliminated. One eccentric detail is that patients' beds were raised to a level where the head of the recumbent patient is on the same level as a standing person, thus eliminating the feeling of being looked down upon by visitors and staff (Fig. 108).

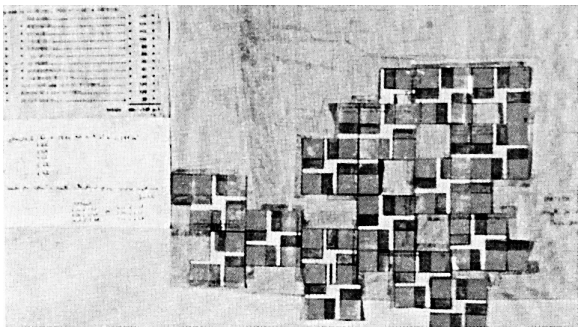
Fig. 108



Pablo Allard held several conversations with his compatriot Jullian during 2001. Referring to a series of technical, functional and programmatic studies provided by the French Ministry of Health, Jullian said "After having access to that report …. we didn't worry that much about those issues; that was easily solved. What we were interested in was the architectural problems of the hospital" (Allard, 2001, p. 27).

Jullian tells Allard, "Sometimes the precision of the building elements and their sequencing in extension were so complete that the building plans turned into virtual musical notations" (Fig. 109). One day everyone at the office selected a different sound, and Jullian assigned to each sound a building element – column, ramp, vault, partition as "notes". Then the resulting "tune" would be played. Allard writes (2001, p. 32-33), "This seemingly ludicrous way of approaching the project belies the serious intent of submitting the structure to every possible test, and Jullian confessed that even without any empirical evidence, they arrived at a point where the best plan was also the best tune".

Fig. 109



Open Building

The Open Building philosophy helps us recognise transformation and stability as twin realities.
American Institute of Architects, 2001

No more 'Man proposes, God disposes' but rather 'Man proposes, time disposes'.
Christopher Powell, 1989

The "open building" philosophy introduces time into equations that result in built form. This is practical from the point of view of lifecycles, sustainability and general economic strategies. No other art form is as closely tied to time as architecture. Its essential elements are time and durability, the past and the future being omnipresent in all our building activities today (Krokfors, 2005).

The "open building" concept is basically a "long life, loose fit" strategy, which views buildings as less specifically "purpose built" and "more inherently adaptable, and looks at adaptability through a broad lens" (Guenther & Vittori, 2008, p. 359). Described in such a way the philosophy does indeed appear to also be relevant to the future-proofing discussion.

The concept can be explained using the city-hospital metaphor. If, for instance, in a hospital building there are three systems and levels, each with their own life spans, the same can be said about a city. The street network, including open areas such as squares and parks, form the Primary system, the city blocks the Secondary system and the individual buildings within the city block the Tertiary system. The city, just like a hospital, is a living organism which is constantly regenerating itself, albeit often

in a rather unpredictable way. The important point is that parts can be replaced with a minimum of disturbance to other parts. Buildings can be replaced, as can complete city blocks, although less frequently. The important difference, however, is that whereas changes in the street network also affect the rest, changes in blocks and buildings can take place without affecting the street network.

An even simpler metaphor is presented by Stefan Geiser, who has compared the three levels and systems to a crate full of bottles. The crate represents the Primary system, the bottles the Secondary system and the liquid in the bottles the Tertiary system (Geiser, 2005).

In the last few decades, commercial developers and clients as well as managers of different facilities have generally accepted the fact that dynamic societies require what is increasingly known as agile architecture. One view is that this can be achieved through two very different strategies; "scrap and build", meaning that you start again (expensive renovation or premature demolition) when the building has reached the end of its useful life, or you follow "stock maintenance practices" which can best be described using the American Institute of Architects (AIA) definition of "Open Building", i.e., "design and construction according to analysis of both current requirements and provision for unknown future uses and technical upgrading" (Kendall, 2004, p. 1).

The INO Hospital in Bern, Switzerland, is the first hospital where the "open building" principle has been applied in full. This new hospital, an addition to the Insel Hospital, is essentially a "core hospital", a new unit with "hot" activities (intensive care, emergency, surgery, imaging) for a large teaching hospital campus. The project was postponed several times because of changes in staff and consequent changes in programming ideas. It gradually became clear that the capacity to accommodate continuous change would be a primary criteria for the new building. An entirely new planning process was thus adopted, based on the building being divided into three different levels of planning and realisation, all with different life spans. The Primary system (level 1, "fixed") has a lifespan of almost 100 years, the Secondary system (level 2, "adjustable") deals with change that takes place approximately every 20 years and the Tertiary system (level 3, "Flexible"), can be completely changed at five year intervals. The systems are independent of each other, any change that occurs on the lower systems having no effect on the upper systems. The Primary system includes all aspects related to the treatment of the site, facades, roofs, and the central technical installation structure. The Secondary system includes all internal walls and ceilings with finishes, other finishes, vertical and horizontal circulation elements and technical installations. The Tertiary system includes all FF&E (furniture, fittings and equipment).

The design and procurement processes in the INO project are also rather unusual. In 1997, an international architectural competition for the Primary system alone was held between nine teams. Only offices with no previous hospital design experience were selected! Practically the only functional brief was the total gross area, although the competitors had to make fairly detailed cost/capacity and ecology/energy analyses. The winners, Peter Kamm and Kundig, belong to the pioneers of the

"open building" movement, although they had only done housing projects up to that point. All competing teams included structural and mechanical engineers. The primary system consists of an 8.4m x 8.4m structural grid with 3.6m x 3.6m "punch-through" zones in the middle of each structural module. These zones are unreinforced concrete slabs, 20cm thick, and vertical penetrations can be made though the floors anywhere in these sections.

Each floor has an area of about 8 000m^2 and internal courtyards to provide daylight can be made anywhere, according to the demands of the Secondary system. The facade consists of two layers, a wooden inner facade being protected by an outer layer of glass. The Primary system is "a low-tech building for a high-tech content" (Geiser, 2005, p. 14).

The competitors for the Secondary system had to show how their proposed floor plans with furniture and fittings could be applied to several different programmatic scenarios within the building, which at that point was already under construction. The second phase competition was won by Itten & Brechbuehl, a Swiss practice with decades of experience of hospital design. HWP Planungsgesellschaft from Germany was commissioned to design the Tertiary system in 2000.

It has been claimed by some of the architects involved in the process that if this experience were to be repeated, the same designer could in fact be commissioned to deal with all the three systems. This is, indeed, the first query that comes to mind, namely the collaboration of three teams of architects in the same project, literally on top of each other. The explanation for doing it this way touches on procurement issues but also other considerations played a part, such as the level of the participating architects' previous experience and references.

Some disadvantages to this system have been identified. Interfaces between the systems are complex. The designers of the different systems have to take each other's requirements into account without actually being involved in the design of the next system, which means extra work. In the end, an additional team has to coordinate the interfaces. The number of people involved increases considerably and thus also the amount of administration. If changes on one level are so major that they affect the previous system level (possibly already built), the changes will be very difficult and costly. Three teams of architects and designers working on the same building could lead to a lack of direction and simply to the syndrome of "too many cooks". In spite of all these complications, this interesting and important experiment is nevertheless probably the strongest example so far of a hospital project entirely based on "future-proofing" principles.

Stephen Kendall identifies two reasons for the resistance that stand in the way of the proliferation of "Open Building" realisations. The first one is ideological, based on the premise that we should design buildings by first defining function in great detail. He refers to writers such as John Habraken and Denise Scott-Brown who have claimed that form must now accommodate (changing) function. This clearly goes against the grain of the old tradition whereby we start with function and then create the architecture to fit. The other, more pragmatic reason for resistance, is an instinctive reaction to avoid changes to ingrained habits

and conventions, particularly if they require new, and possibly more demanding ways of working (Kendall, 2008).

An interesting link with the future-proofing discourse is that the proponents of the "Open Building" concept consider the basic 19th century urban public building, whatever use it was originally constructed for, as a good prototype for their ideas and see these buildings as "models of the kind of buildings that hospital administrators increasingly expect from their architects and engineering consultants, not only do they fit into a coherent urban pattern but they offer spaces of remarkable quality. They are not defined 'functionally' but they are 'open' buildings, sustainable in the large sense because they can accommodate change" (Kendall, 2004, p. 3).

Chapter 7. The Urban Link

Reintroducing the hospital into the city

The question of the best size and form a hospital should adopt in order to give psychic help to the sick and at the same time meet all medical requirements, is somewhat akin to the question of how large a city should be, in order to meet the needs of its inhabitants and fulfill its functional requirements. Siegfried Giedion, 1951

Filippo Brunelleschi's Ospedale degli Innocenti (1419) in Florence is not only the seminal work of the early Renaissance period and one of the most influential buildings in architectural history, it is also an early example of modularity and adaptability. More than simply serving as a model for hospitals it has been an archetype of a classical public building, an urban haven which works masterfully as a mediator between the urban buzz outside and the meditative peace inside its quadrangles.

If we look at an assembled ground floor plan of the Piazza Santissimo Annunziata and the buildings surrounding it, including the Basilica originally designed by Alberti with a later facade (1601) by Caccini, it is impossible to distinguish which portion of the ensemble represents the "hospital" (Fig. 110).

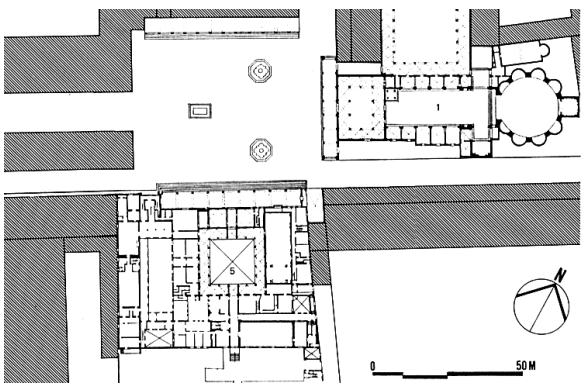


Fig. 110

Traditionally, many public functions were indeed concentrated around religious centres. Social and cultural functions such as church, monastery, hospital, workshop, and school were joined and melted into one around the sacral complexes of many historic towns. Some of these historic ensembles from the past have kept this functional combination of different but closely-related activities until today. At present they form multi-functional socio-cultural concentrations that we admire as masterpieces of our architectural heritage (Johansson et al., 2006).

The features of the Renaissance that are relevant to this study remained virtually intact for centuries, although the architectural language in many other ways changed and few designers possessed Brunelleschi's passion for subtle inbuilt order. The revivalist movements of the 19th century remained largely anchored in the Classicist tradition, which led to most urban public buildings during that period still containing the features that are here considered relevant in terms of hospital design.

During the first half of the 19th century there was a heated discussion about the rebuilding of the Hôtel Dieu in Paris which went on for several decades. Alternative locations were considered in what were then suburbs, but in the end the new hospital was built on the other side of Ile de la Cité, opposite the site of the old one (Fig. 111) that had burnt down in 1772. It was as close to the Notre Dame as its predecessor and the ground level plans and the way they related to the surrounding city are remarkably similar. Le Roy's pavilion approach was abandoned but what was built probably turned out to be more sustainable and future-proof in the end. The hospital is still in use today on a site continuously surrounded by thousands of tourists (Fig. 112).

Fig. 111

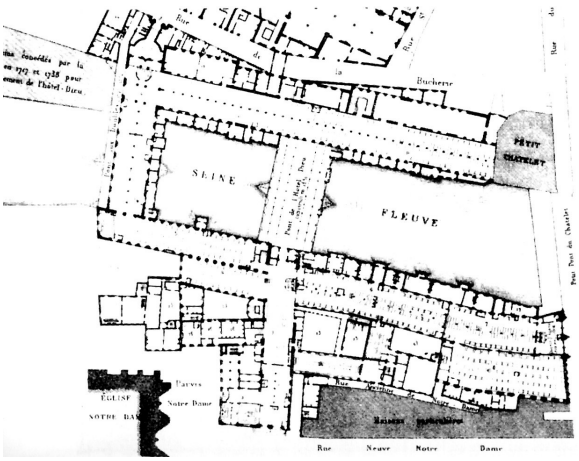
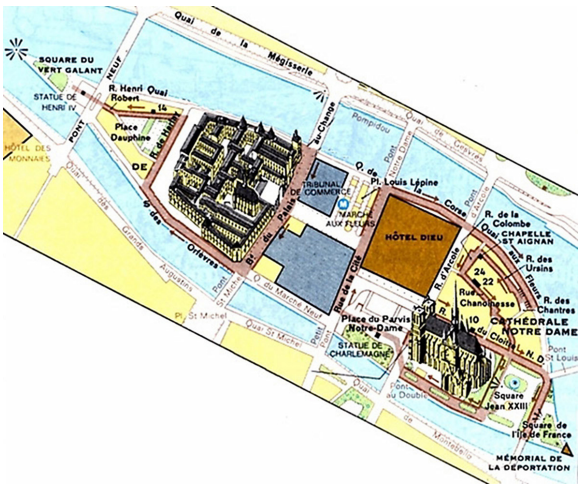


Fig. 112



Later on, when urban pavilion models took over in earnest, the contact between the hospital and the city was weakened because of the inherent characteristics of the pavilion complex. The somewhat daunting, often walled and prison-like compounds, gave out signals which, to our present way of thinking, were not particularly appropriate. A pavilion campus rarely possessed the intimate and open relationship with its surroundings that Renaissance palaces or Hôtels Dieu had. In later large scale pavilion models, where one pavilion would constitute one entire city block, these problems are less pronounced, as we see in many examples of inner city hospitals in the United States and more recently in Trondheim.

The relationship between a hospital and the surrounding urban fabric is elaborated on in this chapter. Issues related to the other side of the coin, i.e. bringing the urban fabric into the hospital, will be brought into the discussion. This latter trend has been growing for a couple of decades. There are, however, only a few examples of hospitals where urban planning and design principles have been used consistently throughout the whole building complex. Hospital complexes are important public elements of a city. Their symbolic meaning is traditionally very strong and should not be underestimated. Along with the other traditional public complexes (town hall, church, post office, etc.) hospitals have formed the important urban network of public facilities and public spaces in cities.

The therapies for tuberculosis that formed the basis for the design of the sanatoria from the beginning of the 20th century established a principle that has been very persistent and it has taken a long time for it to be seriously questioned. The sanatoria, according to the contemporary therapeutic principles, had to be distant from anything man-made. Of the plethora of design norms that have dominated the programming and siting of hospitals during the last century, the one in force in France during the 1930s now seems particularly bizarre. It stated that sanatoria should be surrounded by forests

or parkland, to the extent of at least 15 hectares per 100 beds (Cremnitzer, 2005). This thinking, even though obsolete for many decades, has influenced the location of hospitals ever since.

Hospitals were formerly built outside cities because society wanted to defend itself against those (people with contagious diseases, leprosy, venereal diseases, mental disorders or just of high age and in extreme poverty) who were put there, stored away, out of sight, so as not to disturb ordinary people. The tendency has been amazingly persistent (later explained by cheaper land, more space for logistics, parking, deliveries etc.) with the result that these "impersonal monuments" can still be found everywhere. René Gutton (1979, p. 38) argues that the reverse should be the case: "A hospital, just like a city, is a network of places (*réseau de lieux*). It should be among the people, in the city, because it is an element of life like any other service facility. Only then will the hospital stop to be seen as a sign of forthcoming death but rather a sign of cure, of life".

According to Alberti, the city is no more than a great house (Alberti, 1450). Hence, a building like a hospital can be described as a small city with buildings in it. This argument extends beyond the question of complexity and scale. Above all, it addresses the issue of diversity. The Asclepieions provided sports, arts and recreation of all kinds. This is again now seen as important for therapeutic environments. The cultural and recreational values of city life are constantly emphasised. Cities are competing for the honour of becoming "European Culture Capitals". (When are we going to choose the "European Hospital of the Year"?) The competition "Future Hospital – Competitive and Healing", organised by the Dutch Bouwcollege in 2004, stressed the importance of urban environments, in which hospitals are seen as part of a "normal" setting with cultural and other services in the immediate vicinity. Entries presenting city centre hospitals, where patients can benefit from all the positive effects that an urban environment can provide, won the main prizes. The winners, Ton Venhoeven (VenhoevenCS Architects) and Thomas Gutknecht (Itten & Brechbuehl) created a "core hospital" model that basically could fit into the centre of any major European city (Fig. 113).

The impact of town planners on the creation of an environment conducive to healing and cure in health care buildings is much greater than that of say, interior designers and colour psychologists. Unfortunately, this is today not always understood. The most important decisions are taken very early on in the planning process, during the programming phase and when the location of the facility and the configuration of the site are determined. This applies to extensions of existing campuses just as much as to new complexes on green field sites. What is essential is the location of the building in the civic realm, the selection of the site and the arrangement of the master plan to provide for well-connected and accessible networks close to transport hubs. The contribution the hospital makes towards the "making of places", the sense of civic pride that it helps create, all form part of the recognition of the social, economic and environmental impacts that health buildings should enjoy. They should be landmark buildings in the same way that a Hôtel Dieu used to be. By placing social, educational, cultural and sports facilities in the immediate vicinity, we are close to creating a contemporary Asclepieion, which

Fig. 113

may well be the way to respond to the requirements referred to here.

There are some current examples of designs that illustrate an improved relationship between city and hospital. As examples of an approach where a hospital forms a seamless continuation of an existing urban grain, thus making an important contribution to the present discussion, some very different hospital campuses are briefly presented below.

St. Olavs Hospital (160 000m^2) (Niels Torp, Medplan, Frisk Architects et.al., 1996-2015) is the main hospital for Central Norway (one of the five health regions) and functions as a general and local hospital for 200 000 inhabitants in Trondheim. The new hospital will have a catchment population of 650 000 for highly specialised care. When completed in 2014, it will have a total area of 223 000m^2, divided into seven blocks, each between 20 000 and 40 000m^2. The master planning has been done in such a way that each block has an inbuilt expansion potential of 20% and when the last old buildings have been demolished, the hospital will be left with an additional 60 000m^2 of unbuilt reserve (number of beds/staff).

St. Olavs Hospital is a recent example of a modern urban pavilion hospital. Its organisation is based on target groups and clinical entities, which seems natural considering the physical form of the ensemble. The urban block-based development makes it possible to build a new hospital step by step while the old hospital remains operational at all times. The dimensions of the blocks follow the grain of the grid of the surrounding city structure and are connected to each other by means of the hospital "main streets" on second floor level with bridges crossing the city streets. All the outpatient departments are on the ground floors of each specialty block. Operation theatres and other "hot" activities are on first floor. Inpatients are housed from

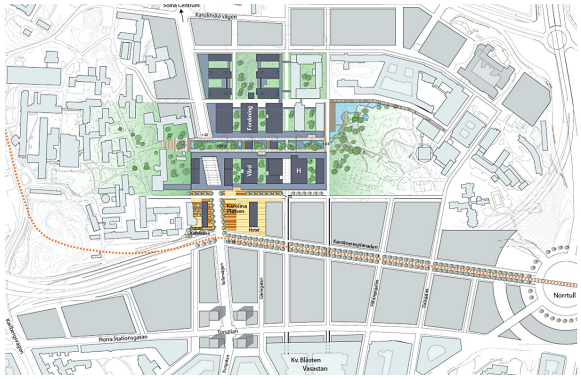
the 3rd floor upwards. Research labs are close to the clinical areas (mainly on the connecting second floor level) in order to facilitate communication between clinicians and scientists. The principal aims of St Olavs are the provision of the optimal solution for patient-centred care and effective logistics, as well as the integration of teaching and research (Helsebygg Midt-Norge, 2006).

The arrangement creates the possibility of achieving more clarity, more intimacy, a better sense of identity and easier wayfinding. A central urban space connects the hospital to the surrounding landscape and neighbourhood as well as providing the access points to all the clinical centres. The hospital becomes the "medical part of town" and thus strengthens its image as part of "normality" and everyday life (Helsebygg Midt-Norge, 2006). Each "centre", i.e., each urban block, contains its own internal courtyard (Fig. 114), thus ensuring that daylight conditions remain optimal and the urban structure, in this respect also follows the traditional grain.

This arrangement is an unusual contemporary solution, particularly in Europe where even city centre hospitals are usually campuses which do not follow the general pattern of a grid-plan city but usually form larger entities only loosely connected to the surrounding urban grain. One reason why this approach has worked so naturally in Trondheim might be that its 15th century urban block structure has particularly wide streets (to prevent fires spreading in the predominantly wooden environment) (Fig. 115) thus approaching the much later grid structure of North-American cities where this kind of city hospital configuration is much more common.

Fig. 114

Fig. 115



Pavilions seem to be experiencing a renaissance. "They allow greater flexibility and versatility of use but also create greater accessibility by health professionals from outside the hospital and by members of the public. This will tend to encourage a design form of linked pavilion structures with clearly articulated elements looking towards the community outside rather than deep planned monolithic blocks looking inwards to reinforce the stand-alone nature of traditional hospital institutions" (Cole, 2006, p. 14).

The urban block-sized pavilion formula is more common in the large grid-plan cities of the United States, a good example being the Northwestern University Medical Centre in Chicago. On plan the urban grain (Fig. 116) is rather similar to that of Trondheim although the scale of the built form is of course a lot bigger. In this complex, which has been developing since 1885, existing city block units have constantly been replaced according to growing demands. This ensemble contains, among others, works by Bertrand Goldberg. The different "pavilions", in spite of forming a hospital campus, can here live their own lives and have their own strong architectural character, just like the surrounding buildings in the city blocks, and they can also be replaced when deemed necessary (Fig. 117).

Fig. 116

Fig. 117

Le Corbusier's Venice Hospital was also an extension of the existing city structure, but the grain of the urban structure in Venice is very different from that of Trondheim or Chicago. Le Corbusier echoed Alberti's ideas in his "The City of Tomorrow" when he wrote, "A detail in a city means a house multiplied a hundred thousand times; therefore it is the city" (Le Corbusier, 1924, p. 85). Essentially the building formed an extension of the city along Canareggio canal, continuing all the way to the shore of the lagoon and beyond. It consisted of a network of urban spaces, modularised to harmonise with the scale of the surroundings. Le Corbusier's project architect in Venice, Guillermo Jullian de la Fuente, says, "In this poetic architectural approach, the mere fact "hospital" is almost incidental: it is integration to the life of the city that matters" (Allard, 2001, p. 30) (Fig. 118).

Fig. 118

The Nuffield Trust and MARU (2001) have emphasised the role of urban regeneration projects and the part health care buildings could and should play in them. They are seen as platforms for community development where issues such as pollution, unemployment, poverty and crime could be addressed. The European Health Property Network also includes urban integration – linking health facility investments with urban regeneration schemes (Dowdeswell, 2006) – as a new development with significant potential. Regeneration is seen as an opportunity for health care to be integrated into different development strategies and give a positive contribution instead of just being something that, in a civilised society, is seen as obligatory. This urban approach is of course closely associated with the idea of "shopping-mall medicine" and that of wellness centres, where other fields of human endeavour that are usually found in cities would contribute to the general well-being of all the population, not just those in need of treatment.

When extending existing hospitals on inner city sites, the alternatives are becoming increasingly limited. The conflicts between townscape factors and hospital logistics are frequently insurmountable. The importance of future-proof solutions is equally important in refurbishments and extensions as it is in the design of entirely new facilities. A new extension may be a (frequently temporary) solution to a pressing problem. The solution should be to design a building that will not become obsolete within twenty years. Compromises struck with the town planners will rarely be the ideal solution at any given time. For this reason the buildings have to be truly adaptable to any new situation in the future. This may become particularly difficult if, for townscape reasons, the depth of building body cannot be changed. But even so, the more limiting the external dimensions of a building block, the more important it is to incorporate a maximum amount of internal structural, mechanical and functional flexibility.

As mentioned earlier, large campuses that have originally been built on the outskirts of cities but are now part of the inner city often appear as "bastions" of health car, with a pavilion-like structure that includes a large number of buildings from different eras. Improving the relationship between these campuses and the surrounding urban grain is frequently problematic. In the case of the Helsinki University Central Hospital Meilahti Campus (total of 480 000m^2), the city planners together with their urban design consultants (Gullichsen and Vormala Architects) have wanted to retain and strengthen ("urbanise") the open, presently rather undignified and spatially unclear space that now forms the entrance and approach area to the campus from the main street.

There are two strong sets of coordinates working on the campus. The two latest additions from the late 1990s, the very large Biomedicum Research Center (Gullichsen and Vormala Architects) and the smaller Medical Library (Olli-Pekka Jokela, architect) follow one of the two grids, whereas the "main building", the 15-storey ward tower with its extensive plinth (known as the "Meilahti Hilton") (Jaakko Paatela and Reino Koivula, 1965), follows the other. The town planners' aim to improve the coherence of the campus through the placing and massing of the three large projected extension phases (Fig. 119) has led to a situation in which the starting point for the detailed design of the extensions is largely predetermined. The results are not likely to be optimal from the point of view of function and logistics. Hospital users, medical staff, administrators and patients alike, have to accept the fact that optimal solutions are impossible in urban hospitals. Tailor-made solutions have proved to be so short-lived that it makes perfect sense that town planning considerations remain in the forefront. After all, individual buildings, whatever their use, by definition always represent a lower hierarchical level and have a lower life expectancy than entire city blocks or neighbourhoods.

In the 1980s the city planners of Barcelona made some bold decisions concerning Hospital del Mar, the seaside hospital, originally a pavilion-hospital with the oldest parts dating from the 1880s. It had been suffering from the urban decay that had been eating away the entire seafront. As part of the enormous urban regeneration project that transformed the area and even made it possible to swim from the beaches again, a new wing was built along the seaside boulevard to firmly anchor the hospital into the urban structure. The new wing houses the out-patient clinics in which the impact of the views of the Mediterranean (Fig. 120) are maximised. As can be seen from the model of the

Fig. 119

Fig. 120

hospital (Fig. 121), the connections from the out-patients' departments in the new wing along the waterfront to the rest of the hospital are far from optimal. What has been achieved, however, is a unique hospital environment for which there is no need to create therapeutic features through any additional cosmetics. All other buildings underwent a major overhaul and a semi-public external area for waiting and relaxing was created that forms a spatial

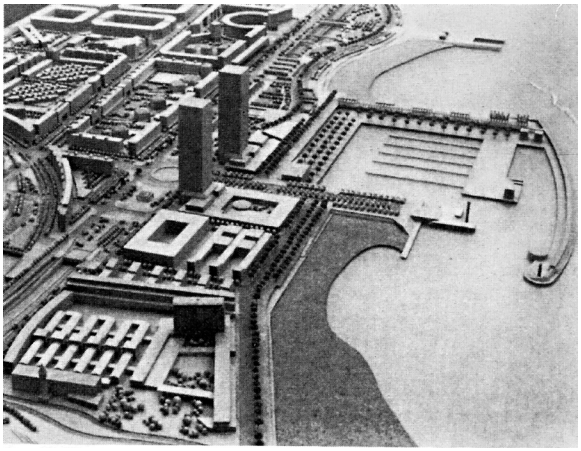


Fig. 121

mediator between the bustle on the street and the more private areas of the hospital (Fig. 122).
The tranquility of this space is reminiscent of the main quadrangle of Brunelleschi's Hospedale degli Innocenti (Fig. 123). This case, exemplary in its approach to the integration of the city and the hospital, was created through the fruitful cooperation between Mayor Maragall, city planning chief Bohigas, the architects Brullet and de Pineda, as well as the hospital administration, and was one of the results of the passionate atmosphere that reigned in Barcelona at the time.

Fig. 122

Giving a new lease of life to old urban pavilion and other hospitals has not always succeeded. Often this has not been because the buildings have been deemed irreparably obsolete, but because of mergers based on the rationalisation of catchment areas and care processes. The enormous bulk of hospital premises in Paris have undergone dramatic changes in the last decade. Many of them have been

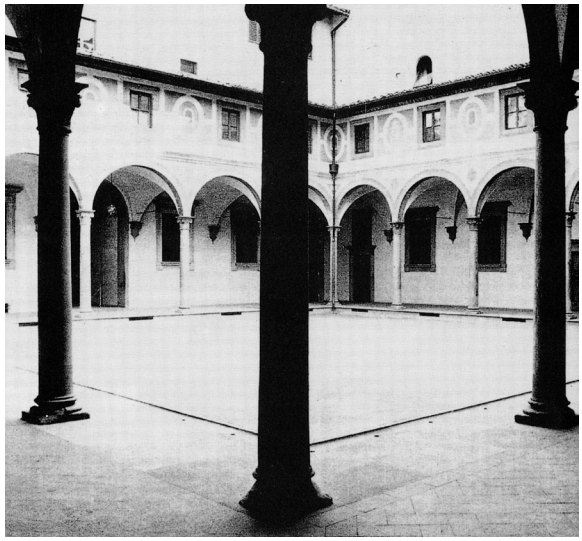


Fig. 123

converted into local "nearby care" clinics (*Hôpitaux de proximité*), day surgery centres or geriatric care centres. Some sites (such as Laennec, established in 1635) have been turned into mixed use development, while others are now used as headquarters for health-care related organisations such as the Red Cross (Broussais, established in 1883) or for laboratories and teaching space (Boucicaut) (Lemonier, 2002).

Introducing the city into the hospital

If the city is like some large house, and the house in turn like a small city, cannot the various parts of the house – atria, xysti, dining rooms, porticoes and so on – be considered miniature buildings?
Leon Battista Alberti, 1450

What are the similarities between designing a city and designing a hospital? Good cities and good hospitals have many things in common, but one stands out; a logical and inspiring hierarchy of streets and squares. Good hospitals have a clear hierarchy of main streets, side streets, main squares and secondary public spaces. Above all it is important to be able to articulate space; public, semi-public, semi-private and private, much in the same way as urban space is articulated. Orientation is a very important part of this. A confusing environment can never be healing. Over-specific design solutions, tailor-made plans that are created for particular moments and for particular people, are rarely sustainable and often lead to confusion and a lack of clarity. In fact, in order to create a truly healing health care environment, we can probably learn more from good urban environments than we can from existing hospitals. These "good" urban environments can be anything from Ludwig Hilbersheimer's "Ideal" and "Decentralised" urban projects of the 1930s (Fig. 124) to medieval Siena (Fig. 125). In spite of the huge contrast, obvious lessons can be learnt from both.

The hierarchy of streets and squares, as well as public and private elements, is an important theme in many hospital projects today. This is very understandable if we consider the ongoing discourse and the complexity of the context. Together, this leads to a complicated synthesis of generality and diversity. From the 1990s onwards there has been a new kind of diversity in the urban structure. Typologies are breaking up. You can have a museum in a department store and a swimming-pool in a library (Stenros, 1992). This presents new challenges to traditional town planning practices.

Fig. 124

Fig. 125

In hospitals a distinction can be made between public spaces, social spaces and private spaces. Other categorisations are possible and have been used. The MARU definition for public spaces refers to "a sense of occasion and surprise", whereas social spaces, created for conviviality and informal social exchanges should be "territorially neutral and provide for stimulation and distraction." Finally, "dignity and confidentiality" are provided for by the private spaces which "foster an atmosphere of calmness, quietness and contemplation" (Francis & Glanville, 2001). This analysis shows that skilful manipulation of spatial hierarchies also enables intuitive wayfinding and minimises the need for a plethora of signs.

Hospitals have often had courtyards that have not been actively used but simply been seen as sources of daylight in deep-framed buildings. Rarely have they been seen as assets, elements than can help to provide identity, ease orientation and so on. Internal public places have just been treated as wider parts of the corridors. In a healing hospital environment these spaces should be used to create real and memorable places that can vary according to the season or the time of day, just like urban open or covered piazzas.

One of the primary challenges that now has to be faced is how to handle the contrasting requirements between the "unique" public spaces and the "repeatable" private spaces. The "cocooning" aspect has already been touched upon earlier in this study. The magnitude of this task is such that if you believe in good design in itself having healing properties, every good architect will want to get involved.

George Baird claims that Team10 was responsible for rediscovering the urban street after Le Corbusier had lifted it up in the air in his *Cité Radieuse* project. Projects such as the Berlin Free University by Candilis, Josic, and Woods recreated the idea of an internal street as a part of an urban grid (Baird, 2006). In the mid-1980s, the first hospitals were built in the United States where the idea was to place the functions on both sides of an internal street. This would also house commercial activities independent of the hospital, but which were relevant to the services provided. The hospital started to be reminiscent of a shopping mall. Even earlier, during the era of Post-Modernism, when the monolithic block-hospitals started to lose ground, the idea of a hospital as a "village" had been coined. This "village" type approach was largely inspired by town planning and urban design ideologies.

One project of that period that makes a gallant effort at both reintroducing the hospital into the city and bringing the city into the hospital is the Children's Hospital Robert Debré in Paris, designed by Pierre Riboulet, and completed in 1988. The winner of a competition (the first one in Paris that allowed architects not "specialised" in hospital architecture for take part), the finished building includes one of the first European "hospital streets" (Fig. 126), and

Fig. 126

manages to glue together semi-dilapidated housing areas, create a new identity to the entire neighbourhood, exude presence and power, while at the same time treat an environmentally and topologically complicated site with admirable sensitivity (Fig. 127). The next major Parisian hospital street appeared about a decade later in Aymeric Zublena's Hôpital Européen Georges Pompidou. In spite of its clarity, clean lines, spatial generosity and elegance (Fig. 128) it lacks the soul of Riboulet's building. Riboulet's own description of his work is presented in BOX 9.

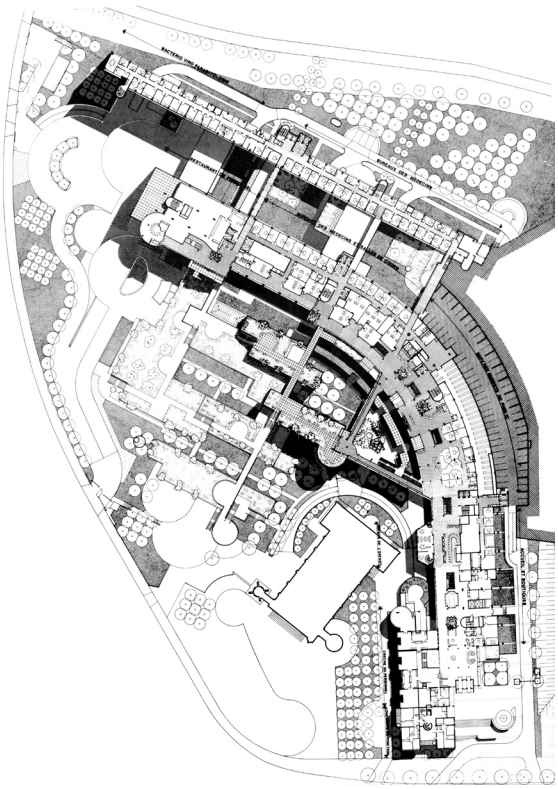


Fig. 127

Box 9

A lot of people who come to visit the hospital say they get the feeling they are in a city there. Firstly because it's big: an entire block in the neighbourhood. But this urban metaphor is the principle throughout the entire project's layout, which in consequence functions as an urban space - in other words public spaces where people move about on their way to more private spaces that have been attached to a system of networks. It is also present in the interplay between the spaces that open full on to the gallery, the winter garden, the garden terraces on the outside…urban space penetrates into the hospital as far as possible. Pierre Riboulet, 1988

Fig. 128

Fig. 129

There are now many impressive examples of "hospital streets". One of best known Nordic examples is Sunderby Sjukhus (FFNS Architects / Tage Isaksson, 1999) near Luleå in northern Sweden, located on a completely flat green field site. The street has been designed with a lot of love and care, with symbolism in constructional details, plenty of art, cafeterias, and libraries taking pride of place along the glass-covered central concourse (Fig. 129). Unfortunately, in most other parts of the building the usual problems surface. There are narrow corridors with endless rows of closed doors and insufficient daylight in the waiting areas. The labyrinthine impression makes wayfinding difficult and gives out signals of a supposedly process-based, "design by committee" procedure. Robert-Debré does suffer from similar problems but these are easier to forgive because of the highly complex urban location and topography.

In Finland, the so-called T-Hospital, an extension of Turku University Central Hospital (designed by Mikael Paatela of Paatela-Paatela & Co and taken into use in 2003), does not suffer from these shortcomings, mainly because of the remarkably generous general dimensioning of all the spaces, but also because of a rigorous pursuit of consistency in the overall high quality of finishes. The building includes the first major "urban" atrium in a Finnish hospital building (Fig. 130).

Letting the architect "do his thing" in the main public areas whilst using him as a rubber stamp in the rest of the building can, in the worst cases, lead to the equivalent of a city with a fine main street surrounded by slums. A more holistic approach is required, where the architect is allowed to take the urban metaphor to the bitter end. The new parts of Groningen University Central Hospital in Holland have been inspired by the old street network that existed on the site before the construction of the hospital. The glass-covered internal streets and numerous atria that now form the backbone of the new hospital all have street names and the entrances to different units have street numbers. The arriving patient is thus given an address (street name and number) and then knows where to go. The "urban plan" of the hospital is a successful combination of clarity and diversity, the hierarchy of the spaces is logical, and even if the quality of the architecture is not always particularly inspiring, the elements of surprise that occur make the hospital an exciting place (Fig. 131).

The urban metaphor was taken to new heights at the new Rikshospitalet in Oslo (Medplan / Arvid Ottar et al., 2000). The building itself is not in an urban setting (Fig. 132), so the exercise was really

Fig. 130

Fig. 132

Fig. 132

about introducing the city into the hospital. Arvid Ottar uses an urban vocabulary when describing the building. He claims that the design process was entirely based on dividing the programme for the hospital into four parts, each with their individual character: "the town" (the routes, foyers, waiting areas), "the city blocks" (canteens, libraries, lecture rooms), "work" (examination and treatment areas) and "home" (wards) (Ottar, lecture at Groningen conference, 2004). The hierarchical spatial analysis of the main "street" of Rikshospitalet (Fig. 133) with its main piazzas and little side pockets can be compared to a corresponding analysis of the main urban links and public spaces in part of Venice (Fig. 134).

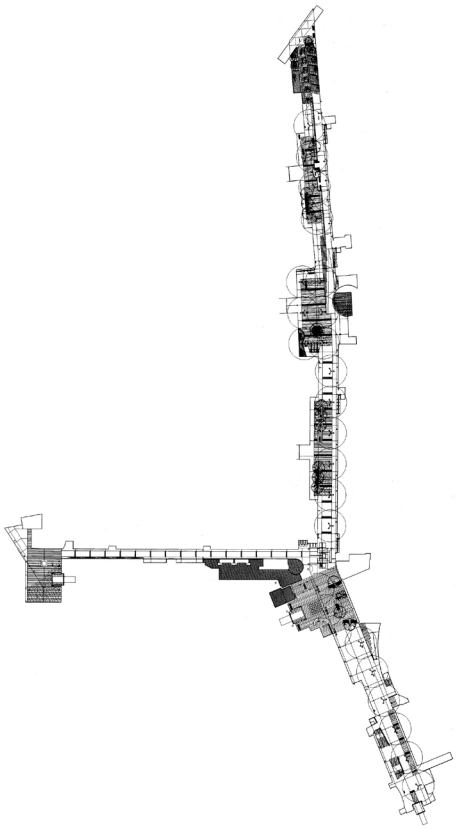


Fig. 133

Returning to Trondheim's St. Olavs Hospital, we see another good example of new hospital where the theurapeutic quality is embedded in the fundamental philosophy of the urban principles involved. The block structure allows sun and daylight into all parts of the building. Tree-lined streets are continued into the entrance areas and private gardens, improving orientation and strengthening the identity of the different centres and departments. All patients have a view from their beds of the sky and also, in spite of the urbanity of the location, of green elements. Trondheim can thus serve as an example of a hospital where the essentials therapeutic elements come, as they should, from the urban context and the architecture.

Fig. 134

PART IV. THE WAY FORWARD

Chapter 8. Improving the design process

The design process of hospitals has always had its idiosyncratic features in countries of the developed world, but as regards the developments since World War Two, essentially the era of the Megahospital, there have also been many similarities. Concerning the architect's role and the main themes of this study these similarities have had an effect on the overall quality of hospital buildings.

In the early 1970s new types of health care provider organisations began to appear in the United States. Large-scale investor-owned companies came to the fore to such an extent that within a couple of years there were 90 of these companies. To illustrate the effect of this, we can take as an example one of these companies, the Hospital Corporation of America. By 1972, this company had built, within a short period, 40 new hospitals using only eight different firms of architects (Verderber & Fine, 2000). Before these developments, high profile architectural practices such as Bertrand Goldberg, C. F. Murphy and Associates (now Murphy and Jahn) and Edward Durell Stone had been heavily involved in hospital work. They lost interest when consultants and experts working for the corporations took over the leading role and when speed and standardised solutions became the keys to success.

There seem to be strong parallels between the situation in the United States in the 1970s and that in England in the beginning of the new millennium. It is a commonly held view that due to the PFI (Private Finance Initiative) programme and the consortia involved in it, a wall is being built between architects and healthcare professionals and this has led to increased difficulties in getting good designers involved.

Such developments have had an effect on the design process because of the decrease in the architect's creative involvement. A hospital design process run by technocrats or profit-making enterprises served by "specialist" architects who, in the worst cases, function as mere rubber-stamps, is very different from the traditional process in which the architect's role is that of the client-user's primary spokesman and trusted expert. Splitting up the design commissions into smaller packages, a procedure that is becoming more frequent due to over-zealous interpretations of procurement laws and short-sighted presumed savings in design fees, is another development that will add to the deterioration of the traditional relationships.

This chapter first analyses some of the reasons why the status of hospital design deteriorated so rapidly from the late 1970s onwards. Other prevalent aspects discussed here include the lack of long-term strategic planning and how this could be combated, changes in the approach to programming and briefs, as well as the incorporation of flexibility in the design development stages. The recent changes in the mechanisms that steer and control hospital design are discussed as well as the potential of process-based design as a new tool for more sustainable and future-proof results.

Our current legacy

Vitruvius did not judge the success of architecture by getting a range of responses from lay user and community groups. He did not use a questionnaire. He understood that good architecture could lift the spirit but did not claim that architecture could heal the sick. He did, however, acknowledge that good architecture advances the health of society. Austin Williams, 2004

Things hit a very low ebb in the 90s.
Richard Burton, 2004

The doyen of Finnish hospital architects, Veijo Martikainen, started an article in *Arkkitehti* (Finnish Architectural Journal) in 1971 with the words, "There is no completed hospital in existence – not in Finland, not anywhere in the world. A hospital can never be completely finished. In this respect it is no different from a university, say, or a city." (Martikainen, 1971, p. 25). Later on in his article he talks about parts of a hospital being out of date before the building is finished, the fact that hospital running costs reach the original investment costs within three years (this figure is now even lower) and the negative effects of overly strict norms and programming. Improvements have taken place concerning the latter, but otherwise one may well ask what has changed and what has been learnt during the last 35 years.

The oil crisis of the 1970s had a sudden and dramatic effect on the design of public buildings. New norms came into effect in most Western countries. Many were based on minimising the window area, thereby improving the heat-insulating properties of the external envelope. In hospitals it meant that an already difficult formula, prioritising all rooms that could possibly be classified as "permanent work rooms" with a window of a certain size, became even harder. The patients and visitors suffered (along with the architecture) and effectively paid for the savings. Some countries tried to respond to the new demands by creating new "systems", not mere limitative norms. In the UK more than 130 schemes were built using the new "Nucleus" system. This was a cruciform block of about 1 000m^2 which could be repeated any number of times. However, criticism soon started to mount and the system was blamed for not actually being very flexible, and for only being a "poor man's Harness". Like almost any over-standardised system, "Nucleus" suffered from a lack of capacity to respond to site-specific aspects.

With its Activity Data Base, "Nucleus" did, however, achieve something lasting that we can still learn from today. The Data Base (ADB) consisted of "A" sheets with the room requirements, "B" sheets with activities and their spatial, equipment and engineering requirements, "C" sheets which were standard room layouts and, additionally, project-specific "D" sheets listing further equipment requirements. They became a key design and briefing tool, but in the end only worked as a summary of user requirements and did not in the long run contribute to improved efficiency, logistics or architecture. As a data base it was nevertheless an impressive achievement and also useful for managing the budget (Francis et al., 1999). It also had a strong influence abroad with the result that different varieties of "room sheets" or "room cards" appeared in many countries as a result of research in various governmental departments and institutes. In the long run, the slavish use of these resulted in a hospital being seen as a mere collection of "ready-made rooms", not

as a series of complex inter-related systems. The lack of understanding of these systems and their inter-relationships can largely be blamed on the straightjacketing effect of the "room sheets".

There is thus a clear distinction between a system and standards programme (type "Harness") on the one hand and actual standardisation of hospital design (type "Nucleus") on the other. Standardisation which is primarily motivated by financial savings has rarely been compatible with implementing desirable standards (Francis et al., 1999). Standardisation philosophies also have strong connotations with "pre-fab" and "throw-away" solutions and inexpensive, short-life disposable buildings. One line of argumentation used in the years of recession following the oil crisis was that these kinds of buildings could be the answer to the demands that were changing at an accelerating speed. Weaknesses soon started to surface and it became clear that temporary often became permanent and sometimes more expensive than permanent, and that much of the philosphy went against some fundamental principles of sustainable development (Cole, 2007).

The reactions against too much modularity, standardisation, flexibility and "plug-in" approaches coincided with the more general reaction against Modernism, including some of the ideas of the Heroic Era of hospital design. While the first manifestations were heard in the United States, these reactions quickly became universal. In hospitals it meant a move towards more "tailor-made" design processes, even if the "room sheet" still reigned supreme, at least in some countries. For example in Finland, in 1978, an editorial in the review *Arkkitehti* stated, "It seems that the more complex the implementation processes of health care buildings become, the more likely it is that the final result will be one of anonymous coldness. The lack of holistic visions, in medicine as well as in architecture, is due to a mechanistic view of the human being, as well as an ever more technocratic way of thinking. The lack of understanding of the importance of design has become ever more obvious. Municipalities are looking for designers through tendering processes, in other words, designers are picked based on who is willing to do it with the most superficial approach to the problems involved" (Komonen, 1978, p. 21). Most of the above text would not be out of place in the same journal today.

A quarter of a century later the *Architectural Review* wrote in a special issue on health care architecture as follows, "... in the era of functionally driven architecture, when the answer to every problem was to measure and calculate, the hospital became the technical building par excellence. A few decades of growth and change – new machines, different medical practices – made it more haphazard and less efficient, the labyrinth more impenetrable. The Utopian moment of building afresh had passed, and the bureaucratic norms intended to establish a plateau of good practice, became a limitation" (Blundell-Jones, 2002, p. 70).

Bureaucratic norms did indeed grow in importance from the late 1970s onwards until they had an iron grip on all aspects of design. In Finland the overriding "mother of all norms" was the net-gross ratio in the floor area of the building. The corridors were seen as necessary evils and the efforts to minimise the proportion of circulation space in relation to the total area essentially eliminated single-loaded corridors.

Corridors, and as a consequence very often also waiting areas and foyers, became artificially lit and minimally-dimensioned architectural afterthoughts.

The "room sheet" (the standardised solution for any room type from cleaner's store to operating theatre) remained for a long time and continued to play havoc with the future-proofing qualities of the floor plans that were being designed. The people involved, particularly bureaucrats and user-clients, failed to pay sufficient attention to the accelerating speed of change, thus producing rooms and spaces that were often obsolete before being taken into use. The other major problem, the fact that designs based on standardised room types never respond to a specific context, was also systematically ignored. For the architects, solving the puzzle of fitting these "perfectly solved" heterogeneous little units together in a sensible way while minimising the amount of corridors was something of a headache, but a lesser one than actually having to create something innovative and sustainable. The reaction had initially been against the "healing machine" principles but the remedies, somewhat ironically, led to an increasingly technocratic approach.

The results of the heavy involvement of government research organisations were, in many countries, far from conducive to innovation and creativity. The accommodation schedules became increasingly hierarchical in character with differences in room sizes of two square metres separating high-ranking doctors and nurses from others of lower rank. The overblown ergonomic and logistical studies resulted in bizarre requirements. An accommodation schedule might include a store room for laundry of $8m^2$, another one of $7m^2$ for medicines and one of $6m^2$ for cleaning equipment. Optimal space allocation became an obsession that strongly contributed to the demise of hospital design, particularly in the 1980s and most of the 1990s. The final judgement on the efficiency of the plan was determined through a coefficient, calculated in slightly different ways in different countries, but essentially stating the ratio between the total areas of individual rooms as expressed in the schedule of accommodation (net area) and the total floor area of the building (gross area). The lower this ratio, the better the solution; the higher the figure, the more wasteful the building and the worse the job performed by the designer.

All this led to deep plans that lacked sources of daylight and suffered from minimally dimensioned circulation areas and difficult orientation. The general "cramped" feeling that dominated these inflexible post-Heroic Era hospitals was a result of a short-sighted lack of life-cycle considerations. These interiors have now proved very difficult to improve and refurbish. Low quality architecture cannot be improved with cosmetics.

The over-specific, "tailor-made", "fits like a glove" type of approach is thus largely to be blamed for the fact that the standards of hospital design declined very rapidly almost everywhere after the Heroic Era. In Finland, only architects with relevant experience were used and all the drawings were inspected at several different stages by central state authorities. There was also "exceptionally intensive user participation in the design process" (Teikari, 1995). From the late 1970s onwards, there was indeed a great increase in the number of people involved in the design process. Certainly in Northern Europe, participation became a key concept and all possible stakeholders had to be

consulted. It was not unusual to have thirty people participating in a design meeting where sketch plans were being drawn up based on finalized schedules of accommodation which accounted for every last square metre. The architect, who by now was almost always a "hospital specialist", spent more time at these meetings than at the drawing board. Heikki Lonka, in his recent thesis, describes the role of an architect in a project as being "sometimes even a mediator between the staff and the management and when people talked about her role, they talked more about her role as a knowledge broker or mediator than as a designer" (Lonka, 2007, p. 136).

In spite of all the inspection procedures and participatory approaches (or possibly because of them) it seems that numerous mistakes were repeated time after time. As an example, a study of six emergency departments in Finnish Central Hospitals revealed that patients who arrived by ambulance were to some extent visually shielded from the public waiting areas in only two of them (Teikari, 1995).

In the same study 30 quality requirements for hospital facilities as working environments were listed under three main headings; Functional Requirements, Technical Requirements and Psychosocial Requirements. The word "architecture" appeared only once as a qualitative factor, with the subtitle "environmental image" under Psychosocial Requirements. The wording used was "aesthetic attractiveness of architectural composition, material choices and colour". The author's conclusion was that visual appearance is "appraised inseparably together with other, principally functional, features of the environment" (Teikari, 1995, p. 151).

The general absence of architectural concepts in post-occupancy evaluation (POE) reports (which were becoming increasingly common during the troubled years discussed here) is maybe frustrating but also very understandable. Words such as "architectural", "aesthetic" or "visual" do not appear at all in the seminal book on POEs by Preiser, Rabinowicz and White (1988). POEs are generally divided into three categories; indicative, investigative and diagnostic. Indicative evaluations are, by definition, less structured than the others and include the "walk-through evaluation" which has been used recently, for example by SOTERA (Helsinki University of Technology) groups of experts, when analysing existing facilities waiting to be refurbished. In the "walk-through evaluation" the evaluators use "direct observation and, if warranted, still photography to identify building attributes that may deserve particular attention. Within a few hours, a walk-through can comprehensively cover a given building" (Preiser et al., 1988, p. 55). The walk-through experts' group can thus make up their own tailor-made criteria for the functional, as well as visual and aesthetic, qualities of the building, the conclusions of which can then be discussed with the management and staff.

The 1980s and 1990s were also a problematic period for mainstream architecture in general. There was confusion and lack of clear direction caused by the Post-Modernist discourse and increased emphasis on public participation in planning and design. The Post-Modernist agenda cultivated individual wants and fancies resulting in specialised, quirky and far from generic architectural forms (Harvey, 1991). This contributed to the "for me – now" approach and led to solutions that were anything but future proof.

Concurrent with these trends architects were, in general, getting a bad press. This was a global phenomenon fuelled by commentators such as the Prince of Wales. In some countries the architectural profession showed a marked lack of professional confidence and reacted to the criticism by becoming increasingly compliant to the short-sighted and ill-founded demands expressed by various lay bodies in business or politics. This also had an effect on the design of public facilities. Hospital design was perhaps particularly vulnerable since it was already suffering from other intrusions such as the strong appearance on the scene of the non-architect "hospital consultant". This role had emerged in the United States in the mid-1970s and spread all over the industrialised world and it led to many good architects losing interest in the field (Verderber & Fine, 2000). The lack of architectural quality, humane surroundings and inspiring environments that ensued was also due to the way designers were appraised and evaluated. The "best" architects were those who got the net-gross ratio right the first time, not those that designed the best buildings.

The lack of coordination between the different actors at the different phases of the work, particularly between the region/district and hospital levels as well the levels of the hospital and the departments within it, is a problem that has now become more serious. Bureaucratic decision-making processes continue to be a problem, as well as the practice whereby the principles of spatial design are predetermined through preliminary layouts based on fixed schedules of accommodation. The processes are thus still usually planned afterwards, within the departments and within the confines of the given physical layouts (Autio, 2006). These remarks particularly apply to Finland but have a wider relevance.

A more recent problem has arisen in the procurement processes through the often obsessive insistence by client bodies on competitive price (as opposed to quality) driven bidding for design services that are also often split up into smaller portions, thus also affecting the continuity of the process. This shortsighted practice is particularly illogical and unsustainable when considering what a negligible percentage the design fees constitute in the life cycle cost of a hospital building. But the overriding problem that can have dramatic and widespread long-term effects remains the lack of strategic and master planning.

The legacy inherited from recent social and political history, particularly in many of the new EU member states, has led to hospitals being refurbished in a piecemeal fashion. Individual hospitals receive the means to refurbish, for example, their operating theatres or ICUs. The results are frequently encouraging and show that the much maligned SNIP norms of the Soviet era still provide reasonable frameworks for dramatic improvements in efficiency and spatial quality. However, the piecemeal approach and lack of master planning often lead to a situation resembling a medieval town where the fine palaces are connected to each other by unpaved streets with open sewers. The labyrinth of corridors leading to the modernized departments has been left untouched for several decades and the general image of the hospital is constantly deteriorating in spite of the investments.

This situation is the reverse of that in several recent hospitals in Europe and the United States where all the fireworks are concentrated in the public areas while the active areas for cure and care appear

almost as an afterthought. One of the culprits is certainly, once again, the tight programming and the almost impossible equation resulting from trying to satisfy the needs and short-lived whims of everyone involved.

Strategic and master planning

Master planning remains a basic tool in planning for an unknown future, yet its success depends on the client's understanding of successive hospital authorities to honour the architect's original vision.
American Institute of Architects, 2003

The vast majority of the world's hospitals have been built with no long-term planning in mind. During recent decades the most common starting point has been to build a new, often Breitfuss-type hospital in the middle of an available site. The complex has subsequently been extended outwards, bit by bit. This has generally led to problems, both in the overall logistics of the hospital and in the urban environment in question. Since it has always been difficult to foresee how health care systems and consequent demands on the physical facilities will develop, there are not many examples of hospital campuses that have grown according to a preset master plan.

There have been reactions to this in many countries recently. The need for master planning has been underlined by the frequent remark that "a hospital is usually outdated before it is finished". Bringing the architects in at a much earlier stage has been seen as an advantage, and rightly so. In many countries, however, there are certain procurement practices (often based on varying interpretations of EU directives and local legislation) that make this rather difficult. It has even become common to chop up the design commissions and organise a separate bidding procedure for each stage of the design process. This has led to situations where the lack of continuity in the design team has become a major obstacle in the quest for better quality and more sustainable solutions.

With the ever-changing requirements, growing demands for flexibility and added emphasis on life-cycle based designs, it is evident that the traditional design processes need to be looked at critically. Although there are major variations even between the world's developed nations in the way that these processes are handled, there are enough similarities to introduce some ingredients into the different design phases to secure better future-proofing aspects, both in new build and refurbishment projects.

Flexibility should be a key issue during all the phases of the design process. The way to achieve it becomes more precisely defined the further along the process one moves. During the strategic planning phase many of the megatrends that have been mentioned in this study, such as demographic changes, developments in technology and new approaches to service delivery, come to the fore.

It is important that a strategic plan is seen as a living document that can and should be adjusted at regular and sufficiently frequent intervals. For example, the projections for the need of services, for example, have, in the past, led to an increasing need for space (AIA/AAH, 2001). It is possible that in the foreseeable future factors such as different ways

to cluster services, the growing role of home care, a larger emphasis on a "core" hospital approach or a clearer separation between facilities providing "cure" and "care", will reverse this trend. In fact, a lot of these issues were discussed in the WHO in the 1960s, which is another indication of the slowness that imbues the decision-making in the field.

In the healthcare sector as well as in other parts of the community there is a need for a fully thought-through strategy for the future development of the resources. Thus, a master plan also serves as a tool for developing the real estate, the buildings and the facilities in use by the organisation, and secures an efficient use of space. Above all, "the master plan addresses the conditions for healthcare and its need for facilities and spaces that are adopted for the business that is conducted in them" (Johansson et al., 2006, p. 46). When working on the development of master plans there needs to be a thorough understanding of the functioning of each clinic or department and the requirements of each user group. The state of the individual buildings, the infrastructure for traffic and the technical systems for heating, water, sewer and ventilation, are important factors to consider in the master plan. The master plan should contribute to the improvement of the environment for both patients and staff, thus increasing the quality of care and the value of the buildings.

Master planning should provide all the essential information about the expandability and flexibility of the facility in question. It should also be seen as a living document which is continuously reviewed and updated in order to provide useful planning guidelines. Experience has shown that for most people it is difficult to think beyond a five-year horizon and to accept ideas that may dramatically change the situation that they are familiar with. This, and the fact that it is genuinely difficult to predict changes that will occur in the future makes it ever more important that flexibility is built in as a prerequisite for the expansion of facilities (Chefurka et al., 2005). It is also of utmost importance that some key individuals or teams of people are involved throughout the master planning process. This is the only way to ensure consistency and adherence to the expressed aims (Nagasawa, 2004).

Throughout the 20th century hospitals were extended and refurbished step by step. This trend has not yet been reversed and when it happens without the existence of appropriate master programmes and plans, it can have disastrous effects on the long term development of the facility. Compromise solutions, evident in almost any major hospital campus, often have a logistic blocking-up effect vis-à-vis subsequent phases. They often also split up departments, which causes dysfunctional solutions and increased operating costs. Since we cannot predict the future, we must make sure that our actions today will not become obstacles in the long-term. The master plan should secure that the whole hospital campus is organised in a way that allows enough space for already known, as well as possible future needs. The plan will indicate what changes will favour or disfavour a positive development. We must not forget that "the activities we perform today form the pieces of tomorrow's puzzle." (Johansson et al., 2006, p. 47). A master plan in six steps, founded on regional strategies and used by the Region Skåne in Southern Sweden, can be found in BOX 10.

Box 10

Part 1 — Background information
The overall regional goals and motives. A description of the area that the plan will cover and the main activities. A short history or background information; why are we doing this plan, what has caused the need to make a plan or to revise the old plan, what is the main purpose and how do we expect the plan to be used?

Part 2 — The Activities — All clinics, departments and businesses
Interviews with the various clinics, departments and other businesses ona regional and campus level recording which conditions or events that influences them the most. Discussions on what could be done to improve facilities and conditions. For example: The development in the society at large - demographic changes, clinical patterns of disease, the role of the patient in the era of the information society, the development of medical technology and diagnostic and treatment modalities. Political visions and demands from customers in a broad sense. Demands from care providers, hospital departments and other enterprise.

Part 3 — The Property
Circumstances and conditions relating to the premises. What shall be preserved or kept up-to-date? What needs to be improved? What weaknesses can be seen? Possible alternative uses? Attached values? Aspects to consider: The property and its current state. Region-wide, urban or municipal plans and their effect on the development of the property. Architecture (adaptability to urbanism or landscape, vegetation, ground conditions, cultural values, preservation rules etc.). Basic facts for each building (size, age, technical status and categories of premises). Communications to and within the campus (parking spaces, traffic thoroughfares, entrances, internal communication routes). Technical and services supply systems (water, heating, ventilation, electricity, back-up, emergency, safety and security systems).

Part 4 — The analysis
All the data collected and conclusions made about the available resources, activities, clinics, departments and businesses, and their needs and use of the buildings (parts 2 & 3), focusing on the entire hospital campus. The collective need for change, short (2-3 years) and long (5-10 years) perspectives. The most realistic alternatives to overall solutions studied in detail and evaluated. Pros and cons with each alternative reported, the most likely scenario chosen as the main theme for the master plan.

Part 5 — The Master Plan
A master plan programme stating the demands that the plan shall fulfil. A map of the surroundings and the hospital campus describing how the area can be developed. Land and building use in an overall view; structure plans and land development plans including zoning; green areas, traffic and parking, technical supply, existing buildings and areas for extensions. Buildings due for demolition. Illustrated plans of one or several alternatives to show how the area can be developed within agreed overall structure. A realisation plan. Phased development (minimising disturbances), the sequence of different phases.

Part 6 — Investment and maintenance plan
Major maintenance needs reported and included in the financial planning for the building maintenance programme. Investment plan reports costs of investments with a five-year horizon and is reassessed every year in line with the master plan.

Johansson et al., 2006

There are some recent changes in the way that hospitals are run that are going to have an effect on the master planning of hospital campuses. For example, certain support services are often carried out by off-site commercial enterprises. Presuming that this trend will continue, space provision for such services as catering, laundry and material management should allow for other functions to occupy that space if and when the strategies change. This should actually become easier in the future since major teaching hospitals will increasingly resemble small cities and development strategies will be based on entities that have a lot in common with urban zoning concepts. Campuses will consist of high-tech space (core hospital activities), industrial space, engineering and maintenance areas, but also facilities that can be likened to residential and commercial space.

The demands from society as well as changes in the surrounding world will also influence the plan. Not only the whole hospital campus but also the adjoining city blocks and prospective plans for the immediate neighbourhood must be considered in cooperation with planners from the city or municipality. Contemporary thinking, also strongly promoted in this study, sees the hospital as a natural part of the city plan, coexisting in harmony with the city, not isolated or divorced from it. Therefore all possibilities regarding the hospital campuses and its surroundings should be mapped, and needs as well as limitations recorded in the master plan. Possibilities for shared facilities with other business must also be explored. For example, a parking garage can be occupied by other users in the area and office accommodation and research facilities can be shared with the academic world or with industry. Alternative development scenarios should be studied and the consequences of all of them carefully recorded (Johansson et al., 2006).

Functional programming and briefs

Briefing should be a consultative exercise in change management, not the staking of territory.
Lawrence Nield, 2003

In its broadest definition, programming is a process by which information about a building project, given by the client or obtained by the architect, is analyzed and interpreted (both graphically and computationally) to better describe the spatial strategy around which the specific tasks and uses of the buildings will be organised.
Hashim Sarkis, 2001

As has previously been pointed out, the notion that built form must echo a previously agreed upon programme of accommodation did not exist in prior epochs. Specific locations for individual functions were not predetermined. Territorial boundaries were thus more complex and fluid than those created through modern Functionalist thinking. N. J. Habraken, 1998

The first central hospitals in Finland were designed before programming as a process became as sophisticated as that described in Sarkis's definition above. In those days, the National Board of Health chose an architect and asked him to design a hospital. The architect then consulted some doctors, friends and acquaintances of his own choice, and proceeded with producing the required drawings. *Arkkitehti* (Finnish Architectural Review) stated in 1971 that these early post-war hospitals were still rather useful, showing that a hospital must basically be a "fairly adaptable building – however you plan it, somehow it functions" (Vauramo, 1971, p. 22).

In the sixties, programming had begun to incorporate more user-oriented methods of data gathering, such as interviewing, questionnaires, post-occupancy evaluation and workplace studies including analyses on light and noise conditions. Programming thus became not only a process of receiving and analysing already formulated ideas and information but also an interactive and educational process (Sarkis, 2001). Groups of users were thus empowered to question accepted practices and to propose new spatial arrangements that would better suit their own interpretations of better work efficiency and logistics.

Programming gradually then became a specialised field that took full control of the analytic and functional aspects of design. Sociologists, statisticians, and economists joined the teams of programmers, introducing new methods and ambitions. As a result the coordination between programming and design was weakened. Client interaction was largely monopolised by the programmers, which meant that architects and principal users no longer formed the power poles of design that had produced some of the best results in the past. The speed and strength at which these developments appeared varied from country to country but it is safe to say that they played a major part all over the developed world by the early 1980s.

The establishment of programming in the 1960s was a case of modern architecture trying to reinforce its functionalist assumptions. However, a high degree of indeterminacy between form and function was discovered as a result. "By separating problem seeking from problem solving", other formal criteria beyond suitability to function were introduced. "One new criterion was flexibility" (Sarkis, 2001, p. 82).

The view that the 1980s and 1990s were indeed a period of stagnation in the design of hospitals is in hindsight further emphasised by the fact that flexibility was introduced to the discourse as early as it was. Its impact on programming has been negligible up to very recently. Today it is always present in the discussions, often disguised in terms like future-proofing or life-cycle costing, but basically responding to the same kind of demands that were first articulated in the 1960s.

What the programmers and other specialists managed to efficiently and lastingly introduce was hierarchical and detailed accommodation schedules supported by standardised "room cards". This contributed to the fact that space was increasingly seen as the equivalent of administrative territory. The need for a certain number of square metres was dictated by territorial hierarchical claims rather than genuine functional requirements. It is now time to see space as a resource to be used to the benefit of all those involved in the care process, and not least the patients themselves.

The traditional, hierarchical spatial schedules should be replaced by space requirements based on processes, taking into account operational trends and resulting changes in the utilisation patterns. At this stage of planning greater open-mindedness among the participants in the design process, particularly the users, will be required than has been the norm until now (Chefurka et al., 2005).

It is also at the functional programming stage of the design process when consideration should be given to standardising room sizes, thus improving overall functional flexibility. A generic approach to

space use is without doubt conducive to improved sustainability and increased life cycles. Modularising of space in general, also when considering larger units and spatial clusters, will make the facilities more adaptable to changing requirements.

It is likely that workplace strategies and workplace management, already becoming commonplace in office environments, will also be taken up as a tool for improved efficiency by hospital authorities and become an integral part of the functional programming phase. This will lead to discussions about systematisation of furniture and fittings as well as that of space itself. A practical example that will benefit everyone concerned is that, in the future, a particular form can be found at exactly the same place in all possible registration venues. As is the case in hotels, each appliance, including items such as light-switches, will be found in each room in exactly the same place. Modular and systemised furnishings and space dividers will be developed specifically for hospital use and pave the way for more open wall-less solutions.

Finding a sensible balance in staff participation in the design processes is obviously crucial. According to the administration at Orbis Medical Park there are three key factors for a successful design process: "1) strong committed leadership at board level (consisting of just two individuals), 2) commitment from physicians who are opinion leaders, including medical managers and 3) a carefully arranged balance of input from the organisation's departments" (Erskine, 2006, p. 5).

Design development

In short, the highest compliment for me is not when someone comes along and grasps the form and says: Ah yes, I see, you were trying to achieve this really cool form, or something, but when the proof of the pudding is in the eating, as it were. That is the highest compliment of all. Peter Zumthor, 2006

Because of the appearance of the "hospital consultant", and other changes introduced in the 1960s in the United States, which gradually spread elsewhere, architects lost their role as the trusted expert and right-hand man of the client. This often led to the designers not entering the design process before the beginning of the design development phase. The architects themselves were not entirely blameless since their work culture began to display a reluctance to put pen to paper before a full schedule of accommodation was presented to them. Major changes in the fee structures and procurement methods have normalised this part of the equation while introducing new problems. At least now, in the first decade of the new century, the majority of the architectural profession is prepared to take on a much more comprehensive role in the design process, including strategic and master planning as well as programming.

It has also become (once again) obvious that the design of the structural, mechanical, electrical and communication systems should, from the start, be an integral part of the design development (and to an extent also of the programming) phase. If future-proofed, flexible and adaptable solutions are the aim, it will no longer be possible for the consultant engineers to be appointed haphazardly and to enter the picture when the architect, together with the

client body, has already fixed the architectural and functional starting points. All members of the design team should become involved at as early a stage as possible. Saving in professional fees at these stages is senseless, since it can have far-reaching repercussions concerning life-cycle economics and sustainability.

The most long-lived examples of good hospital design have been those which have been developed by architects and consultant engineers together, i.e., those where the structural and mechanical systems have been integrated with the architectural concept. The use of interstitial space is one important instance of this, and important lessons can still be learnt from it. The design process of the best sanatoria produced numerous comparable innovations.

One example of current ways of promoting flexibility is placing "heavy" elements, such as imaging diagnostics, next to "soft" space, administration and so on. In this way "soft" space can easily make way for expansions of the "heavy" elements. It should, however, be kept in mind that what are now seen as "heavy" elements, may well be less so in the future. Much less cumbersome mobile imaging equipment could become common, thus making it necessary to rethink the whole concept of imaging departments as "heavy" and inflexible parts of a hospital. This is only one of numerous examples of the unpredictability of the future of hospitals.

In an ideal case the traditional phases, including master planning, briefing and design development, are all part of one continuous creative process based on a design vision. One such vision is shown in BOX 11.

Box 11

A Design Vision should establish:

- **Generic and specific quality objectives that recognise the major contribution that design can play in creating healing environments measured in terms of impact on health and well-being.**
- **A strategy to facilitate in-built flexibility for change of demand and use for health-related purposes and where practical for conversion to non-health use over time**
- **Design principles to ensure that health facilities as far as possible contribute to the quality of the wider built environment and enhance and enrich wider community engagement and development**
- **A focus on whole-life rather than simply capital costs whilst all the time ensuring the delivery of the required quality of design and the contribution to wider environmental, social and economic sustainability.**

John Cole, 2007

Process-based Design

User studies of function are not by themselves a sound basis for hospital design. Functions change so rapidly that designers should no longer aim for an optimum fit between building and function. John Weeks, 1973

The greatest glory in the art of building is to have a good sense of what is appropriate.
Gian Battista Alberti, 1450

The Australian architect Lawrence Nield asks for fundamental changes in the way briefs for hospitals are set up (Lecture at Architects for Health Architecture Week, in London, 2003). He claims that the pre-planning phases should concentrate on change management and no longer on the sharing out of territory ("space should be used as a resource, not as territory"). Ways of using space should take over from counting square metres. The whole concept of a "room" should be rethought. The key word according to Nield is "event", which has something in common with "episode", a term used in process analysis.

Process-based thinking takes into account all the phases of a patient process, including the movement from place to place as well as the waiting. There is no longer any superfluous space. The old "necessary evils", the corridors, are as important and significant in their role in the efficiency of the process as any other spaces. The net/gross ratio no longer makes any sense. It has proved difficult to translate results of a process analysis into concrete space requirements, i.e., producing a new kind of an accommodation schedule where individual "rooms" with their respective required floor areas are replaced by entire processes. It is clear, however, that the traditional way of creating a "room" for practically every single function, person and piece of equipment, leads to inflexible solutions with too many walls and doors, and to plans that do not respond to the requirements of the processes in an optimal way.

Functional diagrams of different kinds have been used as tools for hospital design for a long time. The main difference is that every definable action (consultation, examination, treatment) previously took place in a space reserved for that purpose. The role of the functional diagrams has been to help the designer put these spaces in a formation that is optimal for the overall logistics of the actions. All other space has been seen as superfluous. In a study about interdepartmental adjacencies, published in Finland twenty-five years ago (Kekäläinen, 1982), the terms "chains" and "clusters" are used to describe what are essentially processes. The connection requirements that the study is based on deal with interdepartmental relationships, whereas most process analyses deal with processes within one department. The problematics are, however, the same. When "chains" (basically linear processes) cease to be sufficient to describe the process (patterns becoming too complicated), "clusters" are required. This seemingly simple idea to describe functional adjacencies in, for instance, surgical departments (Fig. 135) or out-patient clinics (Fig. 136) is still a valid tool for the evaluation, as well as design, of facilities.

Process-based design tries to get away from these old concepts. It starts with the presumption that any type of activity is formed through processes that can be manipulated and optimised. However, the objects

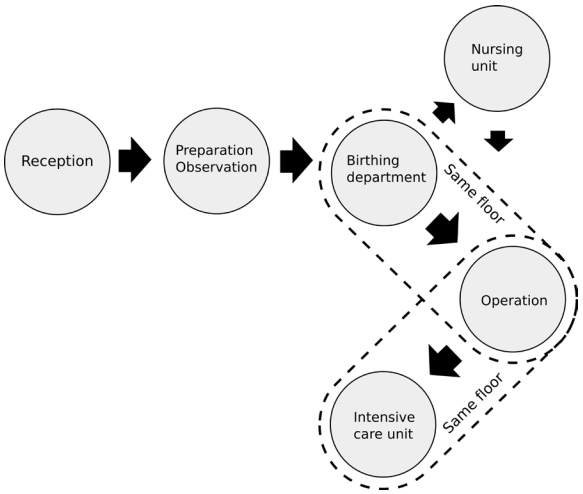


Fig. 135

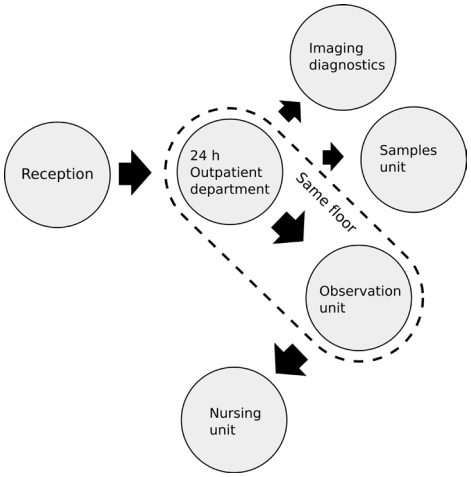


Fig. 136

of the processes are "patients who are reactive, participating subjects in the process, not passive raw material" (Teikari, 1995, p. 32). Every patient is certainly a new and different case, but nevertheless, in the course of treatment, certain routine procedures are repeated in such a way that basic processes can be planned. According to the director Henny van Laarhoven (lecture in Sittard 14.5.2007), the administration of the Orbis Medical Park in Sittard considers that 80% of any process can be made routine, thus reducing overall administration and giving the staff scope to concentrate on the challenges offered by the remaining 20%. In other words 80% of the patient flow is predictable and can be addressed by high quality, systemised treatment programmes. Even if this really is the case, the remaining 20% provide major challenges, not only medically but also in terms of design.

The analogies between industrial processes and hospitals undoubtedly provide useful tools which are not necessarily in conflict with the aim of producing more "humane" hospital environments. Today's general architectural trends, together with the physical expression of the prevalent future-proofing ideologies, will lead to a situation where conflicts between "open and closed" as well as "cure and care", in short the "rational and the poetic", will in any case have to be solved.

Processes can roughly be classified, based on variation and variety, into three groups: standard processes, routine processes and non-routine processes (Lillrank, 2003). Variation signifies a deviation in the result of the process of an explicitly expressed aim, whereas variety signifies different, but functionally similar aims. Standard processes

basically contain one single aim and their efficiency can be improved by the quality of the raw material and the reduction of internal variations within the process. Routine processes are similar but nevertheless not identical to each other. Non-routine processes are open systems where an endless number of aims are expressed. These processes are thus open to interpretations. In industry, quality control has mainly been successful when dealing with standard and routine processes. Non-routine processes are much more challenging. It is, however, possible to make them more efficient through partial standardisation and the introduction of new routines in certain parts of the process. The standardisation of the entire chain is in these cases usually impossible.

A significant proportion of health care processes are non-routine. The quality of the "raw material", i.e., the patients, varies tremendously. The care process is almost always moulded individually as the process proceeds. There is no way to create a set of qualitative aims that would satisfy all cases. Other types of definitions, such as a "satisfied patient", have to be taken into use. Classification of "events" and "episodes" is used to make processes more efficient. However, in the case of patients, undue classification can have detrimental effects. There are nevertheless "events" or "episodes" (such as sample taking and writing of referrals) that can be made more efficient without increasing the risks (Niemi, Kjisik et al., 2004).

The two main functions of a health care facility, "cure" and "care", are not, in any case, easy bedfellows. The difference in the processes involved, as well as the role of the patient, are very different in acute ("cure") and chronic ("care") situations. In "cure", as a result of a process there is a clear "product", whereas in "care" the process itself becomes the "product". This has implications for the design of the facilities which are often not sufficiently understood. It should be noted here that the argumentations based on industrial models to improve efficiency are obviously more applicable to the "cure" situation.

Emergency departments have, in recent decades, proved to be particularly troublesome as far as efficiency, functionality, logistics and staff and patient satisfaction are concerned. The character of the department is such that it is often located somewhere out of the way, in the "backyard". It is, nevertheless, often the real hot-spot of the hospital. Trying to keep seriously injured patients away from those who probably should not be in the emergency department at all, getting the ER to work logistically with the other "core" hospital elements (imaging, operations, intensive care) and finding an appropriate triage and channelling system, are all factors that have contributed to a complex equation and led to cluttered, over-complicated and maze-like plans. This view is also supported by a study of six emergency departments in Finnish central hospitals, which shows that they score much lower in staff satisfaction than the operating and radiology departments in the same hospitals (Teikari, 1995).

These difficulties are probably the reason why emergency departments provide fruitful ground for process analysis related research. This research has largely consisted of case studies. Because of the differences in the processes, not all methods that are found to be conducive to improved efficiency in one place can necessarily be applied to another. Plenty of useful material can be gained relating to

aspects such as optimisation of resources, elimination of repetition, clarification of tasks, prioritisation in the analysis of samples, and improvement in the transparency of the processes. Typical tools for evaluating efficiency have been the measurement of waiting times and the duration of the different care episodes (Matthes et al., 2006). There seems to be a general belief among people in the field that uncontrollable inconsistencies dominate and chaos reigns. However, with thorough analysis, consistencies in the processes can be identified. These will assist in the design and control of the various systems and also constitute a useful tool for the refurbishment of existing departments and the design of new ones.

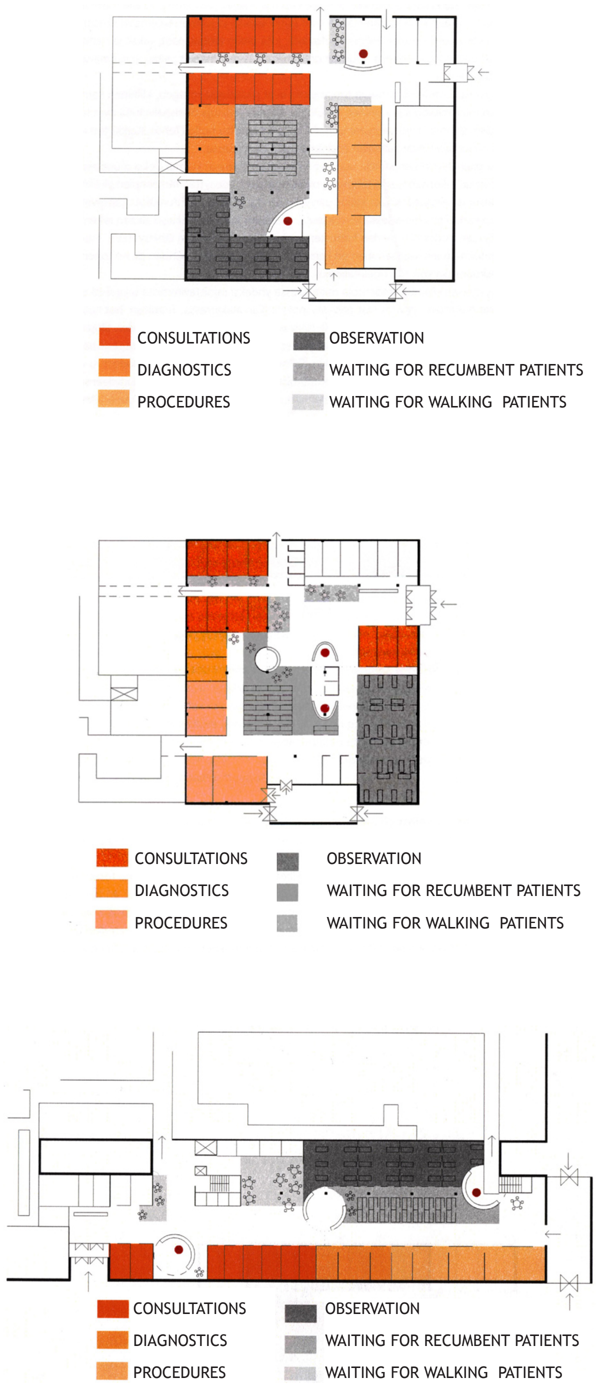
A case study was performed in a Central Hospital in Finland in order to relocate an emergency department. Within the existing 1970s building three alternative locations were studied. Through process analysis of the existing emergency department at the same hospital, four major problems could be identified, none of which is unique to this particular facility:

- The waiting areas were dimensioned for an equal number of sitting and recumbent patients even if the latter were now in the great majority.
- The recumbent patients were scattered around the department, which made observation difficult.
- The physical connections between the most important functions were unsatisfactory.
- While there was congestion in some places, many rooms were drastically underused.

The proposed remedy was based on simplifying the schedule of accommodation through logical functional zoning based on four primary processes: consultation, diagnostics, procedures and observation. Waiting was treated as part of the primary processes, with walking and recumbent patients seen as separate entities (Niemi, Kjisik et al. 2004). The aim was to group the primary processes in a logical way, with a particular emphasis on combining the areas of the recumbent patients and those under observation in such a way that the borderline between them was flexible and could be moved according to need. They should all be controllable from one single common nursing area, which in the best case could also function as the registration and triage point, thus making savings in the work force. An important aim was to minimise the number of solid, full-height walls and traditional doors, thus conforming to current medical and architectural trends, and eliminate under-utilisation through the introduction of multi-purpose spaces for diagnostics and procedures. The schematic floor plans (Fig. 137) show that open, flexible and adaptable solutions could be achieved from all three, rather different, starting points.

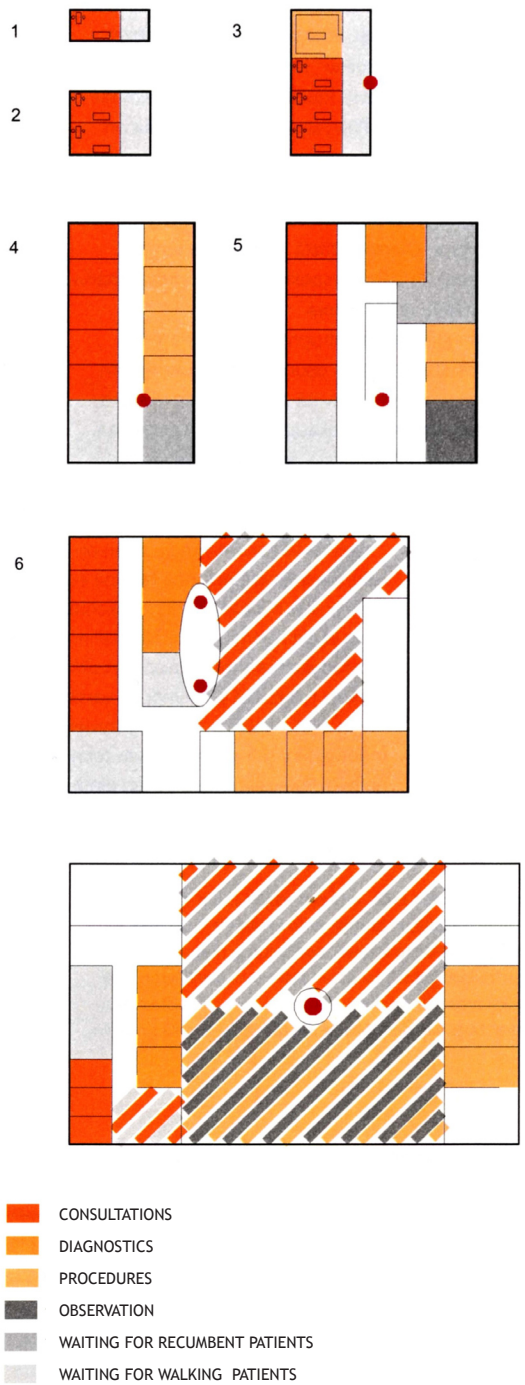
These examples support the belief that processes can adapt to different shapes and building spans if the available areas, on the whole, are dimensioned relatively generously. This does not necessarily mean that more space will be needed. The continuing increase in required floor area can be controlled through designing the processes in such a way that a larger number of the spatial units can be made increasingly multi-purpose. This will in itself increase the future-proofing qualities of the premises, as will the virtual eradication of traditional corridor space.

Fig. 137



As a result of the work done at Hämeenlinna and several visits to new emergency departments in hospitals in various European cities (Barcelona, Haarlem, Helsinki, Lausanne, Montpellier, Stockholm etc.), as well as to units with a clearly smaller population base, it became clear to the research group that the character of an emergency department starts to change radically when the catchment area increases from 100 000 to 200 000 inhabitants. The smaller the unit is, the more conventional and traditional is the optimal plan. The basic module, a doctor's consultation room, dominates the plan, which is often based on a central corridor space. When the population base approaches 100 000, the need for auxiliary diagnostic and procedure rooms starts to exceed that of the basic modules, and by the time a population base of 200 000 is reached, the main pressure on the plan comes from different levels of waiting, monitoring and observation. Finally, in an emergency department for a population base of 400 000 or more inhabitants, the floor area will be between 2 000 and 3 500 square metres. Of this, the majority of the floor area consists of a multi-purpose, largely open space where many of the primary processes (recumbent patients' waiting, consultation, diagnostics, procedures and observation) in fact take place (Fig. 138). These ideas are supported by prevalent and well-justified patient-centred approaches in which the doctor goes to the patient, who is no longer continually moved from place to place. Development of diagnostic equipment, which will become smaller and more agile in the coming years, will further facilitate this. The approach leads to plans which are in line with many of the other future-proofing ideas expressed in this study, as well as with general current architectural trends. The results of these studies indicate that the

Fig. 138



recognition of process-based procedures as a valuable tool will assist in raising the spatial and architectural quality of, not only emergency departments, but also other sections of acute care hospitals. It is, however, only a tool, one which is simply more sophisticated than the "clusters", "chains" or other past diagrammatical representations of functions in a hospital. Process-based design without architectural creativity and skill will solve nothing.

Life-cycle costing

In today's quest to add value at all costs, are we not losing sight of the most important aspect of all – the architecture itself? Austin Williams, 2004

It has taken a long time for decision-makers in both public and private sectors to start applying less short-sighted policies vis-à-vis investment costs in construction projects. During the last few years, organisations such as the European Health Property Network and the Netherlands Board for Healthcare Institutions have developed various tools to facilitate the understanding of the concepts involved and methodologies to be applied.

"Fit for purpose" is a term that is now widely used. A building ceases to be "fit for purpose" when it has come to end of its "functional" life. This usually implies economical obsolescence, at least in terms of the original use of the building. The end of the "functional" life should not be confused with the end of the "physical" life, which implies a level of dereliction that is rarely seen in a health care building. The "economic" life of a building, i.e., the lifespan value of a capital asset, ends when continued

occupation is no longer cost effective and cannot make a positive and sustainable contribution to the delivery of the service (Dowdeswell & Erskine, 2006). Thus a health care building can basically function in some other role after both its "functional" and "economic" lives in the service of health care have ended. It is easier to base the extension of the "physical" life of an "ageing" building on the terms provided by the building itself, rather than the "functional" and "economic" demands forced upon it by its original functions.

There are many ways to define life expectancies in any building type. In health care buildings it is particularly essential that the client organisation carefully defines its aims. The EuHPN has developed LCC methodologies that the organisation can use after it has determined whether, for example, it wants a building with the lowest cost structure, the lowest operating and maintenance costs or the longest life span, or one where the greatest return on investment can be achieved (Dowdeswell, 2006).

From an architect's point of view, most of this should be seen as good news. There is nothing in these principles that is in any way contradictory in terms of attaining improved architectural quality. On the contrary, LCC should be seen as an "architecture friendly" development. After all, it underlines the lack of significance of initial construction costs (and especially the design costs) in the whole life span of a building. This could eventually lead to a complete overhaul of the priorities that guide present fee structures and design timetables.

Steering mechanisms

Hospitals are the buildings that architecture forgot. They are quick-turnaround human repair shops, driven by targets set by politicians and accountants.
Hugh Pearman, 2005

The role of government agencies in the design of hospitals gradually started to change during the early 1990s with the result that individual hospitals now have much more say about the financing, planning and design of their own premises. The National Board of Health in Finland, the provider of norms and "rubber stamper" of architectural plans, was replaced in 1991 by STAKES (National Research and Development Centre for Welfare and Health), the role of which is clearly different from that of its predecessor. Also in Sweden the research activities of SPRI (Swedish Institute for Health Services Development) that had focused on facilities and had an important role in the setting of norms and guidelines for administrators and designers in Sweden, were discontinued as early as 1989. Similar developments took place all over Western Europe.

The Dutch Bouwcollege (Netherlands Board for Hospital Facilities) still provides "certificates of occupancy" and thus has the power to approve or disapprove of architectural plans presented to them. However, this activity will also cease within the next couple of years and the organisation will concentrate on research-related activities in which it has also always been active.

The DIN-norms are still very much in evidence in German-speaking countries. Particularly the DIN 13080 subdivision of the hospital into functional

areas and posts of special responsibility (Meuser & Schirmer, 2006) has limited the development of flexibility and future-proofing in hospitals. These particular steering mechanisms have thus contributed to functional and organisational conservatism in the new hospitals. Nevertheless, some very good architects in Austria, such as Klaus Kada, Günther Domenig and Markus Pernthaler, as well as in Germany (Nickl & Partner, Heinle & Wischer, Günther Behnisch and others), have recently produced hospitals of a high architectural quality.

The upheavals in the political climate of Europe in the early 1990s, from the breakdown of the Soviet Union to the less dramatic reforms in the West, which were largely propelled by severe economic recession, resulted in major changes in the role of the State in controlling the building of public facilities, including those for health. In the Baltic countries, for instance, hospitals had for decades been planned using the strict Soviet "SNIP" norms, so the sudden lack of advice and control from above became a major problem. There is a serious shortage of people who are able to produce appropriate medical programmes and translate them into space requirements. The Ministries give the hospitals a total *carte blanche* and the need for consultative help from abroad continues to be acute.

Work performed by the Sotera Research Institute for Health Care Facilities at Helsinki University of Technology in cooperation with Ministries of Health and many hospitals in the Baltic countries has shown that the smoothness of the design process in the refurbishment and augmentation of their existing run-down hospital stock is suffering as a result of these problems. Ironically, the situation in England is similar but arises from a completely opposing socio-political standpoint. The twenty-year funding drought, started by Margaret Thatcher's neo-liberal policies, meant that little was built and the hospital stock underwent a dramatic deterioration. The 100 hospitals scheme, now in progress, is thus also run by, as Gusack puts it, "first-time buyers". Referring to the fact that Roger Ulrich had been appointed advisor to the Department of Health he states, "having realised that it no longer had a hospital design experience base, the Department of Health has decided that its contribution will now be evidence-based" (Gusack, 2006a, p.3).

The need for clearer guidance and coherence in briefing is also felt in other countries and regions. In Northern Ireland, which is largely able to pursue its own policies concerning health care facilities, methodologies have been created to ensure improved quality and equality of access. Generic overall briefing documentation has been produced for each facility type. There is an emphasis on greater standardisation of elements. A standardised consulting suite which meets the needs of doctors, whether in a central hospital, community facility or a local surgery, has been developed. Also, about 45 other standard room types and room clusters have been produced to simplify the briefing, design and procurement processes. Room sizes and layouts, as well as equipment contents are included, and modular sizing for many of these rooms reinforces the standardisation aims. Apart from facilitating the design and decision-making processes, these developments will improve flexibility and enable change of use, even taking possible non-health uses into account. They will also have an effect on construction costs and encourage off-site prefabrication for repeating elements (Cole,

2006). Considerable and worthwhile research and development work is also performed by the manufacturers of hospital equipment in the form of standardised layouts for typical core hospital "hot floor" elements such as CT and MRI rooms, as well as operating theatres.

Bouwcollege produced new performance criteria for general hospitals in 2006. The booklet is divided into four sections: (A) general performance criteria, (B) patient-related facilities (patient present), (C) patient-related facilities (patient not-present) and (D) general & technical facilities. Section (B) takes up 90% of the book, the "patient present" situation obviously being seen as a "core" element of both cure and care and the only part of significant relevance to improved hospital environments. Minimum room sizes for a multitude of uses as well as recommended widths of corridors and doorways are given, which illustrates an inherent problem with "norms". What if a corridor is not a corridor but an inherent part of a given process, or even a multifunctional communal living space, as has been promoted elsewhere in this study? It is difficult to incorporate innovative thinking in "norms".

The performance criteria (section A) include net-gross area calculations. The 160% (denotated as ratio 1.6 in certain countries) recommended gross area takes account of "departmental traffic areas" only and not the main thoroughfares of the hospital. This can be interpreted as if "main streets" and "grand piazzas" are not part of the equation, only "side streets" and "squares" of a less public character. This is an obvious improvement to the straightjackets of the past but still lacks the approach that all traffic areas are part of the process and basically "useful".

It is perhaps in these semi-private and semi-public parts of a hospital that new "norms" would be required. The bed is no longer the focus of all activities in a hospital, as it was when the majority of the norms that steered the design process in the past were formulated. Now we may need forms that, for example, define minimum floor areas for activities that are dedicated to the quest of keeping the patients out of their beds.

There are also other, more general, regulations that greatly influence the planning and running of hospitals everywhere. The regulations concerning accessibility, hygiene, work environments and fire and safety of public buildings, are becoming increasingly pan-European. Do we want the design process of our hospitals to be controlled by a growing number of specific rules and regulations, which in an integrating Europe will unavoidably lead to a decrease in diversity?

The centrally-controlled norm-based design principles reached their height in Europe in the 1980s. The dynamism that we are experiencing today, the constant flux caused by new ideas and scientific developments that inspire innovative thinking among all those concerned, should not be impeded by a return to the situation of those years. Research that results in guidelines and recommendations will be ongoing and hopefully even accelerate, but the outcomes should be used as inspirational tools that assist the designers and the decision-makers in their most important mission: providing better buildings for cure and care.

Chapter 9. Other essential remedies

Raising the status of hospital design

The rules of hospital design left less freedom, and it became regarded as a building type that was worthy and dull, more or less lost to architecture.
Peter Blundell-Jones, 2002

Aalto, Corbusier and Lubetkin placed health care firmly at the heart of the Modernist agenda. If they were practicing in Britain today would they simply walk away? Isabel Allen, 2003

Architecture is, by its nature, a multidisciplinary endeavour. This is the case in any building design task, however humble. In certain building types, like hospitals, the puzzle that an architect has to decipher is somewhat more complicated than in most other building types. The portion of the creative ingredient that encompasses artistic, aesthetic and visual matters is nonetheless so overriding that architecture can never be seen as pure science, something that can be evaluated in absolute terms.

Thus there is no empirical way of proving that one piece of architecture is better than another. The evidence has to come from the professionals: the critics and the theorists who have the educational and practical background required to evaluate the aesthetic as well as the functional and technical quality of buildings. These are people who sit on architectural juries and who write about new buildings in the architectural magazines. Through modern history, architects have always been primarily evaluated by their peers. The evidence base that has been used to rank architects is founded on the number of successes in major design competitions and the extent to which their buildings have been published in respected professional journals. It is unfortunate that many architects currently working on major health care projects around the world do not figure in this evidence base.

In order for hospital buildings to be sustainable symbols of civilised health care, they have to be manifestations of the best architecture that a particular era can offer. Our aim should be a significant increase in buildings of the highest architectural quality that serve health care in the coming decades. Instead, we continue producing edifices that both the professional critics and the general public look upon as necessary evils, buildings that, apart from being functionally deficient and short-lived, are not even intended to contain any meaningful messages or poetic attributes. Too little has been learnt from past mistakes and too little gained from successes.

Cor Wagenaar argues that the myth of the complexity of hospital buildings has nothing to do with its "core business" but rather with the fact that hospitals are vast, thoroughly institutionalised and economically powerful medical-technological complexes run by politicians and managers with no experience of the "core business", not to mention master planning or architecture (Wagenaar, 2006). Even if one were to accept the complexity of the "core business" per se, pure puzzle-solving should never replace architectural creativity. Environments that respect the emotional needs of sick and vulnerable people cannot be created by playing board games.

If the quality of our future hospital buildings is to be significantly improved and the challenges involved successfully tackled, the status of health

care design commissions among architects has to improve drastically. The best medicine for this would be a permanent flow of high quality contemporary precedents appearing in the professional journals. Two articles that appeared in a special issue on health care in *Arkkitehti* (Finnish Architectural Review) in 1971 have been quoted earlier in this study. They carry a twofold significance. Firstly, both quotations show that little has changed and secondly, since then, only one special issue (in 1978) on health care has been published by that magazine. Meanwhile, thematic issues on educational buildings, for example, appear almost annually.

This tendency has been universal. Other major architectural journals have also printed relatively little related to the field in the last couple of decades. There have been only around a dozen special health care issues in the world's approximately fifteen leading magazines since the late 1980s (Appendix 3 of this study provides a complete list of special issues and major theme numbers that have appeared between 1976 and 2008). This is a strong indication of the low esteem that hospitals have endured in recent decades. The editors of the journals have not refused to publish hospitals just because they are hospitals, but because the buildings have been judged to lack the architectural quality required for publication.

There has consequently also been a marked lack of books of any substance. With a few inspired exceptions, recent books about hospitals have been decorative picture books more concerned with interior design and cosmetics than any real architectural substance, not to mention the broader urban context of the presented hospitals. This has been a change from earlier (1960s to late 1980s), when the majority of books about hospitals seemed to come in the guise of a design guide. Whether this change promotes the status of hospital design or not is debatable.

The fact that serious critics and analysts have not been interested in the field, whether for the purpose of reviews in magazines or compiling a book of recent good examples, is undoubtedly due to the fact that the field has been void of worthwhile examples. Few recent hospital designs have made a positive contribution to mainstream architecture and it is thus hardly surprising that contemporary architectural criticism seems to ignore the field. Healthcare building design is not perceived as fashionable, either in most practices or in the architecture schools (Francis et al., 1999). Of the three main building types that hold transient populations (BOX 12), it seems that even prisons, and most certainly hotels, have been higher up on a good architect's wish list than hospitals.

Schools of architecture have generally not been active promoters of the appeal of hospital design, although the traditions are old. In 1900 in France, Emile Trélat, who founded the *Ecole Speciale d'Architecture,* created a diploma for an *architecte-salubriste* (freely translated as health architect) which concentrated largely on issues related to hygienic living. This was the first organised effort to make architects involved in a new social model based on social progress and improved health (Cremnitzer, 2005). The experiment played at least an indirect role in the heavy involvement of some of the most talented French architects in the sanatorium designs of the 1920s and 1930s.

Box 12

From an architectural perspective, hospitals, hotels and prisons pose similar problems, and in fact these buildings tend to look somewhat like one another. On the one hand, they all hold a transient population that must, however, be cared for twenty-four hours a day, seven days a week, and, on the other hand, they all accommodate a permanent population that does the care-taking, often for many years at a stretch, in daily eight-hour shifts, according to fixed daily rhythm. Thus hotels, prisons and hospitals must all provide for all the physical needs of their inmates and patients, as they eat, sleep, wash and groom, seek entertainment, and go about their daily routines. Hotels, of course, are the most welcoming of these institutions and prisons the most tenacious, with hospitals falling somewhere in between, since a stay there is not quite voluntary but consensual in most cases. Prisons and hospitals sometimes try to look and operate somewhat like hotels, while hotels for their part naturally seek to avoid any associations with the other two. Abram de Swaan, 2006

Since then health care design has not been very evident on the agenda of any architecture school in Europe. The United States still has some strongholds (Texas A&M University among others) but there is no evidence that architects that qualify from those schools end up designing better hospitals than anyone else. On the contrary, the signs of a renaissance in hospital design that are visible today seem to come from Europe, especially The Netherlands and Spain. The higher quality that seems to have prevailed in these countries at the turn of the millennium is well in line with their contribution to mainstream architecture in general. Also, in neither country is the field particularly strongly dominated by architects who only "do health". In Catalonia, in the late 1980s, some of the best local practices, such as Jaume Bach & Gabriel Mora and Elias Torres Tur & Jose Antonio Martinez Lapena, were given commissions for new health centres, thus paving the way for a tradition based on using the best designers, rather than the best "specialists". The quality practices in Spain have generally also remained fairly small and non-hierarchical "studios", as opposed to the ever growing conglomerates in Great Britain, France and lately also in some of the Nordic countries.

In Europe, some of the schools of architecture hold one-off studios, modules and courses. Chalmers Technical University in Gothenburg has a part-time professorship in health care design, which is sponsored by a number of organisations active in the field. In the UK, MARU has existed since the early 1970s and is now part of the Faculty of Engineering, Science and the Built Environment at London South Bank University. It provides a post-graduate PGDip/MSc course in "Planning Buildings for Health" and continues to produce research that makes valuable contributions to the present discourse.

Essential as it is to make the field attractive to undergraduate architectural students in order to promote the status of the field, the single aspect that contributes to the lack of change is the procurement process. It is this that in many countries

has contributed to the general demise. Hospital commissions are given based on a low price and a past track record in health care design. This leads to continuing stagnation and a lack of new ideas. Current procurement methods have led to only very large organisations having a chance of getting involved. The result is depressing because most of the time good architects are successfully kept out of the picture and the low esteem of the field continues.

Open architectural design competitions have traditionally been an effective way of improving standards, identifying talented new designers and procuring design services from occasionally unpredictable sources. However, there have been relatively few open competitions for health care buildings as compared to those for other public amenities. The argument has been that open competitions are wasteful since previous experience is in any case a prerequisite for producing a valid entry that could be implemented. On the other hand, there have been occasions when the organisers have had the foresight to make lack of experience an issue and insisted that new names would be given a chance. This has been the case in some invitational, limited competitions such as the Robert Debré Children's Hospital in Paris and the first round of the INO Hospital Extension in Berne, both mentioned earlier in this study. The organisers of the latter example went one step further and prevented all practices with any previous health care experience from taking part.

The beginning of the early 2000s has seen many limited competitions in Northern Europe. Some of them have been well publicised and helped to activate the discussion on hospital buildings and new approaches to the design of hospital campuses.

The competition for the new hospital in Trondheim, a project mentioned frequently in this study, was won in 1998 by a group of architects including the Norwegian Niels Torp, the high-profile designer of well known mixed-use, office and commercial developments. The new hospital has brought the pavilion model back into the discourse as well as strengthened the debate about the relationship between the hospital and the city that surrounds it.

The competition for the new Karolinska Solna in Stockholm (2006) was marked by an extensive array of documentation required for the submission in spite of the very open-ended brief. By giving the competitors plenty of freedom in determining the spatial hierarchies and logistical lay-outs, emphasis was rightly placed on flexibility, adaptability, sustainability, and life-cycle thinking. These aspects had to be accounted for in the documentation in some detail, rather than the fixed floor plans that usually make up the bulk of the presentation. The new role of the hospital as a bridging urban element towards the core of the city also played a major part in the evaluation of the entries. The short-listed consortia consisted mainly of commercially successful large Nordic practices with substantial hospital experience, some of them in cooperation with a high-profile "design architect". This seemed to be more or less an afterthought since getting new names involved in the hospital design field does not seem to have been a major aim of this competition. The competent but not very innovative winning entry (by a consortium led by White Architects) owes a fair amount to the Trondheim model, both in terms of townscape and logistical principles.

New contributors were deliberately sought in the competition for ideas for Paul Stradins University Hospital campus in Riga, Latvia, in 2005. The competition was of a workshop format, i.e., teams were invited for a few days to prepare the entries on the spot in Riga. The concrete output of such a procedure is naturally less detailed than that of a competition like Karolinska Solna, where the required deliverables were particularly extensive. Very highly-regarded teams, representing nine different countries, were invited to Riga. Most of them had major hospital references but none could be described as being simply a hospital specialist practice. The winning team, JKMM from Finland, was the only one with no previous health care design experience at all. JKMM (who have a particularly successful recent track record in Finnish competitions) produced a model for the future (Figs. 139 & 140), a solution that could well become a new archetype, and one that has already influenced subsequent competition entries and other projects elsewhere.

The Danish practice C. F. Möller (second prize in Riga) is currently a frequent participant (and winner) in invited health care competitions. In 2006, they beat many familiar Swedish and Danish names to win the commission for a new emergency department and infection ward at Malmö Central University Hospital. The circular ward tower with patients' rooms that are served from the outside gives positive signals of the past. The inventiveness of the plan together with the boldness of the general concept is reminiscent of the Heroic Era (Figs. 141 & 142). During the same year C.F. Möller also won the competition for the National Hospital in Reykjavik, Iceland.

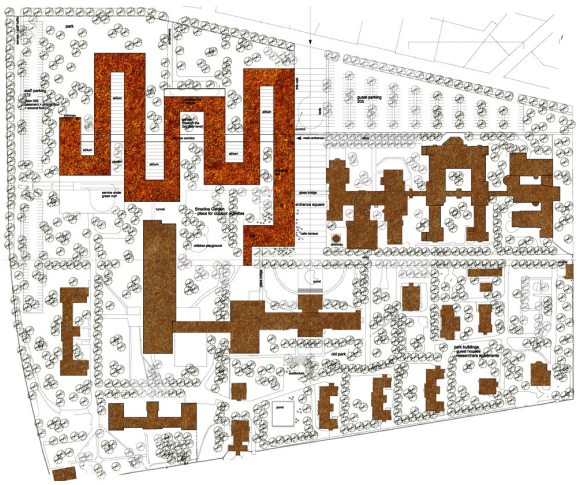


Fig. 139

Fig. 140

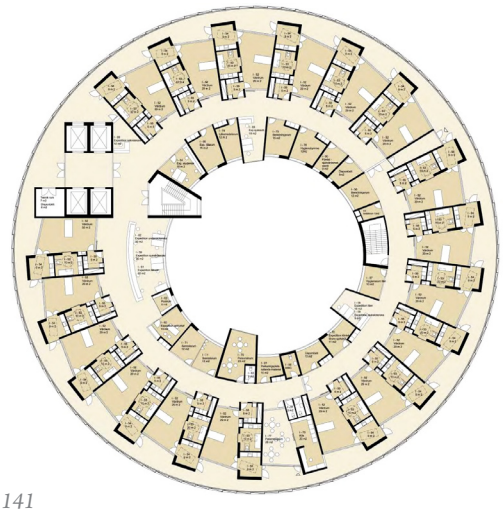


Fig. 141

Fig. 142

Every competition that is organised helps to improve the status of health care architecture, particularly if the results are well disseminated. Competitions in which the participants are given more leeway to take part in the conceptual thinking behind the physical framework are even more valuable. Examples of this approach include Karolinska Solna, Paul Stradins in Riga and especially the open international competitions organised by the Netherlands Board for Healthcare Institutions (see Part 5 – Physical Synthesis).

Finland prides itself in having an exemplary and unequalled track-record in the organisation of open architectural competitions. Nevertheless, in the field of health care, open competitions have, in the last couple of decades, been few and far between. However, some limited competitions have been held in the recent years. The competition for Helsinki University Central Hospital new Entrance Building (won by Lahdelma and Mahlamäki) (Fig. 143), was seen as a "non-clinical" entity, thus justifying the invitation of a number of the best and most successful non-specialist practices in the country. The same had been the case in the 1990s with the Hospital Library (won by Olli-Pekka Jokela) and the Biomedicum Research Centre (won by Gullichsen & Vormala).

However, when the need for procurement of design services for buildings with a stronger clinical content has arisen, no competition has been held, but the usual specialists have simply been called in to give their (largely fee-based) tenders. As an exception to this, Tampere University Hospital organised a competition for a sizable extension in 2003. The competing teams were contractor-run and the designers involved were all hospital specialists,

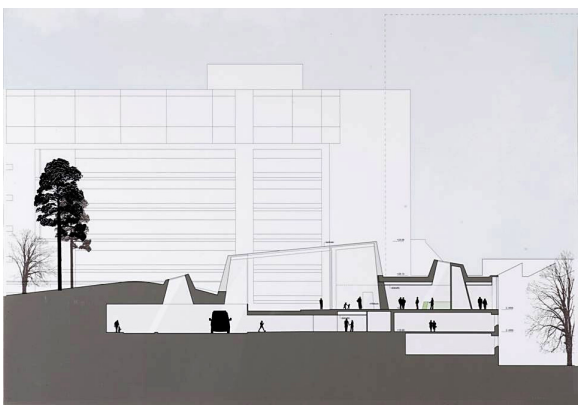


Fig. 143

or at least practices with a considerable amount of experience in the field. The last entirely open competition for a new health care facility to be held in Finland was the Hausjärvi Health Centre competition, held in 1987, and won by 8 Studio, an office whose partners included the aforementioned Ilmari Lahdelma and Rainer Mahlamäki.

Open competitions were held, also in Finland, when the bulk of the present central hospital building stock came to being in the 1960s and 70s. Even if most of the Finnish post-war general hospitals were realised as a result of competitions, the material from these competitions was never sufficiently disseminated to be studied and learnt from in subsequent projects (Kekäläinen, 1982). This still seems to the case – a winner is found and only the jury ever analyses all the entries, many of which could provide valuable lessons to others. A case in point is the competition at Tampere, the material of which was never made public, probably not for any particular reason, but simply because it was presumed that only a handful of people would be interested.

The fact that so few of these competitions are open to all architects remains a major problem. It is discouraging for the majority of the architectural profession to see the same offices being invited, time after time, to the relatively few limited competitions that are held. The aim should be to dramatically increase the number of open international competitions in the design of health care facilities. In fact, every single commission for architectural services in the field should be based on an open architectural competition. As it is, the two-stage open international architectural competition for a new 40 000m^2 rehabilitation hospital in Espoo, that was launched in the beginning of 2008, is at this moment an exception rather than the rule. This first open hospital design competition in Finland since the hospital building boom of the 1970s hopefully signifies the advent of better days.

However, the situation continues to be gloomy in most other parts of the world. In the United States, health care clients have traditionally been, as Verderber says "loath to use the design competition as a means to award commissions for their buildings" and calls design competitions "knowledge-generating vehicles that are being underutilised at the moment" (Verderber, 2006, p. 86).

The remedy for the improvement of the status of hospital design is simple. We need better buildings. Better buildings will get published in the journals and gradually better books will also start appearing. In order to get better buildings we need more intelligent methods for the procurement of design services as well as adequate fees. The lowest fee should never be a decisive procurement criterion. Timetables and fee structures should allow for innovation, not just repetition of what has been done before. More time and consequently more money should be given for the design process. The importance of previous references in the field should be played down since health buildings are clearly becoming more generic in character and since the present system makes it very difficult for the best architects to enter the field. The same design team should be involved in the design process from the beginning to the end. The present trend to chop up commissions and appoint different architects for different phases of the design process, presumably in order to save money and keep stricter control on the process, is shortsighted and illogical.

Only if these remedies start to materialise will an increased interest among the talented young members of the architectural profession start to surface. A demand for studio courses specialising in health care will spread in the architecture schools. Hospital design will cease to be the domain of enormous faceless conglomerates and their technocratic specialists.

It is of course essential that the client body is responsive to these ambitions, and there are signs that this may increasingly be the case. Good architecture is genuinely beginning to be seen as an asset and something worth promoting as a catalyst for the growing respect for the institutions involved. An example of this is the company Locum AB that manages the physical facilities of the hospital property network in Stockholm. They have formulated an architectural policy which aims at a higher architectural quality in all the health care building projects that they undertake (BOX 13). They have also produced a set of rules for Karolinska Huddinge Hospital, one of the most important Scandinavian products of the Heroic Era, which are based on preserving its inherent strengths and architectural qualities.

As an active designer and researcher in the field of health care architecture, it is encouraging to be surrounded by care professionals and administrators who are enthusiastic, knowledgeable and open to new ideas. It seems that the number of these people is on the increase everywhere. They follow the relevant international discourse, they take part in conferences and seminars, visit projects in progress as well as new realisations, and are much more aware of the need for better architecture and design than their predecessors.

Box 13

LOCUM's ARCHITECTURAL POLICY

1. **Locum will work towards good architecture, both through realisations and administration**
2. **Architectural aims shall be formulated at the outset of each project and these shall remain as a basis for the decision making**
3. **Architectural quality shall be assured at each stage of the project**
4. **Locum will pursue the highest procurement competence in connection with architectural questions**
5. **Projects and real estate decisions shall be evaluated from an architectural point of view**

Locum AB, 2004

The case against specialisation

There is also a myth that healthcare architecture is so highly specialised that only the initiated can enter. You may not need experience but you do need staying power. Richard Burton, 2004

Universal design issues – circulation, legibility, space, light – are still of paramount importance. Technological and environmental requirements are simply components in the age-old architectural discipline of marrying function to form.
Isabel Allen, 2003

The "Best Buy Hospital" approach, developed by the British National Health Service in 1967, recognised that there is a "perceived need to simplify the building of hospitals, breaking the monopoly of specialised hospital design practices and builders, so that any reputable architect, engineer or contractor could be employed" (Francis et al., 1999). This was before the Heroic Era had set in, and shows that specialisation has been seen as a potential problem for quite some time. In 1991, the American Institute of Architects published in its journal a round-table discussion about healthcare design which also touched upon the subject of specialisation (Solomon, 1991, pp. 75-81). BOX 14 presents some examples of dialogue from this debate, which show that the representative of the world famous, non-specialist office Pei Cobb Freed gives very different answers from the specialists, who are here on the defensive.

The architectural profession itself is not completely blameless for the situation. It has been argued that the emphasis on process, as opposed to product, makes the sector less attractive to "design architects". However, the fact that the design process is process-based does not in any way detract from the quality of the product, but is simply another way to achieve the goal. The worrying aspect is the claim that when the process dominates the product, clients also become less interested in the design (Allen, 2003). Not only worrying but absurd is the fact that a concept such as "design architect" has come into use in the first place. Are "award winners" now clearly a different category of architects from "hospital specialists"? *Disegno* – the Italian word that covers both the act of drawing and the overall conception of a larger design – has for centuries been seen as indispensable to the proper making of art (Schama, 2006). The same obviously applies to the proper making of architecture. All architects who practice their trade in the traditional way, at the drawing board or in front of a computer, should be "design architects", and no one else should be given a serious design task, particularly one involving a hospital.

The problem is obviously not only about specialisation. More disturbing is the fact that the "specialised" offices today increasingly form part of large, often multi-national, design conglomerates where architectural craftsmanship and ambition have given way to the "bottom line", the interests of the shareholders. This development, if uncritical client bodies let it continue, will make it even more difficult for "design architects" to break the stronghold of the "specialists".

Nevertheless, demystification is undoubtedly called for. Hospitals are logistically as difficult as any other building type, but not necessarily decisively more so. We should not accept the argument that hospitals cannot be part of the general architectural discourse.

Box 14

ARCHITECTURE (A.I.A. / THE AMERICAN INSTITUTE OF ARCHITECTS) July 1991 Round-table discussion between James Falick/Falick&Klein; James Diaz/Kaplan,McLaughlin, Diaz; Jerry L.Quebe/Perkins&Will; Kenneth E.Taylor/ Hoskins Scott Taylor; Chien Chung Pei/ Pei Cobb Freed; I.Lewis Nix/ Nix Mann (Their commission focus varied between 100% healthcare buildings with Falick&Klein and 10% for Pei Cobb Freed)

Q: Is it realistic for a general practice architecture firm to consider entering today's health care market for the first time?

A: DIAZ No. Not without a great investment or the acquisition of another firm or a team of persons bringing a proven record.

A: PEI. It's not only realistic but imperative. But we also have to convince our clients to take the chance.

Q: How do you keep up with changing medical technologies and practices? How do they influence design?

A: DIAZ. We keep up by sharing experiences within our office and with others by reading, attending seminars and trade shows, and learning from manufacturers.

A: PEI. We try to minimise trends and, instead, emphasise the more fundamental architectural concerns such as context, clarity of organisation, economy of means, and quality of space. I think it is a mistake to put too much emphasis on medical technology and practices to generate or justify design decisions.

Q: What are some commonly held misconceptions of healthcare design?

A: TAYLOR. Some clients mistakenly believe that any architect can design complex healthcare facilities without an ongoing investment of time and energy into understanding this most complicated building type.

A: PEI. The single largest misconception is that medical architecture is for specialists only. This is a great disservice to the client who deserves the care and attention that design architects are known for.

N.B. Solomon (Ed.), 1991

They used to be part of it during the Renaissance, the age of the sanatorium and the Heroic Era, and they should be part of it again. Hospitals have a direct impact on everyone, and to design a good one should be one of the most gratifying tasks in architecture. Social and cultural values – essential ingredients that are in a great flux in today's societies – have obviously not attracted sufficient attention. Too much emphasis has been put on finding the technically, functionally, logistically and ergonomically tailor-made and optimal solutions for a particular place at a particular time for very particular people. This has not been seen as very inspiring by the bulk of good designers. This starting point has also turned out to be short-lived, inflexible and far from future-proof. It is time to make a radical paradigm shift based on more emphasis being simply put on providing good architecture. It is time to resolve the tension that exists between the "hospital as one of the most interesting of all building types and the hospital as a dramatic failure and an architectural graveyard" (Wagenaar, 2005, p. 11).

When analysing a hospital complex, one realises that only a part of it is actually "hospital" while the rest of it is just "building". Teikari made calculations based on Finnish material collected in 1991, and he established that 25% of a modern large general hospital floor area was dedicated to diagnosis and treatment. This is the part that could be described as a "hospital building". The rest, wards (30%), out-patients (15%), services (20%) and administration (10%) can be more or less classified as "buildings" (Teikari, 1995). The corresponding average European breakdown 15 years later gives the "hot floor" 31%, wards ("hotel") 32%, offices (administration and out-patients clinics) 23%, and various service functions 14% (Dowdeswell et al., 2006). The proportional share of "hot" activities is on the rise, whereas the predicted reduction of the wards is, according to these figures, not yet apparent. These figures present another strong case against excessive specialisation.

Giancarlo De Carlo described the main preoccupation of Team 10 as "the refusal of specialisations in favour of space reserved for human life" (Avermaete, 2005, p. 307). The most innovative and sustainable developments in hospital design have gone hand in hand with positive and lasting developments in mainstream architecture. Architects have responded to functional, technological, logistical and administrative changes, just as they have with any other building type, but done it by using their own tools and strategies. Hospitals, feared and respected public institutions with a constant need for humanisation, have attracted innovative minds when given the chance. The problem is that, since the sanatorium period, this has only happened intermittently. To paraphrase the admirable theme of the 2000 Venice Architecture Biennale "less aesthetics, more ethics", we now call for "less mystification, more exposure", and vehemently, "less specialist, more generalist".

Rays of hope

Within a few years, hospital design will be on every good architect's wish list. Luub Wessels, 2004

There are many noteworthy recent hospital buildings that have fallen outside the scope of this study. In most cases this has been due to the fact that, in spite of their undisputed architectural quality, they do not present any particular functional and organisational innovations, at least in relation to the main themes of this study. The recent architectural competitions, reviewed in the previous section, provide their fair share of "rays of hope" for the future. So do some of the contemporary hospital buildings that have been referred to earlier in the text. They include St Olavs Hospital in Trondheim (Nils Torp / Medplan et al.), Rikshospitalet in Oslo (Medplan / Arvid Ottar et al.), Orbis Medical Park in Sittard (Bonnema architecten), the Inselspital INO Hospital in Berne (Kamm & Kundig, Itten & Brechbuehl et al.) and the extension to Sant Pau Hospital in Barcelona (Bonell & Gil). These are all important buildings or building complexes that, apart from displaying a good level of architectural quality, also present certain valuable new approaches related to the themes discussed in this work. It is safe to say that all these hospitals are providing models and reference points for hospital administrators, care professionals, and designers, and will continue to do so for the next few years.

A good way to produce a synthesis of the ideas, aims and arguments presented in this study is through contemporary precedents that each, from a certain perspective, illustrate that those ideas and aims can indeed be successfully implemented and the arguments thereby defended and justified. Some of the hospitals taken up in this section have been briefly referred to earlier in this study. All of them are exemplary as far as at least two or three of the main themes of this study are concerned, and can thus act as important sources of inspiration. They have all played a part in shaping the physical synthesis which forms the final part of this study.

The designers of the major new extension of the 1960s **Arras Hospital** in Northern France, Groupe 6 (architects) and Jacobs (project managers), have coined the concept of "debundling". The idea is to divide the hospital into groups of similar functions which share the same structural and mechanical system, thus creating better clarity and functional organisation, which in turn leads to enhanced flexibility and more cost-effective management. Brampton Civic Hospital (2007, part of William Osler Health Centre) designed by Parkin Architects and Adamson Associates in Ontario, Canada, has been quoted as a prototype. However, the Arras project is architecturally more interesting, although the "debundling" principles have become somewhat blurred.

The *plateau technique* (a term used by the French to signify "core hospital" or "hot floor") which one would expect to be "debundled" into its own mass, is at Arras divided into two parts. The emergency department is housed in the "monospace" block and the rest of the "core hospital" elements in the *plateau technique* proper. "Monospace", rather than "debundling", actually becomes the key concept at Arras (Fig. 144). The elegant, large "monospace" mass actually also contains, apart from emergency, the other outpatient clinics and the wards, and all within the same structural frame. The idea is that

when the predicted decrease of bed spaces starts to materialize in earnest, the polyclinics can gradually take over the wards.

The "monospace"-type of super-flexibility is of course not very revolutionary but rather a resurrection of the ideas of Eberhard Zeidler and others during the Heroic Era. This study has tried to encourage learning from the best historical precedents, and at Arras this has been done with considerable skill. The courtyards give the deep framed building sufficient daylight and transparency (Fig. 145), the double façade (outer layer of louvred glass and inner layer of concrete tinted to look like cor-ten, the original architectural choice) gives the mass a welcome lightness and pleasantly contemporary aura.

A very high level of functional, logistical and technical standards as well as remarkable architectural clarity and control can be found in the 350-bed **Mataro Hospital** in Catalonia. On many levels Mataro enjoys a state-of-the-art status, and at the same time resembles many of its Heroic Era precedents. The rationalism, modularity, structural and spatial hierarchy, and generous dimensioning allow for flexibility and easy alterations. In spite of the relatively deep frame, the courtyards and staggered longitudinal section (Fig. 146) provide plenty of daylight that seem to permeate throughout the interiors. The omnipresent views and the abundance of sunshine are of course factors that help to create a therapeutic experience, "factors that the architects Francesc Montaner and Assumpta Teixidor have managed to fully manipulate for the benefit of all users and visitors of the hospital" (Kjisik, 2005, p. 57).

Fig. 144

Fig. 145

At first sight the building looks like a lowly 2-storey structure, but it is on a slope and grows to six storeys further down the hill (Fig. 147). The building is layered in a succession of platforms on six levels with the roofs designed as planted terraces (Fig. 148). This softens the building's profile while respecting the landscape and the topography. The architects have managed to make the topography work in their favour.

The interior is welcoming and relaxing, the different routes being clearly defined and easy to follow considering that the floor area of the building is almost 50 000m^2. Most passageways are placed on the periphery or around lightwells and are thus naturally lit. Colours are used in an imaginative fashion. Marble is used throughout on the floors and natural wood and high quality veneers are other prevalent interior materials, all resulting in more than satisfactory acoustic conditions. The general feeling is simple, functional, elegant and classy (Fig. 149), while lacking any unnecessary, stuck-on luxury (Ihalainen, 2005). After being in use for seven years, everything still appears almost brand new. From this last point of view, the comparison with many of the recent PFI hospitals in England and other new facilities elsewhere is, dramatic.

There are several departments of the hospital where current thinking is expressed in an exemplary way. The emergency room has more than 30 flexible observation "boxes" with sliding glass partitions. The atmosphere is one of calm and control, staff can observe the patients easily, and there is a good balance between openness and privacy. The stress-evoking buzz and clutter, so usual in emergency departments, seems to be missing. Ambulances bring patients into an enclosed, internal space before the doors of the vehicle are opened. This solution has become common in many good new hospitals, but is still rare in many countries, even where the climatic conditions would call for such an arrangement.

The public restaurant, occupying the most public corner of the site, is welcoming, open and light. Administration takes place in open-plan offices. There are two major auditoria as well as numerous smaller seminar and meeting rooms. The architects have created a "five-star" hospital in which aesthetic and functional, and above all human qualities were called for by the Catalan Health Authority. The architecture serves as a medical archetype while offering quality space that facilitates the complex relationship between medical staff and patients (Magrou, 2002).

The **Maternity and Children's Hospital**, part of the Gregorio Maranon teaching hospital campus in central Madrid, was taken into use in 2004. It was designed by José Rafael Moneo (together with José Maria de la Mata), best known for his widely published ecclesiastical buildings, museums and concert halls all over the world. This 7-storey building, which appears much smaller than its actual 46 000m^2 (Fig. 150), is Moneo's first hospital.

Since the early 20th century the campus has developed in a way that is typical of these institutions, through piecemeal additions lacking in coherence and resulting in a haphazard maze of buildings. Moneo's commission also included

Fig. 146

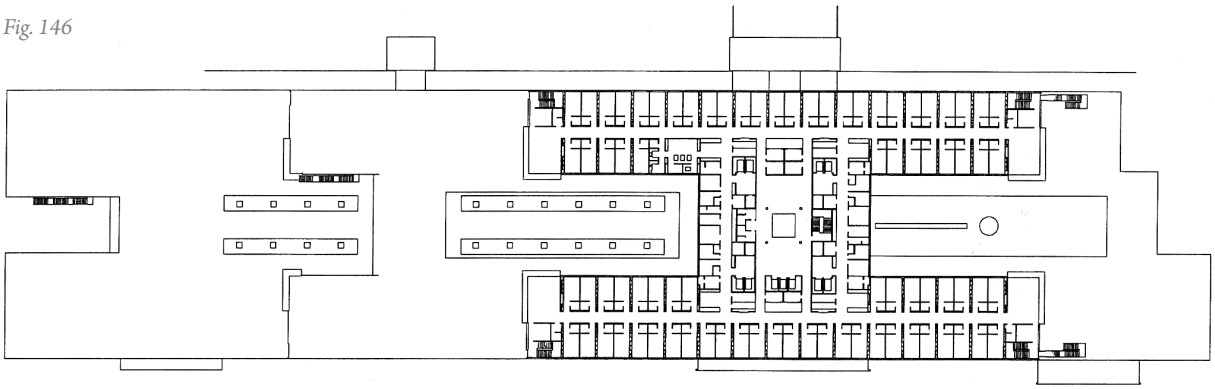


Fig. 147

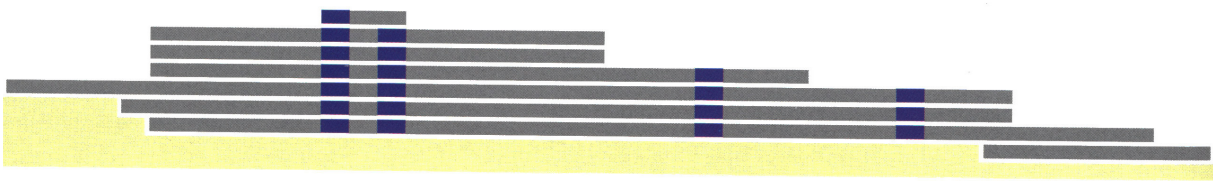


Fig. 148

a new master plan for the campus and thus this contemporary precedent reflects the urban theme that has been in the forefront of the present study. The design of the hospital is based on a logical gridded circulation plan (Fig. 151). Natural light descends from eight courtyards to all the rooms and the corridors. Each of the courtyards gives daylight to corridors on two sides and patient care and staff space on two sides "to achieve 55% (the percentage of space within 5 meters of a perimeter wall) of daylight overall" (Guenther & Vittori, 2008, p. 327). This kind of permeability that draws light into deep plan buildings can be seen in this case, as well as in Mataro, as being embedded in the Iberian tradition, but is also a theme that has been recurrent throughout this text.

Rafael Moneo expressed his aims as follows, "The hospital should be clear, clean, and luminous. It should have the logic one expects from science for those, who, in sickness, seek its aid. It should offer patients and their families every convenience. It

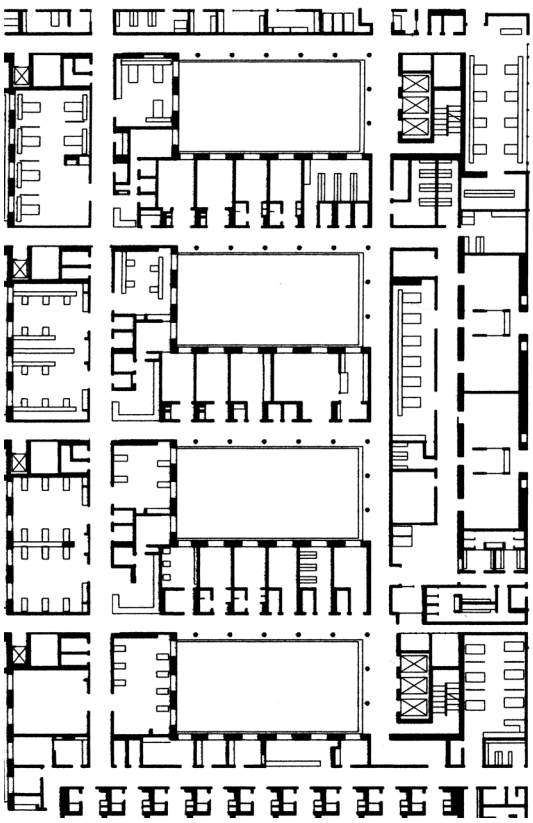
Fig. 149

Fig. 150

should create an atmosphere of calm, tranquillity, and rest. And it should reflect in all its elements the value of hygiene for health" (Cohn, 2004, p. 156). This can be interpreted as a criticism towards some recent hospitals that are cluttered with symbols of domesticity, trying to persuade the patient that he or she is not in hospital all, but in a banal reproduction of an idealised home.

Individual patient rooms open out to the courtyards but instead of facing other patient rooms they the get a view of glazed corridors. This allows them to be in contact with hospital

Fig. 151



life without compromising their privacy. Maple-wood louvred window shutters give the patient the possibility of closing off the view if they wish. All the loose furniture, including the bedside tables and meal trays, is also designed by Moneo's practice. Added on to the highly disciplined and rational general framework there is a sense of enlightenment and good taste where "the luminous interiors with their cool marble floors and white walls embody the stereotypical image of health, hygiene and efficiency, without the intimidating associations" (Bertolucci, 2005, p. 62).

Wilhelmina Children's Hospital at Utrecht University Hospital in the Netherlands was finished in 1999. The designers were EGM Architects (Bas Molenaar), a fairly large Dutch practice that designs a lot of hospitals but also many other commissions. EGM's work is in general characterised by thorough analysis and sober thinking. This leads to dependable quality products which are often timeless but include fashionable features which, when used as imaginatively as at Wilhelmina, inject a sense of fun into the buildings. This is of course especially important in a children's hospital where, as Bas Molenaar says when introducing the building, it is important to give the children a "soft landing" through the public spaces (Fig. 152) into the inner world of the hospital. Molenaar also stresses the importance of avoiding a "Disneyland" approach, as well as a deliberate use of something that people identify as "children's scale". A children's hospital should be as fun to be in as is possible under the circumstances and it should give plenty to look at and touch, but it should not differ from other normal buildings. The aim is not to be "much better than home" (Molenaar, lecture in Utrecht, 8 May 2006). The different elements of the complex, the sweeping curve, the straight main mass and the fingers of the comb (Fig. 153), all have different facade treatments, all part of Molenaar's "collage" approach (Fig. 154). In this case it is particularly justified since it provides additional stimulation for the young patients.

There are indeed many unexpected surprises in this building. The dimensioning is fairly standard and average, but the spatial planning is done so skilfully that the hierarchically important areas have a strong sense of place and the interiors appear spatially generous. The fixed furniture and fittings are all specially designed, both stylish and fun, and of a

Fig. 152

Fig. 153

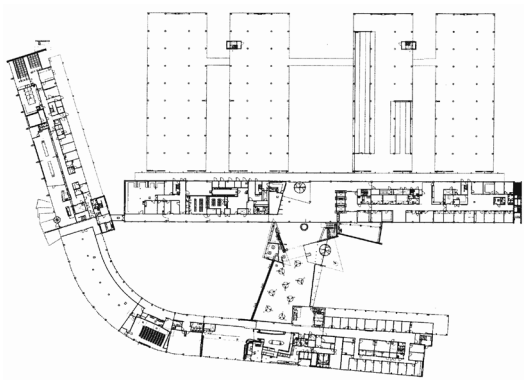


Fig. 154

consistently high quality. The reception desks alone would make an interesting subject of study, exhibition or publication. Each one is distinctive but the palette of colours, shapes and materials make them all part of the same family. Art plays an important role in the public areas. The hospital and the large internal garden are full of fascinating and amusing objects (Fig. 155). They may be geared towards children but not too obviously so, since all of them could easily defend their place in any public space. There is also a roof terrace which is purely for play, where the rule is that no persons in white coats are allowed to enter.

The **Evelina Children's Hospital** in London has been described by architectural critics and other observers as the best new hospital building in England during this century. Designed by Michael Hopkins Architects, the first hospital commission for this highly respected practice, it was based on a competition win in 1999 and financed by the Guy's and St Thomas' charity. Thus, it is not the National Health Service's Private Finance Initiative (PFI) that stands behind the procurement process. The costs per square metre in this 16 500m^2 edifice, are, however, no higher than those of an average new PFI hospital in spite of it being "streets ahead of the bog-standard product" (Pearman, 2005, p. 13).

The "Asclepieion factor" is present here in the way the building opens out towards the adjacent Archbishop's Park, on the far side of which lies Lambeth Palace with its own gardens. The site is nevertheless essentially urban in its approach from Lambeth Road, the main artery of the neighbourhood. The building does immediately reveal its function but is, without doubt, a major public building and a landmark within its immediate milieu (Fig. 156).

The "children's world" was created through formal consultations with the young patients during the design process. Opportunities for socializing were considered important and the atrium has indeed turned out to be a real hub of activity, working well both for organised events and spontaneous togetherness. It is a conservatory-like structure of four storeys (Fig. 157) which acts as a buffer between the park and the wards. The wards also, through the atrium, open out towards the greenery. The basic plan and section forms are such that long, dark corridors have been avoided. The atrium was also planned to work as a solar collector in winter and be naturally ventilated by the stack effect in the summer. There have been some problems with overheating in the atrium, the reasons for which are not yet clear.
The building is "generous in its volumes, and the long-life, loose-fit, low-energy approach to the design is already paying dividends in terms of additional requirements now being absorbed without difficulty" (Finch, 2005, p. 54). The management team has reported improved staff retention and recruitment since the building was taken into use. Of fifty new staff members in housekeeping and patient services, forty-seven remained after one year and applications for posts had increased (Guenther & Vittori, 2008).

The **Hospital of the Cognacq-Jay Foundation** is owned by a French third sector non-profit organisation and originally founded by the family behind the chain of Samaritaine department stores. The old hospital, in the 15th *arrondissement* in south-western Paris needed modernisation and more space and a competition was organised in 1999 between four French practices (Architecture Studio, Chemetov and Huidobro, Jean Nouvel, Dominique Perrault) and one Japanese practice (Toyo Ito).

Fig. 155

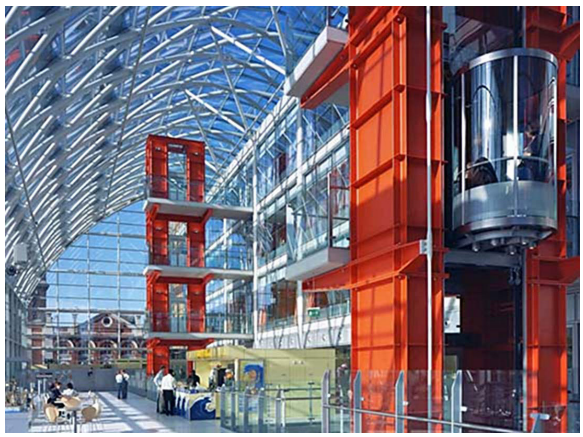


Fig. 156

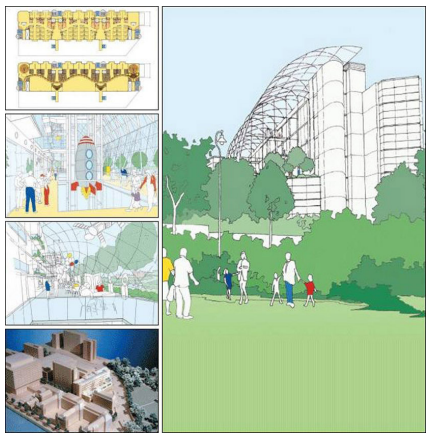


Fig. 157

These offices are all characterised by a lack of experience in health care design while possessing an impressive list of other public buildings in the centres of important cities. The competition was won by Toyo Ito who then, in the midst of designing Japanese headquarters for several major European fashion houses, embarked on designing his first hospital building.

The hospital is not an ordinary acute hospital, but qualifies for inclusion in this study because of its considerable size (35 000m^2). It consists of four separate units: lymphology, infectology, palliative care and orthopaedic rehabilitation. The users praise the architect's precise interpretation of the programme whilst the building is at the same time sensitive and efficient. The site consists of the middle part of a typical Parisian urban residential block consisting of 19th century eclectic buildings (Fig. 158). The old hospital has been pulled down, apart from a small relic which constituted one part of the oldest building. The Cognacq-Jay project is one of urban infill and the chosen solution is a neutral, shimmering and reflecting glass façade on both sides of the block. The buildings have a public character in spite of the fitting scale and the neutrality of the elevational treatment (Fig. 159). All patient rooms open onto the courtyard but there are parts of the main façades from where patients get a direct view onto the streets. The building manages to be architecturally modest without being self-effacing or introvert. It is not a *tour de force* but shows classical serenity with Japanese overtones. "The power lies in the persisting memories that stay in your mind when you leave, not so much the first seductions of the architecture of the exterior" (Nantois, 2007, p. 21).

Fig. 158

The site is open to the city but remains a restful spot. The garden, overlooked by all rooms, is also a public passageway for any passers-by (Fig.160). On a small scale, the beautifully landscaped internal gardens, the proximity of the bustle of the city and the "normality" of it all creates Asclepieion-type features. The light-sensitive glass, with a silk-screen printed pattern that covers all the facades, adapts to the time of day, the intensity of the sunlight and protects the patients' privacy. At the same time it creates a subtle dialogue with the garden and its water features.

The new hospital in Haarlem, The Netherlands, Kennemer Gasthuis Noord is without doubt a "feel good" building, sunny and instantly likeable. A few months after opening in 2006, a post-occupational evaluation in the form of a spontaneous "experts' walkthrough", including on the spot interviews with staff members, indicated that the building has been extremely well received. KGN is a new hospital on a virgin site, but administratively it

forms part of **Kennemer Hospital**, which is a fine 1970s block situated about 15km to the south of the new site. This old hospital has also recently been refurbished by the same architects (EGM / Victor de Leeuw) in a manner that is exemplary for the modernisation of hospitals of that period, a task that countless European hospital administrators are currently facing.

Fig. 160

Fig. 159

Victor de Leeuw (whose first hospital building this is) presents sketches (Fig. 161) that show the simple idea behind the approach to the design. The first sketch represents a typical traditional hospital plan with different wings protruding in different directions. In the second one the footprint of the hospital has been contained within a rectangle and turned into a "negative", void becoming solid and vice versa. This principle is inspired by the Greek town planning method of growth by accretion (Bacon, 1978), rather than an uncontrolled growth further and further into the periphery. Here it has led to a cube-like structure with a central hall (Fig. 162) and internal courtyards breaking up the interior in such a way that every single floor plan is different. Internal and external terraces, bridges linking the different sides of the central hall with its glazed roof, the central open staircase and the fair-faced concrete lift shaft, all contribute to an interior that lacks any clinical signs of hospitals and other institutions but is instead full of warmth, playfulness and spatial interest (Fig. 163). The central hall also lacks the image of impersonal corporate headquarters or luxury hotels that seems to be a common feature of Anglo-Saxon and other hospitals today.

The central hall and the planted courtyards (Fig. 164) also contribute to excellent wayfinding. There is hardly any need for signage and the staff claim that a visitor going anywhere in the building never needs to make more than one 90 degree turn before finding someone behind an open desk to ask for help. The external appearance of the building is many ways unusual. The scale of the large boxlike structure is confusing because of the two horizontal bands of windows per floor

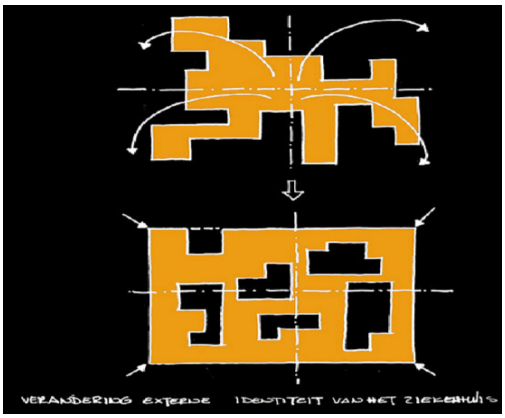


Fig. 161

Fig. 162

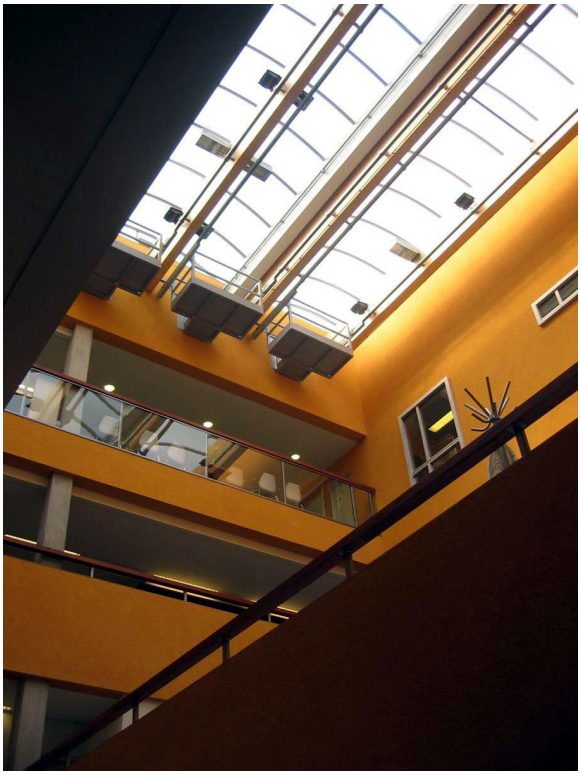


Fig. 163

Fig. 164

(Fig. 165). The actual windows are small (with thick protruding plastic external frames) and "lowlying". The other band is a translucent clerestory window which adds a pleasant quality of light to the interiors. In spite of these visual tricks, or because of them, the building looks smaller than it actually is. KGN is above all an exceptionally successful exercise in spatial manipulation. The site is distinctly suburban but the designers have used classic town planning

Fig. 165

methods in order to bring the "city into the hospital". Because of this, it is potentially therapeutic and a good place to work.

When the oldest existing parts of **Hospital del Mar** in Barcelona were built at the end of the 19th century, its location was far from prestigious. Even in the 1960s, when the ward tower was built, the proximity of the sea was not seen as a particular advantage, the sea front at that point being essentially industrial and the less-than-desirable neighbourhood of Barceloneta was just next door. Things started to

change in the 1980s. Contrary to general belief, major decisions about giving the city a general facelift and a new lease of life had already been taken before Barcelona was designated the host city for the Olympic Games of 1992. Pasquall Maragall, the Mayor, and Oriel Bohigas, the City Architect, had already earlier started their quest to make the city a stunning urban success story.

An important part of the plan was to clean up the shoreline of all the filth and debris that remained from the industrial past. The Olympic Village was built on the wasteland as a continuation of Cerda's *Eixample* grid plan and the sandy beach was reclaimed. Barceloneta was due to become gentrified, and suddenly Hospital del Mar found itself on a site which is one of the most beautiful and prestigious hospital sites in Europe. As is typical of Barcelona in the last couple of decades, the City employed very good architects, Albert de Pineda and Manel Brullet. Their job was to restore Hospital del Mar and design new parts that would act as a glue between the existing parts and also tie it to the new urban situation and the renewed waterfront boulevard, Paseo Maritimo.

The architects designed a long, two-storey block, parallel to the Paseo Maritimo, and a roofed piazza (*palio*), that connects the different parts of the hospital and acts as a public pedestrian area between the hospital and the beach (Fig.166). The first two pavilions towards the sea were also extended to contain the diagnostics and radiology departments, as well as the hospital's main lobby that can be entered through the piazza. On the ground floor of the block running parallel to the street there are shops, a cafeteria and district social services. The out-patient clinics are situated on the first floor, where a continuing glass wall offers a stunning view of the beach and the sea (Fig. 167).

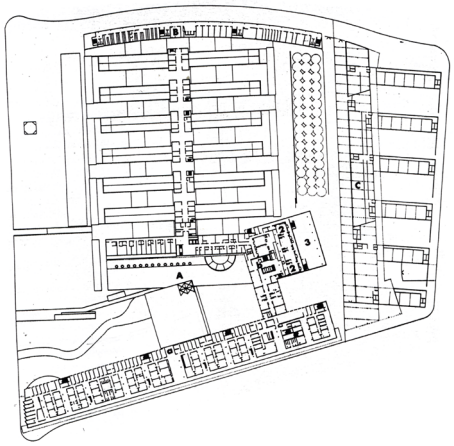


Fig. 166

Fig. 167

Fig. 168

Both the "herringbone" pavilion structure with its beautifully planted courtyards and the 1960s "monobloc" building have been restored in such a way that their potential therapeutic qualities are optimised. The windows in the old pavilions, originally oriented to exploit natural light for heliotherapy, were lowered so that the patients can enjoy the view outside even when lying in bed (Fig. 168). The new day rooms for the patients in the "monobloc" were located so that the patients could get maximum benefit of the views of the lively seashore.

The well-functioning long out-patients' block along the seaside is perhaps not ideal in terms of adjacencies to other departments but as an urban intervention it is of the highest order. The long corridor of the clinics that opens out towards the sea provides a truly therapeutic environment. Everything is crowned by "the central roofed piazza, the *palio*, that connects the different parts of the hospital and acts also as a public pedestrian area between the shops and the beach" (Kalkkinen & Waris, 2005, p. 49). The space blurs the limits between inside and outside and when seated on one of the wooden benches one wonders whether there can be a less "institutional" hospital foyer anywhere (Fig.169).

The Del Mar experience is of crucial relevance in several ways. It is an example of the importance of civic pride and it shows how a hospital can act as an urban catalyst by being used as an important element in urban regeneration. It is in the middle of life while providing a calm and relaxing environment. It displays sensitive handling of spatial hierarchy, public, semi-public, semi-private and private spaces. Above all it represents architectural and urbanistic quality of the highest order.

Fig. 169

PART V. CONCEPTUAL SYNTHESIS

Chapter 10. Relevant precedents and other lessons

Finding a balance between freshness and urbanity, force and transparency, unaffectedness and irony, aloofness and intimacy, between freedom and set patterns, passion and grace, abandonment and style. Alfred Brendel, 2007.

Some of the juxtapositions Brendel describes as being the challenges when performing Mozart's piano music are also particularly appropriate and inspiring when designing a new hospital. "Freshness and urbanity" (freely interpreted) can be seen as a reference to the "urban Asclepieion" idea. Cognac-Jay is a good example of this. Certain new pavilion-type hospitals such as Trondheim and Hospital del Mar with its virtuosic upgrading of urban values, also address this aspect admirably.

"Force and transparency" as well as "aloofness and intimacy" relate to the conflicting requirements for increased openness on one hand, and highly controlled conditions on the other. Additionally, the general balance between open and closed as well as between solid and void is a fundamental architectural challenge. Recent hospitals where this balance is outstanding include Kennemer Noord, Mataro and Moneo's maternity hospital.

Some of the most prominent architectural products created by the "mat building" philosophy, such as Le Corbusier's Venice Hospital, respond best to the requirement of simultaneous "freedom and set patterns". Modularity that does not become a straightjacket, systems that are sufficiently adaptable, and standardisation that creates clarity and order, all also lead to a good mix of "abandonment and style".

"Passion and grace" is a more abstract formula and thus less easily transcribed to the vocabulary of design. As attributes, they (as well as "unaffectedness and irony") are less tangible than the others. The therapeutic or "healing" effects of buildings could perhaps be improved by a deeper insight and understanding of themes like these.

The physical synthesis that follows has been influenced by Brendel's deliberations. Even if architecture has been described as "frozen music", it is not music, and thus the above associations may appear far-fetched. The reason for the innate connectivity is that Brendel's terminology is applicable to a whole spectrum of creative and artistic endeavours of which architecture, and therefore hospital design, forms part.

During the last ten years, The Netherlands Board for Health Care Facilities (Bouwcollege) has organised several open architectural competitions involving cure and care. The last two have been widely publicised international competitions which have attracted entries from all over the world. The first one, in 2004, was entitled "Future Hospital – Competitive and Healing" and the second one, in 2007, "Healthcare 2020 – Building(s) for the Future". Bouwcollege believes that by organising these competitions, "the Board has sought to contribute to the development of architectural solutions that meet the demand for future-proof, efficient, and at the same time humane hospitals" (Boluijt & Hinkema, 2005).

The two competition entries that will be presented as a physical synthesis are the results of the reading, writing, research and design work that has gone

into this study of past, present and future hospitals. During the research and design work that has been directly geared towards the preparation of these proposals, many of the intentions that were expressed in the introduction of this study as well as in the subsequent chapters have been further reinforced.

Four of the historical eras that were discussed in the first chapter of the study have been particularly inspirational and deemed to carry special significance in today's situation and in future design decisions:

The Greek Asclepieions for the following reasons:

- Asclepieions were the original therapeutic environments. Progress in creating truly therapeutic health care environments in the last 3000 years has been slow, in spite of all the recent research and evidence.
- Daylight, views, greenery and moving water were all natural, almost instinctive ingredients in the general plan of an Asclepieion. There was a balance between "freshness and urbanity".
- According to Greek town planning principles, the growth of a complex happened inwards in a controlled way, i.e. "growth by accretion", rather than outwards in a haphazard fashion as in most of our present hospitals.
- The individual buildings formed part of an urban entity and were generic in character.
- Buildings were always oriented in the optimal way as well as being shallow-framed, thus allowing for good ventilation and daylight conditions.
- Hospitalisation was seen as a part of normal life. All pursuits of healthy individuals were continued and those seen as particularly therapeutic were reinforced in the Asclepieions.

The Renaissance and **the Urban Palaces** for the following reasons:

- The urban adaptable and agile hospital of the future is likely to contain features typical of Urban Palaces and Hôtels Dieu. It will be a truly urban building occupying a central site, providing important services and playing a central social role in the urban fabric. It will also be an "open building", not just because of its essentially accommodating character (in terms of change), but also because it houses a variety of functions that by definition need to be accessible to everyone.
- Urban palaces had the appropriate relationship between solid and void and thus they often provided optimal daylight conditions and spatial sequences that succeeded in not being oppressive in spite of repetition. There was a balance between "force and transparency".
- The Urban Palaces offered an exemplary treatment of hierarchies of space: public, semi-public, semi-private, private. The relationship between exterior and interior, between busy and peaceful, was usually well balanced.

- The Urban Palaces were inherently timeless and flexible structures, with a high level of future-proofing. Lessons can be learnt from their early modular thinking, based not only on rationality but also on visual harmony.

The Era of the Sanatoria for the following reasons:

- During the Era of the Sanatoria, innovative architects and enlightened doctors worked in harmony towards a common goal based on strong belief in a certain type of care model.
- Due to the prevalent social and political trends, architects were motivated to make a contribution, not only on an artistic level or for prestige, but also because of a strong social commitment.
- The accelerating levels of industrial production of elements used in construction, together with the social awareness of those involved, led to an increasing use of mass-production, repetition and standardisation.
- Developments in building technology led to engineers being essential members of the design team, which resulted in economical, lightweight, minimalist and transparent "constructural" solutions.
- Hospital design was in the forefront of the architectural debate when sanatoria were built thus attracting the best of the profession and leading to an array of innovation and high quality buildings that displayed both "abandonment and style".

The Heroic Era for the following reasons:

- The Heroic Era is, until now, the only period in history that has made aspects such as flexibility and modularity into essential themes.
- Many technical solutions are still valid and even increasingly topical. Improved versions could be produced due to technological developments, for example, interstitial space, "plug-on" applications and pre-fabricated bathrooms.
- The era was full of innovation, in a way that has not been repeated since. Good designers were involved, hospital architecture was a tempting "specialisation", something that it gradually ceased to be from the 1980s onwards.
- Various "experts' walk throughs" as well as other post-occupancy evaluations in some of the best buildings (MacMaster, MacKenzie, Aachen, etc.), have shown that staff attitudes continue to be very positive. At their best, the buildings of the Heroic Era show both "passion and grace".

Apart from the inspiration provided by these four historical eras, the competition entries were influenced by what can be described as various future-proofing strategies. These include the "mat building" and "open building" concepts as well as Le Corbusier's project for Venice Hospital, but also a plethora of recent studies and writings on process-based design and other design tools that have been used to improve flexible functionality and reduce the negative effects of over-hierarchical and rigid planning methods. These include the research studies performed by the SOTERA

Institute at Helsinki University of Technology, particularly those on the development of emergency departments.

- Hospitals of the future should provide adaptable frameworks rather than rigid containers, which is what they traditionally have largely been.

- Good future hospitals will probably contain many of the features inherent in what Aldo van Eyck called "organised casbahs".

- "Mats" can provide us with other new approaches, hospital archetypes that have not been tried yet, such as those based more strongly on layerings, buffer zones, buildings within buildings etc. (e.g. Mont-Cenis).

- Many "mat buildings" contain a particularly successful mix of "freedom and set patterns". In fact the whole approach could be described as having been based on that mix.

- The "Open Building" philosophy makes it easier to replace and adapt. The buildings should by definition be more agile, adaptable and flexible, thereby having a high future-proofing content.

- Lessons can, and should be, learnt from buildings such as airports and production plants. This does not deter from the patient-centred approach, on the contrary.

- Modular solutions will become commonplace and there will be standardisation of room sizes. There will be less over-specific, hierarchical spatial programming.

- Walls and doors should be used only when absolutely necessary, forgetting the old way of providing a door and walls for every space, "room" or function.

- It would be preferable to think in terms of space dividers rather than walls, pieces of embracing "wrappings", rather than rooms.

- There will be no more "corridors". Circulation areas will be multi-functional and include "aedicular" elements; power posts or pedestals for IT connections, private reading cubicles, booths for individual physiotherapy, private discussions, talking on the mobile phone etc.

- Consequently, what used to be called "wasted" space such as corridors and circulation areas should in the future be seen as assets. A "loose-fit" is more future proof than a "tight-fit".

- Structural, mechanical and electrical installations will again be integrated as part of modular future-proofing and the use of interstitial floors will become more widespread.

- True flexibility will encompass functional, technical and aesthetic aspects as well as, and especially, institutional ones.

Finally, during the course of this work it has become increasingly clear that the hospital, as a "normal" part of human life and existence, belongs to the city just like the manifestations of other human endeavour. Being amongst healthy people in an everyday situation promotes healing. In order to reinforce this vital point:

- A stronger connection, both conceptually and physically, between a hospital building and its context will be required in the future.

- Elements of a hospital should be treated in the same way as elements of a city (spatial sequences, spatial hierarchies, solids and voids etc.). This would generally lead to improved clarity, a more stimulating environment, better wayfinding, and better architecture.

- In order to best illustrate Alberti's idea of interdependence between a building and the city that surrounds it ("the city is like some large house, and the house like a small city"), the hospital is the building type *par excellence*.

- Art in hospitals should be used as art is used in cities (for placemaking and highlighting, to give character, to help in orientation, to provide special moments etc.), not as stick-on, interior design applications.

Chapter 11. Case 1. The 2004 concept

The assignment

Netherlands Board for Healthcare Institutions (previously called Netherlands Board for Healthcare Facilities), generally known as the Bouwcollege, has organised a total of five international architectural design competitions. The last two, 2004 and 2007, have both been particularly forward-looking, calling for ideas and solutions that would "encourage innovative and future-oriented thinking about building in the healthcare sector" (van Staalduinen, 2008, p. 11). The 2004 Bouwcollege open international competition was held under the title "Future Hospital – Competitive and Healing". The choice of the site was open to the entrants but it had to be located in an essentially urban environment, because the social integration of the hospital into the neighbourhood was one of the primary evaluation criteria.

The brief stressed the fact that, apart from being functional and patient-focused, the hospital of the future is also the premises of an enterprise. This would bring into focus certain aspects such as an increased awareness of quality among the users of the services, innovative strength in all activities and especially the need for a more competitive physical setting. Optimal functionality was seen as a vital prerequisite for the enterprising and competitive hospital. In consequence, the facilities had to be designed in such a way that all possible new forms of care could be accommodated with minimal disruption. This naturally led to a demand for a very high level of future-proofing.

Efficient and logical patient flows as well as the general spatial and functional organisation of the hospital were to be based on the presumption that the care would be modelled on the patient's anticipated care programme (both within and outside the hospital), i.e. the principle of care pathways. Moreover, the brief pointed out that the care activities were no longer to be location bound, and that the caregiver would go to the patient rather than the other way around, as has been the case in the past. It is clear that this "development could lead to entirely new hospital concepts" (Netherlands Board for Hospital Facilities, 2004, p.3).

The word "healing" appeared in the title of the competition and thus the brief stressed the need of the patient to also have, in a strongly technological environment, some warm, personal space. The creation of positive stimuli that at their best could influence recovery and be generated through the treatment of the physical environment should thus be encouraged. The stated aim was to create a humane building, in spite of the exceeding complexity of a large-scale modern health care facility.

The participants had to prepare a sketch design for a building, or a group of buildings, to house a modern, enterprising hospital of a medium size, providing medical/specialist care for about 150 000 inhabitants. A common standard used, not only in the Netherlands but in most of Western Europe is 2 beds per 1000 inhabitants. In this particular case this would mean a hospital with about 300 beds which, using other common ratios, would translate into

about 60 specialist and 750 other staff working in the hospital. The given schedule of accommodation was divided into three main sections; patient-related facilities (patient present), patient-related facilities (patient not present) and general and technical facilities (non-patient-related services). The total useful (net) floor area amounted to 25 600m^2 and total gross area to 41 000m^2 (Netherlands Board for Hospital Facilities, 2004).

The brief formulated certain themes that could be worked out in more detail, in addition to the total concept development. These included "Compact building: accommodation solely for the core activities; decentralisation of the premises". The winners of the competition, Ton Venhoeven of VenhoevenCS Architects (The Netherlands) and Thomas Gutknecht of Itten and Brechbuehl Architects (Switzerland), took full advantage of this opportunity and designed a prototype of a "hot hospital" of about 25 000 gross m^2 which basically could be placed in the centre of any major European city. This proposal, with motto "Core Hospital", has been referred to in earlier chapters of this study.

"Cure for Sure"

The design team of "Cure for Sure" (BOX 15) chose from the proposed list "Patient logistics: optimal accommodation of the various patient flows" and "Flexibility: ideal solutions for problems arising from expansion of activities or relocation of functions and technologies" as their primary themes. The chosen site was situated next to the largest shopping centre in the Nordic countries, east of central Helsinki. The entry was shortlisted for the final exhibition at the Oud Conference Centre in The Hague as well as the final competition report published by Bouwcollege (Boluijt & Hinkema, 2005).

Box 15

Design team for "Cure for Sure"

Harris-Kjisik Architects and Planners with Sotera Research Institute, Helsinki University of Technology

Authors:
Hennu Kjisik, architeect, SAFA
Trevor Harris, professor, architect, SAFA RIBA

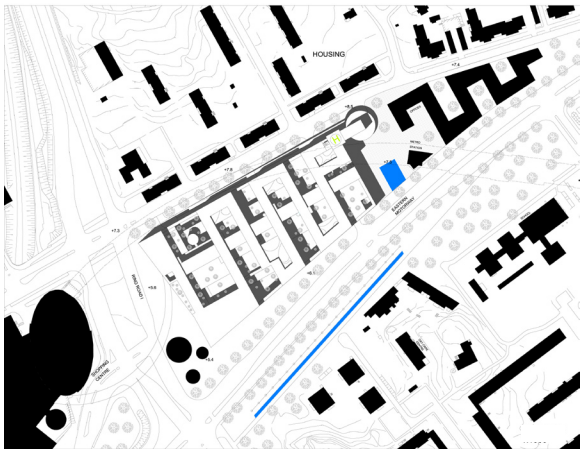
Team members:
Erkki Vauramo, professor
Kalevi Lauslahti, M.D. professor
Jenni Hölttä, student of architecture
Anni Hapuoja, student of architecture
Vesa Kämäräinen, Dr.Tech.
Tuomo Siitonen, professor, architect, SAFA
Pirjo Sipiläinen, architect, SAFA
Vesa Ekroos, M.D.
Christpoher Delany, student of architecture
Beni Kjisik, B.A.

The chosen location was an empty piece of land at the junction of the main motorway leading out of the City towards the east and the innermost of Helsinki's three ring roads (Fig. 170). Apart from the two major roads, the area is dominated by the enormous commercial complex built in three stages during the last twenty years. The surrounding building stock consists of mainly 6-8 storey housing blocks and office developments of similar heights. The massing of the 6-storey high hospital building was designed in such a way that its scale and grain corresponded to that of its neighbours (Fig. 171).

The adjacent shopping centre can truly be characterised as a "cathedral of commerce". As in Renaissance cities where the cathedral and the hospital would coexist in the same square (Ospedale degli Innocenti in Florence, Ospedale

Fig. 170

Fig. 171



Santa Santissima Giovanni e Paolo in Venice etc.), this was to be a juxtaposition of a modern hospital and a modern "cathedral". Since there was no piazza, and in fact no attractive, well-defined external space at all to relate to, the links had to be located in the interiors, and also one floor up from ground level, to mitigate the effects of the heavy traffic. In any case, the idea was to give the hospital back its status of a major public building and a prominent urban landmark.

The "health street" (a five-storey high space with open galleries and bridges) (Fig. 172) that became the backbone of the scheme connected the metro station on the east side of the hospital to the shopping centre on the west. As in some of the better existing "hospital streets" (such as Robert-Debré and Groningen University Hospital) the streetscape was not to be dominated by people in white coats. The team proposed an array of activities loosely connected to health and well-being to be placed along the street. These were designed to attract the general public into the complex and thus help alleviate the threat of institutionalisation.

Fig. 172

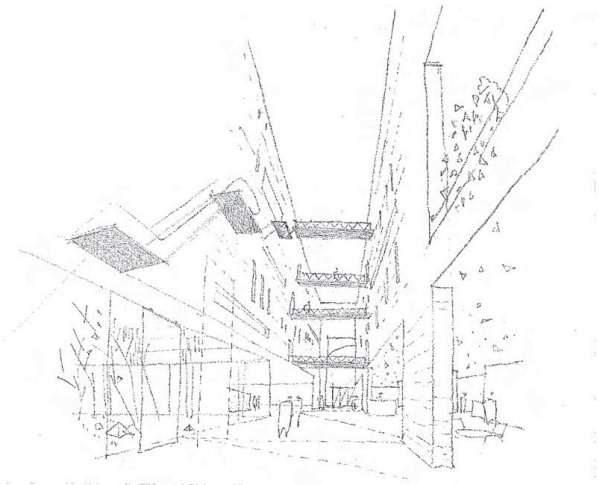
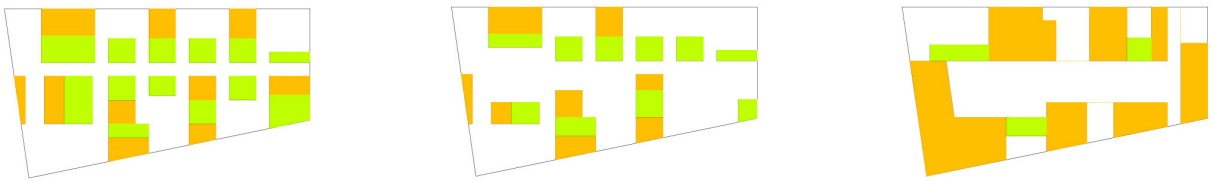


Fig. 173

The plan of the building was based on the Greek town planning principle of growth by accretion (as opposed to extension, thus fixing the peripheral points and allowing for growth towards the centre), a strategy used (at least in theory) in Kennemer Noord, possibly the only existing precedent. The proposed perforated "mat" provided flexibility within its system of courtyards that grew in size the further up the building one went, the top two floors being the most perforated of all (Fig. 173). The difficulties of adding new parts within an existing framework are obvious. Apart from the problems related to disruption of activities (which we believe can be minimised through the innovative use of pre-fabrication, interstitial techniques etc.), there is the problem of the gradual loss of the benefits of the perforation. In this case calculations were made to show that up to 27 000m^2 could be added to the building after which daylight penetration would still be more than satisfactory for a relatively deep plan (Fig. 174).

Fig. 174



The structure was highly modular with clusters of interchangeable rooms ("rooms within rooms") in the central parts, and waiting and circulation areas opening towards the surroundings or to the courtyards. The best daylight conditions were thus reserved for the areas where people spend most of their time. This led to corridors, foyers, waiting areas and open-plan offices being placed along the external walls, as opposed to individual offices, consultation rooms or small treatment units where less time is spent (Fig. 175). This practice has become commonplace in Southern Europe, good examples being Del Mar and Sant Pau in Barcelona. The numerous courtyards were seen as Brunelleschian quadrangles, places for contemplative walks and social gatherings. The courtyards were usually connected to internal "piazzas". Many of the courtyards incorporated level changes, the same external space being accessible from two or even three levels. These public and semi-public external and internal areas contained worship spaces for different faiths, informal areas for lunch breaks and picnics and, bearing in mind the increasingly multicultural profile of the surrounding neighbourhoods, gathering places for family members of patients. The "rooms within rooms" concept, the different levels of privacy, and the configuration of the courtyards, owed a lot to Aldo van Eyck's "organised casbah" concept.

The external envelope included a 1.5m wide flexible logistic buffer zone that could be used for circulation of staff and materials but also for semi-heated greenhouse areas, balconies and semi-enclosed galleries. A similar buffer zone was built at the hospital in Arras where, for financial and security reasons, it has unfortunately not been used in the way the architects originally envisaged. The concept has its roots in the age old practice of creating semi-public zones, "gradients of intimacy" as Gusack (2006) calls them, thus blurring the interface between the inside and the outside.

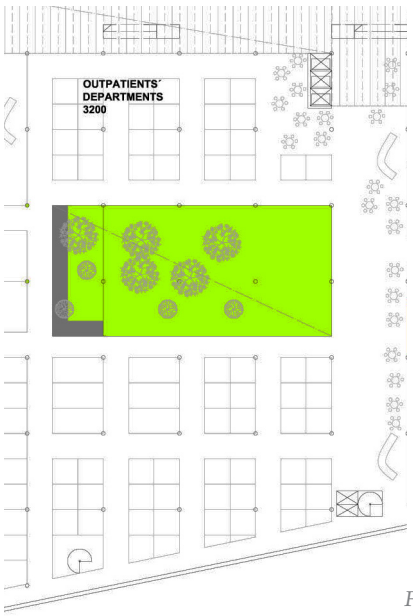


Fig. 175

The organisational model chosen for this general acute care hospital was (in line with the Bouwcollege classification discussed earlier in this study) based on the care process, although certain cultural and historical reasons led to some aspects of patient flow-based planning penetrating the chosen approach. The building was nevertheless essentially divided into six centres; the consultation centre, the diagnostic centre, the treatment centre and the nursing centre as well as centres for knowledge and logistics. Within the centres, the functions were grouped in such a way that the activities directly involving the patients were placed as close as possible to the "health street" and its galleries. The logistic routes for the staff and materials were separated from the patient routes (Fig. 176), and fed from the logistics centre on the ground floor underneath the level of the hospital street, where nearly 500 parking spaces were also located. The buffer zones around the perimeter and the courtyards formed part of the logistics network in the "hot floor" areas, while elsewhere it became part of the patients' semi-private or private territories.

The treatment and diagnostic centres that basically contain the "hot floor" elements of the hospital were placed on the first and second floors. The emergency and imaging diagnostics departments were placed along the "health street", but in such a way that the activities within would not interfere with the normal everyday life on the street (Fig. 177). The design of the emergency department was inspired by research performed at the hospital in Hämeenlinna, Finland, and the theoretical model that was produced as a result of that research. The other parts of the "hot floor" (elective and day surgery, intensive and coronary care, as well as obstetrics) were located directly above these two departments on the second floor (Fig. 178).

Fig. 176

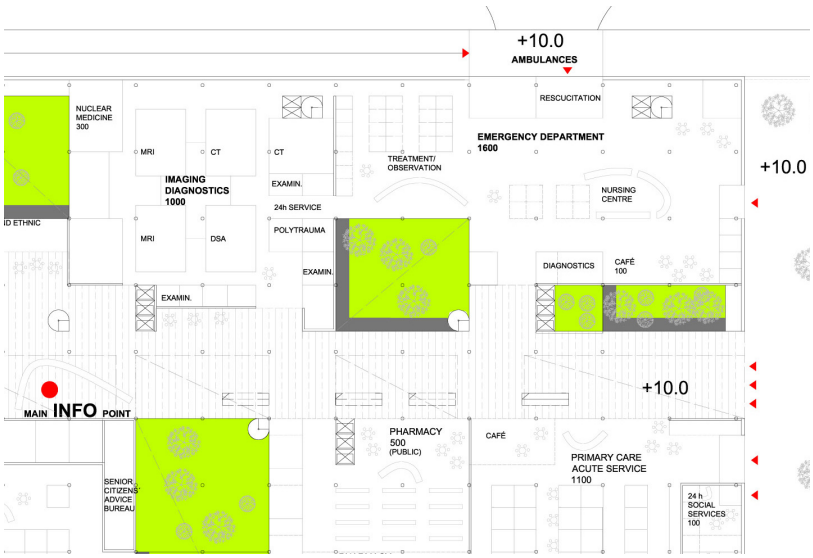


Fig. 177

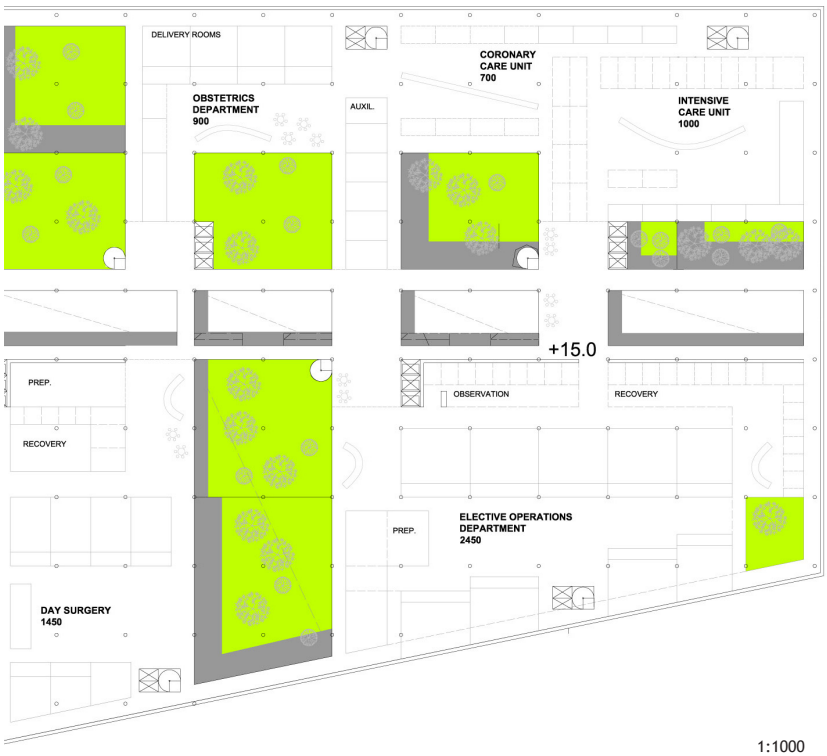


Fig. 178

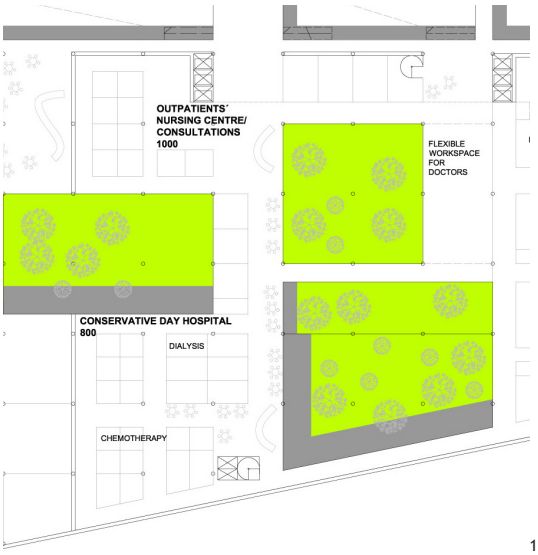


Fig. 179

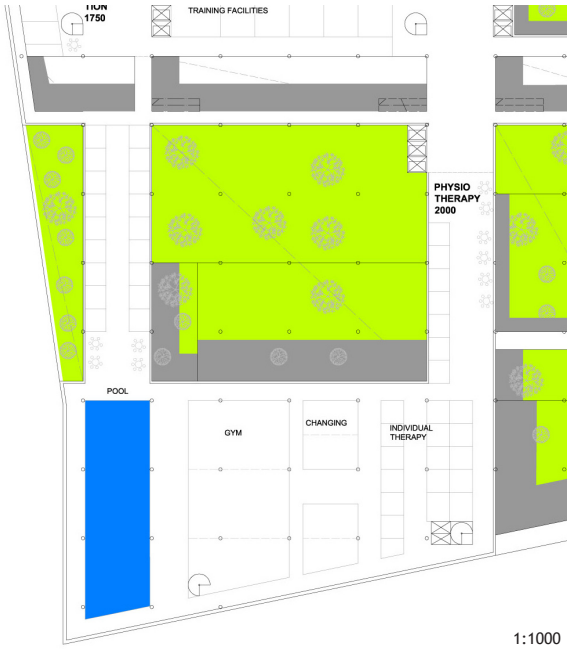


Fig. 180

Some of the new functional elements in contemporary hospitals that have been discussed earlier in this study, and that now occur with increasing frequency in contemporary projects, were also introduced here. The conservative day hospital and the outpatients' nursing centre were both physically placed within the flexible and adaptable confines of the consultation centre on the second floor (first gallery) level (Fig. 179). The conservative day hospital might perhaps find its administrative home more naturally in the treatment centre whereas the outpatients' nursing centre could form part of either the consultation centre or the nursing centre, depending on the administrative system chosen by the organisation. The knowledge centre, one of the six centres that make up the entirety of the hospital, was here essentially shown as open-plan office and work space for the staff, also mainly placed within the physical boundaries of the consultation centre.

The physiotherapy department (organisationally part of the treatment centre) was situated in the south-western corner of the building, on the third floor (second gallery) level (Fig. 180). The double height space that included the gyms and the swimming pool area opened up, through a huge window, towards the best views over the sea, which is only a couple of kilometres away (Fig. 181).

The strictly modular 9m x 9m structural and functional grid was divisible into 9 sub-modules which could be connected to each other in various configurations using sliding walls and other flexible space dividers. The concept was tried out for different functions in the different centres. It proved useful in the treatment centre for observation booths in the emergency department, for consultations in the

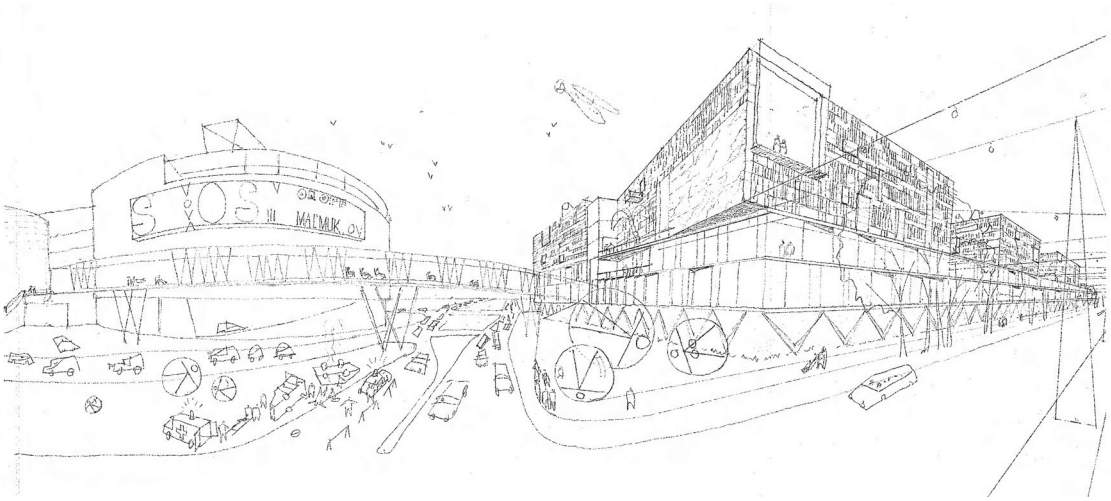


Fig. 181

consultation centre, and for meetings and discussions of different kinds in the knowledge centre. The "corridor" width of 3m that this module led to was seen to be sufficient considering the "recumbent patient module" (the space required for a patient being wheeled around by two carers and moved from a trolley to a bed, as discussed earlier), as well as for being used as reasonably spacious multi-purpose communal activity areas.

The 9m x 9m module as a basis for a ward based entirely on single bedrooms was studied particularly from the point of view of patients requiring different levels of care. The key factor here was, on the one hand, the interface between the room and the semi-public area ("corridor") outside it (important also in terms of ease of surveillance), and, on the other hand, between the room and the flexible external buffer zone. The latter could, in a standard ward situation be used either as a continuous communal winter-garden or as a private balcony, and in situations requiring a higher level of care, for observation or as part of the logistic network (Fig. 182).

This particular modular exercise should be seen as an *existenzminimum* study rather than a realistic proposition. For most parts the module works but there are some serious shortcomings. It is clear that the range of examinations that could be performed in consultation rooms based on this module would be somewhat limited. Also, in most countries, all bathrooms in hospital wards have to be dimensioned for wheelchair use. Later studies led to similar experiments being performed with a 10.8m x 10.8m

module which proved appropriate for "room within a room" clustering and also, in the ward situation, allowed for the required dimensioning of bathrooms. This module was eventually also chosen for the assignment that is presented in the next section.

The proposal also included ideas for artworks and installations that formed part of the fundamental concept of the entire visual world of the large building or, to paraphrase Alberti, the small city that the hospital had become. These artefacts were placed in important junctions and at the end of longer vistas in order to create a sense of place, give character to internal piazzas and assist in intuitive wayfinding, thus reducing the need for signage (Fig. 183). The purpose was to show that artworks in hospitals should not be decorative afterthoughts brought in because art per se possesses therapeutic properties, but intrinsic ingredients of a larger, visually and aesthetically logical spatial experience.

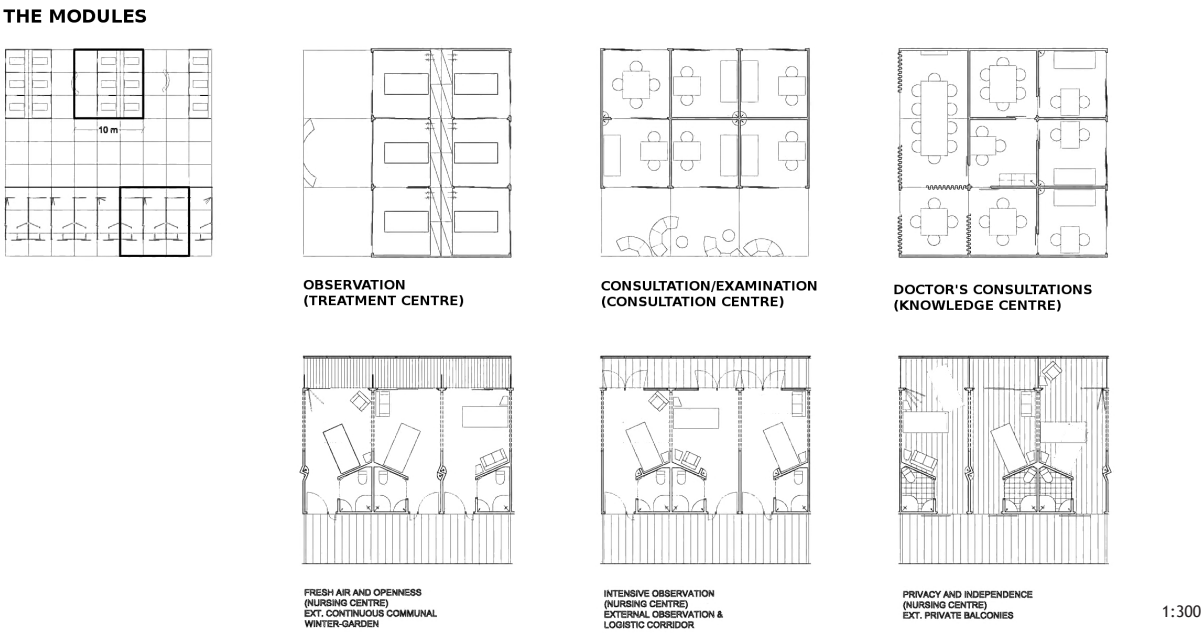


Fig. 182

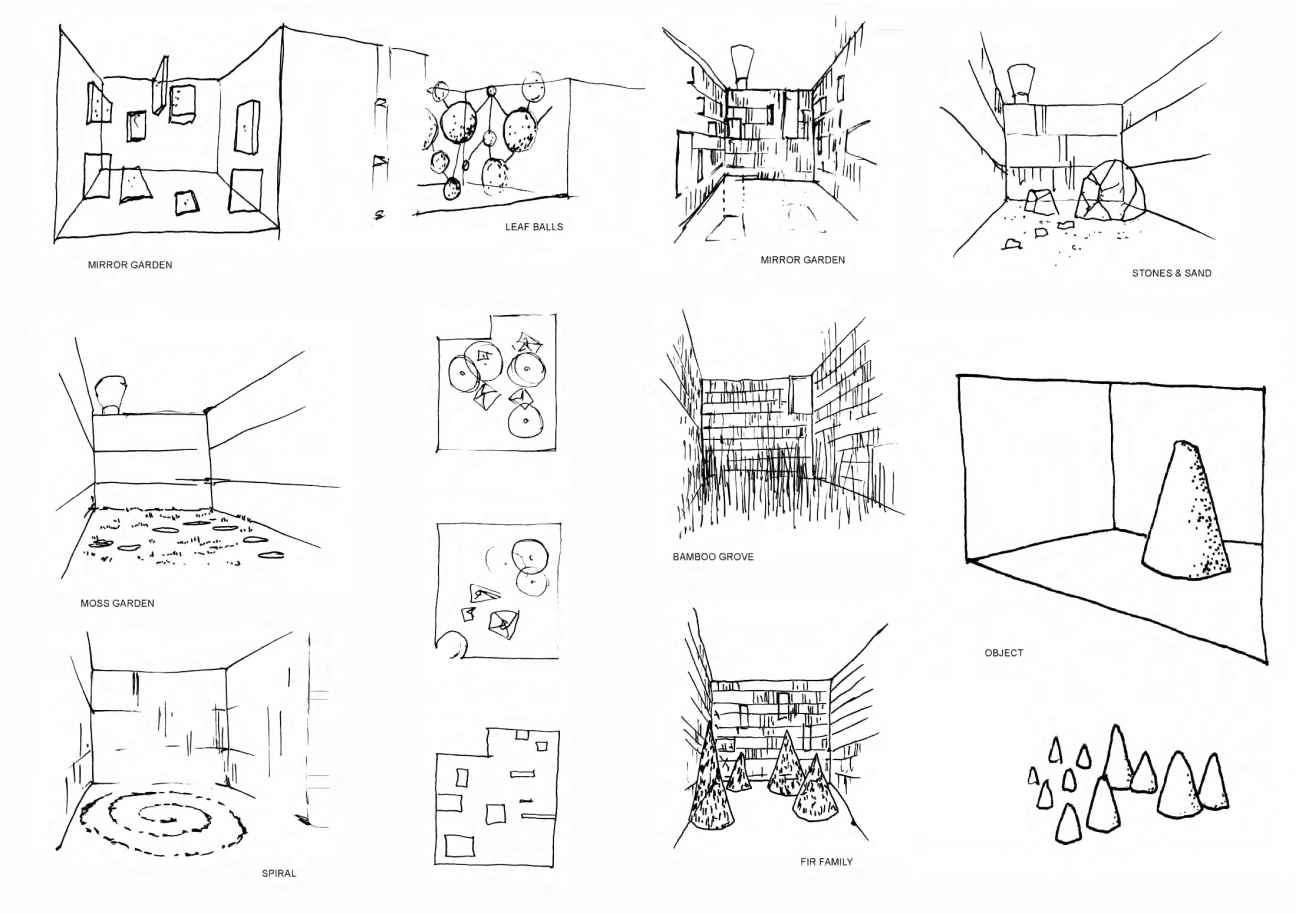

MIRROR GARDEN
LEAF BALLS
MIRROR GARDEN
STONES & SAND
MOSS GARDEN
BAMBOO GROVE
OBJECT
SPIRAL
FIR FAMILY

Fig. 183

Chapter 12. Case 2. The 2007 concept

The assignment

Bouwcollege's international competition under the title "Healthcare 2025 – Building(s) for the Future" was launched in 2007. The given situation was that new reclaimed land of unrestricted type, shape and form will have been taken into use in the Markermeer, the southern part of Ijsselmeer, by 2025; enough to build a city for 160 000 inhabitants. The new city would carry a population base that would correspond to other Dutch cities at that time, both in size and demographic structure, as well as regarding the ethnic and cultural mix. According to the assignment, the healthcare for this city had to be developed in its entirety. The city would require all the basic facilities, so that the residents would only need to go elsewhere to acquire the very highest level of specialist medical care. The assignment was to develop ideas for the layout of the healthcare sector in this new city in 2025. The ideas had to be translated into an organisational and spatial design of the healthcare facilities, and an elaboration of a portion thereof. The full spectrum of the healthcare sector ("from maternity care to terminal care, from home help to intensive 24-hour care for mentally disabled, from simple outpatient treatments to heart surgery") was included (Netherlands Board for Health Care Institutions, 2007a). Put succinctly, the task was to design a city, to plan a healthcare system to serve it and to design the buildings to serve that system "to promote interdisciplinary and unconventional thinking at the interface between healthcare, policy, entrepreneurship, town and country planning and technology" (Netherlands Board for Health Care Institutions, 2007a).

The judging criteria, as formulated in the competition programme can be found in BOX 16.

Box 16

1. A ground-breaking response to the most important issues confronting healthcare in an urban environment in 2025, among them the aging population, economic developments, climate change and changing healthcare demand;
2. An original and daring vision on the provision of care in 2025;
3. A vision on the place taken by the various forms in which care is provided in society and in the urban setting
4. A design that attractively manifests this vision;
5. An inspiring response to the wishes of those needing care in the future, and their social environment;
6. An integrated vision with a clear direction on planning and sector-intrinsic development in the provision of healthcare in 2025;
7. A realistic architectural elaboration on at least one part of the plan.

Netherlands Board for Healthcare Institutions, 2007

The brief emphasised a considerable number of the issues that have emerged earlier in this study. The changing demographic patterns were taken up as a major influence on the character and quality of the facilities that will be required during the coming decades. The new breed of health facilities will be based on a new kind of distribution of the various traditional elements because of an increased consideration for the smoothness of care pathways. Healthcare will also be more tailored towards chronic

disorders. Parallel with demands for organisational upscaling, generally seen as economically unavoidable, there is an increasingly outspoken patient-client body that is calling for smaller-scale solutions closer to home. Just as throughout this study, Bouwcollege also emphasised flexibility, not only in terms of the spatial and technical solutions, but also institutionally.

Bouwcollege challenged designers to explore the possibilities offered by building for the healthcare of the future and concluded that "success will require searching beyond the boundaries of individual professional fields: by collaborating, architects, consultants, urban and rural planners, visionaries, healthcare practitioners and healthcare managers could generate some innovative concepts" (Netherlands Board for Health Care Institutions, 2007a).

About 90 teams from around Europe registered for the competition. Two honourable mentions were given, one to a team led by Victor de Leeuw (the designer of the Kennemer Noord Hospital) and Thomas Gutknecht (who together with Ton Venhoeven had won the previous Bouwcollege competition) and the other to a group from the Technical University of Delft led by Johan van der Zwart.

Two first prizes *ex aequo* were awarded. One went to the Dutch architect Carel Weeber. In his entry, entitled "Big Bang", the whole health care system was based on a large number of small, strictly localised modular units that would give a complete service to people very close to their homes. This attractive idea, somewhat in conflict with current economic and socio-political thinking, could provide fascinating challenges for architects and other designers in the future. The other first prize was awarded to the pseudonym "Fair Care – Care Fair".

Modern Asclepieions – an opportunity

In a dark place the sick indulge themselves too much in various fancies, and are harassed by imaginings devised in an alienated mind, since no external phenomena can fall on their senses; but in a bright place they are prevented from being wholly in their own fancies, which are rather weakened by external phenomena.
Asclepiades of Bithunis, ca. 50BC

Over the centuries, the links between healthcare and the related socio-cultural and educational worlds, as well as the connections between the institutions providing healthcare services and the urban environment surrounding them, have been severed – been severed. The social synergy that supported well-being in the past, has been replaced by a competitive ethos (Sotiriou, 2006). On the other hand, our contemporary world encourages people to look after themselves, both physically and mentally, through engaging in activities similar to those that formed part of the cure in the Asclepieions as at the theatre of the Asclepieion of Epidauros (Fig. 184). As a consequence buildings that serve the cultural, sporting, leisure, and entertainment industries (libraries, concert halls, opera houses, theatres, museums and galleries, stadia, sports halls, leisure complexes) form the most prestigious commissions architecturally and are today often designed by the most prominent members of the profession. Health care, however, seems to have fallen by the wayside.

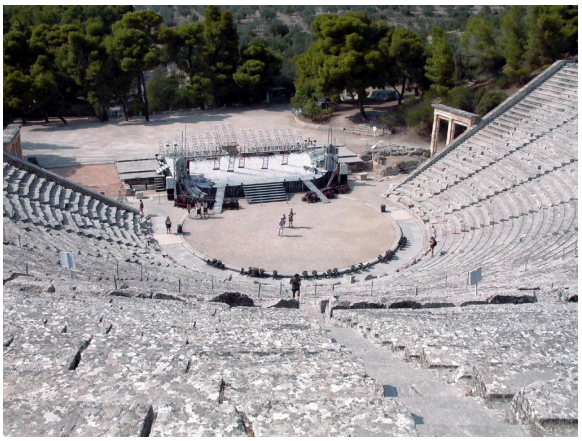


Fig. 184

Box 17

Design team for "Fair Care - Care Fair"

Authors:
Harris - Kjisik Architects and Planners
Hennu Kjisik, architect SAFA (team leader)
Trevor Harris, professor, architect SAFA RIBA
Marta de Abreu, architect, OASRN

Helsinki University of Technology, SOTERA Research Institute
Erkki Vauramo, professor
Urpo Alanko, M.D.
Antti Autio, architect
ITU Design Oy
Robin Wycherley, architect

Cultural and sports centres are found in prominent locations while hospitals are hidden in the bushes. The creation of a modern Asclepieion, both as an answer to the call from Bouwcollege for creation of a "ground-breaking vision" on the delivery of healthcare in an urban setting, and also as a synthesis of the inspirations, ideas, theories and beliefs set out during the present study, became the expressed, and the precisely articulated aim of the "Fair Care – Care Fair" working group (BOX 17).

The idea of resurrecting the Asclepieion, not just as a concept but as a series of real concrete hospital complexes, originated from within the working group but was heavily influenced by the proponents of the new Asclepieion Park of Athens who want to "re-structure the green areas of our cities so that they act as meeting places which are accessible to everyone and combine facilities which provide for our health and welfare.... so that all individuals could be exposed to a holistic approach to the quality of their life and at the same time they could have access to integrated services that are without the structural and conceptual boundaries imposed by current societal systems" (Sotiriou & Boddy, 2006, p. 12).

The conceptual plan for the new Asclepieion Park of Athens was first published in 1998 as a collaborative effort between the School of Medicine at the University of Athens and the Greek Ministry of Urban Planning, Environment and Public Works. A key source of inspiration for the work in Athens, and thus also for the present study and particularly for the competition entry "Fair Care – Care Fair", has come from the thoughts and writings of Professor Dimitrios Sotiriou, who has tirelessly pursued the idea and claimed that much could be learnt from the ancient Asclepieions.

Water is used in the conceptual plan for Athens to shape the landscape and create particular microclimates. Lightweight, flexible, and expandable

construction methods, including tents and inflatables, are exploited in the proposed buildings. Many of these buildings, as well as other elements in the public spaces are used for information delivery since the safe exploitation of modern technologies by all, without social discrimination or exclusion, is an essential feature of the Park, and corresponds to the ancient Greek ideals of citizen empowerment (Sotiriou, 2006).

Another application of the Modern Asclepieion is being planned in Riga, the capital city of Latvia. Riga's Eastern Hospital Group commissioned, in 2006, a plan on how to "glue" together the various old hospitals, dispersed around a large park just outside the core of the city, in order to create a more coherent entity of the different units that formed the Hospital Group. A plan was prepared (Harris - Kjisik Architects and Planners) that took the Asclepieion idea as the guiding light (Fig. 185). Several cultural amenities, together with a variety of social, educational and sporting installations, were proposed as links in the chain that connected the existing health care facilities to each other.

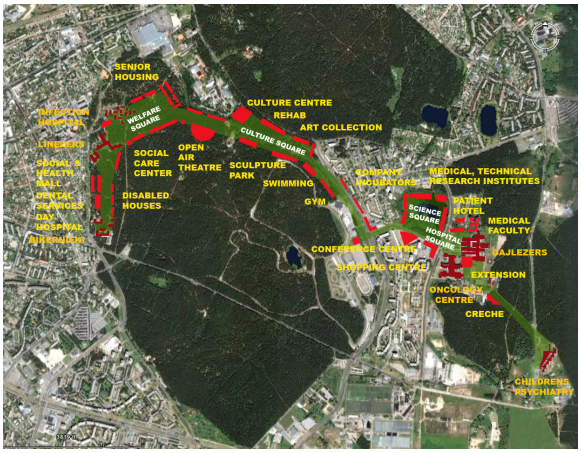


Fig. 185

"Fair care – Care Fair"

The chosen strategy for the gradual occupation of the Markermeer area through land reclamation is one based on modularity on a huge scale, a gigantic grid plan where one "city block" can become a "complete city". A total of approximately 15 of these units can be built, say before the end of the 21st century, thus giving scope for an additional population of about 2.5 million people (Fig. 186).

The first link in the chain, a city of 160 000 inhabitants to be built by 2025, was named "Elysiadam" by the authors of "Fair Care – Care Fair". It is founded on long Dutch traditions of urban life, urban scale and the omnipresence of waterways. Recent urban renewal projects of old harbour areas in many large Dutch cities obviously function as important points of departure and major inspirational precedents. Elements from several urban masterpieces are included, with at least Manhattan, Venice and Barcelona strongly present, both physically and in spirit. Waterways provide not just "streets" but also major and minor public open spaces (Fig. 187). Elysiadam is divided into districts; a central one is surrounded by six others of equal size all named after key figures of Dutch Modernism (Fig. 188). The symbolic significance of the latter is connected to the fact that the work of all these designers has greatly influenced the era of the sanatoria, the Heroic Era, mat building and open building, as well as practically all the aspects related to flexibility and future-proofing that have been covered in this study.

Fig. 186

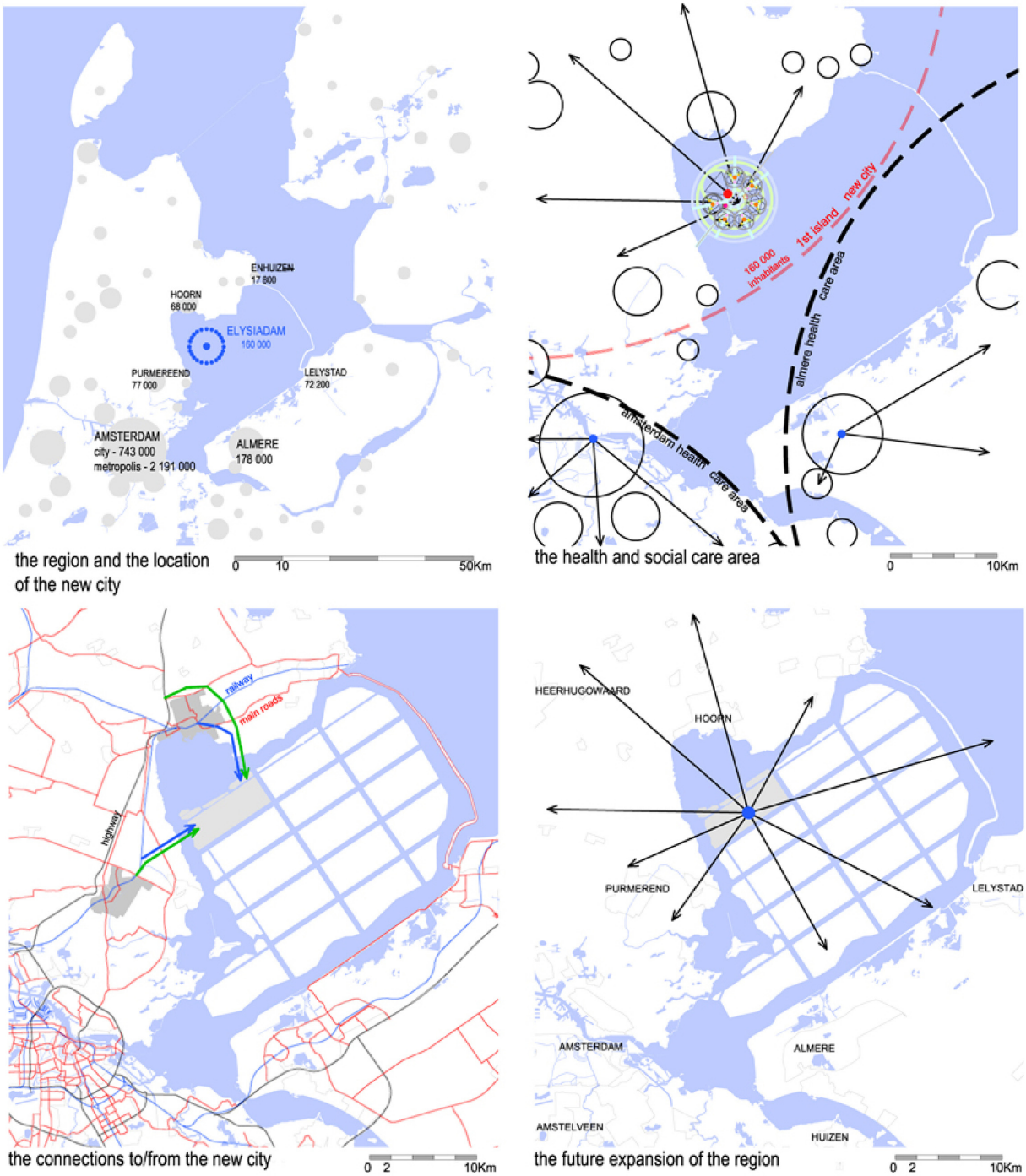

ENHUIZEN
17 800
HOORN
68 000
ELYSIADAM
160 000
PURMEREEND
77 000
LELYSTAD
72 200
AMSTERDAM
city - 743 000
metropolis - 2 191 000
ALMERE
178 000
0 10 50Km
the region and the location of the new city
160 000 inhabitants
1st island
new city
almere health care area
amsterdam health care area
0 10Km
the health and social care area
railway
main roads
highway
0 2 10Km
the connections to/from the new city
HEERHUGOWAARD
HOORN
PURMEREND
LELYSTAD
AMSTERDAM
ALMERE
AMSTELVEEN
HUIZEN
0 2 10Km
the future expansion of the region

Fig. 187

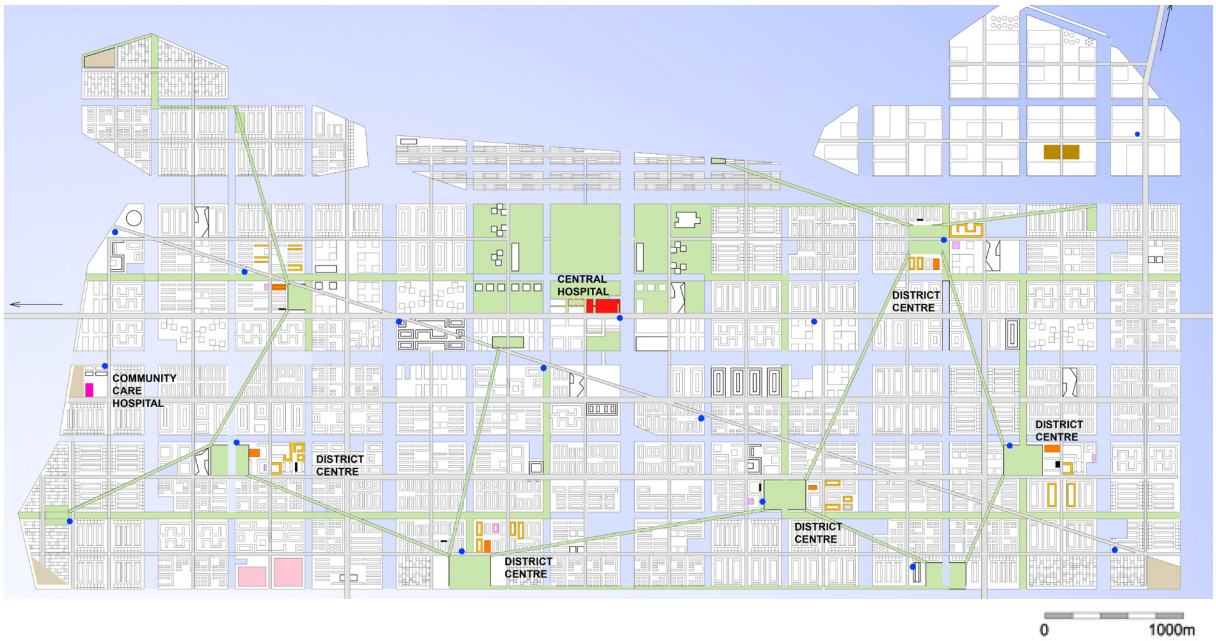
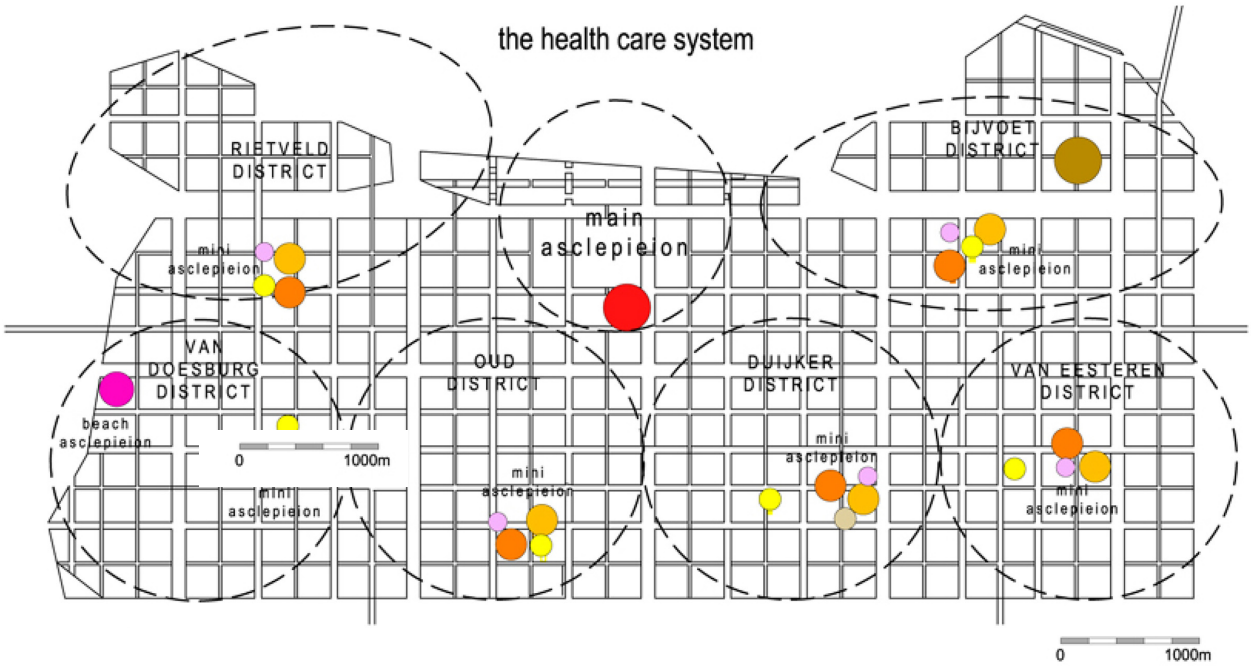


Fig. 188

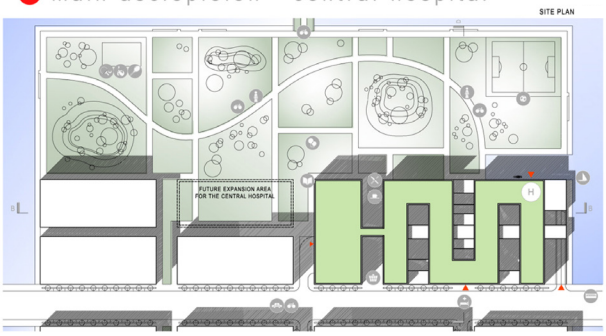


The Central District includes the large central park, the "Main Asclepieion", the majority of the cultural and sporting facilities of the city, as well as the bulk of the "main street" type shopping areas (Fig. 189). Having the "modern Asclepieion" as the theme in all the elements, both in the central acute hospital ("Main Asclepieion", Fig. 190) and the community rehabilitation hospital ("Beach Asclepieion", Fig. 191), as well as in all the six local (primary care and social service) centres ("Mini Asclepieions", Fig. 192), means that several fundamental starting points, both in terms of urban planning, architecture, and health care philosophy, are already fixed. This chosen programmatic approach, bringing other services and urban activities to the immediate vicinity of the health care facilities, not only in the "Main Asclepieion" but also in the other units, means that the hospital is definitely reintroduced into the city. The city, in turn, is introduced into the hospital by the chosen design method, through the way the spatial sequences and their mutual hierarchies are treated. The health care buildings, apart from being parts of modern Asclepieions, are also like Renaissance palaces, important public landmarks in their own right, in prominent roles without being intimidating. While being landmarks they are, at the same time, integral parts of a continuing urban structure, extensions of urban life into the realm of health care, just as Le Corbusier's Venice Hospital was planned to be.

Fig. 189

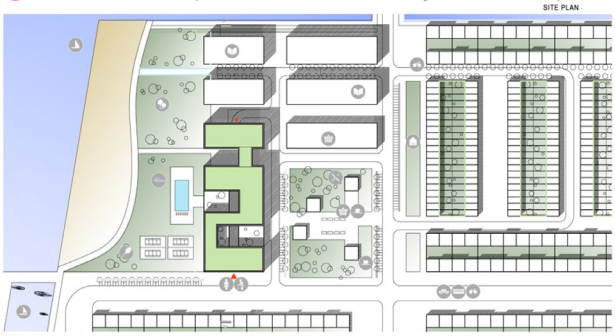
main asclepieion - central hospital

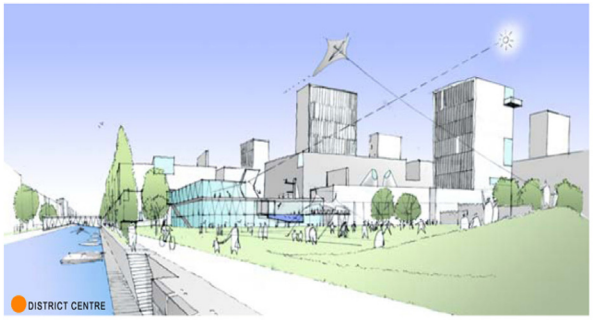
Fig. 190



beach asclepieion - community care hospital

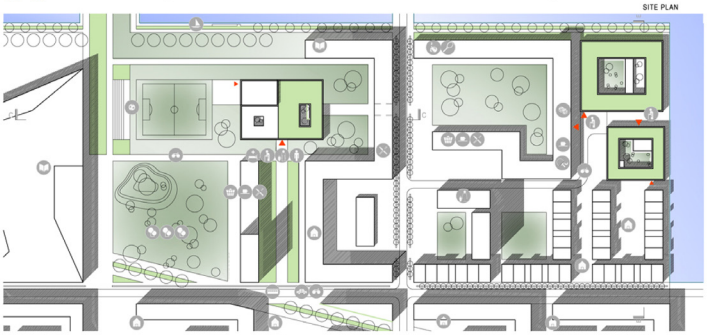
Fig. 191

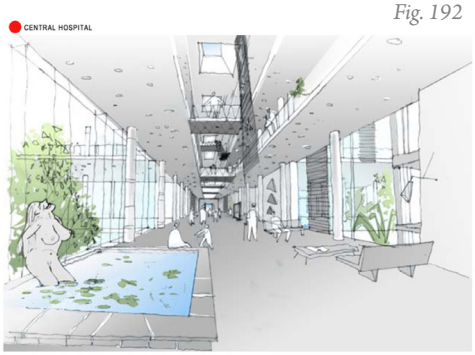




mini asclepieion - a district centre and elderly care centres

Fig. 192





The chosen health care system, the institutional part of the competition task (accounted for in more detail in BOX 18 and Fig. 193), addressed the conflicting requirements expressed in the programme (concurrent demands for larger and smaller units) by general upscaling and concentration of specialised care services in one "Main Asclepieion" while providing six local "Mini Asclepieions" in order to satisfy the growing demands for small scale facilities located at short distances from peoples' homes. The latter is reminiscent of the "nearby care" system developed in Skåne, southern Sweden, and other similar recent developments referred to in earlier chapters.

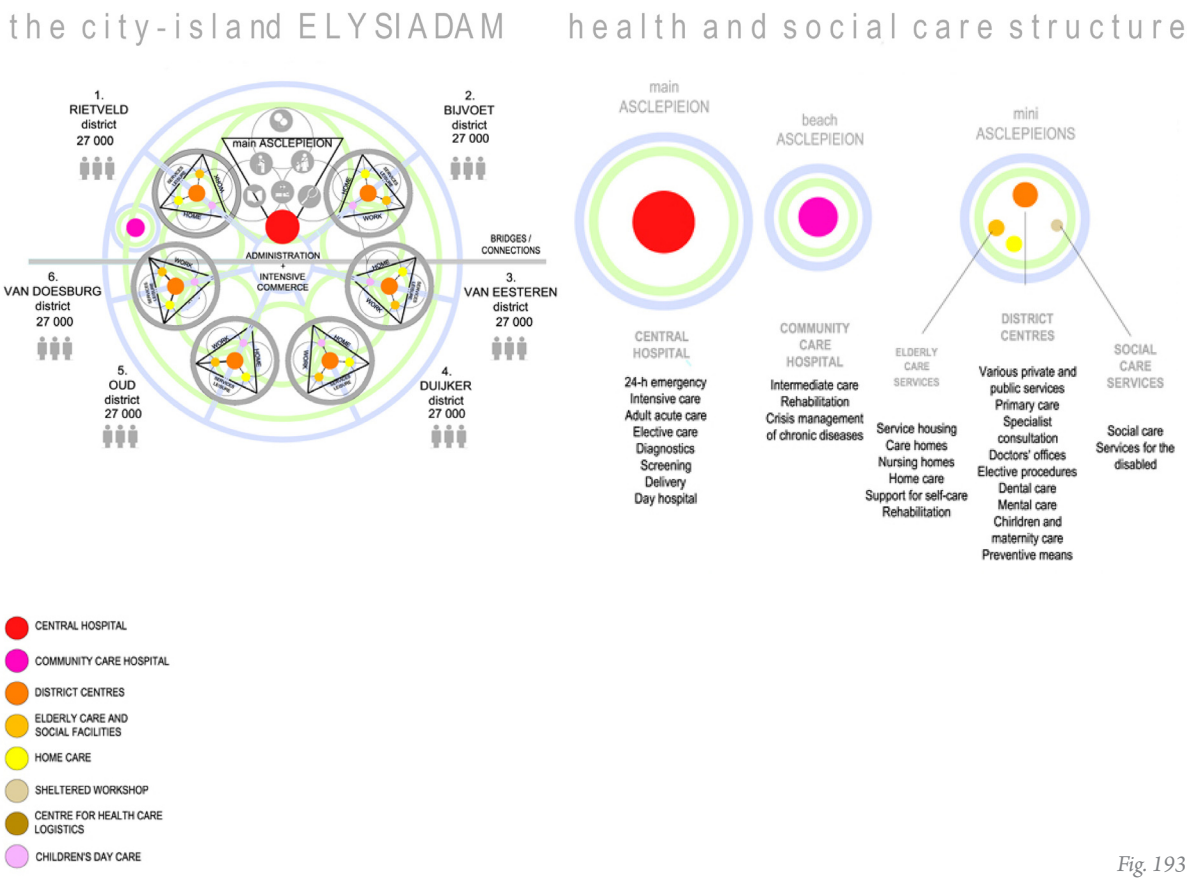


Fig. 193

Box 18

MODERN ASCLEPIEIONS — MORE HUMAN CARE

The new city of Elysiadam and its concept for health and social services

In ancient Greece the State provided an activity centre with cultural and sporting facilities. The sick and the elderly stayed in this healing complex enjoying their last days in a human and inspiring environment. This concept can be modernized and adapted to the requirements of a future city. The result will be a more human and stimulating health care environment with no loss in care quality.

The city of 160 000 inhabitants is organised in 6 districts, each with a population of 27 000 inhabitants with a district centre where public activities are concentrated. An efficient public transport network and sustainable housing design will save energy, bicycle and pedestrian routes will dominate, the dependence on gasoline will decrease and the health of the citizens will improve.

The service system consists of open care services organised in 6 District Centres, a Central (acute care) Hospital and a Community Care Hospital. The system will serve the city inhabitants but the Central Hospital can also serve a larger population being planned for easy expansion. Highest level clinical care is provided by nearby university hospitals in Amsterdam and Utrecht. Health care service provision is based on care pathway principles. The secure and confidential information network integrates the entire system into one entity.

The "Main Asclepieion" is formed in the city centre by locating the Central Hospital and elderly care homes near key public buildings, theatres and galleries. At the "Beach Asclepieion", the Community Care Hospital forms part of the leisure facilities, sports fields, swimming pools and other venues where also open air civic and cultural events are organised.

Open social and health care in district centres - a net of "mini-Asclepieions"

Each District Centre forms a "Mini-Asclepieion". The health care services are combined in district centres with cultural, leisure and fitness activities. Outpatient programmes vary greatly from minor acute services, mental health services, dentistry, family counselling, child and juvenile psychiatry, to special care centres for management of chronic diseases such as diabetes or chronic heart disease. A network of various public and private care providers form different service profiles and serve inhabitants across the district borders.

The District Centre also provides the necessary social care facilities (elderly services, family support, drug abusers, immigration, unemployment support etc.) all connected to the "Mini-Asclepieion".

The Netherlands has 32 health care workers/1000 inhabitants, of which 14 work in open care (OECD 2006). The total floor area needed for this is approx.100 000m^2, corresponding to 15 000-18 000m^2 in each centre. Activities may be placed:

- in a special health care building,
- as part of a larger commercial complex
- distributed in separate buildings in a district centre.

The total amount of mentally disabled people is about 1% of the population while 0.4 % are severally disabled requiring institutional service. The rest live in sheltered housing and attend sheltered workshops provided in 2-3 different locations.

Box 18

Elderly care centres and health centres with multifunctional services

There is a need for an integrated elderly care concept with housing alternatives ranging from owned or rented flats, group homes for people with dementia, to service and nursing homes, including terminal care, for 200-600 clients in each. The facilities, that will be built step-by-step, provide space for clubs, choirs and drama for the elderly thus creating an active community. This requires extensive lobby areas with catering, hairdressers and other such services. Doctors' consultation facilities are also integrated.

Rehabilitation services for the elderly are provided by the district centres. The required swimming pools are integrated into the community by providing public access. Home care is provided by connecting patients to care programmes. District home care units can be located in the district centres or the elderly care centres.

Community Care (rehabilitation) Hospital

The Community Care Hospital is a special care hospital concentrating on the management of chronic diseases, geriatrics, rehabilitation and physiotherapy. The hospital admits acute patients with pre-set diagnoses. Most admissions are, however, planned. The stay in this hospital is limited to 30 days. The size of the hospital is based on the principle of one bed/1000 inhabitants, corresponding to a 160-bed hospital.

Central Hospital

Acute and elective care for all inhabitants is provided by a 320 bed (2 beds/1000 inhabitants), 50 000m^2 Central Hospital. The hospital runs 24-h emergency, general acute and regional care programmes. Its central location makes it possible to organise emergency services within 40min. maximum travel time.

The hospital includes all major medical specialities and auxiliary diagnostic services such as laboratories, and radiology also for screening services. The intake of patients through emergency will increase to roughly 70%, while the share of elective patients correspondingly decreases. The emergency with triage guides the patients to main clinical pathways: trauma, acute abdomen, cardiac and stroke.

Information technology has a major impact on hospital layout, logistics and process efficiency. Present image communication solutions will improve the efficiency by decentralising imaging devices on patients' routes, such as CT for stroke patients and bone imaging in the shock room, while all reporting is centralised in a radiological knowledge centre.

The ground floor of the hospital is part of normal city life, containing restaurants, galleries and shops. The canals, parks, cultural and sports activities are located around the site. The acute hospital and its surroundings form the "Main Asclepieion" of the city.

The hospital buildings are divided into modular blocks sharing the same structural and mechanical system. This will make them extremely flexible and adaptable for future needs. Options for expansion are shown on the site plan. Auxiliary services are located in a separate building, "the factory," which is connected to the hospital through a service bridge at third floor level. Automated vehicles with storage trolleys form the basis of the logistic chain thus eliminating most fixed storage areas. All logistical and technical routings and equipment is concentrated on the third (interstitial) floor. The number of vertical shafts and suspended ceilings is minimised.

Kjisik et al., 2007

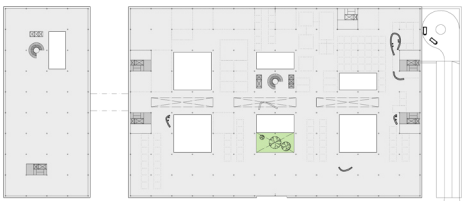
The "Main Asclepieion" forms an integral part of the central park. The ground floor level, the basic level of the park, actually flows through the building and is only interrupted by bars, cafes, performance areas and entrance lobbies from where the vertical connection elements of the hospital can be reached (Fig. 194). The plans of the acute hospital have less in common with "mat building" as those in "Cure for Sure". Instead the concept of "monospace" (as in Arras and elsewhere) has become more dominating. If all the proposed "Asclepieions" are seen as a totality, it becomes obvious that "debundling" principles have also been applied.

The reason for choosing a somewhat different approach to the design of the buildings for "Fair Care – Care Fair" than had been the case with "Cure for Sure" is not that this latter approach was seen as inherently better. On the contrary, in another situation in the future, the "mat" and the "organised casbah" may again turn out to be the preferred choice. In this particular case, however, more generic solutions for the design of the buildings seemed appropriate and more in keeping with the ancient spirit of the Asclepieions. Also, in this case, the acute hospital, the "Main Asclepieion", was clearly a "core hospital" which had not been the case in "Cure for Sure".

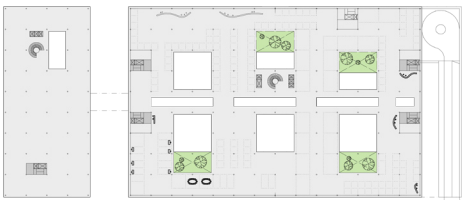
The acute hospital can here be seen as an "extended hot floor" model. It includes certain elements which would not be found in the purest of "core hospitals", such as major facilities for out-patient activities as well as general wards, i.e. not only wards for patients requiring the highest levels of care. The "monospace" design method together with the chosen functional and structural module, is such that when the

Fig. 194

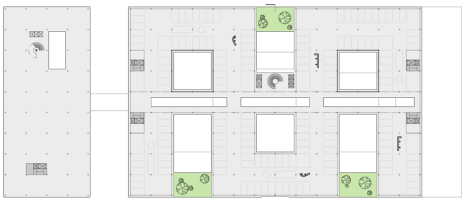
CENTRAL HOSPITAL – GROUND LEVEL 1:4000



CENTRAL HOSPITAL – 1ST LEVEL



CENTRAL HOSPITAL – 2ND LEVEL



CENTRAL HOSPITAL – 4TH AND 5TH LEVELS 1:4000

Fig. 195

number of bed spaces decreases concurrently with an increase in the demand for "hot floor" area and/or outpatients' facilities, the required changes can happen easily without interruption to the daily routines, while at the same time maintaining optimal dimensioning for the different activities (Fig. 195).

The floor plans, as shown, should be seen as diagrams rather than fixed idealised proposals. The principle of having corridors, foyers and waiting areas in daylit areas, thus leaving many small individual rooms windowless, has become commonplace in many recent good hospitals in Europe. This model was also largely applied in "Cure for Sure". However, it should be remembered that, because of building regulation and other directives, this may not be possible in some cases. The best solution might well be a combination of the two models, rather like in Rafael Moneo's Maternity and Children's Hospital in Madrid.

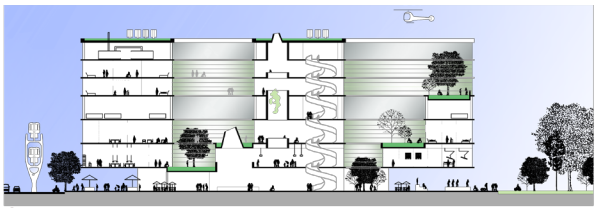
The elements that would be found in a traditional "all-in" acute hospital, but are not found in this one, are placed either in the "Beach Asclepieion" or the local "Mini Asclepieions", or then they function entirely outside the "Asclepieion" network. These include wards for patients requiring a limited amount of care, which are placed in patient hotels near the town centre, as well as a large proportion of central administrative functions, which take place in appropriate office accommodation within the city. What Bouwcollege in its "layers approach" classifies as "industry" (clinical chemistry, medical microbiology and clinical pathology laboratories, pharmacy and central kitchen, together accounting for 9-13% of the total floor area) (Netherlands Board for Health Care Institutions, 2007b), can be placed either as an annexe attached to the main hospital (a mass with a deeper structural frame, thus applying debundling principles) as can be seen in Figure 195. Alternatively, all these functions can be centralised on the "logistics island", in this case north-east of the city centre, as shown in Figure 187.

The sections of the building underline the functional, technical, environmental and aesthetic aims of the architectural solution. As has been pointed out earlier, there is now plenty of evidence that underlines the importance of daylight, views, and usable green external areas and there are claims that ample provision of these elements actually may lead to faster recovery times. The "Fair Care – Care Fair Main Asclepieion" provides all these features in abundance in a way that also emphasises adaptability, repeatability and agility, in order to secure improved future-proofing characteristics. The Heroic Era is echoed by the general design approach as well as, more specifically, by interstitial floors and concentrated service towers in the "hot floor" section of the hospital (Figs. 196 & 197).

The community rehabilitation hospital represents a contemporary hospital concept which is gradually becoming more common. Patients spend periods of one week to one month in the rehabilitation hospital or the "Beach Asclepieion" which is situated on the shoreline and provides a large variety of opportunities for fresh air, exercise and sports. In this hospital, as should increasingly be the case with any health care facility, the bed is no longer the focus, the emphasis being rather on keeping the patients away from the bed. A bedless hospital may well be the real hospital of the future. The community rehabilitation hospital is designed using the same principles and the same basic dimensioning as the central acute

CENTRAL HOSPITAL – LONGITUDINAL SECTION 1:2000

Fig. 196



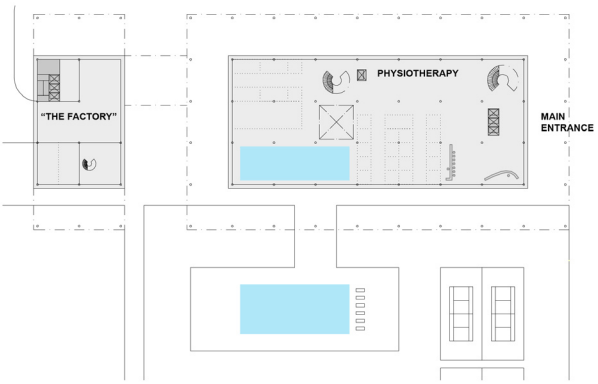
CENTRAL HOSPITAL – TRANSVERSAL SECTION 1:2000

Fig. 197

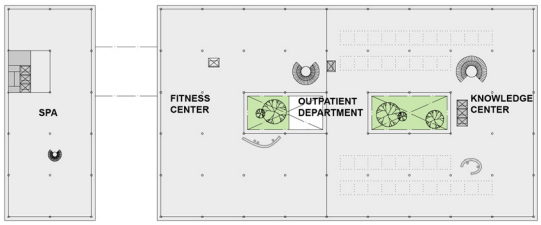
hospital. In this case as well, the "factory" functions can be placed next to the hospital or alternatively be located on the "logistics island" (Fig. 198).

The six district centres, the "Mini Asclepieions", combine primary care, surgeries of general practitioners, preventive programmes, dental care, pre-natal care and various forms of social care (Figs. 199 & 200). These use the same modular dimensioning system as the larger hospital units (the 10.8m x 10.8m structural and functional grid referred to in the description of "Cure for Sure"), thus facilitating the inevitable changes that will occur in the future (Fig. 201). Different levels of elderly housing are included in the immediate vicinity of the district centres as an integral part of the Asclepieion principle (Figs. 202 & 203).

The two competitions organised by the Netherlands Board for Healthcare Institutions have provided excellent opportunities for testing the ideas expressed in this study. The successes of "Cure for Sure", and particularly that of "Fair Care – Care Fair", indicate that there is a demand for a new kind of innovation in hospital design, one that is based on learning from the best past precedents, present best practices and, above all, the very fundamentals of good architecture and city planning.

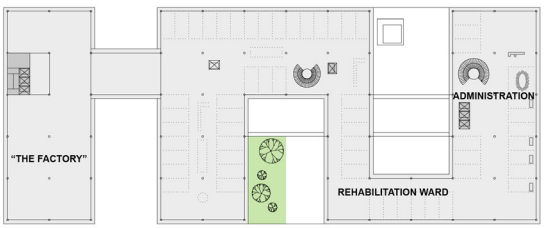


COMMUNITY CARE HOSPITAL – GROUND LEVEL



COMMUNITY CARE HOSPITAL – 1ST LEVEL

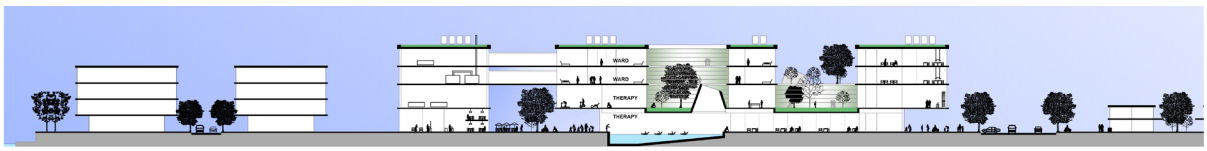
COMMUNITY CARE HOSPITAL – 2ND LEVEL



COMMUNITY CARE HOSPITAL – 3RD LEVEL

1:2000

Fig. 198



COMMUNITY CARE HOSPITAL – LONGITUDINAL SECTION

Fig. 199

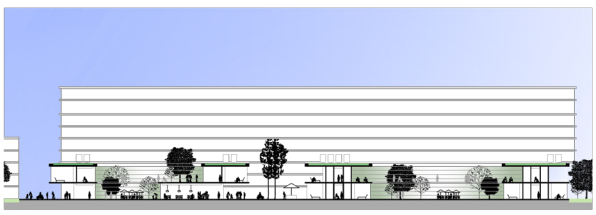
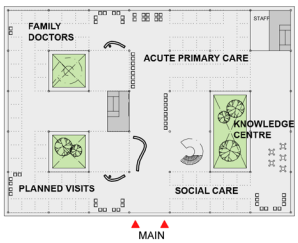


Fig. 200

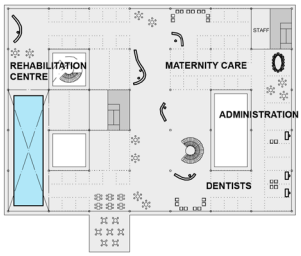
ELDERLY CARE CENTRES – LONGITUDINAL SECTION

1:2000

Fig. 201



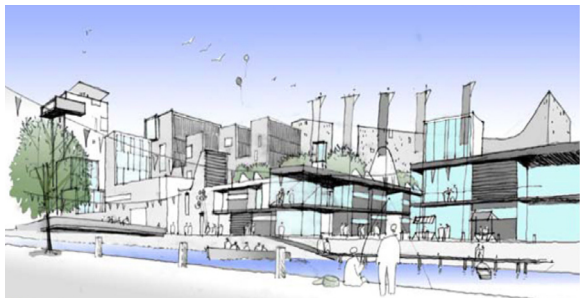
A DISTRICT CENTRE – GROUND LEVEL



A DISTRICT CENTRE – 1ST LEVEL

1:2000

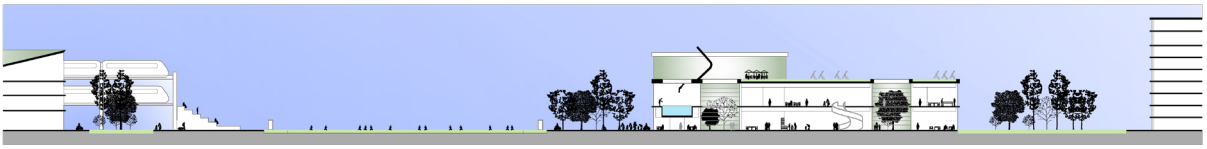
ELDERLY CENTRE



ELDERLY CENTRE

Fig. 202

Fig. 203



DISTRICT CENTRE – LONGITUDINAL SECTION

1:2000

REFERENCES

Aalto, A. (1933). Paimio Sanatorium. In *Paimio 1929-1933: Alvar Aallon arkkitehtuuria n:o 1. Architecture by Alvar Aalto no. 1* (3rd ed.) Jyväskylä: Alvar Aalto Museum.

Addington, M., Kienzl, N., & Intrachooto, S. (2001). Mat buildings and the environment. In H. Sarkis (Ed.), *Case: Le Corbusier's Venice Hospital and the mat building revival* (pp. 66-79). London: Prestel.

Akurgal, E. (1985). *Ancient civilisations and ruins of Turkey from prehistoric times until the end of the Roman Empire.* Istanbul: Haset Kitabevi.

Alanko, U., Kjisik, H., Kekäläinen, R. & Vauramo, E. (2006). *Vidzeme Health 2025 – Discussion Document.* Espoo: Sotera, Helsinki University of Technology,

Alberti, L. B. (1988). *On the art of building in ten books.* (J. Rykwert, N. Leach, & R. Tavernor, Trans.). Cambridge, Mass.: MIT Press. (Original work published in 1450). *De Re Aedificatoria.*

Allan, J. (1988, June). Caring and Causality. *Architectural Review, 1096*, 46-50.

Allard, P. (2001). Bridge over Venice. In H. Sarkis (Ed.), *Case: Le Corbusier's Venice Hospital and the mat building revival* (pp. 18-35). Munich; New York: Prestel.

Allard, P. (2006). Guillermo Jullian de la Fuente and mat building. In M. Risselada, D. van den Heuvel & G. de Waal (Eds.), *Team 10: Keeping the language of modern architecture alive* (pp. 144-169). Delft: Faculty of Architecture, Delft University of Technology.

Allen, I. (2003, April 10). Editorial *The Architect's Journal,* pp. 32-38.

American Institute of Architects Academy of Architecture for Health (AIA/AAH). (2003). *Health Facilities Review, 2003-2004.*

American Institute of Architects Academy of Architecture for Health (AIA/AAH) / Facility Guidelines Institute. (2001). *Guidelines for Design and Construction of Hospitals and Health Care Facilities: 2001 edition.*

Amsoneit, W. (1986, March). The Fairytale of the Stranded Spaceship. *Architecture and Urbanism (A+U),* 186, 64-70.

Arnkil, H. (2007). *Värit havaintojen maailmassa.* Helsinki: Taideteollinen korkeakoulu .

Asenova, D., Beck, M., Akintoye, A., Hardcastle, C. & Chiyio, E. (2003). Obstacles to best value in NHS PFI projects: evidence from two hospitals. *Journal of Finance and Management in Public Services, 4,* 33-49.

Auster, P. (2005). *The Brooklyn Follies.* London: Faber and Faber.

Autio, A. (2006). *Prosessiajattelu ja sairaala-arkkitehtuuri – Pitkän tähtäimen esisuunnittelu ja toiminnalliset prosessit sairaaloiden arkkitehtuurin lähtökohtina.* Master's thesis. Espoo, Finland: Institute of Healthcare Engineering, Management and Architecture (HEMA), Helsinki University of Technology.

Avermaete, T. (2005). Mat building – Team 10's reinvention of the critical capacity of the urban issue. In M. Risselada & D. van den Heuvel (Eds.), *In search of a Utopia of the present 1953-81.* Rotterdam: NAi Publishers.

Bacon, E. N. (1978). *Design of Cities.* London: Thames and Hudson.

Baird, G. (2006). Meaning in Architecture. In M. Risselada, D. van den Heuvel & G. de Waal (Eds.), *Team 10: Keeping the language of modern architecture alive* (pp. 72-87). Delft: Faculty of Architecture, Delft University of Technology.

Bakler, T. & Lind, J. (2006). The present and the future of regional medical care in Virumaa. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC*(pp. 122-126). Helsinki: Technomedicum, Helsinki University Press.

Ball, R., Heafy, M., & King, D. (2001). Private Finance Initiative - a good deal for the public purse or a drain for future generations? *Policy & Politics, 29* (1), 95-108.

Barbet-Massin, O. (Ed.). 2001**.** *Hospital heritage – A journey through Europe.* Paris: Monum / Editions du patrimoine.

Barnett, A. (2004). Architects for Health / CABE, events. London: CABE Health Week.

Barragan, L. (1980). Pritzker Prize Acceptance Speech. Chicago: Hyatt Foundation.

Beisson, G. (2004). L'hôpital Mémorial France États-Unis de Saint-Lô (1956). Le premier hôpital en hauteur moderne de France. *Livraisons d'histoire de l'architecture.* Retrieved April 11, 2008 from (http://lha.enc.sorbonne.fr/document152.html)

Benevolo, L. (1980). *The history of the city.* London: Scolar Press.

Berg, A. E. van den. (2005). *Health impact of healing environments.* Groningen: Foundation 200 years University Hospital Groningen.

Berg, A. E. van den, & Wagenaar, C. (2006). Healing by architecture. In Wagenaar, C. (Ed.), *The architecture of hospitals* (pp. 254-257). Rotterdam: NAi Publishers.

Bertolucci, C. (2005, May 1). Urban healing: a maternity and children's hospital has an impressive urban presence concealing a rich interior life. *Architectural Review*, 217 (1299), 56-63.

Betsky, A. (2006). Framing the hospital: the failure of architecture in the realm of medicine. In Wagenaar, C. (Ed.). *The architecture of hospitals* (pp. 68-75). Rotterdam: NAi Publishers.

Black, B. (2006). *Florence Nightingale, unsung architect.* Retrieved April 11, 2008 from http://cjournal.concordia.ca/journalarchives/2006-07/nov_23/008145.shtml

Blomstedt, A. (1948). Paul Nelson. *Arkkitehti 7-8* (48), 105-108.

Blundell-Jones, P. (2002, March). The hospital as a building type. *Architectural Review 1261*, 42-43.

Boluijt, P., & Hinkema, M J. (2005). *Future hospitals: competitive and healing – competition report.* Utrecht: Netherlands Board for Hospital Facilities (Bouwcollege).

Boluijt, P. (2006). Care models and hospital design in the Netherlands. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 396-399). Rotterdam: NAi Publishers.

Boyer, C. (2006). Keeping the language of modern architecture alive. In M. Risselada, D. van den Heuvel & G. de Waal (Eds.), *Team 10: Keeping the language of modern architecture alive* (pp. 32-71). Delft: Faculty of Architecture, Delft University of Technology.

Brainard, G. C. (1995). Implications of the effect of light on hormones, brain and behavior. *Journal of Healthcare Design, 7.*

Brand, S. (1994). *How buildings learn : What happens after they are built?* New York: Viking.

Brendel, A. (2007). *Alfred Brendel on music: His collected essays.* London: JR Books.

Buchanan, P. (1986, Oct). Medical Megastructure. *The Architectural Review, 1076,* pp. 96-101.

Burger, A. C. M., Afink, G. H., Kriek A. J., & Thiadens, G. A. M. (2006). The new Martini Hospital: The need for flexibility. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 475-477). Rotterdam: NAi Publishers.

Burton, R. (2004). A blueprint for the future. In T. Monk, *Hospital Builders* (pp. 42-44). Chichester: Wiley-Academy.

Burton, R. (2004, August). CABE questions future of 'incoherent' PFI. *The Architect's Journal, August 26,* 18-19.

Bushby, R. (2002, 30 May). Today's PFI hospitals "obsolete in 20 years", warns CABE. *The Architect's Journal, 215* (21), p.8.

Chefurka, T., Nesdoly, F. & Christie, J. (2005). *Concepts in Flexibility in Healthcare Facility Planning, Design and Construction.* The American Institute of Architects Academy Journal. Retrieved August 8, 2005 from http://www.aia.org/aah_a_jml_0401_article68grandCh=yes

Chow, C. et al. (2004). Soundscapes _ Sound and Health. In GUPHA, *26th Industrial Design Seminar – Proceedings* (pp. 69-80). Toronto: Carleton University.

Cohn, D. (2004, October). Maternity and pediatric hospital in Madrid. *Architectural Record, October 2004.*Volume?Pages?

Cole, J. (2007). Developing a strategic plan for healthcare facilities in Northern Ireland: A case study. Belfast: EuHPN.

Cole, J. (2006). Strategic Planning for Healthcare Facilities. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. *356-361*). Rotterdam: NAi Publishers.

Cremnitzer, J-B. (2005). *Architecture et santé : Le temps du sanatorium en France et en Europe.* Paris: Picard.

Davey, P. (1991, Feb). St. Mary's. *Architectural Review, 1028*, 24-33.

Davies, C. (1988, June). Architecture of caring. *Architectural Review, 1096*, 15-17.

Dilani, A. (1996). *Sjukhus i brukarperspektiv – kvalitetsutveckling i vårdbyggnader.* Stockholm: Kungliga Tekniska Högskolan.

Dilani, A. (Ed.). (2004). *Health promotion through environmental design.* Stockholm: Design and Health.

Dixon, T., Pottinger, G., & Jordan, A. (2005). Lessons from the private finance initiative in the U*., Journal of property valuation & investment, 23*, 412-423.

Dowdeswell, B., Erskine, J., & Heasman, M. (2004). *Hospital ward configuration: Determinants influencing single room provision. Report by the EU Health Property Network.* NHS Estates, England, November 2004.

Dowdeswell, B., & Erskine, J. (2006). *The role of lifecycle costing in capital investment in healthcare facilities.* Utrecht: College bouw zorginstellingen.

Dowdeswell, B. (2006a). Sustainable asset planning and investment. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 362-366). Rotterdam: NAi Publishers.

Dowdeswell, B. (2006b). Strategic asset planning in the new health landscape. . In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 74-84). Helsinki: Technomedicum, Helsinki University Press.

Driesen, G. (2006). A strategy for re-urbanising hospitals. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 106-112). Rotterdam: NAi Publishers.

Dunican, P. (1979, November). Review of the book "Pioneers of prefabrication: The British contribution in the nineteenth century" by Gilbert Herbert. *Architectural Design,* November 1979.

Dyer, A. & Schwarz, K. (2006). Delivering healthy environments via private financing initiative (PFI). In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 516-524). Rotterdam: NAi Publishers.

Eaton, R. (2002). *Ideal Cities.* London: Thames and Hudson.

Eklund, F., & Vauramo, E. (2006). *Aspects in implementation of visions of a network for future regional health care.* Espoo: Helsinki University of Technology.

Eklund, F., Vauramo, E., Autio, A., & Kjisik, H. (2007). *Visio tulevaisuuden palvelujärjestelmästä – case Kymenlaakso.* Espoo: Teknillinen korkeakoulu, HEMA-insituutti.

Engqvist, S. (2006). Process based planning of the new emergency clinic at Karolinska Hospital: The importance of early preprogram efforts. In Z. Kolitsi (Ed.), *Transforming health care organisations. Network for Future Regional Health Care, Interreg IIIC* (pp. 70-72). Helsinki: Helsinki University Press.

Erskine, J. (2006). *Case Study: Orbis Medical Park, Sittard, The Netherlands*. Durham: European Health Property Network.

Fermand, C. (1999). *Les hôpitaux et les cliniques : Architecture de la santé.* Paris: Editions du Moniteur.

Finch, P. (2005, May). Light Touch. *Architectural Review,1299,* 46-54.

Fondi, Daniela. (2002). *Architettura per la Sanita; forma, funzione, tecnologia.* Roma: Edizione Kappa.

Foucault, M., Kriegel, B. B., Thalamy, A., Beguin, F., & Foriter, B. (1979). *Les machines à guérir (aux origins de l'hôpital moderne)*. Paris: Pierre Mardaga .

Foucault, M. (1970). *The Order of Things*. London: Tavistock.

Francis, S. (2006). Design developments in the UK: The case for investing in good design. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 525-531). Rotterdam: NAi Publishers.

Francis, S., & Glanville, R. (2001). *Building a 2020 vision: Future health care environments.* The Nuffield Trust. London: The Stationary Office.

Francis, S., Glanville, R., Noble, A., & Scher, P. (1999). *50 years of ideas in health care buildings.* London: Nuffield Trust.

Freeman, A. (1987, January). Evaluation: Therapeutic Environment. *Architecture (AIA). 76* (1), 52-57.

Gaudin, B. (2006). The Hospital and the City. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 113-119). Rotterdam: NAi Publishers.

Gaynor, M. L. (1999). *The healing power of sound: Recovery from the life-threatening illness using sound, voice and music.* Boston: Shambala Publications.

Geiser, S. (2005). Open building in health care architecture: The case of the INO project in Bern, Switzerland. *Open House International, 30* (1), 14-15.

Giedion, S. (1951). *A decade of new architecture.* Zurich: Editions Girsberger.

Global University Partnership for Health Architecture (GUPHA). (2004). *26th Industrial Design Seminar – Proceedings".* Ottawa: Carleton University.

de Gravelaine, F. (1988, April). Santé: L'hôpital change d'image. *L'architecture d'aujourd'hui, 256,* pp. 1-3.

Guenther, R., & Vittori, G. (2008). *Sustainable Healthcare Architecture.* Hoboken, New Jersey: John Wiley & Sons.

Guez, G. (1970, Juin-Juillet). Image ouverte de l'hôspital. *L'architecture d'aujourd'hui, 150,* 5-11.

Gullichsen, K. (2006). Is architecture an elephant? In P. MacKeith (Ed.), *Archipelago – essays on architecture* (pp. 12-4). Helsinki: Building Information Ltd.

Gusack, P. (2005, June). Corridors of power. The practice of theory in hospital design. *Architects for Health, Viewpoint.* Retrieved April 8, 2008 from http://www.architectsforhealth.com/

Gusack, P. (2006a, March). Prof Roger Ulrich: Personal observations about healthcare buildings in the UK. *Architects for Health, Viewpoint.* Retrieved April 8, 2008 from http://www.architectsforhealth.com/

Gusack, P, (2006b, April) What was you thinkin'? *Architects for Health, Viewpoint.* Retrieved April 8, 2008 from http://www.architectsforhealth.com/

Gusack, P. (2006c, June). Wilmington's PFE Conference. *Architects for Health, Viewpoint.* Retrieved April 8, 2008 from http://www.architectsforhealth.com/

Gusack, P. (2006d, December). The rise towards heaven. Review of the London Arts Health Forum seminar on integration of art in healthcare facilities. *Architects for Health, Viewpoint.* Retrieved April 8, 2008 from http://www.architectsforhealth.com/

Gutton, R. (1979, April). L'hôpital et l'espace de vie du malade. *Techniques et Architecture 324*, 35-38.

Habraken, N. J. (1998). *The structure of the ordinary: Form and control in the built environment.* Cambridge, MA: MIT Press.

Hall, E.T. (1966). *The hidden dimension.* New York: Doubleday/Anchor Books.

Hällström, J., & Sandow, M. (2004, September). 70-tals miljön skall bevaras – Välplanerad och rik på konst. *Locum Rum, 3,* 19-20.

Hamilton, K. (2006). Evidence based design and the art of healing. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 271-280). Rotterdam: NAi Publishers.

Harvey, David. (1991). *The condition of post-modernity.* Cambridge, MA: Basil Blackwell.

Healy, J., & McKee, M. (2002). The evolution of hospital systems. In M. McKee, & J. Healy (Eds.), *Hospitals in a changing Europe (pp. 14-35).* Buckingham: Open University Press.

Healy, J., & McKee, M. (2002). The role and function of hospitals. In M. McKee, & J. Healy (Eds.), *Hospitals in a changing Europe (pp. 59-80).* Buckingham: Open University Press.

Helsebygg Midt-Norge. Hospital development project for Central Norway. (2006). *EuHPN Network Study – St. Olavs Hospital.* Trondheim: EuHPN.

Huddy, J., & Rapp, M. T. (2000). *Emergency department design: A practical guide to planning for the future.* Irving, Texas: ACEP.

Hustvedt, S. (1993). *The blindfold.* London: Hodder & Stoughton.

Hutchison, D. (2004). Future proof not future ready – Health facilities as of now. In Monk, T., *Hospital Builders* (pp. 20-31). Chichester: Wiley-Academy.

Ihalainen, R. (2005). Back to Basics. In H. Kjisik (Ed.), *Hospitals old and new: Study tour in May 2004.* Espoo: Sotera, Helsinki University of Technology.

Ihalainen, R. (2005). Gesamtkunstwerk – Catalan Style. In H. Kjisik (Ed.), *Hospitals old and new: Study tour in May 2004.* Espoo: Sotera, Helsinki University of Technology

James, W. P., & Tatton-Brown, W. (1986). *Hospitals: Design and development.* London: The Architectural Press.

Jencks, C. (2006). Maggie's Centres and the architectural placebo. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 448-459). Rotterdam: NAi Publishers.

Johansson, C., Briede, R., Kjisik, H., Stauskis, G., & Freimanis, R. (2006). *New concepts and new environments. Network for Future Regional Health Care, Interreg IIIC.* Helsinki: Helsinki University Press.

Johns, D., & Zirkie, D. (1999). *The Bedless Hospital.* American Institute of Architects Academy Journal. Retrieved August 5 2008 from http://www.aia.org/static/journal/articles/12/abstract12.asp

Kalkkinen, S., & Waris, E. (2005). On the Waterfront. In H. Kjisik (Ed.). *Hospitals old and new: Study tour in May 2004.* Espoo: Sotera, Helsinki University of Technology

Kekomäki, M., Rehnberg, C., Thellman Beck, B., & Vauramo, E. (2006). Future vision of regional health care. In B. Thellman Beck, M. Kekomäki, K. Meigas, & E. Vauramo (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 1-40). Helsinki: Technomedicum, Helsinki University Press.

Kekomäki, M. (2006a). New Health Care Environments. In Z. Kolitsi, et al. (Eds.), *Transforming health care organisations. Network for Future Regional Health Care, Interreg IIIC* (pp. 2-11). Helsinki: Helsinki University Press.

Kekomäki, M. (2006b). Implementation of a Regional Healthcare Network. In G. Stauskis, M. Kekomäki & D. Ratniece (Eds.), *Implementation of future health care visions. Network for Future Regional Health Care, Interreg IIIC* (pp. 73-77). Helsinki: Technomedicum, Helsinki University Press.

Kekäläinen, R. (1982). *Interdepartmental connection requirements in a general hospital building.* Tampere: Tampere University of Technology.

Kendall, S. (1999, October). Base building and fit-out: Principles for 21st century building maintenance and management. *Building Maintenance and Management,* Japanese language journal, October 1999, 18-27, Tokyo.

Kendall, S. (1999). Open building: An approach to sustainable architecture. *Journal of Urban Technology 6* (3), 1-16.

Kendall, S. (2004). *Open Building: A New Paradigm in Hospital Architecture.* American Institute of Architects Academy Journal. Retrieved August 8 2005 from http://www.aia.org/journal_aah

Kendall, S. (2008). Open Building: Healthcare Architecture on the Time Axis – A New Approach. In R. Guenther & G. Vittori, *Sustainable Healthcare Architecture.* Hoboken, New Jersey: John Wiley & Sons.

Keränen, U. (2006). From Home to Operation (FHTO): A new procedure in Hyvinkää Hospital Finland. In Z. Kolitsi, et al. (Eds.), *Transforming health care organisations. Network for Future Regional Health Care, Interreg IIIC* (pp. 73-75). Helsinki: Technomedicum, Helsinki University Press.

Kirkuma, A., & Ratniece, D. (2006). The development of health care in Latvia – the Riga example. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 91-98). Helsinki: Technomedicum, Helsinki University Press.

Kivastik, T. (2006). Evolution and implementation of the masterplan of Tartu University Hospital. In G. Stauskis, M. Kekomäki & D. Ratniece (Eds.), *Implementation of future health care visions. Network for Future Regional Health Care, Interreg IIIC* (pp. 34-39). Helsinki: Technomedicum, Helsinki University Press.

Kjisik, H. (1984). *Etude prospective de constructions scolaires au moindre coût. Rapport de la mission en Mauritanie.* Dakar/Paris: UNESCO/BREDA.

Kjisik, H. (Ed.). (2005). *Hospitals old and new: Study tour in May 2004.* Espoo: Sotera, Helsinki University of Technology.

Kjisik, H., Kekäläinen. R., Lauslahti, K., Louhivuori, O., Vauramo, E., Malahovskis, M., & Kekomäki, M. (2004). *Evaluation of seven hospitals in the City of Riga: A discussion document.* Espoo: Sotera, Helsinki University of Technology.

Kjisik, H., Vauramo, E., & Stauskis, G. (2002). *Evaluation of Healthcare Facilities – a guideline for the user.* Helsinki: Sotera, Helsinki University of Technology.

Kliment, S. (Ed.). (2000). *Building type basics for healthcare facilities.* New York: John Wiley & Sons.

Kolitsi, Z., Kekomäki, M., Pallikarakis, N., Tolkki, O., & Whitehouse,D. (2006). *Transforming Health Care Organisations. Network for Future Regional Health Care, Interreg IIIC.* Helsinki: Technomedicum, Helsinki University Press.

Komonen, M. (1978). Suunnittelun laitostuminen. *Arkkitehti, 1*(78), 21.

Kostof, S. (1991). *The city shaped: Urban patterns and meanings through history.* London: Thames and Hudson.

Krokfors, K. (2005). *Aika asuntoarkkitehtuurissa: typologinen joustavuus pientalosuunnittelun uudistamisen välineenä.* Licentiate thesis, Department of Architecture, Helsinki University of Technology. Lawson, B. (2002, March). Healing Architecture. *Architectural Review 1261,* 72-75.

Lawson, B., & Phiri, M. (2004). *The benefit of single rooms' provision and their impact on staff and patient health outcomes within the NHS in England.* Interim study report for NHS Estates.

Le Corbusier (1929). *The City of Tomorrow.* London: The Architectural Press.

Leibrock, C. A. (1999). *Design details for health: Making the most of interior design's healing potential.* New York: John Wiley & Sons.

Lemonnier, G. *Techniques et Architecture:* Paris juin-juillet: Paris 2002?

Lemonnier, G. (2006). Hospital architecture in Paris: The Assistance Publique-Hôpitaux (AP-HP). In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 372-375). Rotterdam: NAi Publishers.

Levin, B., & Normann, R. (2001). *Vårdens chans: en model för morgondagens vård och äldreomsorg.* Stockholm: Ekerlids förlag.

Li Bing, Akintoye, A., Edwards, P., & Hardcastle, C. (2005) Critical success factors for PPP/ PFI projects in the UK construction industry. *Construction Management and Economics, 23,* 459-471.

Lillrank, P. (2003). Keskeneräinen potilas eli aika sairaanhoidossa. *Suomen lääkärilehti 3/2003.*

Lillrank, P., & Parvinen, P. (2004). Omistaja, prosessi, potilas. Suomen lääkärilehti 10/2004.

Llewellyn-Davies, R., & Macaulay, H.M.C. (1966). *Hospital planning and administration.* Geneva: WHO.

Locum Rum (2004, September). *Locum's Architectural Policy.* Stockholm: Locum AB.

Lonka, H. (2007). *Projects as distributed cognitive actions: The management of two public building projects.* Espoo: Helsinki University of Technology.

Lonsdale, C. (2005). Post-contractual lock-in and the UK private finance initiative: The cases of national savings and investments and the Lord Chancellor's department. *Public Administration,* 83 (1), 67-88.

MacKeith, P. (Ed.). (2006). *Archipelago – essays on architecture.* Helsinki: Rakennustieto.

Magrou, R. (2002, June-July). *Techniques et Architecture*

Mäkelä, M., & Routarinne, S. (Eds.). (2006). *The art of research.* Helsinki : University of Art and Design.

Malkin, J. (2006). Healing Environments as the Century Mark: The Quest for Optimal Patient Experiences. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 258-265). Rotterdam: NAi Publishers.

Marberry, S. (Ed.). (1995). *Innovations in healthcare design.* New York: Van Nostrand Reinhold.

Marberry, S. (1997). *Healthcare Design.* New York: John Wiley & Sons.

Martikainen, V. (1971). Sairaalasuunnittelu on moniarvoinen asia. *Arkkitehti, 1(71),* 25-26.

Mathur, N. S. (2005). *The Next Generation of Operating Rooms.* American Institute of Architects Academy Journal. Retrieved August 5 2008 from http://www.aia.org/journal_aah.cfm?pagename=aah_irnl_20051019_ORs&dspl

Matthes, G., Friedrich, J., Vauramo, E., Kjisik, H., Kämäräinen, V., & Tolkki, O. (2006). Investigation of emergency processes in twelve hospitals in Europe. In Z. Kolitsi, et al. (Eds.), *Transforming health care organisations. Network for Future Regional Health Care, Interreg IIIC* (pp. 90-123). Helsinki: Technomedicum, Helsinki University Press.

McCuskey Shepley, M. (2006). Evidence-based design and architecture. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 266-270). Rotterdam: NAi Publishers.

McKean, J. (2004). *Giancarlo de Carlo – Layered places.* Stuttgart: Axel Menges.

McKee, M., & Healy, J. (Eds.). (2002a). *Hospitals in a changing Europe.* European Observatory on Health Care Systems Series. Buckingham: Open University Press.

McKee, M., & Healy, J. (2002b). The significance of hospitals: an introduction. In M. McKee & J. Healy (Eds.), *Hospitals in a changing Europe (pp. 3-13).* Buckingham: Open University Press.

McKee, M., & Healy, J. (2002c). Investing in hospitals. In M. McKee & J. Healy (Eds.), *Hospitals in a changing Europe (pp. 119-149).* Buckingham: Open University Press.

McKee, M., Healy, J., Edwards, N., & Harrison, A. (2002). Pressure for change. In M. McKee & J. Healy (Eds.), *Hospitals in a changing Europe (pp. 36-58).* Buckingham: Open University Press.

Mens, N. (Ed.). (2005). *Zorgboulevards: Verkenningen in het zorglandschap van morgen.* Bussum: Uitgeverij Thoth.

Meuser, P., & Schirmer, C. (2006). *New hospital buildings in Germany.* Berlin: DOM Publishers.

Migayrou, F., & Collura, C. (Eds.). (2008). *Pol Abraham.* Paris: Centre Pompidou.

Miller, T.S. (1997). *The birth of the hospital in the Byzantine Empire.* Baltimore, MD: Johns Hopkins University Press.

Molenaar, B. (2006). Cocoon and Paradise. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 376-381). Rotterdam: NAi Publishers.

Monk, T. (2004). *Hospital builders.* Chichester: Wiley-Academy.

Mumford, E. (2001). The emergence of mat or field buildings. In Sarkis, H. (Ed.), *Le Corbusier's Venice Hospital and the mat building revival* (pp.18-35). New York: Prestel.

Nagasawa, Y. (Ed.). (2004). *Global hospitals in the year 2050.* Tokyo: GUPHA.

Nagasawa, Y. (1996). *Urbanisation: Global health challenge - Housing problems in rapidly growing megacities.* Kobe, Japan: WHO Centre for Health Development.

Nantois, F. (2007, March-April) Nouvel hôpital de la Fondation Cognacq-Jay. *L'architecture d'aujourd'hui, 369,* 18-21.

Nazarenko, S. (2006). Mobile Technologies. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 69-73). Helsinki: Technomedicum, Helsinki University Press.

National Health Service (NHS). 2003. *The Healing Environment.* Retrieved on June 29, 2004 from http://patientexperience.nhestates.gov.uk

Nelson, W., Krauja. N., & Moeller, T. (2005). *Development Study with Supplements on Veterans' Association Hospital Building System.* Retrieved on April 15, 2008 from http://www.va.gov/facmgt/standard/bsds.asp

Netherlands Board for Hospital Facilities (College bouw ziekenhuisvoorzieningen (Bouwcollege). (2002). *The general hospital: Building guidelines for new buildings (Report No. 0.107).* Utrecht: Bouwcollege.

Netherlands Board for Hospital Facilities (College bouw ziekenhuisvoorzieningen (Bouwcollege). (2004). *Contest programme: Future hospitals: Competitive and healing.* Utrecht: Bouwcollege.

Netherlands Board for Hospital Institutions (College bouw zorginstellingen) (Bouwcollege). (2007a). *Building Differentiation of Hospitals – Layers Approach (report no. 611).* Utrecht: Bouwcollege.

Netherlands Board for Hospital Institutions (College bouw zorginstellingen) (Bouwcollege). (2007b). *Healthcare 2025: Buildings for the Future.* Utrecht: Bouwcollege.

Netherlands Board for Healthcare Institutions (College bouw zorginstellingen). (2006). *Performance criteria for general hospitals.* Utrecht: Bouwcollege.

Nickl-Weller, C., & Nickl, H. (Eds.). (2007). *Krankenhausarchitektur fur die Zukunft.* Berlin: Verlagshaus Braun.

Nield, L. (2003, June). Hospitals are not designed for the 20th century. *Architects for Health, Events.* Retrieved April 8, 2008 from http://www.architectsforhealth.com/

Niemi, H. (2004). *Päivystyspoliklinikan toimintojen määritys ja tehostamisen periaatteet.* Master's Thesis. Espoo: Helsinki University of Technology, BIT Research Centre.

Niemi, H., Kjisik, H., Kämäräinen, V., & Vauramo, E. (2004). *Prosessiajattelu sairaalasuunnittelun lähtökohtana.* Espoo: Helsinki University of Technology, BIT Research Centre.

Nightingale, F. (1859). *Notes on Hospitals.* London: John W. Parker & Sons.

Nightingale, M. (1982, 28 July). Building Update – Hospitals Part 2. *The Architect's Journal, 176* (30), pp. 47-61.

The Nuffield Trust & Medical Architecture Research Unit (MARU) of the South Bank University. (2001). *Building a 2020 vision: Future health care environments.* Norwich: The Stationary Office.

Ottar, A. (2006). Social spaces in the Rikshospital in Oslo. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 413-417). Rotterdam: NAi Publishers.

Overy, P. (2007). *Light, air and openness.* London: Thames & Hudson.

Paatela, M. (2003). *Sairaalarakennuksen kehitys: Development of the hospital building.* Espoo: Arkkitehtitoimisto Paatela & Paatela.

Paatela, M. (2006). *Suomalaisen keskussairaalarakennuksen kehittyminen 1900-luvun jälkipuolella.* Licentiate thesis. Espoo: Department of Architecture, Helsinki University of Technology.

Pallikarakis, N. (2006). Trends in Medical Technology. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 85-90). Helsinki: Technomedicum, Helsinki University Press.

Pearman, H. (2005, November 5). *Just what the doctor ordered.* Sunday Times.

Perez Gomez, A. (2006). *The wall and the stair: Architecture and its limits.* P. MacKeith, (Ed.) (2006). *Archipelago – essays on architecture.* (pp. 18-28) Helsinki: Rakennustieto.

Pesola, K. (Ed.). (1991). *Uutta eurooppalaista sairaala-arkkitehtuuria: Matkaraportti.* Espoo: Helsinki University of Technology/Department of Architecture/SOTERA.

Petillot, A. (2005). *Patrimoine hospitalier.* Paris: Scala.

Pevsner, N. (1976). *The History of Building Types.* London: Thames and Hudson.

Pilosof, N. P. (2005, October 19) Planning for change: Hospital design theories in practice**.** *American Institute of Architects Academy Journal, 8.* Retrieved April 6, 2008 from http://www.aia.org/aah_journal_20051019

Pollock, A. M., Shaoul, J. N., & Vickers, N. N. (2002). Private finance and "value for money" in NHS hospitals: a policy in search of a rationale? *BMJ, 324,* 1205-1209.

Powell, C. (1989, August). Flexibility – scrap or adapt. *Architect's Journal,* 79.

Poynter, F.N.L. (Ed.). (1964). *The evolution of hospitals in Britain.* London: Pitman Medical Publishing Company.

Preiser, W. F. E., Rabinowitz, H. Z., & White, E. T. (1988). *Post-occupancy evaluation.* New York: Van Nostrand Reinhold.

Prins, M., Bax, T., Carp, J. C., & Templemans Plat. (1993). *A design decision support system for building flexibility and costs.* The Netherlands: Kluwer Academic Publishers.

Putievsky Pilosof, N. (2005, October 19) Planning for change: Hospital design theories in practice. American Institute of Architects Academy Journal (AIA/AAH), 8. Retrieved April 11, 2008 from http://www.aia.org/journal_aah.cfm?pagename=aah_journal_20051019

Putsep, E. (1981). *Modern hospital: International planning practices.* London; Lloyd-Luke.

Ribeiro, G. (2001, September). Sarah Network. *Arkitekten (DK), 103,* pp. 16-23.

Riboulet, P. (1989, April-May). La ville dont le prince est un enfant. *Techniques et Architecture, 383,* pp. 68-79.

Riboulet, P. (1988, April). Journal de travail. *Architecture d'aujourd'hui, 256,* pp. 18-21.

Risselada, M. (Ed.). (2005). *TEAM 10: In search of a Utopia of the present 1953-81.* Rotterdam: NAi Publishers.

Risselada, M., van den Heuvel, D., & de Waal, G. (Eds.) (2006). *TEAM 10: Keeping the language of modern architecture alive.* Delft: Faculty of Architecture, Delft University of Technology.

Robert, J-P. (1988, April). *Pierre Riboulet, hôpital pédiatrique Robert Debré, à Paris. Architecture d'aujourd'hui, 256,* pp. 12-15.

Rodger, J. (Ed.). (2007). *Gillespie, Kidd & Coia : Architecture 1956-87.* Glasgow: The Lighthouse.

Ronner, H. & Jhaveri, S. (Eds.). (1987). *Louis Kahn: Complete works, 1935-1974.* Basel: Birkhäuser.

Rosenau, H. (1970). *Social Purpose in Architecture: Paris and London Compared.* London: Studio Vista.

Rudofsky, B. (1964). *Architecture without architects.* London: Academy Editions.

Saarikangas, K. (2002). *Asunnon muodonmuutoksia: Puhtauden estetiikka ja sukupuoli modernissa arkkitehtuurissa.* Helsinki: Suomalaisen Kirjallisuuden Seura.

Sarah Network. (2007). Retrieved September 13, 2007 from www.sarah.br (English version)

Sarkis, H. (Ed.). (2001). *Le Corbusier's Venice Hospital and the mat building revival.* London: Prestel.

Sarkis, H. (2001). The paradoxical promise of flexibility. In H. Sarkis (Ed.) *Le Corbusier's Venice Hospital and the mat building revival* (pp.80-89). London: Prestel.

Scalbert, I. (2006). From anthropology to structuralism. In M. Risselada, D. van den Heuvel & G. de Waal (Eds.), *Team 10: Keeping the language of modern architecture alive* (pp. 136-143). Delft: Faculty of Architecture, Delft University of Technology.

Schama, S. (2006). *The Power of Art.* London: BBC Books.

Scher, P., & Senior,P. (1999). *The Exeter evaluation.* Exeter: Exeter Health Care NHS Trust.

Schildt, G. (1985). *Nykyaika – Alvar Aallon tutustuminen funktionalismiin.* Helsinki: Kustannusyhtiö Otava.

Sitte, C. (1889) *Der Städte-Bau nach seinen künstlerischen Grundsatzen.* Wien: Verlag von Carl Graeser. Reprinted 1909, 1972.

Skaggs, R.L., & Mann, G. (2006). Centers of excellence. In C. Wagenaar (Ed.), *The architecture of hospitals* (pp. 367-371). Rotterdam: NAi Publishers.

Smith, S. (2003, July/August). The beauty that heals. *Saudi Aramco World, 54* (4), 34-37.

Smithson, A. (2001). How to recognise and read mat-building. In H. Sarkis (Ed.), *Le Corbusier's Venice Hospital and the mat building revival* (pp.90-103). London: Prestel.

Solomon, N. B. (1991, July). Advice from Healthcare Experts. *Architecture (AIA), 80* (7), 75-81.

Sotiriou, D. (2006). Modern Asclepieions. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 99-105). Helsinki: Technomedicum, Helsinki University Press.

Sotiriou, D., & Boddy, K. (2006). *Guidelines for Modern Asclepieions and Setting up of Services.* Retrieved April 12, 2008 from http://panacea.med.uoa.gr

van Staalduinen, W. H. (Ed.). 2008. *Healthcare 2025: Building(s) for the Future.* Utrecht: Netherlands Board for Hospital Facilities (Bouwcollege).

Stauskis, G., Streikus, L., & Saladis, T. (2005). Problematic Pavilions. In H. Kjisik (Ed.), *Hospitals old and new: Study tour in May 2004.* Espoo: Sotera, Helsinki University of Technology

Stauskis, G., Streikus, L., & Saladis, T. (2006). Developments in the Vilnius Regional Area Network. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 127-136). Helsinki: Technomedicum, Helsinki University Press.

Stauskis, G., Streikus, L., & Saladis, T. (2006). Analysis of Emergency Processes at Vilnius University Emergency Hospital. In Z. Kolitsi, et al. (Eds.). *Transforming health care organisations. Network for Future Regional Health Care, Interreg IIIC* (pp. 65-69). Helsinki: Technomedicum, Helsinki University Press.

Stauskis, G., Kekomäki, M., & Ratniece, D. (Eds.). (2006). *Implementation of future health care visions. Network for Future Regional Health Care, Interreg IIIC* (pp. 47-58). Helsinki: Technomedicum, Helsinki University Press.

Stenros, A. (1992). *Kesto ja järjestys: Tilarakenteen teoria.* Espoo: Helsinki Department of Architecture, University of Technology.

Strauven, F., & Risselada, M. 2006. Interview with M. Schiedhelm and G. Jullian de la Fuente. In M. Risselada, D. van den Heuvel & G. de Waal (Eds.), *Team 10: Keeping the language of modern architecture alive* (pp. 8-31). Delft: Faculty of Architecture, Delft University of Technology.

Summerson, J. (1986). *The architecture of the eighteenth century.* London: Thames and Hudson.

de Swaan, A. (2006). Constraints and challenges in designing hospitals: the sociological view. In Wagenaar, C. (Ed.), *The architecture of hospitals* (pp. 88-95). Rotterdam: NAi Publishers.

Teikari, M. (1993). *Sairaalahenkilökunnan fyysisen ympäristön laatu – Leikkaus ja anestesiaosastot.* Espoo: Sotera, Helsinki University of Technology.

Teikari, M. (1995). *Hospital Facilities as Work Environments.* Espoo: Helsinki University of Technology.

Thellman Beck, B., Meigas, K., Kekomäki, M., & Vauramo, E. (2006). *Future Vision of Regional Health Care. Network for Future Regional Health Care Interreg IIIC.* Helsinki: Technomedicum, Helsinki University Press.

Thellman Beck, B. (2006). Future health: Implementation of a new health care structure in the Stockholm County Council, Sweden. In G. Stauskis, M. Kekomäki & D. Ratniece (Eds.), *Implementation of future health care visions. Network for Future Regional Health Care, Interreg IIIC* (pp. 59-72). Helsinki: Technomedicum, Helsinki University Press.

Thiadens, L., et al. (2007). *EuHPN Network Study – St. Olavs Hospital.* Groningen: EuHPN.

Thompson, J. D., & Goldin, C. (1975). *The hospital: A social and architectural history.* New Haven/ London: Yale University Press.

Thompson, C. R., & McKee, M. (2004). Financing and planning of public and private not-for-profit hospitals in the European Union. *Health Policy, 67*, 281-291.

Tiuri, U., & Hedman, M. (1998). *Developments towards open building in Finland.* Espoo: Department of Architecture, Helsinki University of Technology.

Tolkki, O., & Parvinen, P. (2006). Impact of modern governance on re-engineering management processes in medical imaging. In Z. Kolitsi, et al. (Eds.), *Transforming health care organisations. Network for Future Regional Health Care, Interreg IIIC* (pp. 53-56). Helsinki: Technomedicum, Helsinki University Press.

Toppin, D. (1981, July). The British Hospital at Renkioi. The Arup Journal, July 1981.

Uffelen, C. van. (2007). *Offices*. Berlin: Verlagshaus Braun.

Ulrich, R.S., Lunden, O., and Eltinge, J. L. (1993). Effects of exposure to nature and abstract pictures on patients recovering from heart surgery. *Psychophysiology 30* (1), 7 (abstr.)

Ulrich, R. (1997). A theory of supportive design for healthcare facilities. *Journal of Healthcare Design, 9*, 3-7.

Ulrich, R. (1984) .View through a window may influence recovery from surgery. *Science, 224*, 420-421.

Ulrich, R. (2006). Evidence based healthcare design. In Wagenaar, C. (Ed.), *The architecture of hospitals* (pp. 26-41). Rotterdam: NAi Publishers.

Ulrich, R.S., Zimring, C., Quan, X., & Joseph, A. (2004). *The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity.* Report to The Center for Health Design. Retrieved April 10, 2008 from http://www.healthdesign.org/research/reports/physical_environ.php

Vahtera, L. (1998). *Defining the architect in fifteenth-century Italy.* Helsinki: The Finnish Academy of Science and Letters..

Vasko, V., Kjisik, H., & Salo-Lee, L. (1996). Culture in Finnish development cooperation. Ministry of Foreign Affairs, Finland. Forssa: Forssan kirjapaino.

Vauramo, E. (1971). Lasaretista terveysasemaan. *Arkkitehti 1(71),* 22-24.

Vauramo, E. (2004). *Vision for network for future regional health care.* Espoo: Sotera.

Veinbergs, A. A., Plavins, M., Briede, R., & Baltraitis, J. (2006). Reconstruction of a single health care facility: Paul Stradins University Hospital: The First Step. In G. Stauskis, M. Kekomäki & D. Ratniece (Eds.), *Implementation of future health care visions. Network for Future Regional Health Care, Interreg IIIC* (pp. 13-33). Helsinki: Technomedicum, Helsinki University Press.

Verderber, S., & Fine, D. J. (2000). *Health care architecture in an era of radical transformation.* New Haven and London: Yale University Press.

Verderber, S. (2006). Hospital futures: Humanism versus the machine. In Wagenaar, C. (Ed.), *The architecture of hospitals* (pp. 76-87). Rotterdam: NAi Publishers.

Wagenaar, C. (Ed.). 2005. *Evidence based design: Architecture as medicine?* Groningen: Foundation 200 years University Hospital Groningen.

Wagenaar, C. (2006). Five revolutions: A short history of hospital architecture. In Wagenaar, C. (Ed.), *The architecture of hospitals* (pp. 26-41). Rotterdam: NAi Publishers.

Wagenaar, C. (2006). The architecture of hospitals. In Wagenaar, C. (Ed.), *The architecture of hospitals* (pp. 10-19). Rotterdam: NAi Publishers.

Waller, D. (2006, August). How veterans' hospitals became the best in health care. *Time, 168*, 36-37.

Weeks, J. (1973, July). AD Briefing: Hospitals. *Architectural Design, July 1973*, pp. 436-463.

Wendt, M. (2006). OR and ICU: The hospital of the future. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC*(pp. 107-112). Helsinki: Technomedicum, Helsinki University Press.

Westelaken, H. (2006). Atrium Hospital in Heerlen. In Wagenaar, C. (Ed.), *The architecture of hospitals* (pp. 124-129). Rotterdam: NAi Publishers.

Westrin, A. (2006). Skåne Region Vision. In B. Thellman Beck, M. Kekomäki, K. Meigas & E. Vauramo, (Eds.), *Future vision of regional health care. Network for Future Regional Health Care, Interreg IIIC* (pp. 113-116). Helsinki: Technomedicum, Helsinki University Press.

Wheeler, E.T. (1979). *Hospital Modernization and Expansion.* New York: McGraw-Hill.

Williams, A. (2004, August) Ticking the right boxes. *Architects' Journal, Aug 26, 2004,*14-15.

Wurman, S. (1986). *What will be has always been: The world of Louis I. Kahn.* New York: Rizzoli.

Zeidler, E. (1974). *Healing the hospital: McMaster Health Sciences Center: Its conception and evolution.* Toronto: Zeidler Partnership.

Zumthor, P. (2005). *Thinking architecture.* Basel: Birkhäuser.

Zumthor, P. (2006). *Atmospheres: Architectural environments: Surrounding objects.* Basel: Birkhäuser.

APPENDIX I.

Headline quote sources

p. 3 Siri Hustvedt, 1993. In Hustvedt, S. (1993) (p. 93).
p. 3 Paul Auster, 2005. In Auster, P. (2005) (p. 297).
p. 12 Cor Wagenaar, 2005. In Wagenaar, C. (2005) (p. 11).
p. 18 Robin Guenther and Gail Vettori, 2008 InGuenther, R. & Vittori, G. (2008) (p. 218).
p. 18 Dimitrios Sotiriou, 2007. In Sotiriou, D. (2007) (p. 14).
p. 18 Alberto Perez Gomez, 2006. In Perez Gomez, A. (2006) (p. 20).
p. 25 Phil Gusack, 2006. In Gusack, P. (2006d) (p. 4).
p. 25 Andrew Barnett, 2004. At lecture, CABE Health Week, April 29, London.
p. 29 Colin Davies, 1988. In Davies, C. (1988, June) (p. 16).
p. 36 Julius Posener, 1934. In Cremnitzer, J-P. (2005) (p. 63) (transl. Hennu Kjisik) from L'Architecture d'Aujourd'hui, no 9, 1934.
p. 36 Frédéric Migayrou and Concetta Collura, 2008. In Migayrou, F., & Collura, C. (Eds.) (2008) (p. 7).
p. 52 American Institute of Architects, 2003. In AIA / AAH (2003) (p. 18).
p. 72 Phil Gusack, 2006. In Gusack, P. (2006b) (p. 9).
p. 72 Susan Francis and Rosemary Glanville, 2001. In Francis, S. & Glanville, R. (2001) (p. 27).
p. 78 Peter Zumthor, 2005. In Zumthor, P. (2005) (p. 27).
p. 87 Berthold Lubetkin, 1938. Original source unclear, possibly speech at opening of Finsbury Health Centre, London, 1938.
p. 88 Susan Francis and Rosemary Glanville (2001). In Francis, S. & Glanville, R. (2001) (p. 34).
p. 104 Louis Kahn (date unknown). In Wurman, S. (1986)
p. 105 John Ruskin, 1879. In Arnkil, H. (2007) (p. 198).
p. 105 Luis Barragan, 1980. Pritzker Prize acceptance speech, Chicago, 1980.
p. 105 Bas Molenaar, 2005. At "The Architecture of Hospitals" Conference, University Medical Centre, Groningen, April 15, 2005.
p. 112 Susan Francis et al., 1999. In Francis, S. et al. (1999 (p. 9-10).
p. 116 Paul Nelson, 1933. Mini-biography of Paul Nelson www.basilisk.com/N/nn2_835.html
p. 116 John Weeks, 1973. In James, W. P. & Tatton-Brown, W. (1986) (p. 5).
p. 116 N. J. Habraken, 1998. In Habraken, N. J. (1998) (p. 8).
p. 122 Leon Battista Alberti, 1450. In Alberti, L. B. (1450) (IX. 10.).
p. 122 Louis Kahn (1969). In Wurman, S. (1986) (p. 89).
p. 127 Lawrence Nield, 2003. Lecture at RIBA/AfH (Architects for Health) Architecture Week, London, June 2003.
p. 127 Gert Driessen, 2005. in Driessen, G. (2005) (p.110).
p. 127 N. J. Habraken, 1998. In Habraken, N. J. (1998) (p. 55).
p. 133 Hashim Sarkis, 2001. In Sarkis, H. (2001) (p. 81).
p. 138 American Institute of Architects, 2001. In AIA/ AAH (2001) (p. 12).
p. 138 Christopher Powell, 1989. In Powell, C. (1989, August) (p. 79).
p. 142 Siegfried Giedion, 1951. In Giedion, S. (1951) (p. 157).
p. 151 Leon Battista Alberti, 1450. In Alberti, L. B. (1450) (I.11.9)
p. 158 Austin Williams, 2004. In Williams, A. (2004, August) (p. 15).
p. 158 Richard Burton, 2004. In Burton, R. (2004, August) (p. 19).

p. 163 American Institute of Architects, 2001. In AIA/AAH (2001) (p. 25).
p. 166 Lawrence Nield, 2003. Lecture at RIBA/AfH (Architects for Health) Architecture Week, London, June 2003.
p. 166 Hashim Sarkis, 2001. In Sarkis, H. (2001) (p. 87).
p. 166 N. J. Habraken, 1998. In Habraken, N. J. (1998) (p. 55).
p. 168 Peter Zumthor, 2005. In Zumthor, P. (2005) (p. 27).
p. 170 John Weeks, 1973. In Weeks, J. (1973) (p. 457).
p. 170 Leon Battista Alberti, 1450. In Alberti, L. B. (1450) (IX.10)
p. 175 Austin Williams, 2004. In Williams, A. (2004, August) (p. 15).
p. 176 Hugh Pearman, 2005. In Pearman (2005, November 5).
p. 179 Peter Blundell-Jones, 2002. In Blundell-Jones (2002, March 02) (p. 42).
p. 179 Isabel Allen, 2003. In Allen (2003, April 10) (p. 22).
p. 187 Richard Burton, 2004. In Burton, R. (2004, August) (p. 18).
p. 187 Isabel Allen, 2003. In Allen (2003, April 10) (p. 22).
p. 190 Luub Wessels, 2004. Presentation at Bouwcollege Symposium, The Hague, October 12.
p. 204 Alfred Brendel, 2007. In Brendel, A. (2007) (p. 2).

APPENDIX II.

Box sources

BOX 1. Florence Nightingale, 1859. In Nightingale, F. (1859).
BOX 2. Peter Blundell-Jones, 2002. In Blundell-Jones, P. (2002, March) (p. 42).
BOX 3. John Cole, 2006. In Cole, J. (2007) (p. 4).
BOX 4. Netherlands Board for Hospital Facilities, 2002. In Netherlands Board for Health Facilitites (2002) (report no: 0.107).
BOX 5. René Gutton, 1979. In Gutton, R. (1979, April) (p. 37).
BOX 6. E. Todd Wheeler, 1979. In Wheeler, E. T. (1979) (p. 212–213)
BOX 7. Phil Gusack, 2006. In Gusack, P. (2006a) (p. 5).
BOX 8. Hennu Kjisik, 2008.
BOX 9. Pierre Riboulet, 1988. In Riboulet, P. (1988, April) (p. 20).
BOX 10. Johansson et al. 2006. In Johansson et al. (2006) (pp. 56–58)
BOX 11. John Cole, 2006. In Cole, J. (2007) (p. 3).
BOX 12. Abram de Swaan, 2006. In de Swaan, A. (2006) (p. 91).
BOX 13. Locum AB, 2004. In Locum AB (2004, September) (p. 14).
BOX 14. N. B. Solomon (Ed.), 1991. In Solomon, N. B. (1991, July) (pp. 75-81).
BOX 15. Design Team for "Cure for Sure", 2004.
BOX 16. Netherlands Board for Healthcare Institutions, 2007. In Netherlands Board for Healthcare Institutions (2007b) (pp. 15-16).
BOX 17. Design Team for "Fair Care – Care Fair", 2007.
BOX 18. Hennu Kjisik et al., 2007. Modern Asclepieions – more human care / explanatory text for "Fair Care – Care Fair" competition entry.

APPENDIX III.

Illustration credits

Fig. 1. Asclepieion, Pergamon. In Thompson, J. D., and Goldin, C. (1975): *The Hospital: A Social and Architectural History* (p. 5). New Haven and London: Yale University Press.

Fig. 2. Asclepieion, Acropolis, Athens. In Thompson, J. D., and Goldin, C. (1975): *The Hospital: A Social and Architectural History* (p. 5). New Haven and London: Yale University Press.

Fig. 3. Asclepieion, Pergamon. In Thompson, J. D., and Goldin, C. (1975): *The Hospital: A Social and Architectural History* (p .4). New Haven and London: Yale University Press.

Fig. 4. Military Hospital, Vindonissa. In Thompson, J. D., and Goldin (1975): *The Hospital: A Social and Architectural History* (p .4). New Haven and London: Yale University Press.

Fig. 5. Medieval cruciform plan hospital, France. In Rosenau, H. (1970): *Social Purpose in Architecture* (p. 52).

Fig. 6. Tonnerre Hospital, France. In Pevsner, N. (1976): *The History of Building Types* (p. 140). London: Thames and Hudson.

Fig. 7. Hôtel Dieu, Beaune, France. In Pevsner, N. (1976): *The History of Building Types* (p. 142). London: Thames and Hudson.

Fig. 8. Hôtel Dieu, Beaune, France. *(http:// int-pediatrics. org/PDF/Volume%2015/15-1/history.pdf)*.

Fig. 9. Ospedale degli Innocenti, Florence, Italy (arch.: Filippo Brunelleschi) *(Photo: Hennu Kjisik)*.

Fig. 10. Ospedale Maggiore, Milan. In Pevsner, N. (1976): *The History of Building Types* (p. 143). London: Thames and Hudson.

Fig. 11. Hôpital La-Pitié-Salpêtrière, Paris *(Photo: Erkki Vauramo)*.

Fig. 12. St. Bartholomew's Hospital, London *(http:// www.answers.com/topic/stbartholomwshospital)*.

Fig. 13. Hôtel-Dieu, Lyons (arch.: J-G.Soufflot) *(Photo: Trevor Harris)*.

Fig. 14. Hôtel-Dieu, Paris *(Photo: Erkki Vauramo)*.

Fig. 15. Stonehouse Naval Hospital, UK *(http://www. webrarian.co.uk/stonehouse/royalnavalhospital)*.

Fig. 16. Hopital Labroisière, Paris. In Paatela, M. (2006): *Sairaalarakennuksen kehitys – Development of the Hospital Building* (p. 33). Espoo: University of Technology, Finland.

Fig. 17. Prefabricated Hospital by Isambar Kingdom Brunel. In *The Arup Journal, July 1981* (p. 8). *Courtesy of Arup.*

Fig. 18. Hospital Sant Pau y Santa Creu, Barcelona (arch.: Lluis Domènech i Montaner). In Fondi, D. (2002): *Architettura per la Sanitá; forma, funzione, tecnologia* (p. 102). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 19. Hospital Sant Pau y Santa Creu, Barcelona (arch.: Lluis Domènech i Montaner) (*Photo: Hennu Kjisik)*.

Fig. 20. Paul Stradins University Hospital, Riga (arch.: Reinhold Schmaeling). *Courtesy of Paul Stradins University Hospital.*

Fig. 21. Hopital Edouard Herriot, Lyons (arch.: Tony Garnier) *(Photo: Hennu Kjisik)*.

Fig. 22. Government Hospital, Haifa, Israel (arch.: Erich Mendelsohn). In Fondi, D. (2002): *Architettura per la Sanitá; forma, funzione, tecnologia,* (p. XII). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 23. Manifesto of Finsbury (arch.: Berthold Lubetkin). In *Architectural Review, June 1988, no. 1096.*

Fig. 24. Sanatorium, Plateau d'Assy, France (arch.: Pol Abraham and Henri-Jacques Le Même). In Cremnitzer J.-B. (2005): *Architecture et santé – le temps du sanatorium en France et en Europe (p . 62)* Paris: Picard. *Courtesy of J-B. Cremnitzer.*

Fig. 25. Sanatorium, Waiblingen, Germany (arch.: R. Döcker). In Cremnitzer, J.-B. (2005): *Architecture et santé – le temps du sanatorium en France et en Europe* (p. 77). Paris: Picard. *Courtesy of J-B. Cremnitzer.*

Fig. 26. Sanatorium, Durtol, France (arch.: Pol Abraham and Henri-Jacques Le Même). In Cremnitzer, J.-B. (2005): *Architecture et santé – le temps du sanatorium en France et en Europe (p. 95)*. Paris: Picard. *Courtesy of J-B. Cremnitzer.*

Fig. 27-28. Zonnestraal Sanatorium, Hilversum, Netherlands (arch.: Johannes Duiker and Bernard Bijvoet) *(Photo: Hennu Kjisik)*

Fig. 29-30. Sanatorium, Paimio, Finland (arch.: Alvar Aalto). *Courtesy of Alvar Aalto Museum.*

Fig. 31. Sanatorium project for the Italian Alps (arch.: Nicola Visontai). In *L'Architecture d'Aujourd'hui, no.9, 1934. Courtesy of J-B. Cremnitzer.*

Fig. 32. Turning sanatorium ("solarium") project, Ecole des beaux-arts de Paris, undated diploma project by Fernand Ottin. In Cremnitzer, J.-B. (2005): *Architecture et santé – le temps du sanatorium en France et en Europe* (p.113). Paris: Picard. *Courtesy of J-B. Cremnitzer.*

Fig. 33. Archbishop Bergan Merchy Hospital, Omaba, Nebraska (arch.: Leo A. Daly). In Verderber, S., and Fine, D. J. (2005): *Health Care Architecture in an era of Radical Transformation,* (p. 29). New Haven and London: Yale University Press.

Fig. 34. Bellshill Maternity Hospital (arch.: Gillespie, Kidd and Coia). In Rodger, J. (Ed.) (2007): *Gillespie, Kidd and Coia: Architecture 1956-1987* (p. 98). Glasgow: The Lighthouse. *Courtesy of A. MacMillan.*

Fig. 35. Bellshill Maternity Hospital (arch.: Gillespie, Kidd and Coia). In Rodger, J. (Ed.) (2007): *Gillespie, Kidd and Coia: Architecture 1956-1987* (p. 101). Glasgow: The Lighthouse. *Courtesy of A. MacMillan.*

Fig. 36. Bellevue Hospital, New York, USA (arch.: R. Pomerance and S. Breines). In Verderber, S., and Fine, D.J. (2005): *Health Care Architecture in an Era of Radical Transformation* (p. 33). New Haven and London: Yale University Press.

Fig. 37. France United States Memorial Hospital, Saint-Lô, France (arch.: Paul Nelson). In Fermand, C. (1999): *Les Hôpitaux et les Cliniques – architectures de la santé* (p. 37). Paris: Editions du Moniteur.

Fig. 38. France United States Memorial Hospital, Saint-Lô, France (arch.: Paul Nelson) *(http://lha.enc.sorbonne.fr/document152.html).*

Fig. 39. Princess Margaret Hospital, Swindon, UK (arch.: Powell & Moya). In Monk, T. (2004): *Hospital Builders (p. 51)*. Chichester: Wiley-Academy. *Courtesy of T. Monk.*

Fig. 40. Wexham Park Hospital, Slough, UK (arch.: Powell & Moya). In Monk, T. (2004): *Hospital Builders (p. 55)*. Chichester: Wiley-Academy. *Courtesy of T. Monk.*

Fig. 41. Wycombe General Hospital, High Wycombe, UK (arch.: Powell & Moya). In Monk, T. (2004): *Hospital Builders (p. 61)*. Chichester: Wiley-Academy. *Courtesy of T. Monk.*

Fig. 42. Venice City Hospital (arch.: Le Corbusier / Guillermo Jullian de la Fuente). In Fondi, D. (2002): *Architettura per la Sanitá; forma, funzione, tecnologia* (p. 41). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 43. Prentiss Hospital for Women, Northwestern University Medical Centre, Chicago, Illinois, USA (arch.: Bertrand Goldberg) *(Photo: Hennu Kjisik).*

Fig. 44. Gailezers Hospital, Riga, Latvia (arch.: Purvins, Bivins, Bivina, Kardikovs, et al.), *Courtesy of Riga Eastern Hospital Group.*

Fig. 45. Huddinge Hospital, Sweden (arch.: Hellman, Lindblom, Löfström & Sandberg), *Courtesy of Huddinge Hospital.*

Fig. 46. Northwick Park Hospital, London, UK (arch.: Richard Llewellyn-Davies and John Weeks). In *Architecture d'aujourd'hui, juin-juillet 1970* (p. 62).

Fig. 47. Greenwich Hospital, section (arch.: Department of Health, Hospital Building Division, UK). In Verderber, S., and Fine. D. J. (2000) *Health Care Architecture in an Era of Radical Transformation* (p. 120). New Haven and London: Yale University Press.

Fig. 48. Pyramid Hospital (arch.: E. Todd Wheeler / Perkins & Will). In Wheeler, E.T. (1979): *Hospital Modernization and Expansion* (p . 213). New York: McGraw-Hill.

Fig. 49 Tree Hospital (arch.: E. Todd Wheeler / Perkins & Will). In Wheeler, E.T. (1979): *Hospital Modernization and Expansion* (p. 213). New York: McGraw-Hill.

Fig. 50. McMaster University Health Sciences Centre, Hamilton, Canada (arch.: Craig, Zeidler and Strong). In Verderber, S., and Fine, D. J. (2000): *Health Care Architecture in an era of Radical Transformation* (p. 123). New Haven and London: Yale University Press.

Fig. 51. McMaster University Health Sciences Centre, Hamilton, Canada, (arch.: Craig, Zeidler and Strong). In Verderber, S., and Fine, D. J. (2000): *Health Care Architecture in an era of Radical Transformation* (p. 121). New Haven and London: Yale University Press.

Fig. 52-53. Walter MacKenzie Center, Edmonton, Canada, (arch.: Zeidler Roberts Partnership). In Verderber, S., and Fine, D. J. (2000): *Health Care Architecture in an era of Radical Transformation* (p. 138-139). New Haven and London: Yale University Press.

Fig. 54-57. Aachen Technical University Medical Centre (arch.: Wolfgang Weber et al. / Weber Brand und Partner) *(Photo: Hennu Kjisik).*

Fig. 58. Sarah Kubitschek Hospital, Brasilia, Brazil (arch.: Joao de Gama Filgueiras Lima). In *Arkitekten DK, 22-2001,* (p. 18).

Fig. 59. General Hospital, Kaëdi, Mauritania, site plan (arch.: Fabrizio Carola). *Redrawn by Hennu Kjisik.*

Fig. 60. General Hospital, Kaëdi, Mauritania (arch.: Fabrizio Carola) *(Photo: Hennu Kjisik).*

Fig. 61. Kreiskrankenhaus, Neu-Ulm, Germany (arch.: Kubanek, Möller, Röder, and Fukerieder). In *Baumeister, 2/85* (p. 37).

Fig. 62. Scottsdale Memorial Hospital, Scottsdale, Arizona, USA (arch.: The NBBJ Group). In *Baumeister, 2/85* (p. 41).

Fig. 63. Lexington Memorial Hospital, Lexington, North Carolina, USA (arch.: Freeman-White Associates). In *Baumeister, 2/85* (p. 42).

Fig. 64. Asyl Gottesgnad, Bern, Switzerland (arch.: Atelier 5). In *Baumeister, 2/85* (p. 55).

Fig. 65. St. Vincent's Hospital, Santa Fe, New Mexico, USA (arch.: Kaplan, McLaughlin and Diaz) In Verderber, S., and Fine, D. J. (2000): *Health Care Architecture in an era of Radical Transformation* (p.93). New Haven and London: Yale University Press.

Fig. 66. Ospedale SS. Giovanni e Paolo, Venice, Italy (arch.: Semerani, Tamaro, and Cosimini) *(Photo: Hennu Kjisik).*

Fig. 67. Hôpital pediatrique-maternité Robert- Debré, Paris (arch.: Pierre Riboulet) *(Photo: Hennu Kjisik).*

Fig. 68. St. Mary's Hospital, Newport, Isle of Wight, UK (arch.: Ahrends, Burton and Koralek). In Monk, T. (2004): *Hospital Builders* (p. 66). Chichester: Wiley-Academy. *Courtesy of T. Monk.*

Fig. 69. St. Mary's Hospital, Newport, Isle of Wight, UK (arch.: Ahrends, Burton and Koralek). In Monk, T. (2004): *Hospital Builders* (p. 68). *Courtesy of T. Monk.*

Fig. 70. Hospital Sant Pau, Barcelona (arch.: Esteve Bonell, Josep M. Gil, Francesc Rius) *(Photo: Hennu Kjisik).*

Fig. 71. Potsdam Tower (arch.: Erich Mendelsohn) *Gnu Free Documentation License, Wikipedia (http://en.wikipedia.org/wiki/Image:Babelsberg_Einsteinturm.jpg).*

Fig. 72. Competition entry "hOspital" (arch.: Mac Bouw Design). In Boluijt, P., Hinkema, M. J. (Eds.) (2005): *Verslag van een prijsvraag - competition report* (p. 94). College bouw ziekenhuisvoorzieningen: Utrecht. *Courtesy of Bouwcollege, Utrecht.*

Fig. 73. France United States Memorial Hospital, Saint-Lô, France, operation theatres (arch.: Paul Nelson) *(http://lha.enc.sorbonne.fr/document152.html).*

Fig. 74. GLA Authority Building, London, UK (arch.: Foster + Partners) *(Photo: Hennu Kjisik).*

Fig. 75-76. Hospital Del Mar, Barcelona (arch.: Manel Brullet & Albert de Pineda) *(Photo: Hennu Kjisik).*

Fig. 77. Competition entry "FDH001" (arch.: K2 Architectenbureau). In Boluijt, P., Hinkema, M. J. (Eds.) (2005): *Verslag van een prijsvraag - competition report* (p. 86). College bouw ziekenhuisvoorzieningen: Utrecht. *Courtesy of Bouwcollege, Utrecht.*

Fig. 78. Model developed for the Nuffield Trust by MARU, London. *Courtesy of the Medical Architecture Research Unit at South Bank University, London.*

Fig. 79. Model developed for Erasmus University Medical Centre, Rotterdam. *Courtesy of Bouwcollege, Utrecht.*

Fig. 80. "Core Hospital" from competition entry "Future Hospital – competitive and healing" (arch.: Venhoeven CS and Itten & Brechbuehl) (2004). *Courtesy of VenhoevenCS Architects, Amsterdam.*

Fig. 81. Anatomical Theatre, Padua, Italy. In Meuser P. & Schirmer, C. (2006): *New hospital buildings in Germany Vol. 2* (p. 34). Berlin: DOM Publishers. *Courtesy of P. Meuser.*

Fig. 82. Helsinki University Central Hospital. Plan of operation block (2001) (arch.: Pekka Koivula et al.). *Courtesy of Arkkitehtiryhmä Reino Koivula Oy, Espoo, Finland.*

Fig. 83. Arbeitskrakenkasse, Vienna, Austria, plan (arch.: Judtmann & Riss). In Meuser P., and Schirmer, C. (2006): *New hospital buildings in Germany Vol. 2* (p. 25). Berlin: DOM Publishers. *Courtesy of P. Meuser.*

Fig. 84. Orbis Medic Park, Sittard, Netherlands, knowledge centre and out-patient consultation. *Courtesy of Henny van Laarhoven, Orbis Medical Park.*

Fig. 85. Orbis Medical Park, Sittard, Netherlands, activity areas. *Courtesy of Henny van Laarhoven, Orbis Medical Park.*

Fig. 86. Territories in a single bedroom (arch.: HKS Architects). *Courtesy of Scott Wing / HKS Architects.*

Fig. 87. Wilhelmina Children's Hospital, Utrecht, Netherlands (arch.: EGM Architekten / Bas Molenaar) *(Photo: Hennu Kjisik).*

Fig. 88. Hospital Kennemer Zuijd, Haarlem, Netherlands (arch.: EGM Architekten / Victor de Leeuw) *(Photo: Hennu Kjisik).*

Fig. 89. "Prototype patient capsule". *Courtesy of William Berger and associates.*

Fig. 90. Capsule (arch.: Archigram) *(http://www.archigram.net/projects_pages/capsule_homes.html).*

Fig. 91. Mataro Hospital, Catalonia, Spain (arch.: Francesc Montaner and Assumpta Teixidor). *Courtesy of Mataro Hospital.*

Fig. 92. Hospital del Mar, Barcelona, Spain. In Fondi, D. (2002): *Architettura per la Sanita; forma, funzione, tecnologia,* (p. 116). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 93. Concentric form, grid-structure and functional zoning. In Teikari, M. (1995): *Hospital Facilities as Work Environments (redrawn by Otso Helenius).*

Fig. 94. Radiology departments in Finnish hospitals. In Teikari M. (1995): *Hospital Facilities as Work Environments (redrawn by Otso Helenius).*

Fig. 95. Operation departments in Finnish hospitals. In Teikari, M. (1995): *Hospital Facilities as Work Environments (redrawn by Otso Helenius).*

Fig. 96. The Harness System. In Francis, S., et al. (2006): *50 Years of ideas in health care building (p.34). Courtesy of the Medical Architecture Research Unit at South Bank University, London.*

Fig. 97. Veterans' Administration VAHBS system. *Courtesy of the Medical Architecture Research Unit at South Bank University, London.*

Fig. 98. Moving of a recumbent patient, dimensioning according to HMSO (Her Majesty's Stationary Office, UK). In Teikari, M. (1995): *Hospital Facilities as Work Environments* (p. 146). Espoo: University of Technology.

Fig. 99. Johnson Wax Building, Wisconsin, USA (arch.: Frank Lloyd Wright) *(Photo: Hennu Kjisik).*

Fig. 100. Centraal Beheer, Apeldoorn, Netherlands (arch. Herman Hertzberger).

Fig. 101. Orphanage, Amsterdam, Netherlands. (arch. Aldo van Eyck). In Sarkis, H. (Ed.) (2001): *Le Corbusier's Venice Hospital and the Mat Building Revival* (p. 55). London: Prestel.

Fig. 102. Marrakesh, aerial view. In Rudofsky, B. (1964): *Architecture Without Architects* (p. 54). London: Academy Editions.

Fig. 103. Village of Children (arch.: Piet Blom). In *Le Carré Bleu, 2/1963.*

Fig. 104. Berlin Free University (arch.: Candilis Josic Woods). In Sarkis, H. (Ed.) (2001): *Le Corbusier's Venice Hospital and the Mat Building Revival* (p. 71). London: Prestel.

Fig. 105. Mount Cenis Academy, Herne, France (arch.: Francoise Jourda et Gilles Perraudin). In Sarkis, H. (Ed.) (2001): *Le Corbusier's Venice Hospital and the Mat Building Revival.* London: Prestel.

Fig. 106. Tent Hospital (arch.: E. Todd Wheeler / Perkins and Will). In Wheeler, E.T (1979): *Hospital Modernization and Expansion* (p. 209).

Fig. 107-109. Venice Hospital Project (arch.: Le Corbusier / Guillermo Jullian de la Fuente). In Sarkis, H. (Ed.) (2001): *Le Corbusier's Venice Hospital and the Mat Building Revival.* London: Prestel.

Fig. 110. Piazza Santissimo Annunziata, Florence. In Bacon, E.N. (1978): *Design of Cities* (p 108). London: Thames and Hudson.

Fig. 111. Hotel Dieu, Paris, Pevsner, N. (1976). In *The History of Building Types* (p.150). London: Thames and Hudson.

Fig. 112. Hotel Dieu, Paris. *The City of Paris - Tourist brochure.*

Fig. 113. Competition entry "Core Hospital" (arch.: Ton Venhoeven and Thomas Gutknecht). In Boluijt, P., Hinkema, M. J. (Eds.) (2005): *Verslag van een prijsvraag - competition report* (p. 12). College bouw ziekenhuisvoorzieningen: Utrecht. *Courtesy of Bouwcollege, Utrecht.*

Fig. 114. St Olavs Hospital, Trondheim, Norway (arch.: Medplan with Nils Torp et al.) *(Photo: Elina Kylmänen-Kurkela).*

Fig. 115. St Olavs Hospital, Trondheim, Norway, site plan (arch.: Medplan with Nils Torp et al.). *Courtesy of the European Health Property Network.*

Fig. 116. Chicago, USA *(Google Inc.).*

Fig. 117. Northwestern University Medical Centre, Chicago, USA *(Photo: Hennu Kjisik)*.Fig. 118. Venice Hospital Project (arch.: Le Corbusier / Guillermo Jullian de la Fuente). In Fondi, D. (2002): *Architettura per la Sanitá; forma, funzione, tecnologia* (p. 39). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 119. Helsinki University Central Hospital, Meilahti Campus, Helsinki. *Courtesy of HUS (Hospital District of Helsinki and Uusimaa).*

Fig. 120. Hospital Del Mar, Barcelona, Spain (arch.: Manel Brullet & Albert de Pineda) *(Photo: Hennu Kjisik).*

Fig. 121. Hospital Del Mar, Barcelona, Spain (arch.: Manel Brullet & Albert de Pineda). In Fondi, D. (2002): *Architettura per la Sanitá; forma, funzione, tecnologia* (p. 111). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 122. Hospital Del Mar, Barcelona, Spain (arch.: Manel Brullet & Albert de Pineda) *(Photo: Hennu Kjisik).*

Fig. 123. Hospidale Degli Innocenti, Florence (arch.: Filippo Brunelleschi). In Fondi, D. (2002): *Architettura per la Sanitá; forma, funzione, tecnologia* (p. 38). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 124. Ludwig Hilbersheimer's "Hochhaussstadt". In Eaton, R. (2002): *Ideal Cities* (p. 153). London: Thames and Hudson.

Fig. 125. Medieval cityscape, Siena, Italy *(Photo: Hennu Kjisik).*

Fig. 126. Hôpital Pediatrique Robert Debré, Paris (arch.: Pierre Riboulet) *(Photo: Hennu Kjisik).*

Fig. 127. Hôpital Pediatrique Robert Debré, Paris (arch.: Pierre Riboulet). In *L'Architecture d'Aujourd'hui, no.256, avril 1988* (« dossier santé » p.16).

Fig. 128. Hôpital Européen Georges Pompidou, Paris (arch.: Aymeric Zublena) *(Photo: Hennu Kjisik).*

Fig. 129. Sunderby Sjukhus, Luleå, Sweden (arch.: FFNS/ Tage Isaksson) *(Photo: Hennu Kjisik).*

Fig. 130. University Central Hospital, Turku, Finland (arch.: Mikael Paatela) *(Photo: Hennu Kjisik).*

Fig. 131. University Central Hospital, Groningen, Netherlands *(Photo: Hennu Kjisik).*

Fig. 132-133. Rikshospitalet, Oslo, Norway (arch.: Medplan with Arvid Ottar et al.). In *Byggekunst, no 7, Vol. 81, (1999).*

Fig. 134. Analysis of external spaces in Venice. In Bacon, E. N. (1978): *Design of Cities* (p. 108). London: Thames and Hudson.

Fig. 135. Functional chains. In Kekäläinen, R. (1982): *Interdepartmental Connection Requirements in a General Hospital Building.* Tampere: University of Technology.

Fig. 136. Functional clusters. In Kekäläinen, R. (1982): *Interdepartmental Connection Requirements in a General Hospital Building.* Tampere: University of Technology.

Fig. 137. Three alternatives for a new emergency department in Hämeenlinna Central Hospital, Finland. In Niemi, H., Kjisik, H., et al. (2004): *Prosessiajattelu sairaalasuunnittelun lähtökohtana.* Espoo: Helsinki University of Technology, BIT Research Centre.

Fig. 138. The growth of a theoretical emergency department. In Niemi, H., Kjisik, H,. et al. (2004): *Prosessiajattelu sairaalasuunnittelun lähtökohtana.* Espoo: Helsinki University of Technology, BIT Research Centre.

Fig. 139-140. Stradins University Hospital, Riga, Latvia, international workshop competition entry (2005) (arch.: JKMM Architects). *Courtesy of JKMM Architects.*

Fig. 141-142. Malmö University Hospital, Sweden, new isolation wards, competition entry (2006) (arch. C. F. Möller). *Courtesy of C. F. Möller Architects.*

Fig. 143. Helsinki University Central Hospital, Meilahti entrance building, competition entry (2006) (arch.: Lahdelma & Mahlamäki). *Courtesy of Lahdelma & Mahlamäki Architects.*

Fig. 144. Hospital, Arras, France (arch.: Groupe 6). *Courtesy of JE Jacobs.*

Fig. 145. Hospital, Arras, France (arch.: Groupe 6). *(Photo: Hennu Kjisik).*

Fig. 146. Mataro Hospital, Catalonia, Spain. (arch.: Francesc Montaner and Assumpta Teixidor). *Courtesy of Mataro Hospital.*

Fig. 147-149. Mataro Hospital, Catalonia, Spain (arch.: Francesc Montaner and Assumpta Teixidor). *(Photo: Hennu Kjisik).*

Fig. 150. Maternity and Children's Hospital, Madrid, Spain (arch.: Rafael Moneo). In *Bauwelt 33, 2004* (pp.10-14).

Fig. 151. Maternity and Children's Hospital, Madrid, Spain (arch.: Rafael Moneo). In *Architectural Record 10/2004* (p.158).

Fig. 152. Wilhelmina Children's Hospital (arch.: EGM Architekten / Bas Molenaar) *(Photo: Hennu Kjisik).*

Fig. 153. Wilhelmina Children's Hospital, plan (arch.: EGM Architekten / Bas Molenaar). *Courtesy of EGM Architekten, Gerda ten Cate.*

Fig. 154-155. Wilhelmina Children's Hospital (arch.: EGM Architekten / Bas Molenaar) *(Photo: Hennu Kjisik).*

Fig. 156. Evelina Children's Hospital, London, UK (arch.: Michael Hopkins) (http://www.hughpearman.com/articles5e*velina.htm).*

Fig. 157. Evelina Children's Hospital, London, UK (arch.: Michael Hopkins) *(http://www.architectsforhealth.com/gallery/japan02-hopkins-partners.html).*

Fig. 158. Hôpital Cognaq-Jay, Paris, France (arch.: Toyo Ito) *(http://www.hopital-cognaco-jay.fr/).*

Fig. 159-160. Hôpital Cognaq-Jay, Paris, France (arch.: Toyo Ito) *(Photo: Hennu Kjisik).*

Fig. 161. Kennemer Gasthuis Noord, Haarlem, Netherlands (arch.: EGM Architekten / Victor de Leeuw). *Courtesy of Victor de Leeuw.*

Fig. 162-165. Kennemer Gasthuis Noord, Haarlem, Netherlands (arch.: EGM Architekten / Victor de Leeuw) *(Photo: Hennu Kjisik).*

Fig. 166. Hospital del Mar, Barcelona, Spain (arch.: Manel Brullet & Albert de Pineda). In Fondi, D. (2002): *Architettura per la Sanità; forma, funzione, tecnologia* (p. 116). Roma: Edizione Kappa. *Courtesy of D. Fondi.*

Fig. 167-169. Hospital Del Mar (arch.: Manel Brullet & Albert de Pineda) *(Photo: Hennu Kjisik).*

Figs. 170-183. "Cure for Sure". Competition entry for the open international competition "Future Hospital – Competitive and Healing" organised in 2004 by the Netherlands Board for Healthcare Institutions (Bouwcollege). Entry prepared by *Arkkitehtitoimisto Harris-Kjisik Architects and Planners, Helsinki,* together with the *HEMA (Healthcare Engineering, Management and Architecture) Institute at Helsinki University of Technology (team leader: Hennu Kjisik). Copyright Arkkitehtitoimisto Harris-Kjisik Architects and Planners, Helsinki.*

Fig. 184. Asclepieion, Epidauros, Greece *(Photo: Trevor Harris).*

Fig. 185. Modern Asclepieion at Riga Eastern Hospital Group, Riga, Latvia. *Copyright Arkkitehtitoimisto Harris-Kjisik Architects and Planners, Helsinki.*

Figs. 186-203. "Fair care – care fair". Competition entry for the open international competition "Healthcare 2025 – Building(s) for the Future" organised in 2007 by the Netherlands Board for Healthcare Institutions (Bouwcollege). Entry prepared by *Arkkitehtitoimisto Harris-Kjisik Architects and Planners, Helsinki,* together with the *SOTERA Institute at the Department of Architecture at Helsinki University of Technology (team leader: Hennu Kjisik). Copyright Arkkitehtitoimisto Harris-Kjisik Architects and Planners, Helsinki.*

APPENDIX IV.

Healthcare in architectural magazines 1978-2008

Special issues:

Arkkitehti (Finland), vol. 75, no 1, 1978.
Byggekunst (No rway), no 3, 1979.
Techniques et Architecture (France), no 324, 1979 Apr.
Architecture Australia (Australia), vol. 71, no 1, 1982 Jan.
APlus (Belgium), no 78, 1982 Oct.
Existics (Greece), "Health and Human Settlements", vol. 48, no 296, 1982 Sep-Oct
SIAJ (Singapore), no 121, 1983 No v-Dec
Aufbau (Austria), vol. 38, no 9/10, 1983.
Baumeister (Germany), vol. 82, no 2, 1985 Feb.
Projeto (Brazil), no 77, 1985 July.
Architecture and Design (India), "Healing houses", vol. 1, no 6, 1985 Sep-Oct.
Perspektiven (Austria), "Healthy Vienna", vol. 43, no 3, 1988 May.
Architectural Review (UK), "Architecture of Caring" vol. 183, no 1096, 1988 June.
Architecture d'Aujourd'hui (France), "Santé", no 256, 1988 Apr.
Arquitectura Cuba (Cuba), vol. 38, no 371, 1988.
Bauwelt (Germany), vol. 80, no 30, 1989 Aug 4.
Arkitektur (Sweden), vol. 89, no 3, 1989 Apr.
Canadian Architect (Canada), vol. 35, no 3, 1990 Mar.
Malajah Arkitek (Malaysia), vol. 3, no 2, 1991 Mar-Apr.
Architecture Australia (Australia), vo. l.80, no 11, 1991 Dec.
Architectural Review (UK), "Health and Sport", vol. 189, no 1128, 1991 Feb.
Architecture AIA (USA), "Health Facility Planning", vol. 80, 1991 July.
Progressive Architecture (USA), "Hospitals made simple", vol. 73, no 3, 1992 Mar.
Deutsche Bauzeitung (Germany), "Speedy Recovery", vol. 126, no 5, 1992 May.
Architecture AIA (USA), "Health care Facilities" vol. 82, 1993 Mar.
AV Mono grafias (Spain), "The Architecture of Medicine", no 49, 1994
Building Journal Hong Kong (China), "The new face of hospitals in Hong Kong", 1996 No v.
Projeto (Brazil), "Hospitals", no 214, 1997 No v.
CA (Chile), "Architecture and Health", no 88, 1997 Apr/June.
Byggekunst (No rway), "Rikshospitalet", vol. 81, no 7, 1999.
Baumeister (Germany), "Be ill no more", vol. 97, no 5, 2000 May.
Building Journal Hong Kong (China), vol. 27, no 7, 2000 Sep.
Architectural Review (UK), "Health Care", vol. 211, no 1261, 2002 Mar.
Techniques et Architecture (France), "Hospitals, Hospitality", no 460, 2002 Jun-July.
Architecture Australia (Australia), vol. 91, no 4, 2002 July-Aug.
Architectural Review (UK), "Designed for Healing", vol. 217, no 1299, 2005 May.
De Architect (Netherlands), no 10, 2006 Oct.

Arkitektur (Denmark), no 2, 2007 Feb.
Industria delle Costruzioni (Italy), "Architecture of Hospitals", vol. 42, no 402, July-aug. 2008
Architektur Aktuell (Germany), "Health", no 334/335, 2008 Jan-Feb.
Architecture Today (UK), "Special healthcare issue", handbook no 29, 2008 Oct.
Domus (Italy), "Wellness", no 919, 2008 no v.

Major theme issues (minimum four project presentations and/or major articles)

Arkitektur (Denmark), vol. 22, no 2 1978.
Aktuelles Bauen (Switzerland), vol. 15, no 7, 1979 Apr.
Architecture Australia (Australia), "Three hospitals by Lawrence Nield" vol. 72, no 2, 1983 Mar.
Mur Vivant (France) "5 hospitals in Middle East and Africa", no 60, 1981.
Arkitektur (Sweden), vol. 84, no 1, 1984 Jan/Feb.
Mimar (Singapore / Switzerland), "Hospitals in Developing Countries", no 14, 1984.
AC (Switzerland), "9 hospitals in Switzerland", vol. 30, no 1, 1985 Apr.
Mur Vivant (France), "4 hospitals in developing countries", no 76, 1985
Architecture AIA (USA), vol. 76, no 1, 1987 Jan.
Projekt (Czechoslovakia), vol 29, no 2, 1987 Feb.
Yorkshire Architect (UK), no 114 and 115, 1987 May/June and July/Aug.
Aufbau (Austria), vol. 42, no 10, 1987 Dec.
Plan (Dublin) (Ireland), vol. 19, no 6, 1988 June.
Architecture and Design (India), vol. 7, no 6, 1990 no v-Dec.
Architecture New Zealand (New Zealand), 1991 May/June.
TVAI (Israel), no 29-30, 1991.
Architect (Melbourne) (Australia), "The Future Hospital", 1995 Aug.
World Architecture (UK), no 42, 1996 Jan.
Trama (Ecuador), no 69, 1996 Dec.
Alam Albena (Egypt), no 186, 1997 Jan
Architecture and Design (India) vol. 14, no 3, 1997 May-June.
Architecture Malaysia (Malaysia), 1998 No v-Dec.
Archis (Netherlands), "The Cognacq-Jay competition", no 6, 2000 June.
Indian Institute of Architects Journal (India), "Medical Architecture", vol. 167, no 8, 2002 Sep.
Architecture in Ireland (Ireland), "Buildings for Health", no 213, 2006 Jan.

Regular features in:

Architectural Record (USA) Building type studies (544, 563, 589, 601, 628, 646, 664, 680, 702, 732, 749, 775. 811, 838, 846) annually with 4-12 hospital projects and several articles in each issue.

AIT (Germany) (1978-1999), annual special issues each with presentations of 3-10 hospitals and several articles.

Architektur Wettbewerbe (Germany), competitions in Germany and occasionally elsewhere; no . 97, (1979 Mar), no . 117 (1984 Mar), no . 155 (1993 Sep), no . 184 (2000 Dec) etc.

Deutsche Bauzeitung and **Deutsche Bauzeitschrift** (Germany), regular articles, project presentations and theme issues once a year (1978-2008).

Architect's Journal, Building and **Building Design** (UK), regular articles, including occasional project presentations (1978-2008).

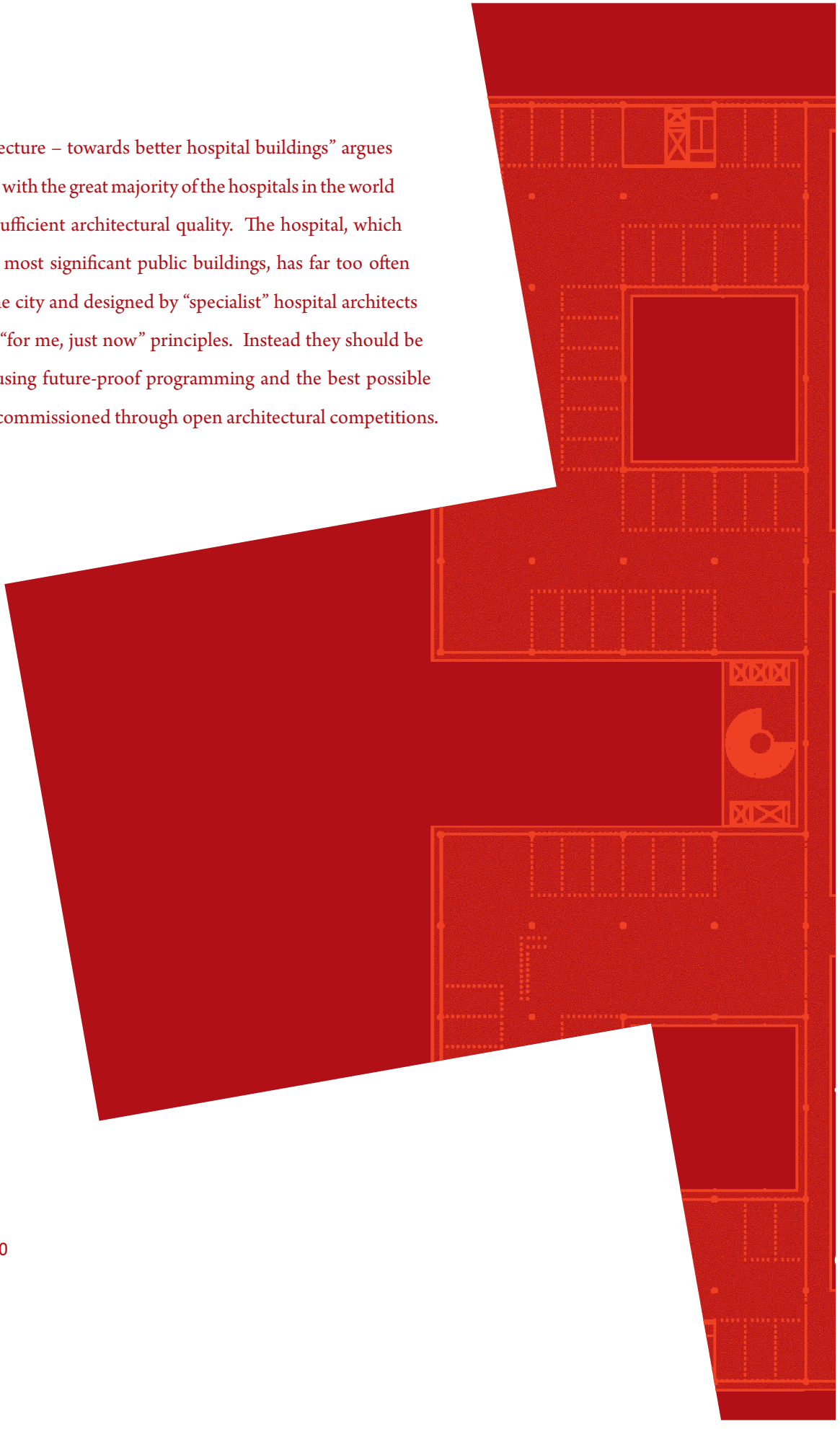
Healthcare Design (USA), monthly specialist magazine, since 2001.

APPENDIX V.

Abbreviations:

AAH Academy of Architecture for Health (AIA/US)
AIA American Institute of Architects (US)
CABE The Commission for Architecture and the Built Environment (UK)
CIAM Congrès International d'Architecture Moderne
CT Computed Tomograph
DIN Deutsches Institut für No rmung (Germany)
DSA Digital Signature Algorithm
EBCT Electron Beam Computed Tomography
ER Emergency Room (department)
EU European Union
EUHPN European Health Property Network
FF&E Furniture, Fittings, and Equipment
fMRI Functional Magnetic Resonance Imaging
GDP Gross Domestic Product
GUPHA Global University Programme in Healthcare Architecture
HDI Human Development Index
HEPAC Heating, Piping and Air Conditioning
HEMA Institute of Health Care Engineering, Management and Architecture (Helsinki University of Techno logy)
ICU Intensive Care Unit
IHF International Hospital Federation
IT Information Techno logy
LCC Life-Cycle Costing
LDRP Labour Delivery Recovery Post-partum (birthing suites)
MARU Medical Architecture Research Unit (South Bank University, London, UK)
MRI Magnetic Resonance Imaging
NHS National Health Service (UK)
OR Operating Room (surgical department)
PET Positron Emission Tomography
PFI Private Finance Initiative (UK)
POE Post-Occupational Evaluation
PPP Public Private Partnership
REM Rapid Eye Movement (Bleep)
RIBA Royal Institute of British Architects
SAD Seasonal Affective Disorder
SAFA Finnish Association of Architects
SNIP Indexes of Russian Industry Standards (Soviet Union/Russian Federation)
SOTERA The Research Institute for Health Care Facilities (Helsinki University of Techno logy)
SPRI Swedish Institute for Health Services Development
STAKES National Research and Development Centre for Welfare and Health (Finland)
UNDP United Nations Development Programme
UNESCO United Nations Education Science and Culture Organisation
VA Veterans' Administration (US)
WHO World Health Organisation

"The Power of Architecture – towards better hospital buildings" argues that the main problem with the great majority of the hospitals in the world has been the lack of sufficient architectural quality. The hospital, which should be one of our most significant public buildings, has far too often been thrown out of the city and designed by "specialist" hospital architects using briefs based on "for me, just now" principles. Instead they should be built in city centres, using future-proof programming and the best possible architects, preferably commissioned through open architectural competitions.



ISBN 978-952-248-033-0
ISSN 1797-3511