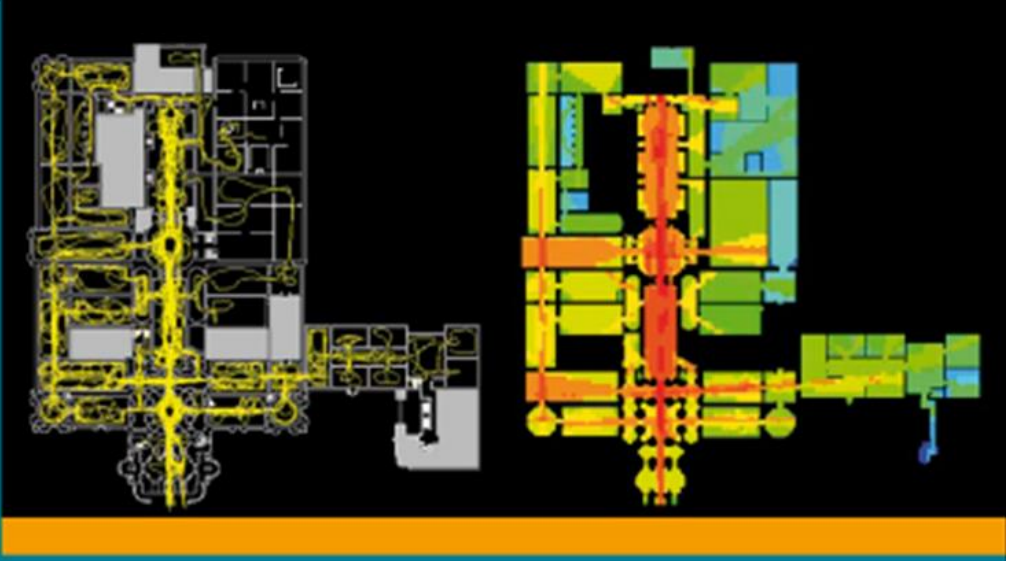

Research tools for design

SPATIAL LAYOUT AND PATTERNS OF USERS' BEHAVIOUR

Proceedings of Seminar, 28-29 January 2010, Department of Architectural Technology and Design "P. Spadolini", University of Florence

a cura di

Nicoletta Setola

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TABLE OF CONTENTS

Nicoletta Setola (edited by), *Research tools for design*, ISBN 978-88-6655-024-2 (print), ISBN 978-88-6655-027-3 (online), © 2011 Firenze University Press

DESIGN RESEARCH AND THE SOCIAL NATURE OF ARCHITECTURE

Maria Chiara Torricelli

The fact that we spend most of our lives in the built environment means that architecture, built and projected, is a social art. Generally speaking, in the Western world at least, this assumption has always been reflected in the various activities that go into creating architecture: legislation, planning, architectural heritage management, training, theorising and research. Over the years, however, many different meanings have been attributed to the term «social» when associated with architecture, in many different contexts, and there are many different ways in which these meanings have been reflected in theory and practice.

In terms of the role the University should continue to play in developing theories for formulating ideas and drawing up practices, both young and experienced researchers have worked together to explore and update the foundations and instruments of the disciplines that come under the heading of architectural technology, with architecture seen as a core social value, ranging from the meetings promoted by OSDOTTA, the Network of Doctorates in Architectural Technology[1], to the Incontri dell'Annunziata workshops promoted by the Eduardo Vittoria School of Architecture and Design at Ascoli[2], to the meetings of the PhD School of Architectural Technology at the University of Florence held at Palazzo Vegni[3].

This seminar also forms an integral part of this undertaking. What we are interested is trying to get to grips with the changes that have already taken place and those that now need to be brought about today in order to be able

[1] See the Bibliographical reference to volumes containing the proceedings of the OsDotta seminars (acronym for the Osservatorio del Dottorato in Tecnologia dell'Architettura – Network of Doctorates in Architectural Technology) held at national level each year.

[2] The Incontri dell'Annunziata are study days for the purposes of reflection on issues connected with technological innovation and design experiments, organised on an annual basis by the Faculty of Architecture, Research Doctorate in Architecture and Design Network, University of Camerino.

[3] A series of meetings promoted by the Doctorate in Technology, University of Florence; the proceedings of which form part of the *Un diario a più voci* series.

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to interpret the social value of architecture: how methods and instruments can be developed to ensure that this value becomes an integral factor in transforming the built environment; how projects experiment with theories and methods geared to bolstering the social value of architecture, and how the latter contributes in turn to the development and updating of such instruments.

As a contemporary design discipline, architectural technology took off around the mid-Fifties in the USA and Great Britain, followed by France and Italy in the Sixties, launching two complementary and interrelated strands of research: research into building process and project management and research into building system design (Torricelli, 2010). It was during this period that architectural theories became cemented «freely and contentiously», paving the way for «what is thinkable and sayable», in line with contemporary philosophical thought, and determining a particular theoretical stance that tore down traditional theorising «putting in its place concepts and codes that interpret, disrupt and transfom one another» (Hays, 2000 p. XI). One given, however, is common to all the architectural theories that were spawned during that period: the social and historical context of architectural production and architecture as a product are inseparable. Theories have a duty to structure these totalities, producing concepts and tools that will enable architectural endeavours to be referred back to the context giving to them rise and in which they belong.

Thus the social dimension of the built environment assumes particular relevance in relation to planning theories and experiments. Architecture, space and society became keywords in the mindset and designs of architects and schools from the Seventies (take, for example, the journal *Spazio e Società*, founded by Giancarlo De Carlo in 1978) right up to the present day (the Venice Architecture Biennial, directed by Richard Burdett, that went under the name of *Città. Architettura e società*).

The social dimension also lies at the centre of an environmental vision of projects, both in terms of the influence of environmental conditions on individual and collective wellbeing and in terms of the impact of the building operations and buildings and the relationship between the built and the natural environments (Moffatt and Kohler, 2008).

On different scales, ranging from social housing to districts, cities and regions, the influence of space on modes of social behaviour is being studied and interpreted with a view to tackling the consequences of the current globalisation, migration and economic recession processes. Equally this relationship lies at the root of any 'local' commitment to planning ventures carried out in close collaboration with communities and geared to introducing positive social change. In terms of planning instruments and techniques, these ventures go hand in hand with studies into 'collaborative projects', designed to boost the social dimension of the planning process, both with regard to the clients, the 'stakeholder', the users, and the various disciplines that are enmeshed in the planning and design process.

Within this context, we thought it would be interesting to draw a comparison between the theories and techniques identified by the term space syntax, founded on an evidence-based approach and targeted at analysing spatial layouts in order to identify the consequences of planning decisions on the social behaviour of those who use urban spaces and complex buildings.

This theory, originally conceived between the Seventies and Eighties by Bill Hillier and Julienne Hanson of The Bartlett School, University College London, was carried forward by several researchers making up an international scientific community and there are now a wide range of space syntax applications, including basic academic research, masters, doctoral and post-doctoral studies and consultancy in Space Syntax Laboratory and Space Syntax Ltd.

Sparked by doctoral research (Setola, 2009) and previous seminars (CHaMSpaM, City History and Multi-Scale Spatial Master-Planning, 2nd International Research Workshop, held in Shanghai 2008) a comparison of techniques particular to the technological side of architecture using Space Syntax was set in motion, and then further amplified with a view to future joint research possibilities, the proceedings of which are contained in this volume.

Space Syntax provides a specific and complex system of computing tools, quantitative analysis and interpretations based on hypothetical assumptions stemming from the definition of the term «space configuration». Hiller defines this term «as the relations between two spaces taking into account a third, and, at most, as the relations among spaces in a complex taking into account all other spaces in the complex» (Hillier *et al.,* 1987, p. 363). Originally applied to the analysis of certain behavioural models such as pedestrian paths, the technique has become increasingly versatile and applicable to different behavioural models, as well as becoming a valuable constituent of simulation technique, underpinning planning decisions on both an urban and on an individual building scale.

Quantitative analysis of the relations between spatial configurations and social behaviours using the Space Syntax approach, is described by Alan Penn as follows:

Architectural design can be considered as the construction of potential spatial relations that can be appropriated for specific social acts and thus become meaningful to those involved. If there is one certainty in this, it is that the individuals, structures and tasks that a building will need to support in the long term will not be those present at its inception. What we are engaged in as designers is therefore something like designing an ecological system. A building is an environment within which complex and unforeseen structures will emerge. Our job then, is to make these appropriable by organisations and users over the lifetime of the building. […] The specialist knowledge of how spatial morphology relates to social action forms a necessary component in making the ecology flourish (Penn, 2005).

The seminar to which this volume relates, therefore draws its impetus from the thesis of the relations between spatial layout and social space, as summed up by Alan Penn (above), and begs the following questions:

1. How can management and governance of the built environment work positively towards these relations?
2. How can a project and its design methods positively influence these relations?
3. What tools could promote awareness of these relations in design practice?

The seminar was split into two days, under the following headings:

- Research tools for design. Spatial layout and patterns of users' behaviour
- Santa Maria Nuova hospital: the public spaces system.

On the first day papers were presented by the following guests:

- Prof. Alan Penn, Professor of Architectural and Urban Computing, Dean of Faculty, University College London
- Maximo Martinez, Architect, Associate Director at Space Syntax Ltd
- Dr. Ilaria Geddes, Research Fellow – Health Inequalities Post 2010 Review – Global Health Equity Group University College London.

These were followed by presentations of various research projects carried out by groups from the Department of Architectural Technology and Design, in which the subject matter could be considered to chime with the Space Syntax approach in terms of project and research:

- Students' Housing: Functional Model Quality (RSU group)
- Environmental Communicativeness (Design for All group)
- Designing for Emergency (Temporary Architecture group)
- Airport Terminal Design (TxP group)
- Hospital Building Project Monitoring (MonLab group).

The second day, on the other hand, was given over to the study of a particular project - the rehabilitation project for the historic Santa Maria Nuova Hospital in Florence.

The approach to the rehabilitation project for Santa Maria Nuova Hospital in Florence has the value of the health of each and every patient and the insertion of the hospital in an urban context as its core. Although on one hand this has meant being extremely mindful of the service network and the historic city centre context, the layout of the internal areas has led to the valorisation of the internal areas, cloisters, green spaces and courtyards as relational spaces open to various different modes of utilisation by hospital users and operators and as elements that give meaning and legibility to the paths.

The seminar was geared to discussing this theme, starting with the valorisation of the square, the access loggia, the historic hospital spaces and the effects of their transformation over time.

The volume has been split into two parts, in conformity with the seminar structure: the first contains the papers from the research day and the second deals with the presentations and discussions that took place as part of the Santa Maria Nuova Hospital case study day.

The first day Alan Penn opened the session with a lecture about architecture and the social. He illustrates some preliminary on the representation of space by graph and the related techniques to read the urban fabric. Then he goes to show how the urban and spatial structures effect the built environment and the social relations. For example the geometry of how spaces interconnect reflects the contact that people make with each other, in a significantly different relationship with what is visible locally and the perception of the system as a whole. From this, implications for the architectural research arise, such as contributing to the body of two kind of knowledge: scientific and social.

Maximo Martinez highlights, in a brief introduction, how particular design ideas have generated environments that have failed to deliver the ideals behind the approach. Then he presents an overview of the work of London based design consultancy Space Syntax, specifying its special contribution to healthcare designing through the Space Syntax evidence-based approach, a powerful tool in endeavours of architectural practice. The key innovation in the theory of space syntax is that space is an object in its own right and as such it can be objectively described and quantified as the fundamental influence on behaviour.

Ilaria Geddes presents her study on impact of environment quality on health and considers the initial implications of the Marmot Review's recommendations for built environment practitioners. In her presentation she highlights how the use of analytical tools as GIS and spatial models, that better measure the complex relationships between social variables, urban form and health outcomes, can encourage integrated planning strategy focusing on health.

Among Department TAeD researches, Adolfo Baratta presents the work of RSU group titled on Students' Housing, an ongoing research in collaboration to University and Ministry of Education, University and Research. After an overview on actual heritage of student houses in Europe and Italy, he considers some approach to a deep study on student house typology, using space syntax methodology: the relations that exist between town and university; the spatial organisation of common facilities inside the residence; the adequacy of residential functions and related services in student housing in relation to individuality and sociability.

The intervention by Antonio Laurìa focuses on Environmental Communicativeness (Design for All group) presenting a study about interactions

between man and the environment. Environmental Communicativeness is in fact a study sector that aims to raise the autonomy, comfort and safety of people in terms of orientation, mobility and device usage, by improving the communicative quality of the habitat.

Sabrina Borgianni and Virginia Serrani show the work of Temporary Architecture group about planning and design strategies for post-disaster transitional settlements and housing projects. They presents summaries of three research projects focused on Designing for Emergency. Among upshots of research it comes out that in emergency settlements quality of life and consequent user behaviour depends primarily on two factors, the ability of temporary settlements and housing models to reproduce rules, spaces and relations typical of the urban fabric and the balance between private and public spaces.

Architect Irene Macchi, Airport Terminal (TxP group), showed researches of TxP group, Technology for Project, (coordinator prof. M.A. Esposito) that deals with experimental studies on methodology for project integratine quality, environment, and comunication. In particular, this investigates how the relations between architectural and social spaces in airport buildings can be identified, their influence on project and governance management, and how they influence planning methods and, especially, what sort of contribution Project Management and SGI have to make.

The intervention by Nicoletta Setola and Francesca Reale, Hospital Building Project Monitoring (MonLab group), illustrated some of the research activities undertaken by the Monitoring Laboratory at the University Hospital of Careggi. There was a presentation of the tool conceived by the laboratory (SACS software) for monitoring the progress of the rehabilitation project and user uptake of the facilities over time, with particular focus on transit, user space appropriation and the relationship between organisation and spaces. Two laboratory-spawned theses on hospital accessibility using the space syntax method for reading spatial relations were illustrated briefly.

The second half of the book deals with the programmed interventions that took place during the Santa Maria Nuova Hospital study day:

- History and motivations for an intervention, by Marco Geddes Da Filicaia
- Paths and relationship of the building with the square, by Francesco Napolitano, Roberto Lapi
- Monumental parts, by Vincenzo Vaccaro.

The volume contains the substance of and contributions to the discussion entitled *About the public spaces system: ideas for research*, in the form of a discursive text. The issues covered in this section concerned the hospital public spaces system and its relationship with the city (the square, the portico and the access system, the surrounding urban fabric, the paths and stopping areas, the new museum, and were considered from the follow-

ing viewpoints: urban centrality, accessibility, building flexibility, and the environmental and financial sustainability of the rehabilitation operation.

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PROGRAM

Florence the 28th of January 2010
Research tools for design. Spatial layout and patterns of users' behaviour

Theme

Spatial layout in buildings and urban spaces affects patterns of users' behaviour and interaction and in this the social nature of architectural function shows itself regarding to other fields of design. Space Syntax (theory, methodology and techniques for the analysis of complex systems) assumes this thesis as basis of its research.

Aim

The seminar proposes to attend a meeting with Prof. Alan Penn and arch. Maximo Martinez, in order to know Space Syntax researches and to have a discussion about their researches and experiences and those leaded by the APSA School of PhD and the Department TAeD of the University of Florence, in the field of social architecture. That comparison aims to establish future partnership on research and training.

Questions

The comparison can be articulated starting from the thesis about the relationship between spatial layout and social space according to following questions.

1. How is the relationship between architectural space and social space identifiable in the development of built environment or buildings and how does it affect the management and governance strategies?
2. How does design is conscious of this relationship? And what solutions are offered by design methods?
3. What kind of tools can help the knowledge on this relationship in the design practice?

Program

2.30pm-2.45pm Welcome

- Welcome of Dean of the Florence School of Architecture – Prof. Saverio Mecca
- Welcome of Head of Department TAeD – Prof. Roberto Bologna
- Introduction – Prof. Maria Chiara Torricelli

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2.45pm-4.30pm Lectures
- Prof. Alan Penn, Professor of Architectural and Urban Computing, Dean of Faculty, Bartlett School, University College London
- Arch. Maximo Martinez, Associate Director Space Syntax Ltd
- Doct. Ilaria Geddes, Research Fellow - Health Inequalities Post 2010 Review - Global Health Equity Group - University College London

4.30pm-5pm Coffee break

5pm-6.30pm Researches presentation - University of Florence, Department TAeD
- Hospital Building Project Monitoring (Lab Mon)
- Designing for Emergency (Temporary Architecture)
- Students' Housing: Functional Model Quality (RSU)
- Airport Terminal (CpDd)
- Environmental Communicativeness (Design for All)

6.30pm-7.30pm Discussion

Date and venue

The seminar will be held in Florence on 28th January from 2.30 pm to 7.30pm at Great Hall of Department TAeD, Via San Niccolò, 93 – 50125 Firenze.

Florence the 29th of January 2010
Santa Maria Nuova hospital: the public spaces system

Theme

The refurbishment programme of Santa Maria Nuova Hospital in Florence has followed a patient centred approach focusing on health value and localisation of Hospital in the urban context. On one hand this meant attention to public services network and old centre context; on the other hand this led to enhance inner spaces value - cloisters, green areas, courts. They aim to become both spaces of relations opened to different needs of users and hospital staff, and elements giving meaning and legibility to the paths.

Aim

Moving from Prof. Alan Penn statement «Architectural design can be considered as the construction of potential spatial relations that can be appropriated for specific social acts and thus become meaningful to those involved», the seminar intends to discuss these themes as they are tackled in Santa Maria Nuova Hospital: from the valorisation of the square, access loggia, and hospital old spaces during their temporal transformations. The discussion aims to verify possible future partnership about these research themes.

Program
9am Welcome, ASL General Director Eng. Luigi Marroni

9,15am-10,45am The Santa Maria Nuova project
- History and motivations for an intervention, Dott. Marco Geddes da Filicaia
- Paths and realtionship of the building with the square, Arch. Francesco Napolitano, Arch. Roberto Lapi
- Monumental parts, Arch. Vincenzo Vaccaro

10,45am-11,20am Hospital visit

11,20am-12,30pm Discussion about public spaces system: ideas for a research, Prof. Alan Penn, Prof.ssa Maria Chiara Torricelli

Date and venue
The seminar will be held in Florence on 29th January from 9am to 12.30pm at Board Room of Santa Maria Nuova Hospital, Piazza S. Maria Nuova, 1 – 50123, Firenze.

SPEAKERS PRESENTATION

Professor Alan Penn
BSc (Hons) MSc Dip. Arch RIBA ARB,
The Bartlett, Faculty of the Built Environment,
Dean of Faculty
a.penn@ucl.ac.uk
www.vr.ucl.ac.uk

Alan Penn is Professor of Architectural and Urban Computing at The Bartlett School of Graduate Studies, University College London, and Director of the VR Centre for the Built Environment. He is Dean of the Bartlett. His research focuses on understanding the way that the design of the built environment affects the patterns of social and economic behaviour of organisations and communities. How is it that architecture and urban design matter for those that inhabit them? How is it that the spatial design of cities and neighbourhoods leads to the generation of cultural and community identity? Under what conditions do vital and thriving creative communities occur, and under what conditions does crime and urban malaise develop?

In order to investigate these questions he has developed both research methodologies and software tools. These are known as 'space syntax' methods. Current research includes the development of agent based simulations of human behaviour, the development of spatio-temporal representations of built environments, investigations of urban spatial networks and the application of these techniques in studies of urban sustainability in the broadest sense, covering social, economic, environmental and institutional dimensions.

He is a HEFCE Business Fellow, a founding director of Space Syntax Ltd, a UCL knowledge transfer spin out with a portfolio of over 100 applied projects per year, including whole city masterplans, neighbourhood development plans and individual buildings. He was the founding Chair of the RIBA's Research and Innovation Committee, and served in that role until 2006. He is Chair the Architecture & the Built Environment sub-panel 30 for the UK National Research Assessment Exercise 2008,

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and is a member of its Main Panel H. He is also lead academic on the £5m Urban Buzz: Building Sustainable Communities knowledge exchange programme which is promoting more sustainable forms of urban development and intensification in London and the greater South East Region of the UK. He is Principle Investigator on the City History and Multi-scale Spatial Master-planning UK-China Research Network, funded by the UK's Engineering and Physical Sciences Research Council, will develop UK-Chinese academic research collaboration. He is a trustee of the Shakespeare North Trust.

Maximo Martinez
BArch, Associate Director at Space Syntax Ltd
m.martinez@spacesyntax.com
www.spacesyntax.com

Maximo Martinez qualified as an architect in Mexico where he ran his own architectural practice, and was a consultant on many urban design projects.

Max has worked with Space Syntax since 1999 and became an Associate Director in 2005. He leads interdisciplinary projects which range from strategic urban design to brief development, and the strategic design of complex buildings including hospitals, museums and office environments.

Space Syntax provides a unique, evidence-based approach to the planning, design and operation of buildings and urban areas. Through over twenty years of research-informed consulting, Space Syntax has developed a powerful technology that demonstrates the key role of spatial layout in shaping patterns of human behaviour. These patterns include movement on foot, on cycles and in vehicles; wayfinding and purchasing in retail environments; vulnerability and criminal activity in buildings and urban settings; co-presence and communications in the workplace.

Max's particular interest lies in providing design solutions that optimise available resources. He is a member of the UK National Health Service Design Review Panel, and an honorary member at the Bartlett, University College London where he lectures regularly on the Advanced Architectural Studies Masters programme. He is also a guest lecturer at Reading University and speaks at industry events.

Education, awards & appointments:
- 2005 Member, NHS Design Review Panel
- 1997- PhD in Urban Morphology, UCL
- 1996 Housing Diploma UNAM, Mexico
- 1990-94 BArch (Distinction) Universidad Iberoamericana, Mexico

Ilaria Geddes
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www.marmotreview.org

Ilaria Geddes is a Research Fellow with Marmot Review Team, based in the Department of Epidemiology and Public Health at University College London (UCL). Her current research focuses on the role of spatial planning and built environment professionals in addressing health inequalities, she also works on housing and health issues, health & well-being at work and the role of the medical workforce in addressing health inequalities. Prior to this she was a Research Fellow at the Institute for Public Policy Research (IPPR), contributing to the Institute's publications and seminar series on housing. Ilaria worked as a Consultant at Space Syntax Limited, a UCL spin-off company, managing data collection and carrying out research on planning policy and design guidelines, and analysis of urban morphology, pedestrian and vehicular movement, public space and housing forms. In this role she has worked on Tate Modern 2 Environmental Impact Assessment (EIA) and Bucklesbury House EIA. She has also worked for Brent Adult and Community Education Services (BACES) and for the Thomas Coram Research Unit (TCRU). She has published on issues relating to housing, the spatial distribution of poverty and health inequalities. She holds an MSc in Housing, with distinction, as well as an MSc in GIS and Spatial Analysis from the University of London. She currently holds honorary research appointments in the Department of Epidemiology and Public Health at UCL, and in the Faculty of the Built Environment at UCL.

FIRST DAY

ARCHITECTURE AND THE SOCIAL

From a lecture by Alan Penn

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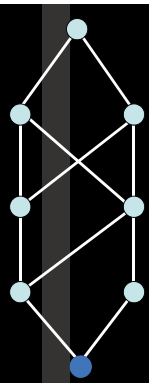
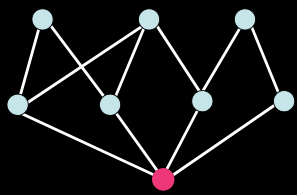


Mean depth = 2.29

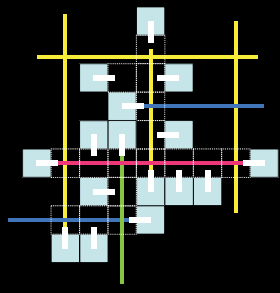


Mean depth = 1.43

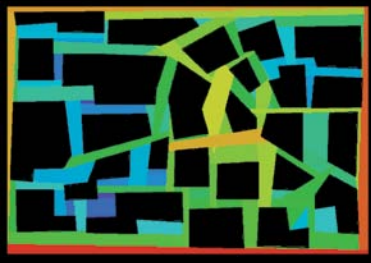
A single structure is capable of generating differently-shaped graphs, because they are determined from different nodes.
Each graph will therefore have a different depth, according to its conformation. The depth means the depth of each node as compared with the other nodes on the graph.
The same space therefore appears in different simplified forms.

By transferring the depth values relative to the graph nodes onto the lines representing the spaces, we can illustrate the urban deep structures by means of an axial integration map with colours identifying the depth values: red corresponds to the highest value, and blue to the lowest.

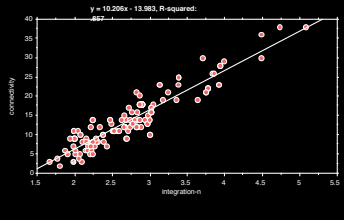
Urban deep structures:
'Axial integration map'

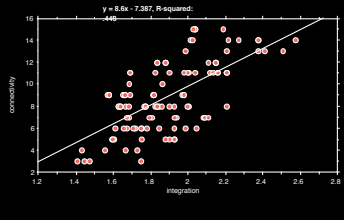


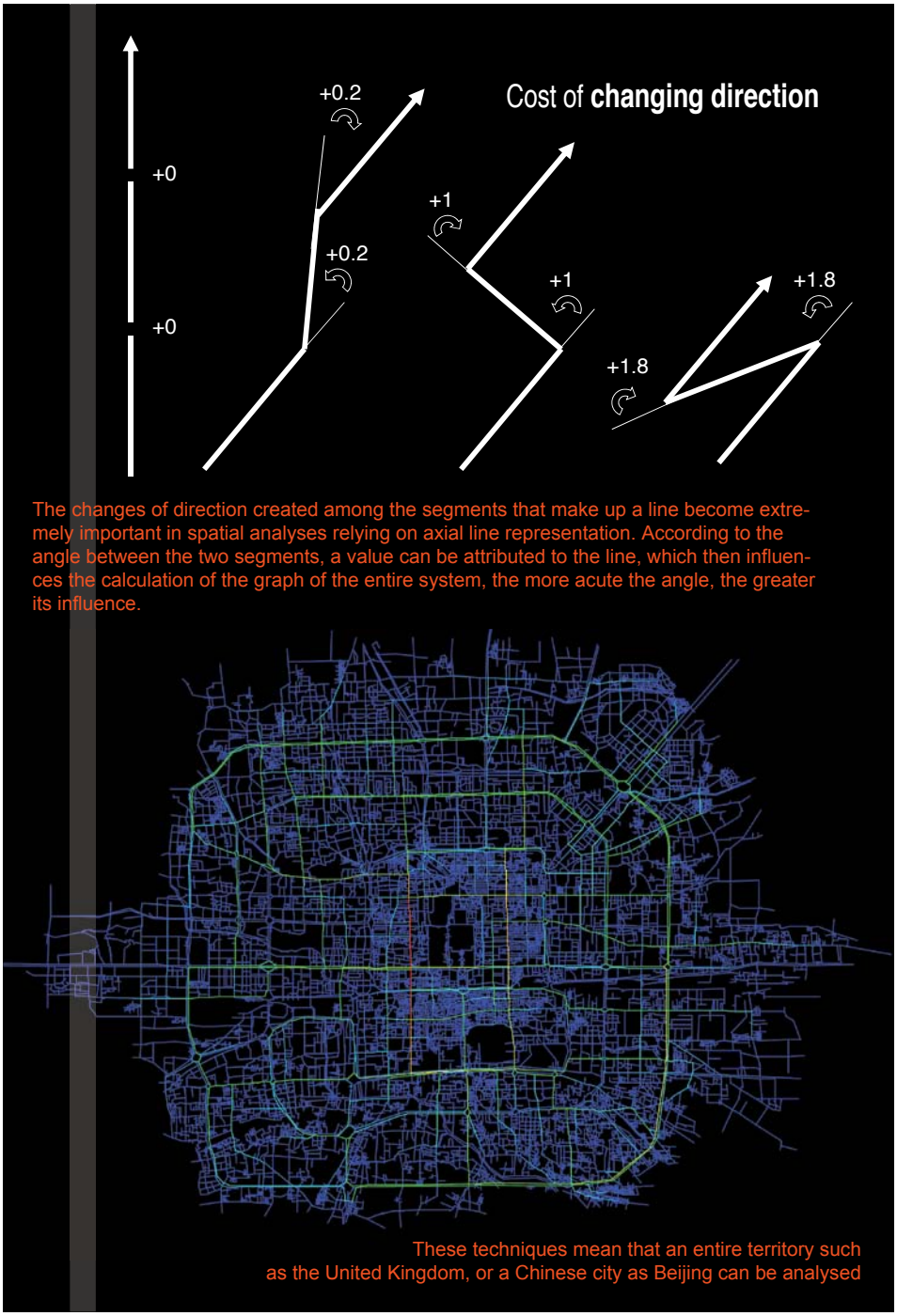
Linking a local vision of an urban structure to a global one calls for the introduction of another concept, Intelligibility. The image below shows that the two very similar urban fabrics do, in fact, have a significantly different relationship with what is visible locally and the perception of the system as a whole. This is also borne out by the graphs that show better correlation in the first case than in the second, in which is it possible to see from the central city square right to the edges of the system. A system's ability to enable its structure to be seen from any point makes it more user-navigable.



Intelligibility: the correlation between local and global



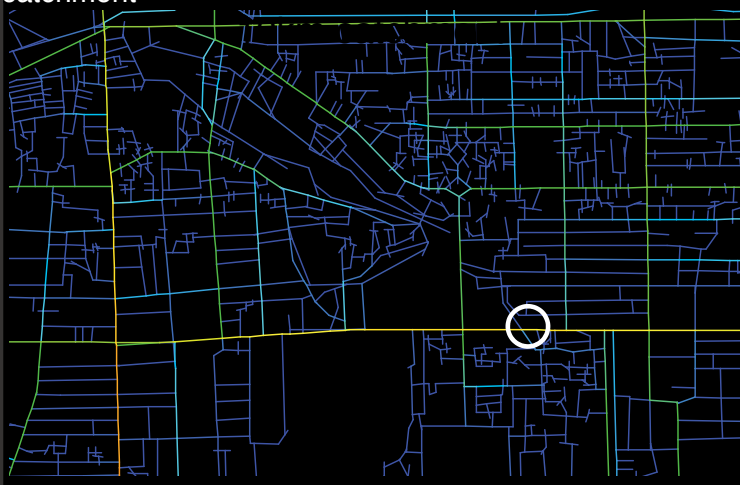




The changes of direction created among the segments that make up a line become extremely important in spatial analyses relying on axial line representation. According to the angle between the two segments, a value can be attributed to the line, which then influences the calculation of the graph of the entire system, the more acute the angle, the greater its influence.

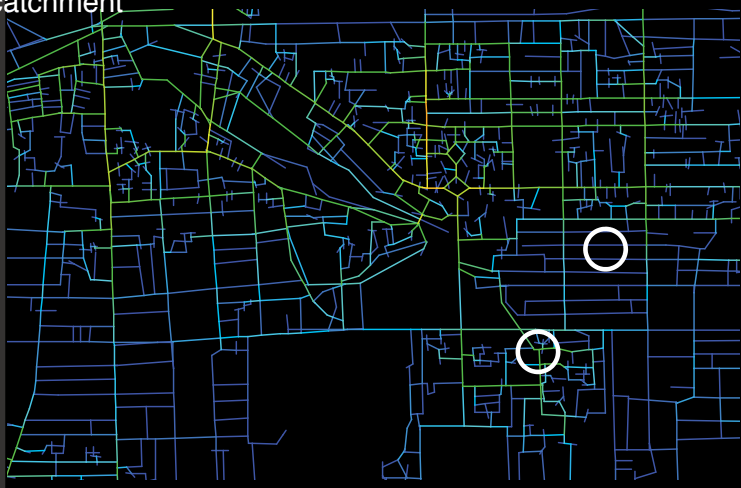
These techniques mean that an entire territory such as the United Kingdom, or a Chinese city as Beijing can be analysed

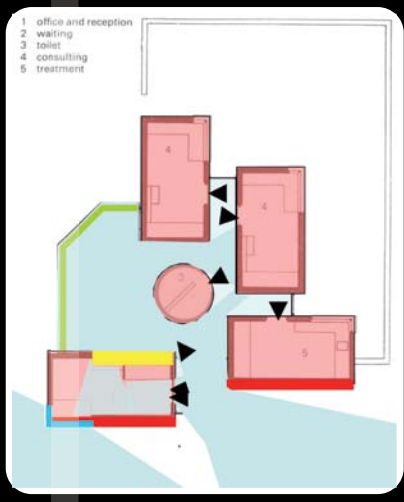
2000m catchment



It is interesting to note that the geometry of how the spaces interconnect reflects the contact that people make with each other.
If we take the map of Beijing city with a catchment area of 2000m, and watch what actually happens at one particular point, for example a road identified by our analysis as being a well-integrated road, a video recording of that particular area will tell us that the road is well-used, by vehicles, bicycles and pedestrians alike.
By downscaling to a more local analysis, within a radius of 500m, and moving onto one of the better integrated parts of the map, the video will pick up a lot of bustle, commercial activity and even sounds in that particular spot.
On the contrary, if we move onto a red, and therefore less integrated road, all that disappears.

500m catchment

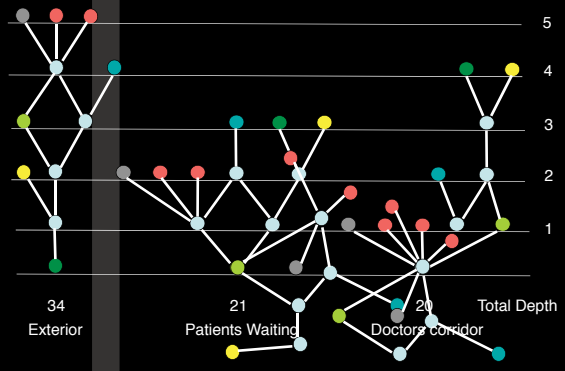




Architecture can 'mean' something

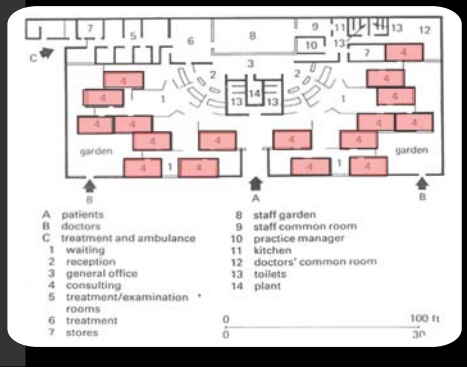
Let us now move to an example that demonstrates the social nature of the function of architectural practice, a doctor's surgery. It is made up of 4 rectangular blocks of equal size, with one cylindrical block in the centre and a space that connects the blocks together. The outer sides are blind; the only opening is on an outer corner. I will try and describe what it is like to move around inside it: on entering the reception area there is a glass wall giving a view of the internal connecting space but it gives me no information on how to access the other blocks because of the central cylinder obscuring the entries.
The same is true of the waiting room, the space that connects the various blocks. This description shows that the space is made up of the relationship between its blocks and the forms.
The space can, however, be read on a second level, i.e. in terms of the activities that take place therein. The spatial relations serve to build specific relationships between the different user categories involved. The patient never sees the other spaces and is controlled by the reception area. The doctors are able to come and go without being seen.

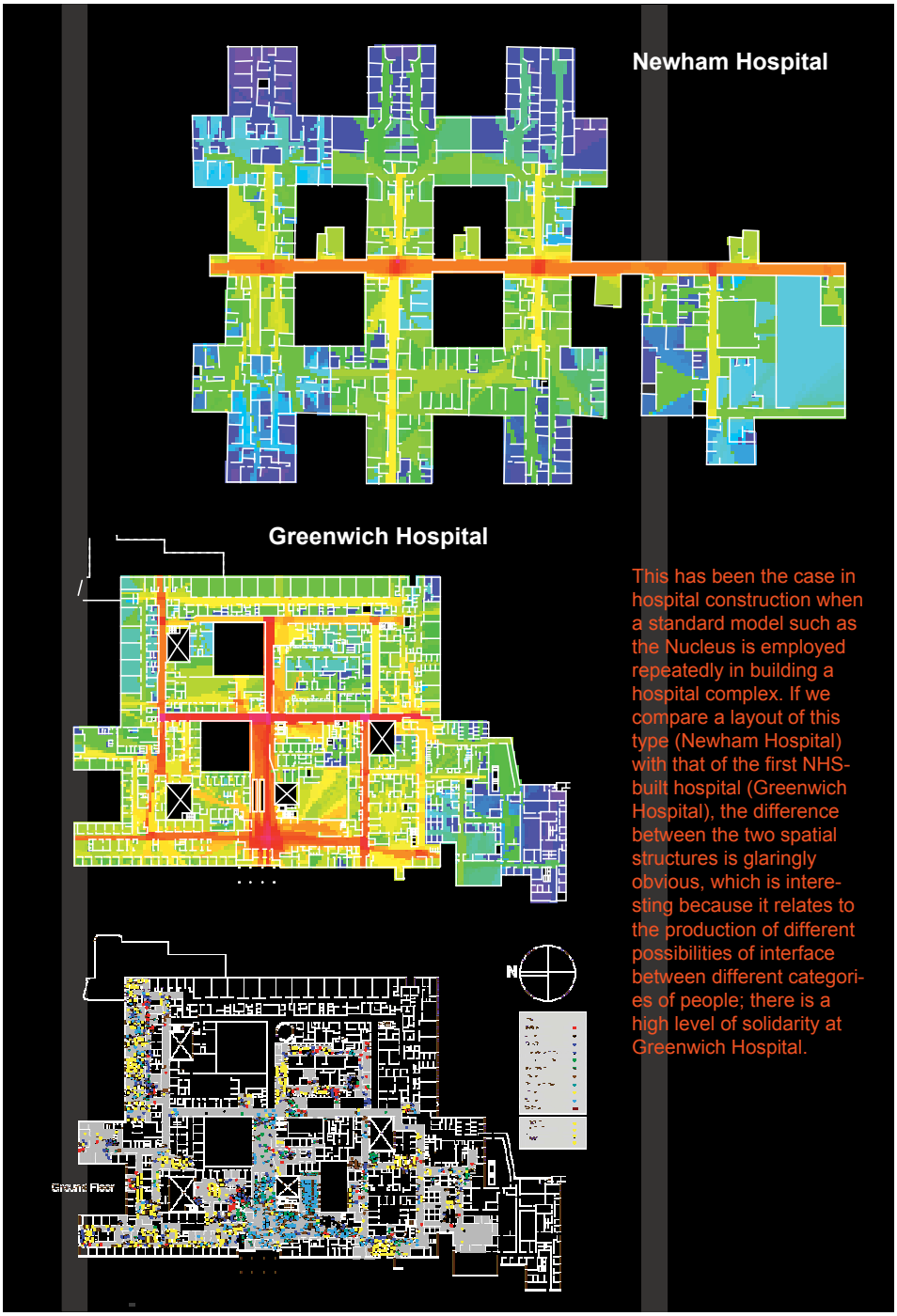
In fact, were we to subdivide this building into convex spaces, analyse it by means of graphs with three different types of graph – from the outside, from the waiting area, from the doctors' corridor, and calculate the depth of each of them, we would find that the smallest space is the doctors' corridor.
This graph captures some of the basic aspects of a medical practice at a social interface level.



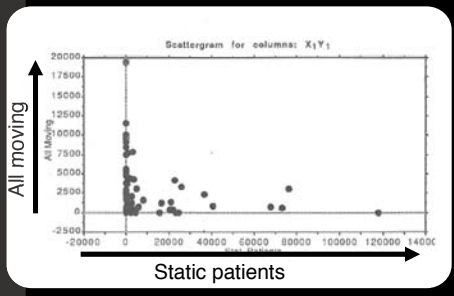
So architecture can 'mean' something, but it also has to 'matter'. It needs 'Causal bite'. Buildings, like cities themselves, act as mechanisms that generate and control the interaction between people.

If we try to replicate this same type of experience, it is prone to failure because increasing the sizes and repeating the same template also increases the relations that should be established between the various elements, and thus the intelligibility decreases.



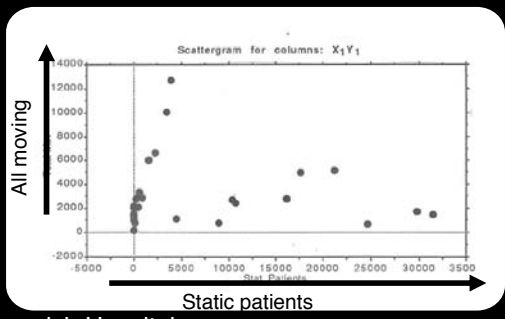


This has been the case in hospital construction when a standard model such as the Nucleus is employed repeatedly in building a hospital complex. If we compare a layout of this type (Newham Hospital) with that of the first NHS-built hospital (Greenwich Hospital), the difference between the two spatial structures is glaringly obvious, which is interesting because it relates to the production of different possibilities of interface between different categories of people; there is a high level of solidarity at Greenwich Hospital.



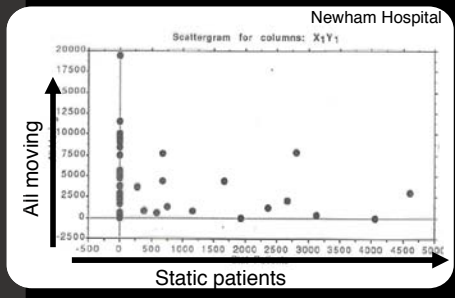
Newham Hospital

"By looking at the correlation between static patients and all moving people, initially we see that they are not correlated in either building. In Newham the relationship is weakly negative, but significant, in Greenwich it is even weaker.
Overall we might surmise that moving people in general tend to not be in the same place as static patients.

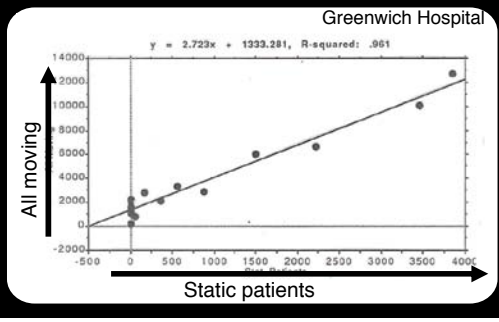


Greenwich Hospital

But these figures hide a more detailed story. Looking at the scattergrams shows a massy negative trend for Newham, but a strikingly bifurcated one for Greenwich. If we abstract the areas in which patients wait for programmatic reasons – in the various clinics for instance – for the two hospitals we find no discernible relationship either way. If we abstract all other spaces though – the non-programmatic spaces – for Newham there is no discernible relationship, but for Greenwich there is a striking correlation. Static patients in Greenwich, in areas other than designated clinic waiting areas, are informally interfaced with all other categories of moving people to a remarkably high degree.

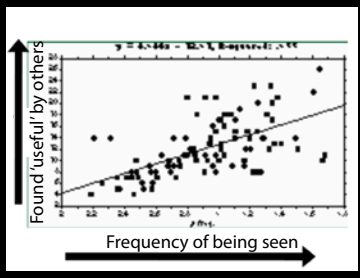


The implication is clear, whereas Greenwich creates a strong informal encounter field over and above the programme, risking the generation of new informal social groupings in doing so, Newham eliminates the possibility by making the organizational boundaries – the department coextensive with the spatial boundaries – the template - and segregating department from department.

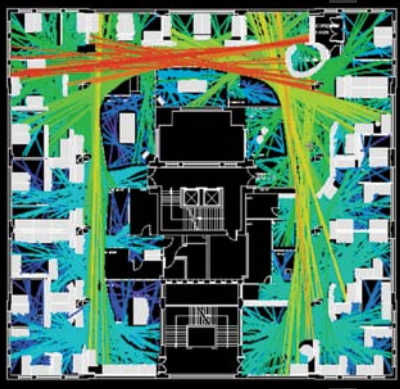


In this case the greater part of the encounter potential within the building, informal as well as programmatic is invested
in the reproduction of organisationally defined groupings and relationships.
Here the effect of random interaction is eliminated by a strict control of departmental boundaries and a strategy of global segregation". (1)

"One of the main effects of spatial structure in the built environment is to define patterns of movements. A side effect of these is on patterns of encounter and co-presence between different groups of people as they move around an environment. As people within a building move from place to place to fulfil their roles in the organization the configuration of the circulation network coupled to the locations of specific functional spaces in that network (the origins and destinations) generates a pattern of movement. In a tree like structure on average, the less likely that any two sets of routes will share a common set of spaces. This means that random meeting between people on different missions (and so those fulfilling different social or organisational roles) is reduced in this kind of structure. Conversely, in ringy and shallow structures there is both a greater choice of routes, and greater mixing between those on different routes from place to place. These properties are a natural c onsequence of the layout of the environment, and can go a long way to explain how different organisational cultures might be inscribed in, and partly reproduced by, the spatial design of the built environment." (2)



Spatial layout drives communication and innovation in the workplace



Past studies have concluded that patterns of space use and movement generated by spatial configuration have a direct impact on the frequency of contact between workers in office buildings. The frequency of contact, moreover, has an influence on the work communications deemed 'useful' as per questionnaires filled in by the workforce. The more visible a person, the higher other people's opinion of their work.

Implications for research

"The idea that one of architecture's functions is to construct and reproduce social structures has deep implications not only for architectural practice, but also for architectural research. Ultimately, if the role of research is to contribute to the body of knowledge, then a distinction must be drawn between two kind of knowledge: scientific and social. Scientific knowledge is explicit, linguistic or mathematical in its expression. It allows 'what if' questions to be addressed and forms the basis for goal directed design practice. Social knowledge however is most often tacit and incorporated in the accepted behaviours and norm of society. It is generated by communities of practice through exploratory design processes. It seems that the field of architectural research contributes to both types of knowledge; the former in building sciences, technological and engineering research; the latter through practice.

There are, however, two continual processes through which the boundaries between these types of knowledge are negotiated. First, the critical theorist draws from practice and brings into the realm of explicit discussion the work of practitioner, while the historian sets these acts into their wider social, political and technological context. Second, there is an underlying move towards explicit and scientific explanation of broadly social and cultural processes. The space syntax research field described earlier gives a clear example of this; however there are many other dimensions in architectural research which follow a similar trend, moving our understanding from tacit to explicit.

As each of these fields of knowledge matures it gives rise to new science based divisions of labour in practice – essentially new branches of engineering – in which explicit knowledge allows 'what if' questions to be answered and enables more goal directed design processes". (2)

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THE NEED FOR AN EVIDENCE-BASED TOOLKIT. THE SPATIAL DNA OF HOSPITALS: EVIDENCE BASED PLANNING AND DESIGN

Maximo Martinez, Associate Director at Space Syntax Ltd

Introduction

This note accompanies a presentation given at the Research Tools for Design conference held at the Dipartimento di Tecnologie dell'Architettura e Design "Pier Luigi Spadolini" on the 28th of January 2010.

The presentation is an introduction to the work of London based design consultancy Space Syntax. Space Syntax provides evidence-based design advice using the theory and methods of space syntax as developed by Bill Hillier and his colleagues at University College London (UCL) over the last 30 years.

The key innovation in the theory of space syntax is that space is an object in its own right and as such it can be objectively described and quantified as the fundamental influence on behaviour. Space Syntax becomes a powerful tool in two key endeavours of architectural practice. First, as it addresses the fundamental properties of space, it allows an objective baseline assessment of how the design of buildings and cities affect the way we use them. Secondly, as a design tool, it provides the designer with the ability to design using 'first principles' of space in order to forecast how a design will be used.

The presentation has three main sections. The first gives a brief background on the prevalent paradigm of architecture and design highlighting how particular design ideas have generated environments that have failed to deliver the ideals behind the approach. This sets the scene for the second part which provides an outline of the way Space Syntax works in practice using an evidence-based approach in two stages: diagnostic and design intervention.

What is Space Syntax?

Space Syntax provides a unique, evidence-based and industry-leading approach to the planning and design of buildings and urban areas. Our aim is to help create environments that are socially, economically and environmentally sustainable.

Combining technology, ability and extensive global experience, we target the social, economic and environmental value that good planning

Nicoletta Setola (edited by), *Research tools for design*, ISBN 978-88-6655-024-2 (print), ISBN 978-88-6655-027-3 (online), © 2011 Firenze University Press

and design bring. We show how value can be created through the analysis, understanding and skilful manipulation of space.

Over twenty years of research-informed consulting, we have developed a powerful technology that demonstrates the key role of spatial layout in shaping patterns of human behaviour. These patterns include movement on foot, on cycles and in vehicles; wayfinding and purchasing in retail environments; vulnerability and criminal activity in buildings and urban settings; co-presence and communications in the workplace.

Our technology is underpinned by spatial design principles that have influenced planning and design policy throughout the world.

The Space Syntax approach empowers people to make informed decisions about the key issues concerning them. We add value through a unique approach:

- We *create places* by producing visionary planning and design ideas, leading and supporting multi-disciplinary teams.
- We *shape knowledge* by developing technology, undertaking research and publishing findings.
- We *inform practice* by training and licensing people to use our technology as well as by contributing to the production of new planning and design policy.

The challenge of practice

Institutional silos have emerged to the detriment of the built environment. Cities, which can only be understood as *long-durée* collaborative endeavour, adapt organically to the changing economic, social and environmental conditions are now being planned by few actors in a short period of time. The time constraints of a project, in conjunction with the specialisation of disciplines and the complexity of projects, has lead to a fragmented and often simplified to approach to the planning and design of cities. The result can be summarised in three categorical failings of architecture and urban practice.

Flaw 1_ We have stopped building main streets. Urban design has replaced the main street which successfully mixed global and local movement. As a consequence we have lost the potential to create movement economies: a fundamental property of good working cities. Instead, we have produced a traffic-oriented urbanism that reduces the connectivity of local street networks to the detriment of the movement economy. (Fig. 1)

Flaw 2_Mix of land uses have been separated into zones. Cities and parts of cities that we enjoy offer a rich mix of land uses. This is not only sustainable because as it reduces trips and transport demand, it also creates rich and vibrant environments by establishing a walkable city form. (Fig. 2)

Flaw 3_We have stopped building urban buildings. The previous flaws implicitly create the framework for the anti-urban building. The anti-urban building fails to make a positive contribution to the public realm as it doesn't create active frontages, it becomes a standalone piece that encourages a vehicle-dominated public realm with, typically, the car park separating the entrances of the building from the public domain. (Fig. 3)

In short, we have replaced urbanism with transport.

√	X
urbanism	*transport*
main streets	fast highways
active frontages	blank frontages
mix global & local movement	separates movement
enhanced movement economy	suppressed movement economy

The Space Syntax approach

Space Syntax, through an evidence-based approach, offers a framework to readdress these flaws. The principle of the approach is that it defines space as an object which can be objectively described and measured. In turn, it establishes a link between spatial properties and behaviour in a probabilistic manner. The design of buildings and cities influences the choice people have when moving in them and research has found that most people, most of the time, prefer to move using simple well connected routes. Using this information we can evaluate and forecast the social, economic and environmental outcomes of design interventions.

The starting point is creating an analytical framework to understand that space can shape behaviour by either bringing people together or keeping them apart. This does not happen in a deterministic manner, space will not make anyone do anything, but rather in a probabilistic way: most people, most of the time, are likely to choose the most convenient and easy way to move from A to B. Central to the analytical framework is understanding space as a relational entity. The properties of a particular space are not defined by the space itself but by the spatial relations or connections it has with all other spaces in the network. Thus, a street or a room in a building, are not only defined by their shape and the objects they contain, but by the way they are connected to the rest of the building or city.

The object of study in Space Syntax is the patterns of space that give buildings and cities a unique 'spatial signature'. Each signature is enables a pattern of human activities. The routes that people use to move through, the places they decide to stop, the locations of shops and patterns of crime are all related by the spatial layout of cities. Ultimately, the success of public places and well functioning buildings depend on the way they are able to

articulate the patterns of movement and copresence. (Figs. 4-5-6) Use and programme need to be conceptualised as a single entity in the design process.

An evidence-based design tool

We then turn to how Space Syntax is used in practice. This presentation, while drawing on a wide background of projects, concentrates on healthcare. The introduction established some of the current design risks associated to modern planning and design, particularly the separation of land uses and movement modes, where the large-scale movement has taken preponderance over the local-scale movement. When we look at hospitals, we can find a similar problem. Hospital buildings and hospital campus grow, often without a long-term vision and design is largely driven by clinical briefs and not user's environments.

One way of conceptualising healthcare design is through the idea of 'normalising' healthcare. This means two different things. On the one hand it implies applying the lessons learned through our extensive portfolio of complex buildings and public realm design. On the other hand, normalising healthcare requires thinking across scales: from how a hospital building integrates to the context in order to make a positive contribution to the urban realm, to the design of room layouts that improve interaction and innovation amongst members of staff and improve patient experience and outcomes. (Figs. 9-10-11)

From city to bedside: thinking across scales

Scale	*Output*
City	Designing cities that encourage a healthy lifestyle – walking and cycling
	Thinking strategically about the location of healthcare facilities
Masterplan	Integrating and enhancing the existing urban fabric and land uses
Public spaces	The hospital as a civic building – normalising healthcare
	Learning from other building types
Building layout	Ease of wayfinding
	Safety and security
Room layout	Workplace innovation and interaction
	Improving patient experience and outcomes

Understanding the Location and Linkages of the city

The links between health and city form have long been established and continue to be investigated, however there is still a strong disciplinary

boundary between healthcare and planning/urban design professionals. The World Health Organization (WHO) through its Healthy Cities project aims to place health at the centre of the social, economic and political agenda of city governments. In the UK, the National Institute of Clinical Excellence (NICE) as well as other bodies related to the National Health Service (NHS) have been actively looking for opportunities to influence the health outcomes by participating in the planning process. The change of the UK's planning system towards spatial planning and a focus towards sustainable communities has encouraged this engagement.

Space Syntax provides a tool for strategic decision making in order to help in the location and planning of health infrastructure. It provides valuable information related to the accessibility of health infrastructure in terms of population catchment, public transport accessibility and overall population catchment.

Creating a robust masterplan Layout that enhances the movement network

Moving into the scale of the masterplan, Space Syntax analysis can be used to assess the movement network, land use distribution and landscape design of a site. Early design advice will help articulate a spatial brief and propose a spatial strategy to guide development plans. The way a building is related to the context and to other neighbouring buildings will inform important internal issues architectural features such as location of entrances, the structure of circulation and the distribution of departments across the building.

Buildings

Working across scales is the need to provide ease of movement and wayfinding. The aim is that the building must be the main device for orienting people to their chosen destinations: the building becomes the signage. A clear and simple layout, supported by a robust circulation system, and the adequate distribution of the programme in response to the accessibility properties of each location will ensure that popular destinations will be more accessible. Back of house areas such as research can be located in less accessible areas of the hospital. Of course, it is important to point out that any organisation will have different categories of users with different access privileges. Visitors, patients and staff each will have access to different parts of the hospital complex and therefore will be confronted by different layouts. A staff member will be able, for example, to make use of shortcuts which are not available to patients. This is an important function of layout: the categorisation of users and the structuring of encounter patterns.

The relation of layout and activity patterns plays a key role in the design of hospital wards, particularly when designing single or double room wards. In the UK the layout of the ward had been largely coded by a typology of layout with clearly identifiable types. For example, there is only one way to design a Nightingale ward: the design is coded in the name. On the other hand, as the ward moves from multi-bed room accommodation into double or single-room accommodation the design permutations increase. There are a number of different ways to design a single-bed ward: L-shaped, linear, racetrack and circular to name few generic layouts. Research carried out by Space Syntax has demonstrated that it is layout, rather than accommodation type, the key variable that affects behaviour of patients and staff. Our studies have shown that:

- layout is a key determinant of behaviour over accommodation type
- as a result, patients in single rooms do not necessarily experience less interaction than patients in multi-bedded bays or wards
- in areas with high levels of natural surveillance, supervision happens in an informal way which tends not to involve conversation
- if visibility is lost, nurses have to make a specific journey to see patients, at the
- end of which, interaction is more likely to take place
- visibility of bed areas and resulting surveillance patterns are related to accommodation type. Nightingale wards and multi-bed rooms offer more visibility than single rooms, however
- overall layout, location, and number of nurse bases and the specific design of rooms each play a part in determining visibility
- the 50/50 and single-bed wards in the study demonstrate different visibility patterns due to their configuration
- overall, layout over accommodation type is a key determinant of behaviour
- spatial layout of well-designed wards can accommodate requirements of privacy, close nurse-patient access and surveillance and reduced travel distance for nurses, while at the same time provide opportunities for co-presence and informal interaction.

In summary

Our contribution to healthcare design covers:

- development of design thinking,
- understanding and managing the complex challenges which the briefing, design and building procurement processes present, and
- informing design guidance and policy.

Our research has shown that:

- good design has a strong role to play in shaping a positive user experience,
- a positive user experience can help improve operational and clinical

outcomes,
- this kind of experience is tangibly related to the user's relationship with other people and with their physical surroundings,
- these relationships are generated in significant part by the spatial layout of the building and its setting,
- there is a quantifiable way of describing some of the spatial characteristics for evaluation, and
- they can be applied in the design of new hospitals.

Well designed spatial layout is important:
- it provides users with an instinctive understanding of their location within the larger hospital complex and provides a natural setting for social interaction,
- it works across scales regardless of signage or adjacent functions,
- buildings that offer intuitive wayfinding also help to reduce stress, and
- this improves the quality of the overall experience for patients, patients and visitors.

Through a baseline diagnostic we are able to establish clear design objectives that should be achieved in the masterplanning of hospitals:
- Effective edge-to centre movement routes
- Routes which crate strong global-to-local connections
- A strong interface between pedestrians and vehicles
- Intuitive understanding of the hospital complex
- Provision of a natural setting for social interaction
- Improve communication patterns between patients-staff & staff-staff
- Reduce stress through ease of wayfinding
- Ease of surveillance
- Improve outcomes through design interventions.

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Figure 1. Flaw 1: We have stopped building main streets

Figure 2. Flaw 2: We have separated land uses into zones

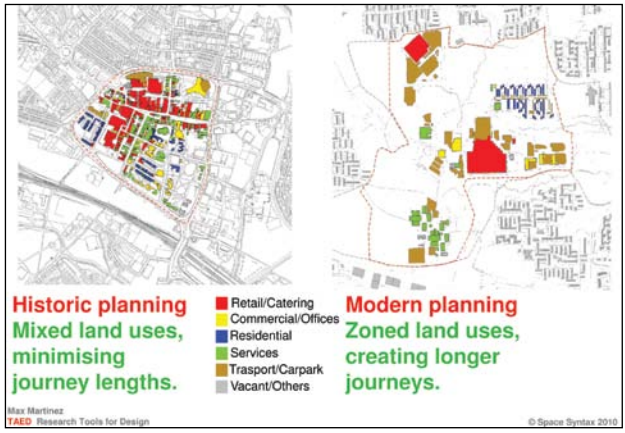


Figure 3. Flaw 3: We have stopped building urban buildings

Figure 4. Movement is the lifeblood of the city

Figure 5. Almost all transactions takes place between people on foot

Figure 6. We move seamlessly through environments

Figure 7. A space syntax movement simulation software

Figure 8. From city to bedside: thinking across scales

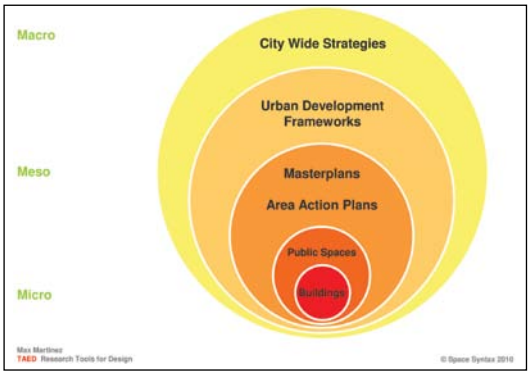


Figure 9. Understanding the context: access to healthcare facilities (spatial accessibility, public transport access, pedestrian movement flows)

Figure 10. Wayfinding and accessibility in Hospital facility

Figure 11. Generating evidence: movement tracing, evaluating accessibility, evaluating visual fields

Figure 12. Building layout evaluation process

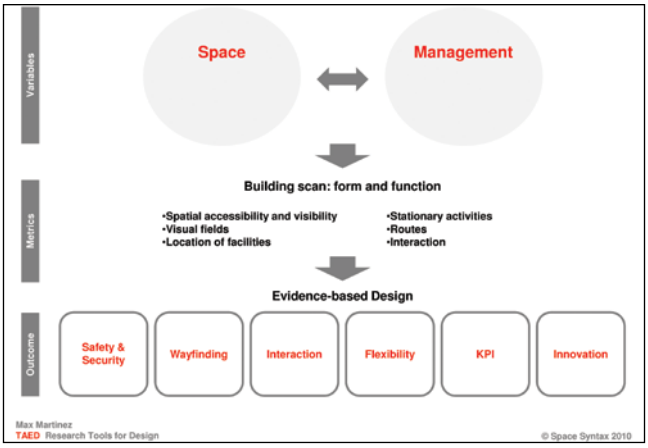
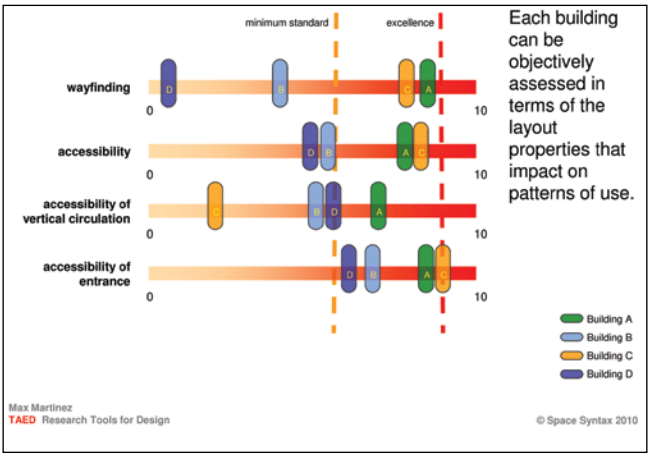


Figure 13. The spatial DNA of buildings



THE MARMOT REVIEW: EMERGING IMPLICATIONS FOR BUILT ENVIRONMENT PRACTITIONERS

Ilaria Geddes, Matilda Allen
Department of Epidemiology and Public Health, University College London

Introduction

The aim of this paper is to present the findings of the Strategic Review of Health Inequalities in England post-2010 (The Marmot Review) with a particular focus on the built environment. The Review's policy recommendations for the built environment and their justification are outlined and the emerging issues around implementation and practice are raised.

Inequalities in health arise because of inequalities in society – in the conditions in which people are born, grow, live, work and age, which are commonly referred to as the social determinants of health.

In this paper the findings and the Review's associated work on the built environment are analysed further to consider the initial implications of the Review's recommendations for built environment practitioners.

The objective of this paper is to discuss the socio-economic distribution of 'environmental burdens'. The Review identified and collated the evidence relating to aspects of the built environment and their interrelationships with health. There is a social gradient in environmental disadvantage: health and environmental inequalities are inexorably linked.

Environmental inequalities happen wherever 'environmental burdens' and 'environmental benefits' are not equally distributed across society. In some cases the burdens precede the development of a deprived area due to the reduction in land value and the attractiveness of the area, while in other cases planning decisions and design cultures that are tilted against weak populations lead to concentrations of burdens in economically deprived areas.

Health and planning

In English national planning policy, health is a cross-cutting theme. None of the national planning statements are specific to health, health inequalities or social inequalities; however the statement on *Sustainable Development* sets the overall planning policy framework, the role, purpose, and aims of the English planning system, and states that «planning policies should: ensure that the impact of development on the social fab-

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ric of communities is considered... seek to reduce social inequalities; address accessibility (both in terms of location and physical access) for all members of the community to jobs, health, housing, education, shops, leisure and community facilities… deliver safe, healthy and attractive places to live, and… support the promotion of health and well being by making provision for physical activity»[1].

Such statement recognises not only the impact that the built environment has on health, but also the impact that the built environment has on other social determinants, as well as the needs of communities beyond involvement in planning decisions.

These principles are not included in other, more focussed policy statements and are not elaborated upon in local planning frameworks - guidance on *how* to promote health and wellbeing remains unclear, and because health issues are not enshrined in government guidance on planning policy, they tend not to be picked up by planning inspectors when plans are being examined[2].

Nevertheless, a body of design guidance focusing on health published by varied stakeholders exists in England[3]. However, much of this guidance often deals with separate elements of the environment, such as provision of cycling routes, quality of public spaces, standards of housing, etc. It fails to provide a theoretical framework to understand the interaction between such elements, the distribution – both social and spatial – of different characteristics of the built environment, in particular in complex urban systems.

The Marmot Review

The Marmot Review aimed to develop a strategy, including policies and interventions, to address the social determinants of health and reduce health inequalities by identifying the evidence most relevant to underpinning future policy and action and show how this evidence could be translated into practice.

The Review showed that socio-economic inequalities and their determinants, including the built environment, have a stark effect on the health outcomes of different population groups. It confirmed that there

[1] Office of the Deputy Prime Minister, *Delivering sustainable development*, London, TSO, 2005.

[2] National Institute of Clinical Excellence. Workshops on the Health Outcomes in Local Spatial Planning Decisions. London and Birmingham 12.07.10 and 13.07.10.

[3] For example: Commission for Architecture and the Built Environment, *Community Green: Using Local Spaces to Tackle Inequality and Improve Health*, London, 2010; National Institute for Clinical Excellence, *Guidance on the promotion and creation of physical environments that support increased levels of physical activity*, London, 2008.

is a social gradient in health, but it also showed that there is a social gradient in environmental disadvantage.

The Strategy proposed six policy objectives and related interventions aimed at reducing the gap in life expectancy between people of lower and higher socio-economic backgrounds:

- Give every child the best start in life
- Enable all children, young people and adults to maximise their capabilities and have control over their lives
- Create fair employment and good work for all
- Ensure a healthy standard of living for all
- Create and develop healthy and sustainable places and communities
- Strengthen the role and impact of ill health prevention.

Although the built environment has an impact on many aspects of all the above, the fifth objective is the one most relevant to built environment practitioners. The Review identified a number of factors for which the evidence of the relationship with health was particularly strong; such evidence also showed that these elements and their disadvantages or benefits were also socially distributed – they are:

- Transport
- Green/ Open Space
- Pollution
- Housing
- Community Participation
- Social Isolation

The Social Gradient in Health

Analysis of data on mortality and morbidity confirmed not just that life expectancy is socially graded, but also that so is ill-health. Both the expected length of life and the physical quality of that life are influenced by social conditions: people at the bottom of the socio-economic scale not only die, on average, seven years earlier than those at the top, but also spend many more years with a disability. The top curve in figure 1 shows the relationship between neighbourhood income and life expectancy.

The association is clear – those living in the poorest neighbourhoods in England will, on average, die earlier than people living in the richest. The gradient of the lower curve is even steeper: this represents the difference in disability free life expectancy – the number of years the resident of an area will live in good health. The average difference between the richest and poorest neighbourhoods on this measure is seventeen years. For both lines, the gradient applies across levels of deprivation. The relationship between deprivation and health is not only relevant for the

most and least deprived areas – every small increase in the conditions of someone's life is likely to result in an increase in their life expectancy.

To reduce the steepness of the social gradient in health, actions must be universal, but with a scale and intensity that is proportionate to the level of disadvantage: this is called *proportionate universalism*. Greater intensity of action is likely to be needed for those with greater social and economic disadvantage, but focusing solely on the most disadvantaged will not reduce the health gradient, and will only tackle a small part of the problem. Action is needed to improve health for all, but must be focussed proportionately more for those lower down the gradient, with the aim that all have the health outcomes of the most advantaged – this is called *levelling-up*.

The Social Gradient in Environmental Disadvantage

In terms of environmental inequalities lower socio-economic groups, those living in the more deprived areas will find themselves exposed to a greater spectrum of environmental burdens (Fig. 2). This gradient raises many fascinating questions about equity and the built environment – can we identify groups that are susceptible to living near environmental burdens? Such gradient suggests that socio-economic characteristics dominate the location of population groups regarding environmental burdens.

Environmental inequalities impact on health and wellbeing, and 'conspire' with other factors to reinforce health inequalities. People who live next to 'environmental benefits', such as good quality green spaces, enjoy better air, less noise and access to natural spaces, while people who, for example, live in the vicinity of polluting factories, major roads or railway lines inevitably suffer from the related noise and air pollution. While the impact of environmental quality on health has been known for a long time, its distribution and concentrations of burdens have not been extensively analysed.

The evidence of the distribution of environmental burdens across the social scale analysed by the Review highlighted the disproportionate impact of such burdens on disadvantaged groups, in particular poor housing, higher rates of crime, poorer air quality, lack of green spaces and places for children to play, and more risks to safety from traffic. Figure 2 shows the presence of unfavourable environmental conditions according to levels of deprivation. In the least deprived areas, over 70% of the population experience no unfavourable environmental conditions, compared to less than 30% in the most deprived areas. The relationship between deprivation and unfavourable environmental conditions holds true across the social gradient.

The key areas where socio-economic status correlated with environmental disadvantage are outline below.

Transport:

The proportion of people cycling (and therefore likely to be benefiting from the associated health improvements) follows a clear social gradient, as can be seen in figure 3.

The lower the social grade of a person, the less likely they are to cycle. Where interventions have taken place to improve cycling rates, they have focused on the whole population of selected areas rather than looking at the gradient in cycling. While cycling has increased in 6 areas of intervention from 2006 to 2009, this has been equally true across the social grades and has therefore not changed the gradient.

The impact of transport is perhaps most notable when examining the rates of death from road traffic injuries as figure 4 shows.

The single major avoidable cause of death for children over five is unintentional injury on the roads. The social class gradient in injury across all ages is steeper than for any other cause of death or long-term disability. Furthermore, in the last 20 years, rates of child death from unintentional injury have not declined in families in which no adult is in paid employment, despite overall reductions. The inequalities are indisputable - children in the 10% most deprived wards in England are 4 times more likely to be hit by a car than children in the 10 % least deprived wards.

Green Space:

Access to green space can have a clear effect on physical and mental health and well-being. Many studies show the positive effect of green space – it helps to decrease blood pressure and cholesterol, improving mental health and the ability to face problems, and reduce stress levels. It also encourages social contact and integration, provides space for physical activity and play, improves air quality and reduces urban heat island effects. There is a significant difference in the frequency of different classes visiting a green space.

Figure 5 shows that over 35% of those in the lowest social grade visit green spaces infrequently (less than once a month). This is likely to be due to both the low availability and bad quality of green space in deprived areas.

Pollution:

Pollution also follows a social gradient, with poorer communities on average experiencing higher concentrations of pollution and therefore higher prevalence of cardio-respiratory and other diseases. Where air pollution is caused by car or air traffic, noise pollution often adds to the environmental burden shouldered by poorer sections of society - studies have shown that noise pollution is worse in areas of high density housing, rented accommodation, areas of deprivation and areas which are highly urbanised[4].

[4] Power A., Davis J., Plant P., Kjellstrom T., *The built environment and health inequalities. Task group submission to the Marmot Review*, 2009.

Housing:

The 'clustering' of social and low-cost housing into relatively poor or relatively rich areas has increased, and often correlates with multiple environmental advantages or disadvantages. This is partly because those features of a local area that encourage health also increase house prices to a point where the poor are effectively priced out. Thus, those who need these benefits most are least likely to experience them, and inequality increases[5].

Since the 1970s social housing is a source of disadvantage: there have been clear negative outcomes associated with living in social housing and this applies to health as well as education, self-efficacy and income[6]. These disadvantages have increased with the growth of owner occupation and did not exist in earlier decades, which suggests that the negative effect is caused not by social housing itself, but by its relative status in the housing market[7].

Cold housing is believed to be the main explanation for the excess winter deaths that occur each year. From December 2008 to March 2009, there were 36,700 additional winter deaths in England and Wales[8]. As can be seen in figure 6, approximately 33% of the poorest fifth of households are in fuel poverty, compared to less than 1% of the richest fifth of houses.

Extreme weather conditions are a particular risk to health and have an impact on inequality, because of the spatial distribution of people on low incomes, who are more likely to live in areas which are warmer during the summer months[9], more exposed to weather extremes and to flooding[10].

Community Participation and Social Isolation:

Social networks and participation act as protective factors against cognitive decline and dementia for those over 65[11]. They also aid recovery

[5] Dorling D., *Using the concept of 'place' to understand and reduce health inequalities*, in Campbell F., *Improvement and Development Agency*, The social determinants of health and the role of local government, 2010.

[6] Feinstein L., Smith Institute, *The public value of social housing: a longitudinal analysis of the relationship between housing and life chances*, London, Smith Institute, 2008.

[7] Because of a reduction in the supply of social housing over the past 25 years, there has been what is termed a 'residualisation' effect in the make-up of social housing tenants, so that as a group they have higher rates of unemployment, ill health and disability than the average for the rest of the population.

[8] Marmot M., *Fair society, healthy lives: the Marmot review; strategic review of health inequalities in England post-2010*, The Marmot Review, 2010.

[9] Stern N.H., Great B., *The economics of climate change*, Stern review on the economics of climate change, HM Treasury, 2006.

[10] Environment Agency. Addressing environmental inequalities: position statement, 2004.

[11] Fabrigoule C., Letenneur L., Dartigues J.F., Zarrouk M., Commenges D., Barbergergateau P., *Social and Leisure Activities and Risk of Dementia – A Prospective Longitudinal-Study*, Journal of the American Geriatrics Society, 1995; 43(5): 485-490.

of those who fall ill and therefore reduce the risk of death[12]. On the other hand, those who are socially isolated are between two and five times more likely to die prematurely when compared to those with strong social ties. Social isolation can cause stress and depression, particularly for those with young children.

Figure 7 shows the gradient in social support: 19% of people in the most deprived areas of England have a severe lack of social support compared to 12% in the least deprived quintile.

In some cases social isolation is heightened by the physical environment, especially for elderly and disabled people: the design of neighbourhoods, in particular street crossings and the quality of spaces can stop many vulnerable people from leaving the home[13]. Fear of crime in public spaces and fear of traffic often stops elderly people from reaching public spaces, services and community groups.

The Review's Recommendations

The findings reported above could provide a basis to assess how different groups are distributed proximally to environmental burdens and whether interventions, developments and regeneration projects are addressing the gradient in environmental disadvantage. An understanding of how different environmental burdens are experienced by different groups could provide a framework to evaluate interventions on the environment aimed at reducing health inequalities.

Many interventions target specific highly-deprived areas, and have shown a little improvement in a few indicators of health. However, such targeted interventions, even if successful, are unlikely to affect the gradient as a whole, while some universal interventions have shown to have an impact on the gradient; such an example is the London Congestion Charge.

Figure 8 shows that after the congestion charge was introduced, levels of pollution had decreased progressively more in the more deprived neighbourhoods. Considering the inequalities in pollution distribution, the effect of these proportionate decreases is likely to reduce the steepness of the social gradient.

The Review recommended three policy objectives to tackle the problem areas highlighted above and to ensure that the built environment promotes health and reduces inequalities for all local populations.

[12] Halpern D., *Social capital*, Cambridge, Polity, 2004.

[13] Allen J., *Older people and well-being*, London, IPPR, 2008.

All interventions should be targeted progressively across the social gradient.

1. *Prioritise policies and interventions that both reduce health inequalities and mitigate climate change, by:*
   a. *Improving active travel.*
      Interventions to encourage active travel include investing in better walking and cycling routes, reducing car speed to improve road safety, and improving public transport. Designing local areas so that they are easy and safe to walk around and better cycling infrastructure often leads to long-term increases in walking and cycling, and lower numbers of cyclists killed or seriously injured.
   b. *Improving good quality open and green spaces.*
      This includes providing more green space, of better quality, that is well designed, and close to people's homes. The proximity of green space is essential to good health. Having green space that residents can walk to will provide clear health benefits for the local community – prevalence rates for diabetes, cancer, migraine/severe headaches and depression are lower in areas with more green space within a one kilometre radius.[14]
   c. *Improving the food environment in local areas.*
      Residents of deprived areas could particularly benefit from policies which aim to improve availability of healthier food options and better access to shopping facilities. Having local shops within walking distance and generally high accessibility to shops which stock healthy food is likely to improve health within these areas.
   d. *Improving the energy efficiency of housing.*
      This would go some way to decreasing the fuel poverty of households in deprived areas, although increases in income are also necessary. It also decreases energy emissions which helps to tackle climate change and has positive health impacts.

2. *Fully integrate the planning, transport, housing, environmental and health systems to address the social determinants of health in each locality through:*
   - A planning policy statement on health.
     This would incorporate health equity into planning processes and locate it more centrally in the work of all practitioners in the built environment.
   - Better use of existing tools.
     Existing tools such as area assessments, GIS, and spatial models could be used to encourage and facilitate integrated local planning procedures and informing development and regeneration plans.

[14] Power A., Davis J., Plant P., Kjellstrom T., *The built environment and health inequalities*, Task group submission to the Marmot Review, 2009.

- Training:
  There should be more information and training provided on health equity issues for architects, urban designers, local authority managers and officers in planning, housing, environment and transport.

3. *Support locally developed and evidence-based community regeneration programmes that:*
   a. *Remove barriers to community participation and action*
      Regeneration programmes should involve local communities in the development and delivery of local plans. This should happen in a way that reflects the capacity of local communities - local areas should be designed in a way that facilitates and encourages community participation.
   b. *Reduce social isolation*
      There are recommended pathways to reducing social isolation:
      1. Collecting better information from communities to identify population needs.
      2. Providing the support and space for communities to direct and control local interventions and services.
      3. Enhance community empowerment in the design process.

Conclusions

The lack of an integrated planning strategy focusing on health diminishes the potential for implementing healthy design principles and assessing equity issues in relation to the environment. Education on the impact of the environment on health is minimal in both formal academic education and professional development.[15]

Inequalities that are avoidable are fundamentally unfair. If built environment practitioners concern themselves with designing good quality, sustainable places, they are not systematically concerned with the impact of design on health and equity - even though these should be core outcomes of a design process that is informed and inclusive.

While separate working in silos continues, and separate elements of the environment are addressed individually, it will be hard tackle inequalities in environmental disadvantage. The value of presenting the Review's evidence to built environment practitioners is to inform a theoretical understanding of how deprivation is spatially distributed in complex urban systems and the use of analytical tools that better measure the complex relationships between social variables, the urban form and health outcomes.

[15] Marmot Review Team and guests. Policy Dialogue 3 – Sustainability and the Built Environment – Summary of Discussion, 2009.

Figure 1. Life expectancy and disability-free life expectancy (DFLE) at birth, persons by neighbourhood income level, England, 2009. Source: Office for National Statistics

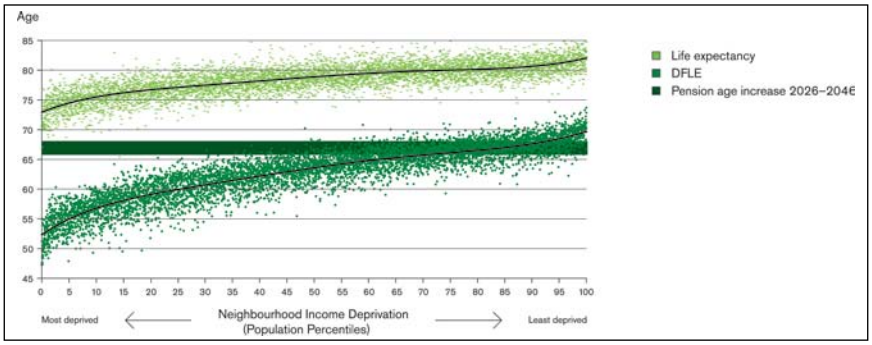


Figure 2. Populations living in areas with, in relative terms, the least favourable environmental conditions. Source: Department for Environment, Food and Rural Affairs. Environmental conditions: river water quality, air quality, green space, habitat favourable to biodiversity, flood risk, litter, detritus, housing conditions, road accidents, regulate sites (e.g. landfill)

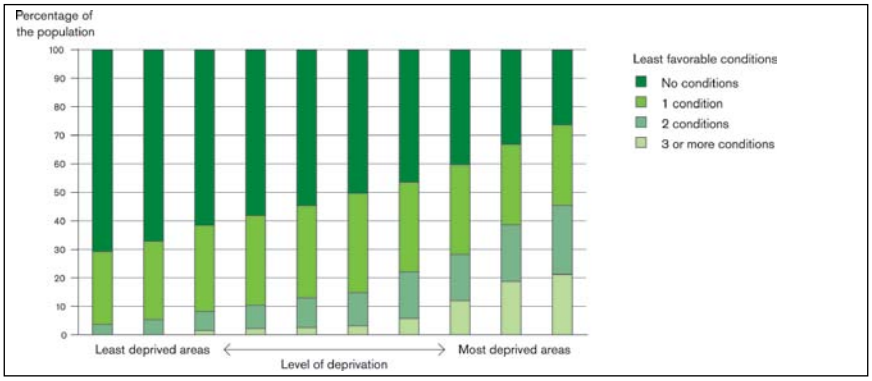


Figure 3. Proportion reporting any cycling in a typical week in the previous year in 6 Cycling Demonstration Towns, by social grade, 2006 and 2009. Source: Department for Transport

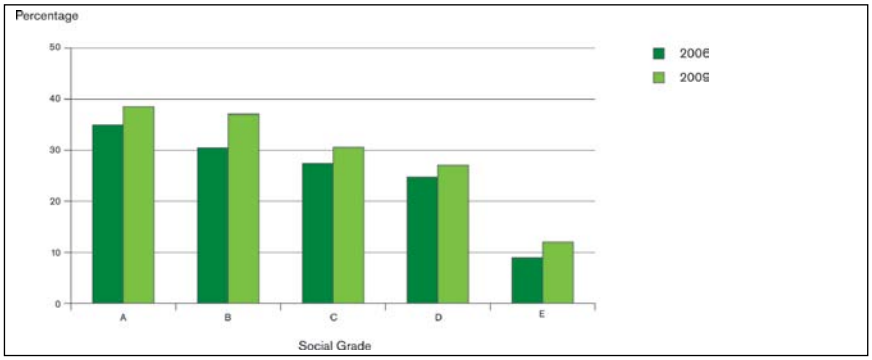


Figure 4. Child deaths by socio-economic class (NS-SEC), 2001-2003. Source: Office for National Statistics. Socioeconomic classification (NS-SEC, National Statistics Socio-economic Classification): 1. Higher managerial & professional; 2. Lower managerial & professional; 3. Intermediate; 4. Small employers & own account; 5. Lower supervisory & technical; 6. Semi-routine; 7. Routine; never worked & long term unemployed. Vertical bars (I) represent confidence intervals

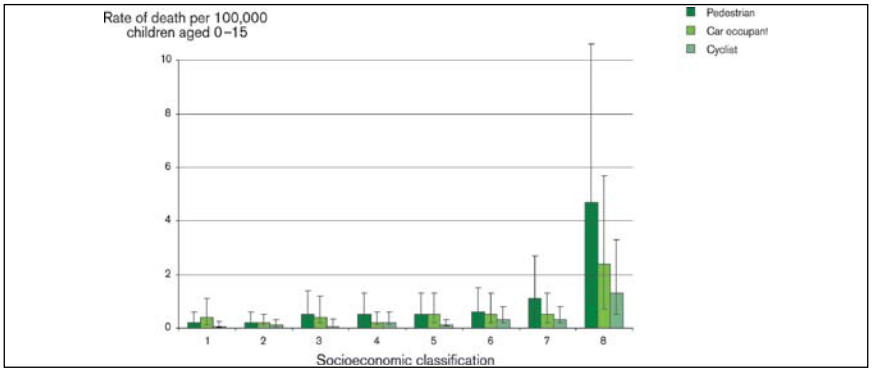


Figure 5. Percentage of the population by social grade who visit a green space infrequently in a year 2009. Source: Department for Environment, Food and Rural Affairs; Energy Saving Trust

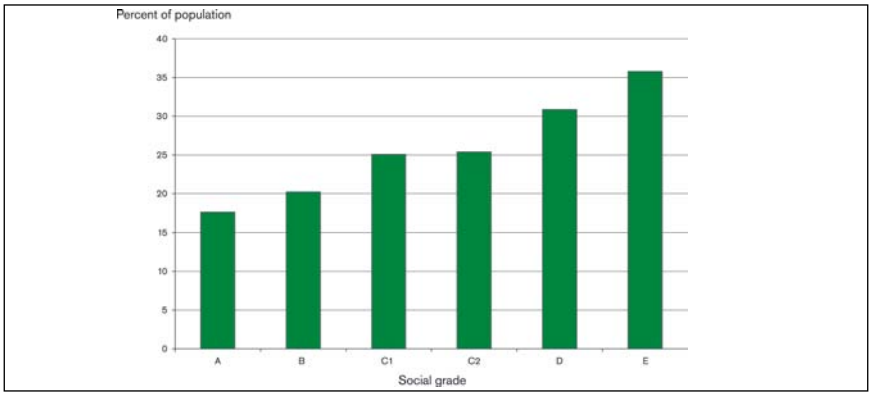


Figure 6. The risk of fuel poverty according to household income. Source: English House Condition Survey; Department for Communities and Local Government. Percent in fuel poverty relates to households in fuel poverty after deducting housing costs

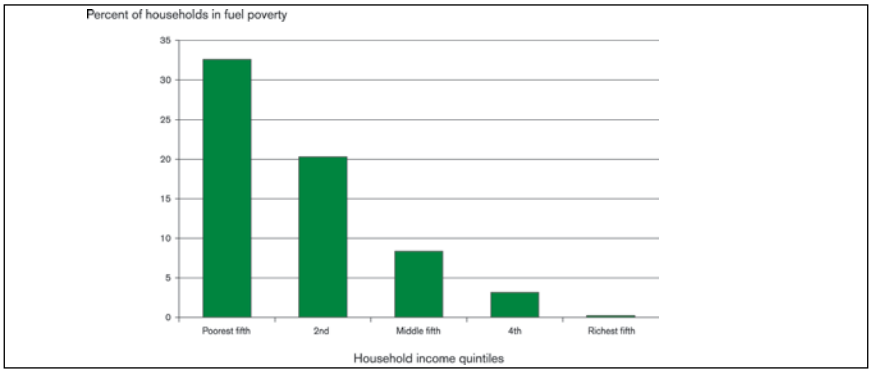


Figure 7. Percentage of those lacking social support, by deprivation of residential area, 2005. Source: Health Survey for England

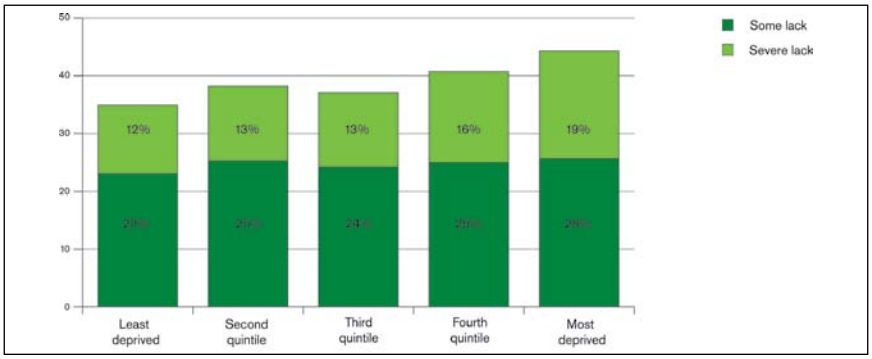
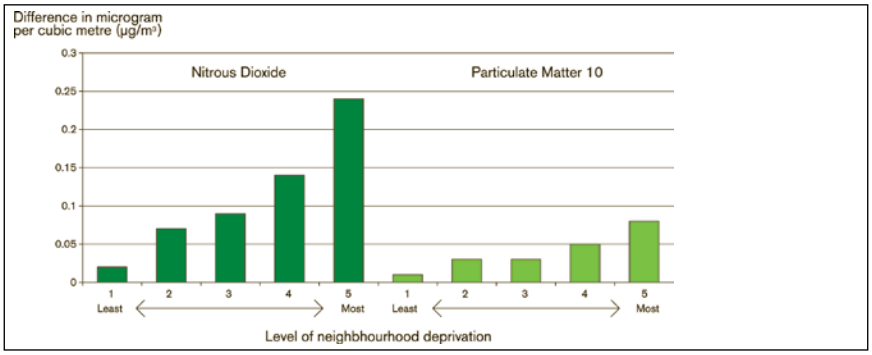


Figure 8. Modelled changes in air pollution concentration due to London Congestion Charge, by area of London and level of socio-economic deprivation, 2003-2007. Source: Tonne et al. Post-pre difference mg/m3=change in air pollution concentration



STUDENTS' HOUSING: FUNCTIONAL MODEL QUALITY

F.L. Adolfo Baratta

In 2000 Italy was one of the European countries with the fewest university student residences. A comparison with countries such as France and Germany, in particular, speaks for itself: with almost the same number of students, Italy has 32,000 student beds, France has 150,000, while Germany has 220,000. The percentage estimate is much clearer: while, in terms of the student/bed ratio, Italy scores less than 2%, France over 7% and Germany 12%. The Italian situation becomes even more embarrassing when compared with countries like Sweden.

In 2000, in order to respond to this demand, the Italian Government provided for funding for the building of student housing under Financial Law No. 388. This law has been succeeded by others, such as Law No. 338/2000, and the promulgation of decrees setting out procedures and formalities for the application of funding and identifying qualitative and quantitative project standards. The purpose of these laws is to bring existing buildings up to current regulatory standard and to provide for the building of new housing, in order to increase the provision of beds.

In the wake of these laws, two calls for tender were issued: the first in 2001 and the second in 2007. Overall about 1,800 million euros have been invested, 50% of which (approximately 870 million euros) has been allocated funded by the Ministry of Education, University and Research, 40% by public and private bodies and 10% by Regions and the Autonomous Provinces.

The funds were required to finance 69 interventions geared to the maintenance and refurbishment of existing buildings, in conformity with existing regulations, providing 9,100 beds and 164 rehabilitation, new build or purchase interventions, providing 20,000 beds - 60% up on 2000.

For the whole operation the Ministry for Education, University and Research (MIUR) has involved Cineca (a non- profit consortium, made up of 32 Italian universities, the National Research Council (CNR) and the MIUR, (involved for data diffusion and management purposes) and the Cassa Depostiti e Prestiti (a public joint-stock company of which the Italian Government owns 70%; the remaining 30% is held by a group of bank foundations, involved for fund-management purposes). Furthermore, the Department of Technolo-

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gies has organised a Technical Support Group, which will carry out most of the activities (Fig. 1). Besides researching the issue of student residences, the group has looked after the preliminary funding applications, supervised the on-going interventions, and has provided advice to public and private bodies.

The research group consisted of over twenty researchers, and was co-ordinated by Prof. Roberto Bologna until 2005, when Prof. Romano Del Nord took over.

During the preliminary stage, the group put together various tools for assessing the finished product and reporting back to the Ministerial Committee, provided administrative support, drew up a draft Convention and models for data updating and information relating to each project; during the monitoring stage tools were put together for assessing the calls for bids, progress, alterations to work in progress and completion. All this information has been entered onto a database.

In actual fact, it has not proved possible to gauge the real quality of the projects, or it could be that this has not been deemed important enough.

The issue in question could provide Space Syntax with future fodder for developing a method for optimising student housing projects as well as assessing existing residences.

Specifically, the relationship between places and between places and students can be split into in three different initial points.

1. In terms of setting (Fig. 2), the quality of student sojourns and integration is also affected by the relations that exist between town and university: the best-known types of accommodation are integrated town-university situations, lonely but inner-urban settlements and university campuses. In the first category, university, housing and facilities coexist in a town; this is typical of the model commonly adopted in Italy when setting up universities and makes for easy exchange of information and interface. In the second category, residences are located at some distance from lecture halls and facilities, sometimes even in neighbouring towns; users are not keen on this solution but it is very common. In the third category, of Anglo-Saxon provenance, campuses are independent structures with no urban links;
2. In terms of layout (Fig. 3), handbooks and guidelines differentiate between three kinds of residence, which make for different ways of life. In dormitory or collegiate halls the spatial organisation provides for rooms giving onto corridors: the common facilities are located in distinct, separate areas. This type of residence fosters relationships between resident and non-resident students sharing the facilities. Residences divided into small units are known as houses and contain small flats (housing only 2-3 students): the facilities are partly contained in the house, providing less opportunity for inter-student interface. Suites or pods are made up of digs with a larger number of rooms (3-8 students), and internal facilities: there are no external facilities in these cases. Clearly, residences

can consist of more than one type of building, which can prove more complicated, despite ensuring easier interface between students, married students, PhD students, grant holders and teaching staff;

3. Finally, in terms of function (Fig. 4), the adequacy of residential functions and related services in student housing must be guaranteed, in a way that caters to the demands of both individuality and sociability. Here again, there are many different solutions and conditions: internal and external services, interface with non-resident users, etc.

Naturally, this paper sets out not just potential study strands, but also gives some idea of the complexity of the issue and provides some ideas for reflection.

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D.M. 22 maggio 2007, n. 42, Procedure e modalità per la presentazione dei progetti e per l'erogazione dei finanziamenti relativi agli interventi per alloggi e residenze per studenti uni-versitari di cui alla legge 14 novembre 2000 n. 338

D.M. 22 maggio 2007, n. 43, Standard minimi dimensionali e qualitativi e linee guida relative ai parametri tecnici ed economici concernenti la realizzazione di alloggi e residenze per studenti universitari di cui alla legge 14 novembre 2000 n. 338

Figure 1. Research team and technical support people

Figure 2. Settlement typologies of students' housing in the town

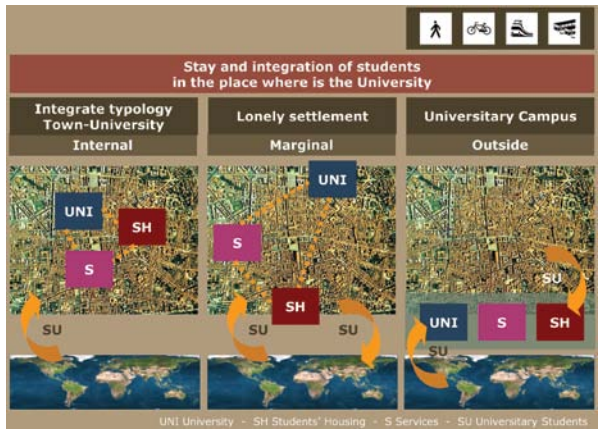


Figure 3. Building typology of a usual students' housing

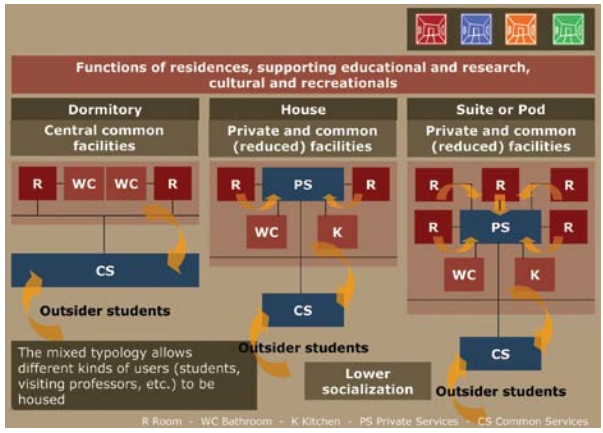
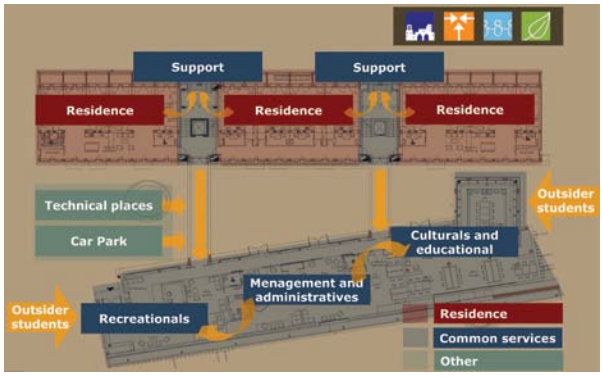


Figure 4. Functional typology of a usual students' housing



ENVIRONMENTAL COMMUNICATIVENESS

Antonio Laurìa

The existence of human beings is shaped in respect to and as part of the context surrounding them. All human activities, what we do, what we communicate, form the tangible side of the interactions between man – in the complexity of his physical, sensorial, cognitive, social and cultural variables – and the environment.

The very shape of the different environments and the activities for which they are meant tend to fill human spaces with a wealth of environmental signals, such as sounds, lights, smells, etc. These environmental signals are synergically registered by our senses, and our brains turn them into environmental information, something that makes us capable of a meaningful awareness of our habitat.

The quality of the communication is determined both by the environment's potential to transmit discernible and identifiable signals (emission's quality), and by man's ability to perceive these signals and correctly interpret them.

Perception is a dynamic and complex two-stage process, made up of sensory reception and the interpretation of environmental signals. When the man-environment perception conflicts because of problems in receiving a signal, it creates a sensory barrier; when the conflict derives from problems in interpreting the meaning of a signal, it creates a cognitive barrier. Thus a perceptive barrier can derive either from problems with a signal's reception or with its interpretation (Fig. 1).

These sorts of barriers, unlike other types of hurdles, can be overcome by increasing or improving the information provided. For example, providing landmarks in complex environments, improving environmental legibility through the functional characterisation of the spaces, flagging up dangerous situations, etc. Clearly, the informative improvement will be more effective as more sensory modalities are affected (perceptual synaesthesia) (Fig. 2).

Environmental communicativeness is a study sector that aims to raise the autonomy, comfort and safety of people in terms of orientation, mobility and device usage, by improving the communicative quality of the habitat.

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Environmental communicativeness not only helps people to build cognitive maps, thus optimising their navigation of unknown environments (wayfinding) but, more generally, aims to provide users with environmental signals likely to improve the quality of perceptual man-environment interaction (Tab. 1).

Environmental communicativeness can be defined as «the potential of places, products and services to be perceptible by anyone, especially by people with sensory or cognitive problems» (Laurìa, 2002).

Of those with sensory problems, people affected by visual impairments have demands of the utmost importance, because the sense of sight is paramount in the reception of environmental signals, while extra-visual signals are of minimal importance.

Of those with cognitive problems, children, the elderly and, naturally, some people suffering from intellectual deterioration or a mental illness, need special attention.

In general terms, taking environmental communicativeness into account enables designers to reconsider human sensory richness as well as the relationship between man and the physical and immaterial essence of the habitat: light, sounds, smells, textures, etc.

Basically, making an environment more communicative means acting on the factors that help to define the quality of environmental signals – in terms of significance and appropriateness – in accordance with the potential perception of different types of people, historical and cultural values and social conventions operating in the locus in question. Our research group has been focusing on the investigation of theories, procedures and designs connected to environmental communicativeness since the 1990s, with specific reference to meeting the needs of blind and vision impaired people.

We have developed well-structured premises for reading and assessing space and for designing solutions that will help people with severe visual problems overcome perceptive barriers in public spaces, and, where possible, applying design strategies that do not rely on 'dedicated' materials or components (Fig. 3). We have also developed bilingual (Italian/English) multimedia[1] tourist guides of Florence (Laurìa, 2003-2005) with supplementary information that also describes the spaces and buildings of the historic city for the vision impaired.

In particular, we examined the information capabilities of walking surfaces to help visually impaired people orientate themselves in public spaces (Felli *et al.*, 2004).

In a quest for solutions that would lend themselves more readily to historical centres and natural areas, we investigated the possibility of cre-

[1] Information can be acquired from different sources: hard copy, web (www.comune.fi.it/viverefirenze/itinerari.html), audio guides and tactile maps.

ating alternative paving signs to those achieved by means of traditional tactile walking surface indicators – TWSI – (typically, raised studs or bars).

The detectability of the signals, in this case, can be achieved through appropriately matched normal paving, using three kinds of contrast: tactile (smooth/rough underfoot), acoustic (sound/silent on percussion or rubbing the tip of a long cane) and visual (light/dark).

The tactile and acoustic contrast is specifically geared to blind people; and the visual contrast specifically to the vision impaired.

In order to design walking surface signals for the visually impaired based on sensorial contrast, tests were carried out to measure the acoustic (amplitude and frequency), tactile (friction) and visual (luminance) parameters of many paving materials with different surface treatments (Fig. 4).

In particular, in order to assess the effectiveness of the sensory contrast signals on the walking surface for blind people in Certaldo (Florence) two experimental paths were built, each 50 metres long. These paths were tested, according to a standard testing protocol, by a representative sample of blind people (Fig. 5).

Tests have shown that the sensitivity of the sensory system to changes in slipperiness (caused by a combination of tactile and kinaesthetic stimuli), where appropriate contrasts of friction between paving materials exist, can actually relay reliable information to help blind people find their way.

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Figure 1. Factors influncing and typologies of perceptive barriers

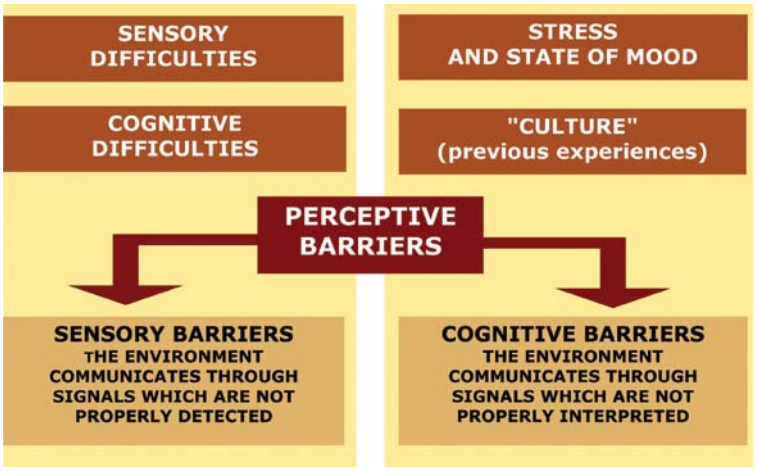

Table 1. The principles of the environmental communicativeness. (Laurìa, 2002)

1. Informative improvement To act consciously in the environment, man needs to achieve from spaces, elements ed services adequate and appropriate environmental signals (such as sounds, lights, smells, etc.). Habitats poor in useable environmental signals or with excessive or confusing environmental signals produce in the users weariness and discomfort, misinterpretation and, also, present possible risks to their safety (perceptive barriers). In these settings, the designers should provide design solutions capable of providing a meanigful informative improvement.
2. Informative effectiveness Environment signals, to be perceived, must be *discernible* (opportunity to tell them through sensory contrast) and *identifiable* (opportunity to give them value and meaning). Informative effectiveness, usually, increases if the environment produces environmental signals detected simultaneously by multiple sensory modalities (perceptual synaesthesia).
3. Informative appropriateness The design solutions to increase environmental communicativeness must respect the historical and cultural values and the social conventions of the place of intervention
4. Generalization of effect The design solutions to increase environmental communicativeness should be as general as possible and shouldn't evoke users reference. 'Dedicated' solutions, aimed at only one type of problem or at one group of people needing special attention, should be used only when it is not possible or desiderable apply design solutions for all people equally effective (mimetic intervention versus prosthetic intervention).
5. Coherence of effect The design solutions to increase environmental communicativeness must achieve an improvement of the accessibility conditions (reachability, comfort, safety in use, etc.) of spaces, devices and services for all users

Figure 2. Bergamo. The clear functional layout (distinct separation between the path and devices) helps the legibility of the scenario for all persons and specifically for people with perceptual problems

Figure 3. Comacchio (Ferrara), Treponti. The edge of the path was made detectable especially by persons with severe visual problems through paving materials typical in the place of intervention (cobbled – for blind person - and istrian stone – for visually impaired)

Figure 4. Tests to fix contrast parameters (acoustic, luminance and frictional coefficients) in order to design walking surfaces signals for people with serious sight disabilities

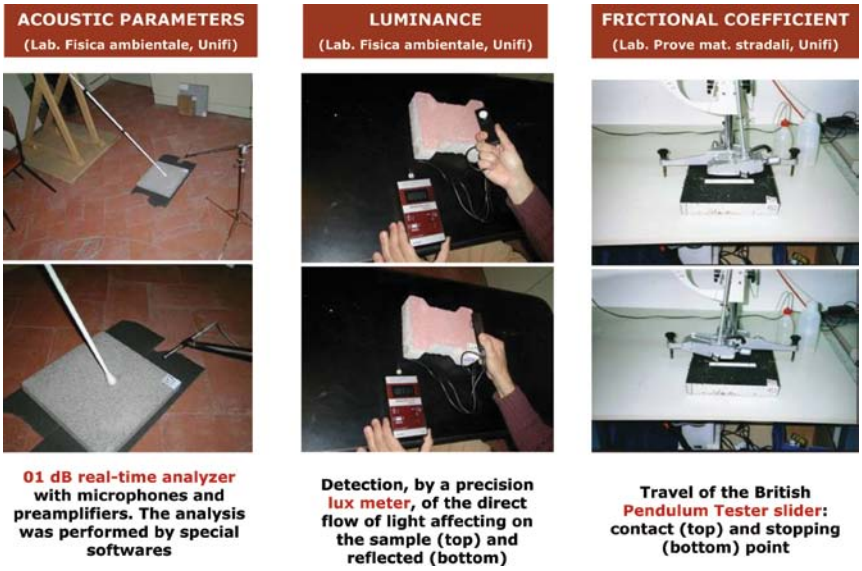

Figure 5. Experimental paths executed in Certaldo (Florence) for evaluating sensory contrast of signals on the walking surfaces. At left, tactile path; at right, acoustic path

DESIGN FOR EMERGENCY. TEMPORARY ARCHITECTURE

Sabrina Borgianni, Virginia Serrani

The research group headed by Prof. Roberto Bologna, has been engaged for some time in planning and design strategies for post-disaster transitional settlements and housing projects.

Emergency building is a complex activity and implies a high degree of responsibility for designers and planners. After a disaster, people are mentally fragile and are psychologically sensitive. A disaster that destroys houses, cities and environments triggers a loss of identity. Temporary design and temporary settlements are not just geared to providing shelter for a devastated population, but also to restoring a partial sense of identity to it.

This means that any post-disaster research or design activity should start from an awareness of what living through an emergency means, from basic human needs and activities onwards.

Emergency architectural design means building an achievable building, taking the following parameters into consideration:

- the actual time needed for designing, producing, installing;
- the quality of life of those who will live in it;
- the environmental impact in terms of reversibility.

The following are summaries of three research projects focused on design for emergencies. The two first projects set out theoretical cases based on subsequent project experiences.

The first related to housing settlement models and aimed to define a dimensional standard as a reference for post disaster operations.

Strategic planning of emergency areas for transitional settlement (2005)

In emergency conditions, the creation of a settlement develops according to an unplanned process that affects the transformation – often permanent – of places through the imposition of uncodified rules. This particular research project has put together criteria and guidelines for planning transitional housing settlement areas that will effectively meet the requirements

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of emergency prevention and post-disaster reconstruction through a co-ordinated approach between land/town urban planners, emergency planners, disaster managers, users. The core issue is presented by following the stages leading to the final results. Equally, the sequence of single conceptual elements is based on the logic of problem-solving, as demanded by any architectural project, so as to facilitate its interpretation by the end users. We believe that the most important contribution of the research consists of its analytical approach to the problem, which is based on the holistic approach to the project, rather than on merely identifying technical standards. The research outcomes are represented by a framework of possible design solutions that mark out settlement patterns according to the characteristics of an area and the size of its population. The research product is a transitional settlement planning guide for use by local land authorities.

Another research project, on a smaller scale, is focused on a minimum housing unit and the requisite demands. This research is innovative in two respects. First, because of its very nature: it differs from all previous tools and strategies in that it is not intended to be a prescriptive guideline and is based on requirements and performances. The civil defence performance specification is intended to encourage technological innovation in the sector, in terms of process and finished product, to offer the production market the widest possible supply of available goods likely to be able to fulfil the established requirements. Second, it is geared to sustainability and deals with aspects such as reversibility, flexibility, transportation, integrability and energy.

The civil defence performance specification (2008)

A study on procurement tools for the supply of prefabricated emergency housing units was carried out in 2008. A research project developed for the Italian National Department of Civil Defence was set up under the umbrella of the national RELUIS (Seismic Engineering University Laboratories Network) project. The national Civil Defence Department decided to commission research for the purposes of identifying a new instrument for regulating the supply and demand of temporary housing systems for use in case of an emergency. The supply of temporary houses was therefore achieved using technical specifications of a type previously described and which the Civil Defence department already had at its disposal. The technical specification, independently of the components available on the market, is geared to setting out the characteristics of prefabricated civil protection housing modules, whatever the approach to the supply of civil protection containers. The technical specification identifies strict performance specifications referred to the structural and functional characteristics of the prefabricated modules, these specifications make up a list of objective conditions for evaluating business offers from the production market.

2009 provided an opportunity to verify the theoretical needs sparked by the previous research projects in the form of a design project put together for an international competition.

An idea for reconstruction. Proposal for the emergency (2009)

Following the earthquake that devastated the Abruzzo region on 6th April 2009, the architectural journals presS/Tletter and The Plan, with the support of InArch, and in collaboration with Collettivo 99 (a young architects' association in L'Aquila), launched a project competition entitled "An idea for reconstruction: proposals for the emergency". The aim was a reflection on temporary structures that could be erected in the disaster-stricken territory, and which could be dismantled and reutilised in other emergency situations or easily recycled, thus becoming a part of the new urban fabric. The project proposal, based on concreteness and feasibility, aims to tackle the problem of the temporary habitat in emergency situations bearing in mind the mechanisms of the intervention process and systems logic: it is not confined to a specific period in temporary housing, but considers a longer time span involving the passage from the immediate emergency housing phase to the re-appropriation of permanent housing. MIA is a temporary housing system made up of two parts, the infrastructure module and the housing module. The infrastructural module, thus named because it is the connection between the housing system and the settlement's primary infrastructural system, consists of a raised walkway and a roof. The functional and distributive solution of the housing module is rational and simple: according to modularity criteria, the housing module can increase the number of bedrooms and living-dining-kitchen areas longitudinally, according to the size of the family unit. Particular attention is paid to the quality of housing, with a sheltered outside area rounding off the strictly private space and the creation of an organised series of open and semi-open spaces of an urban type in which the aggregation models generate a different level of space appropriation (from private to public). The upshot of this research was that in emergency settlements quality of life and consequent user behaviour depends primarily on two factors, the ability of temporary settlements and housing models to reproduce rules, spaces and relations typical of the urban fabric and the balance between private and public spaces.

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Figure 1. Strategic planning of emergency areas for transitional settlement (2005), living standards planimetric diagram and settlement models planimetric diagram

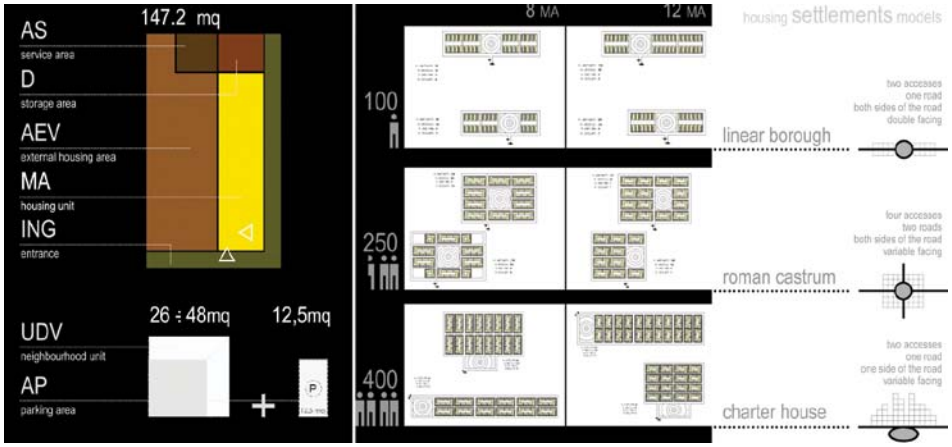


Figure 2. The civil defence performance specification (2008)

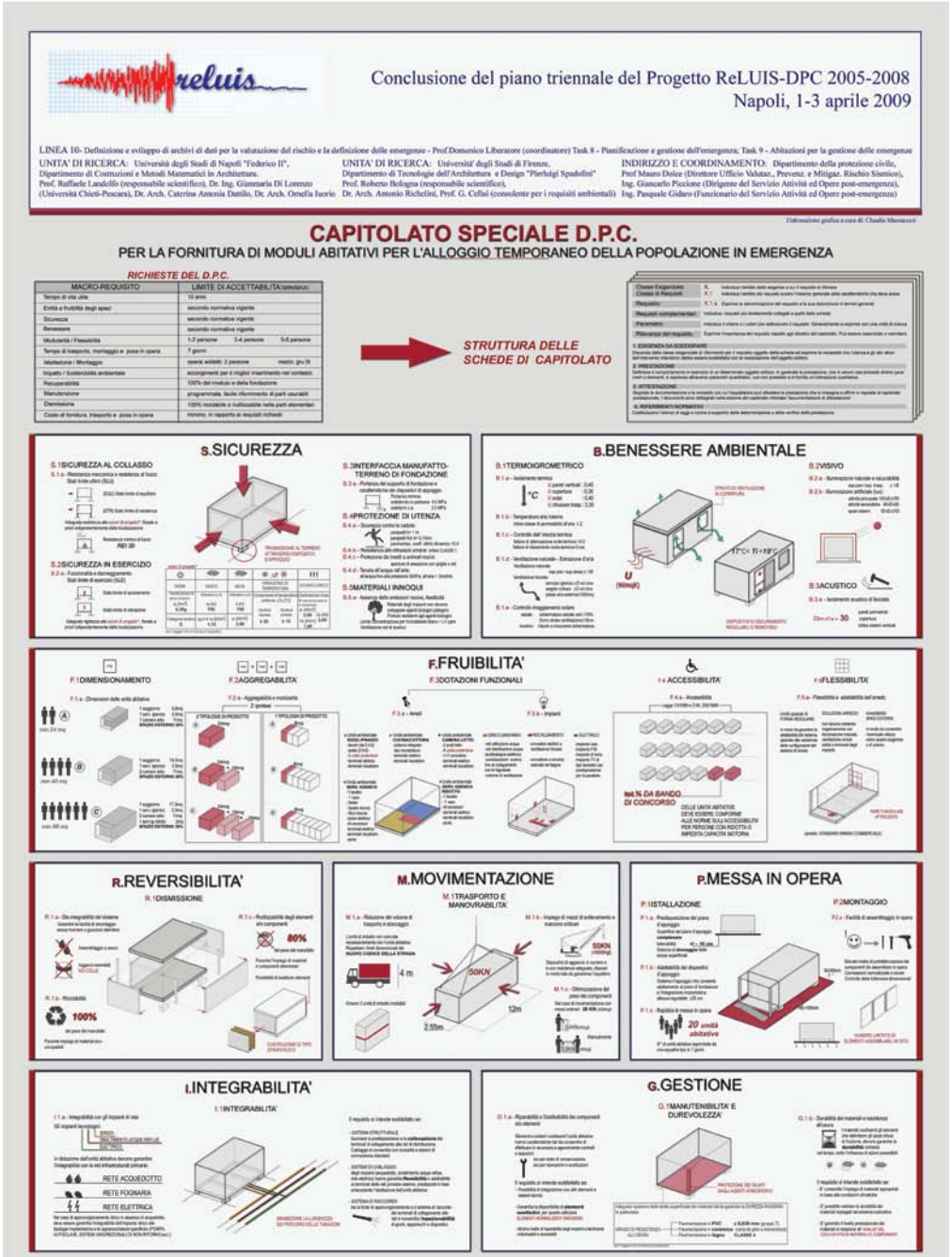
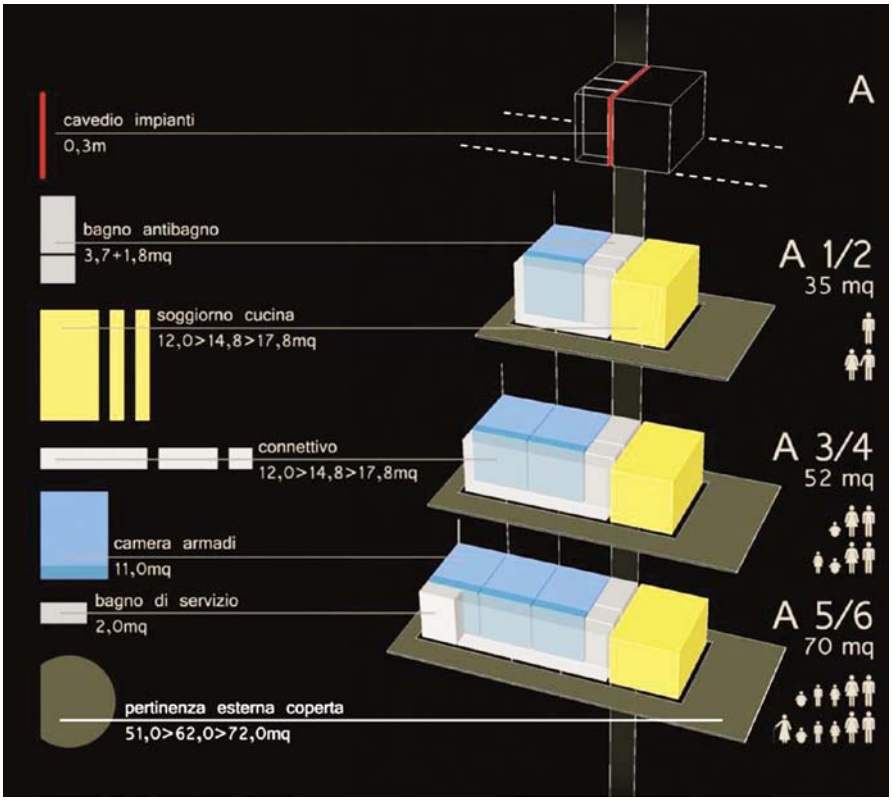


Figure 3. An idea for reconstruction. Proposal for the emergency (2009), perspective and perspective of the semipublic space

Figure 4. An idea for reconstruction. Proposal for the emergency (2009), functional diagrams



AIRPORT TERMINAL DESIGN COMMUNICATION PROCESSES. THE TXP GROUP METHODOLOGY

Irene Macchi, Maria Antonietta Esposito

The TxP (Technologies for Project) research group conducts experimental studies applied to design technologies. TxP operates in the field of performance-based and management optimisation for architectural and engineering design. Project planning, development, communication and management are conducted using methodologies that integrate quality, environment and communication.

TxP is a research group that works in synergy with the National Network of PhD courses in Architectural Technology (OsDotta). The TxP Group is a network node at Florence University, which aims to offer experimental and applied research opportunities for promoting innovation in industry and in the construction sector.

TxP Group defines and applies innovative methodologies and tools for: design management and development, design integration, communication and control, according to international standards and methodologies, together with project validation.

Our Group has achieved significant results in terms of new methodologies and tools for design development, control and integration, innovative technological applications and field trials.

This paper reports the results of a doctoral research project that analyses the communication processes in building design teams specialising in airport passenger terminal projects. The analysis focuses on the demands of the communication processes. The topic fundamentally concerns the Construction Industry, given the complex relationships existing within design teams. These teams encompass different organisations, based in various sites or countries, who speak different languages and who, most importantly, are culturally different.

The first question is: how can the relationship between architectural space and social space in the development of airport and terminal buildings be identified and how does it affect Design Management and Owner Governance strategies?

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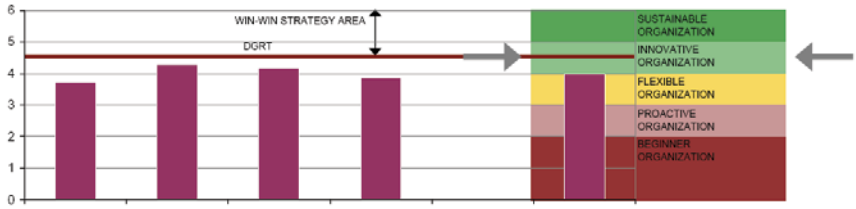
Airport terminals are essentially the mechanisms for generating and controlling interactions during passenger embarkation worldwide. Thus airport design has to conform to international standards; it has to meet a series of common targets in regard both to spatial function and to technical specifications. Project Management - and Integrated Management Systems in particular - is needed to underpin all performance targets engendered by the complex nature of airport projects. These targets need to be seen as continually evolving planning activities. The evolutionary nature of terminal design calls for interdisciplinary design groups and extremely fast communication tools.

The research identifies the lack of communication management. The basic concept of the method is to compare the designer's approach to design communication with a theoretical threshold known as the Design Gap Risk Threshold**.** When over the DGRT, the project may prove more effective in achieving the quality targets (pro-active area).



The second question is: how does this relationship affect Design and Design Methods? And what solutions are offered by PM and SGI methods?

This study stems from doctoral research and is currently undergoing field validation during the construction of the terminal addition at the Amerigo Vespucci Airport of Florence (ICAO: FLR).

The basic research was carried out during the doctoral course (XX cycle; 2004-2008), taking point 7.3 of the ISO 10006:2005 standard as its starting point. This states that Communication Processes are defined as an Appropriate Requirement of the Quality Management System for improving work methodology in effective design development. The research focuses on four main topics which are:

- Design and communication planning;
- Design development and communication management;
- Design verification and communication control;
- Data and information purchasing processes.

The results of the field research pick up on many interesting points: for example we found that certified quality standard organisations often fail to plan, carry out checks or properly implement communication pro-

cesses. In brief, we flag up evidence of non-awareness of the critical importance of communication processes and their impact on design quality.

The third question is: what kind of tools can help communication process management within the design group relationship in the design practice?

The methodology developed in the research is a toolkit for planning, managing and controlling communication in design projects.

The results of the research demonstrate the possibility of fully exploiting the potential of communication processes in design projects with effective methodologies, tailored to each individual project. The research provides an actual customised methodology for planning and managing communication processes within project teams. The TxP methodology is generalised and addresses the following targets according to the main design development stages.

- Master plan: the planner's concept of the long-term development of an airport
  Users: Airlines and operators, public, concessionaires, commercial services, airport management, design team, government units, authorities
  PM tools goal: to define the complete development of the airport project and to verify its sustainability.
- Schematic design: conceptual studies, layouts and schematic drawings
  Users: airport management, design team, consultants, governmental units, authorities
  PM tools goal: to define Terminal layout, functional relationships of Terminal components, transit system configurations.
- Construction documents: final version of the design, which has to conform to the specified requirements and be suitable for the next construction stage
  Users: airport management, design team, consultants
  PM tools goal: to assure interoperability and efficient communication strategies between the involved parties.

The fact is that airport terminal design development is essentially relational, in which any 'technical solution' only becomes meaningful in relation to all the others. There is the problem of how to move from abstract representations of design group tasks, knowledge, communication processes and information to a concrete representation of the structure of dialogues and interactions.

Foreseen Impacts

In brief, the research identified the need for some important 'new skills':

- Ability to prevent the threats of the Design Gap, including: formulation of common requirements, early involvement of all team members and their participation in planning and developing the design solution, technical and cultural interoperability, use of customised advanced tools to support the virtual team;
- Ability to plan the required design information: accurate performance information is necessary, the shape and technologies of the building envelope, for example (with particular regard to façade orientation and solar shading, glass and balancing of the main walls, heating, cooling and ventilation systems), have to be assessed on an on-going basis during the project process rather than just at a later stage;
- Ability to pre-check design conformity to requirements: re-engineering the validation process: the later design stage should show evidence of design compliance to building and airside regulations. Faster validation could be achieved using integrated data models;
- Enabling sustainability: ability to organise the project in such a way as to be able to adapt the design process to a modified scenario.

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HOSPITAL PROJECT AND BUILDING MONITORING. THE MONLAB EXPERIENCE

Nicoletta Setola, Francesca Reale

This paper deals with some of the activities of the Monitoring Laboratory (MonLAB) and their development within the context of space analysis.

MonLAB was set up in 2001 thanks to an agreement between the Florence General Hospital of Careggi and the University of Florence, as part of the hospital refurbishment programme. The ongoing programme aims to improve buildings and technological structures while optimising hospital health provision. The Careggi Hospital refurbishment project was a complex one because of the number of hospital buildings and the need to ensure continuity of hospital service while construction was ongoing. To this end, MonLAB developed support tools for operators involved in the refurbishment, during the design management and planning selection stages. The chief underlying aims were:

- Monitoring of time and cost of construction works;
- Monitoring of infrastructural, structural and technological possibilities during the refurbishment process;
- Creating an Integrated Information System for managing data on different (hierarchical) levels;
- Providing integrated project management through a Network Information System.

S.A.C.S (Italian acronym for System for the Analysis of Hospital Equipment) is one of the tools developed by MonLAB and is geared to the setting up of a structured database related to the functional quality of Careggi Hospital buildings. It is a monitoring system that can be consulted by hospital staff via intranet. It allows for the cataloguing of spaces and functional quality control by means of measurement data (square meters), functional destination data and Department affiliation data. Moreover SACS provides objective and quantitative data that promotes awareness, monitors and improves the organisation of spaces inside the hospital and the management of the transformation process from a functional point of view.

SACS is therefore capable of generating reports for each building, with differing outputs: functional destination plans in which each colour cor-

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responds to a different function (for example connective spaces – lifts, corridors, halls, stairs – are shown in blue); pie charts with provision for different functional destinations; plans with separate spaces for each Department (e.g. Oncology, Cardiology, Maternity etc.); bar charts with the amount of space required by each Department shown in square meters.

In this study we propose a different use of SACS, which is to read the evolution of buildings during their life time, looking at changes in the use of rooms and how users and hospital organisation alter them. We have selected the San Luca Nuovo building as a case study. This was one of the first facilities to be built under the new Careggi Hospital master plan, and was completed in 2004 (fig. 1). The building is of the double corridor type, designed for wards – essentially General Medicine – and Outpatient services.

An analysis of the upper floor plans (figs. 2-3) shows changes of use during the building's lifetime, in other words from the design stage in 2003 until now, 2009. Change in the yellow rooms and aqua rooms is evidenced. The first transformation concerns the wards (in yellow): in 2009 there were far fewer of them than in 2003, while there was an increase in pink rooms. Thus the trend appears to have been for cutting ward space in favour of doctors' rooms (in pink). This may have been due to a lower demand for beds, because of changes to the organisational structure of the Hospital, or perhaps to the particular power of the category – medical staff in this case – taking over the spaces. The second transformation concerns the service areas, between the two corridors, where stores (aqua spaces) gradually multiplied over the years. This is evidence of the ever-increasing lack of storage space for the large quantities of drugs, linen, and equipment.

Moving on to an analysis of the ground floor plans, it is clear that the change of use of some of the rooms is similar to the upper floor: for example the winter garden became a service room (indicated in figure 4 by dashed circles). Otherwise other changes in the use of spaces (and corresponding changes of colour) also determine flow changes in the model: for example some of the transit system links vanished when corridors became storage or service areas, as shown on 2009 and 2005 maps respectively.

A different type of space analysis concerns the Departments that occupy the building, which change over the years according to the Hospital Trust organisation. In this case each colour represents a Department. A comparison of this kind of data over a year enables us to read the relationship between building transformations and the overall Hospital organisation. Moreover in this case, unlike in previous examples, we should like to underscore the fact that changes should be ascribed the organisational model. This might be a good time to raise the subject of space appropriation by 'organisations'.

The MonLAB monitoring provides data for other studies too, as in the case of two PhD research theses on hospital accessibility. The first relates to accessibility for disabled people. Figure 5 shows the accessibility map of routes and the network of services in the centre of Careggi Hospital. The

map clearly shows that different colours have different meanings, for example, a green line denotes an easier route to a particular place, whereas a red one indicates a more difficult route. The summary above shows the degree of accessibility to care services based on an evaluation of paths and accesses.

The second study relates to room accessibility in an overall hospital context, for people arriving for there for the first time. The most easily accessible Outpatient service rooms are shown in red. Their accessibility derives from a space syntax analysis: each line signifies a pedestrian route to the Outpatient room and is coloured according to level of accessibility in relation to the entire hospital path network (fig. 6).

To sum up, we have read the SACS tool "from the perspective of" the Hospital Board, designers, and researchers.

Space is a resource for the Hospital Trust. Data is acknowledged as being useful in controlling effectiveness and managing productivity. Planners are able to access information about space and social behaviour stemming from user appropriation over the course of a building's lifetime. Researchers acquire methods and tools for POE and accessibility studies.

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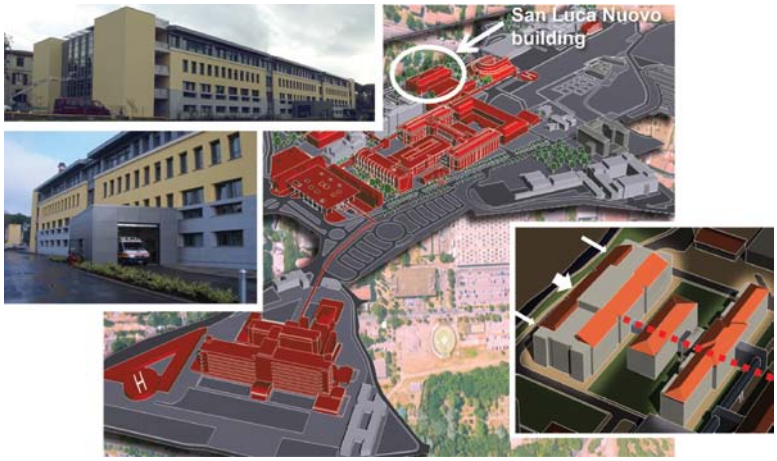
Figure 1. Picture of Careggi Hospital area with San Luca Nuovo building. On the right a corridor that joins it directly to the paths network, but today not active yet



Figures 2-3. Upper floor maps with rooms uses

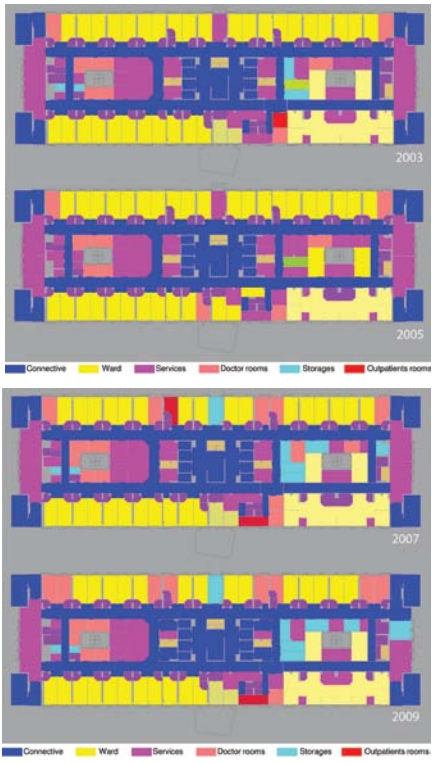


Figure 4. Ground floor map: white lines represent circulation routes

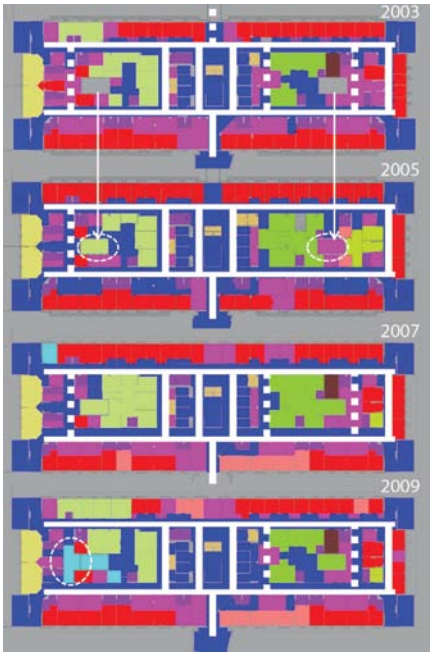


Figure 5. Department affiliation map

Figure 6. Accessibility map for disable people

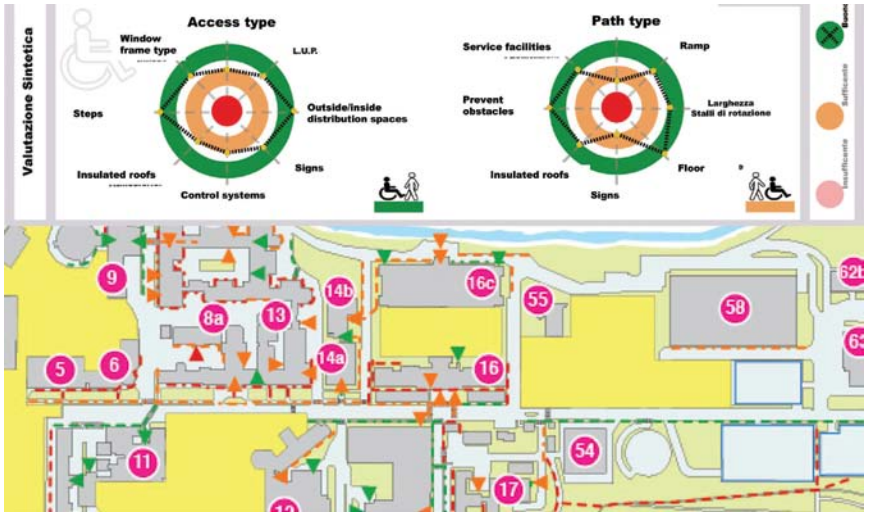


Figure 7. Accessibility map from syntactical analysis

SECOND DAY

SANTA MARIA NUOVA HOSPITAL: THE PUBLIC SPACES SYSTEM

Nicoletta Setola

Introduction

The second day of the seminar was spent at the Santa Maria Nuova Hospital, and was coordinated by the hospital's Medical Director, Dr. Marco Geddes.

In addition to the English visitors, Prof. Alan Penn, Max Martinez, architect, and Dr. Ilaria Geddes, the following people took part: Ester Diana, Coordinator of the Documentation Centre for the History of Florentine Social Assistance and Medicine, Vincenzo Vaccaro, architect, Director of Cultural and Landscaping Heritage for the Provinces of Florence-Pistoia-Prato, and the Medical Directors of other hospitals (Alberto Appicciafuoco, Fabrizio Gemmi and Lucia Turco) within the same Local Health Authority (ASL). Members of the hospital's technical departments were also present, together with the architect behind the earlier rehabilitation project (Francesco Napolitano) and the architect responsible for the latest one (Roberto Lapi). Professors, researchers and graduate students from the TAED Department at the University of Florence and the ITACA Department at the Valle Giulia Rome University also took part in the discussion. All those who attended brought useful contributions, with accounts of their various experiences.

The first part of the day was devoted to a presentation of the hospital rehabilitation project.

Dr. Marco Geddes da Filicaia spoke about the *History and motivations for an intervention*; followed by Francesco Napolitano, architect, and Roberto Lapi, architect, who discussed *Paths and relationship of the building with the square*; then Vincenzo Vaccaro, architect, brought the session to a close with a talk on *Monumental parts*.

This was followed by a visit to the hospital, after which an extremely animated discussion took place, stimulated by the content of the presentations, the hospital visit and the diverse range of participants. This was chaired by Prof. Maria Chiara Torricelli (TAED Department).

The issues under discussion ranged from the system of public spaces in the hospital and their relationship with the city: the square, the portico and the access system, all part of the urban fabric, the functionality of the reception areas (cloisters, public spaces, new museum), and their equipment. These factors were considered in the light of issues inherent in the

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architectural project such as wayfinding, urban centrality, urban accessibility, building flexibility and environmental and financial sustainability.

The following pages will not be concerned with the individual contributions made during the presentations; these will be dealt with in a separate document that will bring together both the talks on the hospital and the comments generated by the discussion.

The reasons behind a decision

What informed the decision to use the SMN Hospital as a study case for the second day of the "Research tools for design. Spatial layout and patterns of users' behaviour" seminar?

The first reason for this decision lies in the particular qualities of the Santa Maria Nuova hospital. It is in a league of its own because of its history, its location, and its cultural and symbolic value, a part of the consolidated heritage of the citizens of Florence.[1] These intermeshed factors continue to make it one of the city's great institutions, to such an extent that its hospital activities have retained their original position and, moreover, on their original site

The architectural history of the Hospital of Santa Maria Nuova is an extremely complex and fascinating one; it spans the years from the 13th century to the present day, mirroring the development and culture of the city of Florence. Given its current layout, and from a brief comparison with an ancient plan, the traces of this complicated history, with its additions, demolitions, and incursions into the urban fabric are there for all to see. Any attempt to describe the last 15 years of its life, and in the absence of much structured detailed information (for which please refer to the bibliographical sources) at that, it is clear that even today neither the direction the hospital is taking nor the way ahead are particularly linear.

The second reason, closely bound up with the first, derives from a desire to examine the issues inherent in hospital building and the relative design support tools – an issue with which our TAED Department has always been involved – with English researchers, architects and interested doctors.

The latest hospital rehabilitation programme is geared to respond to the needs of each individual patient and to the hospital's insertion within the

[1] There have been several points in history, such as in the aftermath of the French Revolution, when religious congregations were suppressed; the Oblates in Florence, an order that had been devoted to helping the sick since the Hospital was founded in the 13th century, remained unscathed, however. In 1966, when there was a serious ingress of water into several parts of the hospital on the night of the 1966 flood, no patients were harmed thanks to the quick-thinking of the health staff. What is more, only a few hours later, many of the city's inhabitants appeared at the porters' lodge off their own backs to offer free help, without leaving their names (Pezzati, 1988).

urban context. This approach has focused on the hospital's relationship with the service network and the historic city centre context on one hand, and on the configuration of the internal spaces, with the valorisation of some of the areas – cloisters, green spaces, courtyards – as open public areas responding to the various needs of hospital users and operators and as elements that bring significance and legibility to the spaces on the other. In an analytical paper on the typological evolution of UK hospitals, Alan Penn said: «Architectural design can be considered as the construction of potential spatial relations that can be appropriated for specific social acts and thus become meaningful to those involved». A study of these spatial relations, stemming from a valorisation of the square, the access loggia, and the historic hospital spaces is therefore an extremely interesting exercise. Space Syntax tools and methods have been identified as a possible approach to such a study.

SEEDS OF A DISCUSSION.
Marco Geddes Da Filicaia, Francesco Napolitano, Roberto Lapi, Vincenzo Vaccaro talking with Alan Penn, Maximo Martinez, Maria Chiara Torricelli

Nicoletta Setola

Historical notes

Dr. Geddes began by running briefly through various historical points in order to provide a complete frame of reference and to provide an explanatory background to the decision to conserve this hospital in the centre of Florence and the rehabilitation project that ensued.

The hospital opened in 1288, thanks to the generosity of its founder, Folco Portinari. The first hospital building abutted the Church of Sant'Egidio and consisted of a single long 12-bed ward, known as the Ospedale degli Uomini (Hospital for men). It was surrounded by kitchen gardens – land that had not been built on, in other words – which meant that the original nucleus had room for expansion later on. A few years later, the women's hospital was built on the other side of the Piazza di Santa Maria Nuova, near the Convento delle Oblate, and linked to the men's hospital by an underground passage (Fig. 1). By the 13th century, there were 62 beds for men and 58 for women. There is also evidence of urbanisation works in the streets surrounding the hospital (1332), which was also responsible for maintaining the urban spaces immediately delimiting it.

Over time the men's ward developed side-shoots until it eventually took on a cruciform shape[1]. The urban fabric surrounding the men's section and the church became steadily populated by cloisters, infirmaries, chapels, burial places, houses and rooms for hospital staff and, more recently, by the spaces taken up by the School of Surgery, a library and a dedicated childbirth suite. Buontalenti's design for the loggia overlooking the square dates back to 1574, although it was not built until later. A new cruciform women's ward was built during the 17th century, when the land next to the church was acquired. The two cross-shapes were still in evidence in 1870 (Fig. 2), but the women's ward was demolished in the early 18th century.

[1] The wards, arranged in Greek or Latin cross-shape with the altar at the head of the principal nave or at the intersection of the limbs, formed the basic nucleus of hospital building during the first half of the 15th century (Torricelli, 2006).

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By the second half of the 19th century, at the height of its healthcare activities, the hospital had 1288 beds; many of its services were transferred to the new Careggi hospital complex in 1900, however.

2. The rehabilitation projects

Given the huge advances in treatment methods, medical techniques and health technology over the last 20 years, the question of rehabilitating a hospital facility that was not longer fit to assure a sufficiently high quality of health service began to make itself felt. At about that time, the age-old[2] debate over whether or not it was worth keeping a hospital in the historic city centre or whether it might not be better to move its activities to a newly built area outside the historic city centre, as had been the case with other sorts of buildings in Florence, such as the University Social Sciences campus and the new Courthouse, which were moved to the northern outskirts of the city, resurfaced.

Dr. Geddes went on to introduce the operative context of the hospital: the historic city centre of Florence exercises a strong magnetic pull; the hospital therefore serves in the region of 650,000-700,000 people, mostly elderly and needy, a good percentage of tourists for much of the year, university students and commuters working in the city centre. Furthermore, current municipal policy is geared to preserving and promoting the residential use of the historic centre in an endeavour to boost resident numbers. This is exacerbated by the objective difficulty in finding a use for the Santa Maria Nuova complex other than as a health facility. The buildings have served as a point of reference for the city over many centuries, a tangible landmark in an evolving society concerned with the common good.

These healthcare, urbanistic and "user-friendly" factors therefore needed to be considered in tandem with more political and symbolic issues (Geddes, 2003), and lay at the root of the decision to keep the hospital going in the historic city centre.

Thus in 1995 it was decided to adapt the hospital to new functional demands, in compliance with national and regional law; a decision bolstered over the following years by Law No. 67/88 ex Art. 20 (Extraordinary Funding Programme for Upgrading Health Structures) in which the SMN Hospital took part. Work did not begin until 2002, however.

Dr. Geddes then gave a brief outline of how the rehabilitation project

[2] The question of decentralising hospital activities is very long-standing one, and can be traced right back to the aftermath of the fire at the Hotel Dieu, one of oldest-established hospitals in the centre of Paris, in 1750. The idea of moving Santa Maria Nuova was first mooted in around 1870, at a time when the city of Florence was gearing itself up to become the capital of Italy (Geddes 2004).

had panned out and the needs that had informed it. The first project, in 1999, was the result of deliberation, which had been ongoing for several years, on the role of a hospital structure within the historic urban fabric. That combination of qualities and social values that make for urban integration, and therefore also with the structure of a city, were intrinsic to the condition of the hospital as it was then. The interventions carried out to the hospital structure during the intervening years had been geared to solving individual problems, but there had been no global vision of the system; this project was intended to bring unity and order to structural intervention measures through a unitary design that also took account of the more social aspect, characteristic of the hospital facility as a whole.

This was compounded by the fact that the Region's strategies at that time were targeted at setting up a network of services, endeavouring not to duplicate those services already being carried out by similar bodies. The kinds of services involved were dictated by the fact that Santa Maria Nuova is part of the Florentine hospital network, through which the hospital takes on and consolidates its emergency, outpatient and day hospital activities.

Fifteen years on, the general objectives drawn up at that time are still live and current issues, to such an extent, in fact, that they also form part of the discussion topics for our seminar:

- boosting integration with the urban context
- boosting integration within the health service network
- ensuring leeway for possible future alterations.

The factors underpinning the rehabilitation project were aimed at reclaiming the 15th century layout, to ensuring legislative conformity, to reorganising the facilities into dedicated areas, to separating out the internal paths, to boosting emergency facilities with the provision of a dedicated operating suite, improving outpatient services previously located in separate buildings, and to finding solutions for remedying the significant structural and plant-engineering degradation.

Again in 2003 a series of considerations led to the putting together of a new alteration project (the so-called 2004 Modification). As it happens, the process was so slow-moving that there was time for some of the issues to be developed and explored more deeply. These included the approval in 2002 of the Strategic Plan for the Florentine Metropolitan Area, which underscored the interest in the historic hospital, the change of use of buildings belonging to the University in the Santa Maria Nuova area, the funding obtained for restoring those parts of historical interest and for setting up a museum facility, thanks to Law No 448/98 ex Art. 71 (Subproject D1).

In the meantime, various other factors came into play that led to the project having to be revised. These concerned the relocation of some services (pharmaceutical dispensary, test laboratories, relocation of ophthalmic services), changes in the accreditation legislation and security

regulations, as well as the acquisition of spaces that had not belonged to the hospital, seismic problems that came to light as works began and the unearthing of archaeological remains.

The first rehabilitation programme in 1999 was followed by a modification to the alterations in 2004, both undertaken by the ASL 10 Technical Unit (Torricelli, 2006). A period of specialist assessment then proved necessary, which led to further changes to the project assigned to the architect Roberto Lapi in 2005.

Francesco Napolitano and Roberto Lapi then spoke, introducing the basic premises of the definitive variation to the project, which conserved the spirit and guiding principles of the earlier projects. The organisation and division of the hospital into 3 large functional areas was thus more clearly defined: the emergency facility, with Casualty, intensive care, emergency radiology, day surgery and operating suite; outpatient and service facilities, complete with reception area; in-patient facilities, complete with reception area, dialysis unit and pharmacy on the ground floor and wards on the upper floors. The radiology department acts as a link between the emergency and outpatient areas.

As provided for in the project, the hospital complex is arranged on four main levels. The areas designated for technological plants, the horizontal distribution of ward provisions, storage and centralised staff changing rooms are all situated in the basement.

The ground floor is entirely given over to diagnostic services and emergency/urgent areas, while the nephrology treatment areas are on the first floor, with specialist dialysis beds and day hospital areas.

The second floor contains the wards and interventionist areas, composed of the new operating suite and intensive care unit.

2.1 Hospital access

Mr. Lapi described the new hospital access in particular detail. The project has improved the accessibility of the hospital with the provision of a well-planned set of paths that takes account of the need for both ordinary access and emergency access. Pedestrian routes are made easier by the resiting of the entrance area and the removal of the barriers impeding disabled access.

Access flows have been planned and split according to the chief types of access: emergencies, users and visitors, staff, technical/logistics. The access control points have been split into three, according to function, of which only one (Casualty) is open at night.

The main access to the hospital is on the ground floor, with four gates leading to the emergency and user entrances: three to the front of the portico and one on the eastern side of the square. The entrances are differentiated – emergency, museum, visitors/out patients – determining the internal layout, along longitudinal and vertical axes (Fig. 3). The emergency entrance (shown in red), in Piazza Santa Maria Nuova, gives instant access to the Casualty department, and therefore to the most serious treatment areas.

The visitors' entrances (in blue) are to the south of the square and consist of a patient and visitor entrance and reception areas and an entrance to the laboratory testing area.

The internal patient and visitor routes provide user-friendly access to the diagnostic radiology department, the outpatient department and the in-patient departments on the two upper floors. Building the two new vertical links, one for emergencies and one for the public, has gone a long way towards solving the question of flow differentiation, thus enabling a more joined-up distribution of the functional areas (Fig. 4).

A different sort of approach was taken in regard to the logistics paths that run from the entrances on Via della Pergola to the basement floor, occupying the spaces behind the hospital complex. A wide corridor link at basement level enables provisions to be distributed to wards throughout the hospital and paths used by hospital staff (in green). The loading/unloading bay in courtyard 8 has two platform lifts serving the distribution corridor linking the new elevator plants. The centralised changing rooms are also on this floor, and thus health staff will be able to access their workplaces along internal routes, kept separate from those used by users and visitors.

Access to the museum area is gained from the middle of the portico, along a route that skirts the Church of Sant'Egidio and the cloister behind it, and then leads up to the next floor (Fig. 5).

3. Urban centrality, public spaces, flexibility, research: what does the future hold?

Following the exhaustive and stimulating presentations, Prof. Torricelli took up various points in order to lead into the discussion. A great many steps forward have been achieved over the years since the 1995 projects were drawn up. However, the difficulties that beset a historic hospital inserted in an urban context are many and varied; this is why some of the major issues surrounding the rehabilitation of Santa Maria Nuova, already highlighted as weak or strong points by evaluation committees as part of past projects, have yet to be taken in hand.

The as-yet unresolved problems, or those currently being dealt with, on which focus is to be brought to bear, are those previously flagged up by Dr. Geddes: accessibility of the hospital structure, respect for the cultural heritage, the functionality of the reception areas and the way in which these areas are equipped.

3.1 Urban centrality. The loggia and the square

The issue of the accessibility of the hospital facility is closely bound up with that of urban centrality. The hospital's extremely central place in the urban fabric of Florence and its history make it a symbol and personal icon for the city's community. The question of how the hospital

relates today to the population and the city from both a community and an urban point of view is therefore well worth exploring.

Professor Torricelli underscored the fact that this hospital/city relationship is initially concretised by a series of spaces bordering the built confines of the hospital such as streets, squares, widenings, alleys etc., of which by far the most important is the square in front of the main entrances, which has always been called Piazza Santa Maria Nuova, with its elegant seventeenth century loggia backdrop. These spaces might well be described as the 'pivot' of the hospital, in that they constitute its arrival and departure points, as well as being spaces in which urban life carries on. The square and the loggia are part of the urban fabric but they are equally an integral part of the hospital, providing users with their first impression of it. Various activities and various sorts of interface are thus played out in these spaces.

The architectural evolution currently overtaking hospital buildings has always been an ingrained part of Santa Maria Nuova Hospital. Over the last few years, we have in fact been witnessing a steady acceptance of a new hospital approach to construction – where buildings had previously been seen simply as areas in which services were performed – with spaces intended not just for strictly health-related use, but to become 'hybrid' spaces, regulating the relationship dynamics between external/internal users and specific public/functional spaces.

Roberto Lapi backed up this thesis, pointing out that the portico encircling the square is extremely wide (7m deep); its purpose is not just to provide shelter or a Renaissance backdrop to the square, it is a living space in its own right. It is in strict spatial continuity with the square thanks to the visual relationship engendered by the size of the bays (5.70m). It leads into the health structure and more besides: it contains an Emergency entrance (therefore with dedicated vehicle lanes and paths), an entrance for outpatients, diagnostics services and visitors (largely for pedestrians in both cases), a museum entrance (for tourists and citizens, with different opening hours to those of the hospital).

What sort of square, therefore, would be most appropriate for Santa Maria Nuova? A public, ornamental square? Yet functional. What about accessibility? Over time the very nature of the square has evolved from empty space to meeting place, as evidenced by old photographs, to nothing more than a car parking space and, more recently – for obvious reasons – a support yard for internal construction work at the hospital.

One design proposal was put forward by the Lapi+Partners Studio, inspired by a study of the history of the ancient *pietra serena* paving. The idea for the new square hinges on revalorising the monumental access to the hospital, bringing back the elegance of the portico façade to its original splendour by restoring the original colours, restoring the Baroque busts and using whitewash to lend a warmer and more luminous aspect to the whole. Restoration work would also be carried out to the

lunettes on the walls of the portico, to the access portals and internal cloisters, fully illustrated in Vincenzo Vaccaro's presentation. Rounding off the functional emergency area is a new Emergency entrance, created beneath the loggia. The main objective of the proposal is to preserve the look of the façade and of the loggia in particular on one hand and to adhere to the legal stipulations for Emergency access on the other; these prescribe a dual access system: one catering for pedestrians and the other for emergency vehicles and patient transport, in a protected and air-conditioned environment (Fig. 6).

A "transparent box" is envisioned inside the loggia, which would enable all the required technical provisos to be met, while minimising the visual impact.

3.2 The public spaces system

The issue of the hospital's public spaces is an ongoing one. The portico and the access system take up a city space that is part of the urban fabric, and also constitute the first impact with the hospital structure. Thought is seldom given to the users' first approach to the facility, despite the fact that this is undoubtedly the most delicate moment, because it is as from that point that the citizens' rights to be received, cared for and treated begin to take effect.

The outside, urban fabric, and the inside, within the hospital walls, are closely linked thanks to the accesses and corridors, tunnels and halls that convey the users to the care and treatment areas. These transitional spaces are those that beg the question of how best they should be used and properly equipped in terms of furnishings and services.

Thus the external and internal spaces make up a *continuum*, referred to as the public spaces system. The museum area, which was set up to document the history of the hospital and its identity through time, through the documents and many works of art conserved in the hospital that testify to the alterations over time both to the building and to the health service.[3] It consists of a dedicated path that takes in the church of Sant'Egidio, the Chiostro delle Ossa and the Chiostro delle Medicherie, has its own independent external access for visitors not directly involved with the hospital activities: scholars, citizens, students and tourists. The museum is also open to ambulant hospital patients, health workers and relatives, with access directly from inside the hospital, thus bolstering the feeling to being part of a story that began 800 years ago.

Max Martinez highlighted the fact that this public spaces system has a fundamental part to play in attempting to solve the wayfinding problems inherent in such a complex historic building, the intelligibility of

[3] For a more in-depth treatment of this issue, see the interesting contributions by Geddes, De Benedictis and Coppellotti in *La bellezza come terapia,* ed. by Ghidetti E. and Diana E.

the building, and the often almost irrelevant signposting, and the question of accessibility, taken to mean ease in getting to a certain place.

The system of cloisters and internal courtyards, a relic from the historic hospital, lends itself to the degree of orientation and recognition required to help make the hospital facility user-friendly.

The public spaces system, an *unicum,* also raises the question of decisional power over how the spaces should be used: the Municipality, the Health Board, the Department of Cultural Heritage.

In this regard, Vincenzo Vaccaro suggested that the considerable attention paid to preserving the hospital's historical and cultural should not be overlooked. When considering the overall rehabilitation of the entire system, we asked ourselves exactly which line to take: conservation restoration or functional rehabilitation? For example, restoration works to the Chiostro delle Ossa (also known as the Chiostro Galli Tassi in memory of the monument erected to one of the hospital's major benefactors) and the Chiostro delle Medicherie, both early fifteenth century, are envisaged in order to bring them back to their original condition.

3.3 Flexibility

When embarking upon the rehabilitation of a hospital facility, the question of the flexibility of the buildings, their transformability over time, their potential for accommodating new services or the evolution of current ones arises – as is the case where health functions are concerned – and can be summed up in a single word as the 'capacity' of a building.

Professor Rossi Prodi made the point that the least flexible buildings are those that have actually been designed to respond to a precise functional plan, whereas the old ones possess a 'harmony' that goes beyond mere function.

Professor Penn believes that the Santa Maria Hospital is possessed of this 'harmony' and is therefore capable of being transformed over time without losing its own value and its own purpose. There will still be margin for restructuring in 2050, unlike hospitals recently built to measure. There is in fact quite an abundance of spaces in the hospital complex, despite the tight-knit urban fabric, which have enabled a new lift block to be carved out with having to sacrifice anything that could be described as ancient or original.

So what therefore happens when one or more rehabilitation operations are needed in a complex historic building such as this? There would appear to be something unchanging over time that can be architecturally defined as a building's 'generic function'[4]. Penn has identified a study of

[4] The Space Syntax theory defines 'generic function' as the properties of spatial arrangements which all, or at least most, 'well-formed' buildings and built environments have in common, because they arise not from specific functional requirement, that is, specific forms of occupation and specific patterns of movement but from what makes it possible for a complex to support any complex of occupation or any pattern of movement.

the spatial elements of the generic function of Santa Maria Nuova as an interesting potential subject for research.

3.4 Sustainability and energy issues

Lastly, Professor Terranova raised a problem that is frequently skirted around, but which is hugely relevant in terms of the rehabilitation of historic hospital structures: the ratio of the costs involved in conserving a building to its sustainability. What effect does including sustainability criteria have on conserving the original functions of an historic building? To what extent could energy saving become an integral part of the rehabilitation plan for Santa Maria Nuova?

3.5 Society, health and architecture

The Santa Maria Nuova rehabilitation project also provides a good platform for architectural research within a social context. Various research topics were suggested during the discussion, by the English members of the group in particular. These can be summarised as follows.

A spatial reading of the strengths of Santa Maria Nuova Hospital, i.e. its wealth of history and urban centrality, serves to demonstrate the relationship that exists between medicine and society more thoroughly. An architectural reading of the building's historic stratification provides a picture of the changes in healthcare over the centuries, which in turn describe the conception a society has of itself.

Another issue that encompasses the sociology of architectural spaces and Medical Sociology is that of the comprehension of the nature of Medicine nowadays, and citizens' perception of health problems in terms of the use of spaces in particular. This would call for a study of the various areas within the hospital complex (intensive care, radiology, medicine, etc.) the social relationships that are triggered during treatment, transition, co-working, staff training etc.

Geddes highlighted the fact that health workers enjoy working in this hospital, and this is partly to do with the beauty of the spaces, the architectural features and the touch of grandeur. Equally, there is a need for new organisational models (faster transit, more frequent patient care,

Generic function refers not to the different activities that people carry out in buildings or the different functional programmes that building of different kinds accommodate, but to aspects of human occupancy of buildings that are prior to any of these: that to occupy space means to be aware of the relationships of space to others, that to occupy a building means to move about in it, and to move about in a building depends on being able to retain an intelligible picture of it. Intelligibility and functionality defined as formal properties of spatial complexes are the key 'generic functions', and as such the key structures which restrict the field of combinatorial possibility and give rise to the architecturally real (Hillier, 2007).

etc.) and technology (televisions, automatic doors, etc.). Over the last few decades, for example, there has never been a specific place inside the hospital where staff and patients could swap information. The new project also caters for this need with new briefing and relatives' rooms.

These issues are bound up with the intelligibility or comprehension of a building, in other words, the ease with which it can be navigated and understood by patients and staff. The spatial limitations, the cloisters and all those other elements that currently appear to have little to do with health care in this particular case, have their own part to play in constructing an intelligible building.

The Space Syntax methodology plays an important role in research of this kind. The configurational Space Syntax method does not merely analyse the community and collective dimension of urban structures and spaces by means of social assessment tools, but also and above all enables correlations with the configurational characteristics of a space to be made. The methodology uses social observations and analysis of the spatial layout to gauge the correlation that exists between the social and the physical dimension, by assessing how great an effect the architecture has on social interface; two dimensions that are normally considered individually; physical space and society – as in the co-presence and interface of different categories of user – are therefore reunited.

This methodology enables spaces to be analysed as a *continuum* that takes into account the reciprocal relationships and connections that exist between urban spaces and healthcare spaces.

The seminar closed with a general commitment to carrying studies and research into the Santa Maria Nuova Hospital forward. Of those present, Professor Penn for the Bartlett School, Max Martinez for Space Syntax Ltd and Professor Torricelli for the TAED Department of the University of Florence, in particular, reiterated their suggestion of collaborating with Dr Geddes on a more in-depth exploration of the issues thrown up during the study day.

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Figure 1. Actual view of Santa Maria Nuova Hospital area within the Florentine urban context

Figure 2. Santa Maria Nuova Hospital 18th century plan. Showing the two cross-limbs: women's wards in blue and men's wards in orange

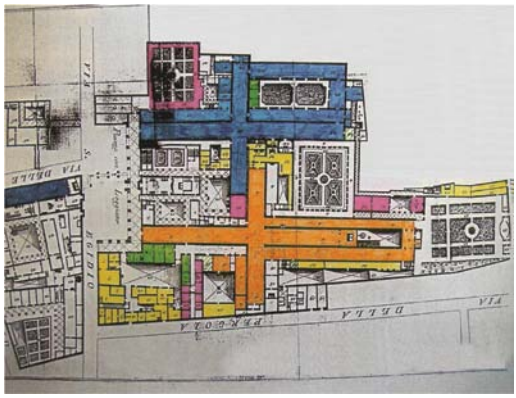

Figure 3. Differentiation of accesses to Hospital and traffic axis: Emergency in red; Outpatients and Visitors in blue; logistics in green; public spaces in yellow

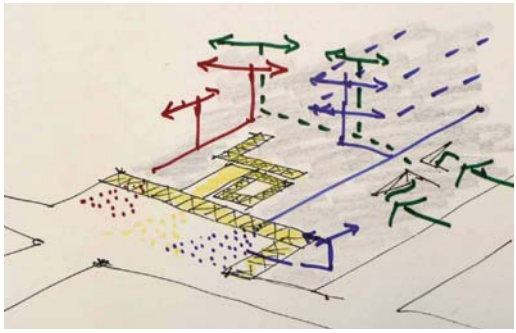

Figure 4. Ground floor plan, 2005 project

Figure 5. Santa Maria Nuova Hospital as it will look in several years' time. Hospital model with areas: Emergency Area in red; Public Area in yellow; Outpatients and Visitors area in blue; and functions: 1. Emergency Department; 2. Intensive Care; 3. Emergency Radiology; 4. Day-Surgery; 5. Physician's Offices; 6. Operating Theatres; 7. Sub-intensive Care; 8. Sant'Egidio Church; 9. New Bar; 10. Blood Testing Centre; 11. New Entrance Hall; 12. Morgue; 13. Technological Management Services; 14. Pharmacy; 15. Dialysis Services; 16. Cardiology Surgeries; 17. Technical Rooms; 18. Radiology; 19. Medicine Wards; 20. Dressing Room; 21. Day-Hospital; 22. General Surgery; 23. Wards Hall; 24. New Elevators

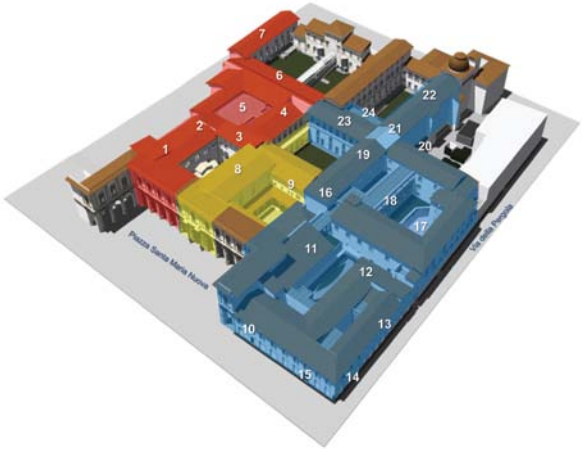

Figure 6. Renders of design proposal of Lapi+Partners Studio with Emergency access and façade and loggia restoration

⋆*Thanks* are due to L+PARTNERS S.r.l., and to Roberto Lapi, architect, in particular for the provision of project documentation.

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