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The Architecture of Hospitals

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NAi Publishers

Five Revolutions: a Short History of Hospital Architecture

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## The prehistory of hospital architecture

Sometimes the helicopter view reveals more than microscopic analyses, and occasionally a movie shown at double speed demonstrates patterns of change more clearly than when played in slow motion. Shifting one's perspective often helps to clarify historical trends. History is hardly ever a simple, linear process, and the historical evolution of hospital architecture is no exception. Long periods of slow transition alternate with sudden changes, and sometimes these changes are real revolutions that drastically change the way hospitals operate and put new people in charge. Although hospitals have always been designed to help people in their struggle against illness and injury, they have not always been medical institutions. This essay attempts to sketch the way the modern hospital came into being by focusing on five revolutions, one of which failed, and the last one of which embodies the 'era of radical transformation' we are now witnessing.[1]

Hospitals are buildings used for the care and cure of the ill and the injured. They can be traced back to times immemorial. Limiting the definition of a hospital to a building especially designed for healthcare, we can state that the first examples probably appeared in ancient Greece. The hospitals of antiquity emulate the model of the classical temple, which is hardly surprising, since the concept of healing was closely linked to religious rites and rituals. In this respect, they are comparable to the monastic hospitals of the Middle Ages, which, naturally, resemble monasteries. Also closely linked – literally – to religious buildings is the Hôtel-Dieu, which was often connected to a church or a cathedral. The hospitals constructed by the bourgeoisie in Europe's rapidly growing medieval cities stand apart from the ecclesiastical institutions. They were civic buildings commissioned by the municipality and were usually constructed as spacious halls with high-pitched roofs. Though often run by religious orders, they are definitely civic, urban buildings, founded either by wealthy merchants or by

1. Stephen Verderber, David J. Fine, *Healthcare Architecture in an Era of Radical Transformation*, New Haven, London 2000.
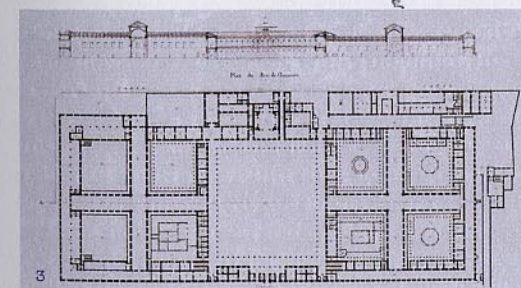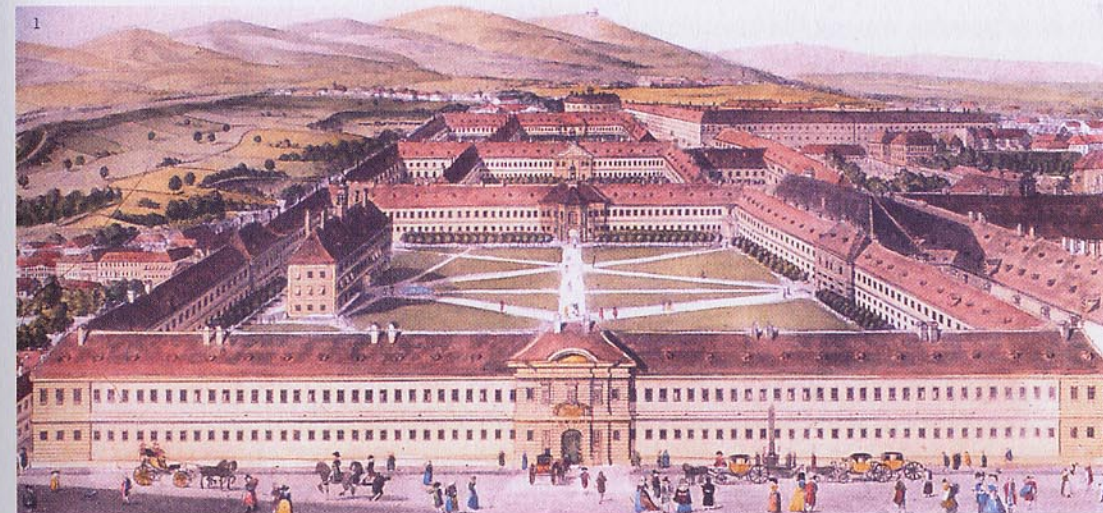
city governments. Among the most famous is the Ospedale Maggiore, founded in Milan in 1456, and designed by Antonio Averulino, better known as Filarete. The first hospital to be designed according the geometrical principles of the Renaissance, it is a symmetrical composition with a large central courtyard; on both sides of it, the wings of the building delineate four smaller courtyards. Also structured around courtyards is Vienna's famous Allgemeines Krankenhaus, built to the designs of J. Gerl in 1783. F. Beer is credited with having initiated the corridor hospital, where all the rooms are arranged alongside internal walkways. His hospital in Bern, built between 1718 and 1724, is the first of this type. Integrated into the street facades, these buildings look like schools; their symmetric layout reflects the separation of men and women.

The spread of secular hospitals in the seventeenth and especially the eighteenth century was triggered by the emergence of mercantilism: since the economic success of a nation depended largely on the output of the labor force special measures were deemed necessary to keep them fit. In France, this 'politique de santé' was carried out by the centralized state, while in Great Britain private citizens were responsible for most new hospitals and their use as the means for keeping the sick paupers in line. Military hospitals represent a special category (in a way they still do). Many of them were founded in the Middle Ages, in the wake of the military campaigns against the infidels: the Moors in Spain, and the Muslims who occupied the holy land and most of the Eastern Roman Empire, and, later, the Ottomans in the Balkans, who even besieged Vienna several times. These military hospitals also took shape as large halls, which, however, were sometimes heavily fortified. On the Iberian peninsula, in the Middle East and, much later, in regions re-conquered by the Vienna-based Habsburg Empire, these hospitals stand out as the silent markers of devastating global conflicts. Though especially designed for the purposes they had to fulfill,

these buildings do not differ very much from other ecclesiastical, civic or military constructions. A.E. Martinelli's military hospital in Budapest, built in 1747, is a brilliant example. Whereas Vienna's Allgemeines Krankenhaus, its predecessor, was built beyond the open space encircling the inner city's fortifications, this hospital was constructed on top of what remained of the medieval walls of Pest; although designed for the troops that were driving back the Ottomans, its luxurious architecture as well as its size still impress visitors today (even though part of it was destroyed in order to construct the inner ring road). Maria Theresa is rumored to have lauded this palatial structure, which now houses Budapest's city council, as more beautiful than her own palace.

Until the beginning of the twentieth century, hospitals were often conceived as representational civic and, occasionally, military, buildings. By the middle of the nineteenth century, however, these concepts were considered outdated; for the pavilion type had conquered the world, with its small structures spread out on relatively spacious green plots, usually divided into a men's and a women's part by a central axis that started at the main building. Though the roots of the pavilion system are manifold, it can be seen primarily as an offspring of the first revolution that shook the hospital world. None of the hospitals of this type functioned as a temple for the medical sciences; they were either almshouses with integrated healthcare, or an indispensable part of the military. The medical sciences made steady progress, but they were not based in hospitals. Already at that time, statistics played a major role. The correlation of the data collected with their geographic origin made it quite clear that most contagious diseases started in the poor parts of the city, where hygienic conditions were the worst, that is, in the areas that stank the most because there was no adequate sewage system and not enough clean water. Clean air became one of the priorities in the campaigns to improve healthcare. Hospitals did not escape close scrutiny: it was demon-

strated, for instance, that the corridor type showed serious deficiencies. It was time for a change, and when change finally came, it proved to be a true revolution.

The first revolution: a victory of science, philosophy, and technology

Hospitals are revolutionary buildings. The hospital is the first building that was completely determined by scientific and philosophical concepts. These revolutionary thoughts were unleashed by the fire at the Hôtel-Dieu in Paris in 1772, and they inspired an avalanche of revolutionary proposals for its replacement. Statistics showed that between 1721 and 1773, on average, one patient in four and a half did not survive hospitalization there. The Hôtel-Dieu had long been criticized, but it was the fire that led to the numerous suggestions to do away with the old institution entirely and replace it by a series of hospitals that were smaller and conceived in a totally new way. The king, Louis XV, did not listen to these revolutionary voices, however, and the old buildings were hastily rebuilt. Still, this did not prevent the counterproposals from having an effect: if the first revolution was destined to remain an intellectual rather than a practical one, the consequences were nonetheless felt all over Europe.

In the fifteen years following the great fire, ongoing criticism forced Louis XV to establish several committees charged with making suggestions for fundamental reforms, and these committees were responsible for most of the dozens of proposals for a veritable revolution in Paris' hospital system. Two models stood out: the radial solution favored by, among others, A. Petit and B. Poyet, and the pavilion system promoted by J.R. Tenon, J.B. Leroy, and C.F. Viel. Though the designs are very different, the principles are the same. In what way were they believed to help people overcome illness and injury? Though medical doctors were deeply involved in revolutionizing the hospital, the reformers assumed it

derived its healing qualities not from medicine, but from being a purified, natural environment that provided clean air. Hospitals were wind machines, radiators, specimens of 'pneumatic design'; they healed by architecture, they were 'machines à guérir'.

Almost half a century after the first hospital revolution, M.P. Gauthier realized his famous Hôpital Lariboisière. Built between 1839 and 1854, it is credited with being the first pavilion hospital. All the original ideas are there, though the chapel is no longer dedicated to Nature, as had been the case in many late eighteenth century revolutionary designs: it is, rather, a small Catholic church, located on the central symmetrical axis of the complex, which in turn coincides with the axis of J. Hittorff's famous Church of Saint-Vincent-de-Paul, some hundreds of meters to the south of it – a fine example of Hausmann's mastery in creating visual links in his new Paris. The tremendous success of the pavilion type was further enhanced by the work of Florence Nightingale, who introduced the concept of the barracks hospital during the Crimean War of 1854. Easy to assemble and take apart again, this is a temporary, military, counterpart of the pavilion type.

Apart from making the hospital as comfortable a place as possible, the architects focused on its representational aspects as an important public building. In Germany, especially, many outstanding examples were built in the neo-gothic style typical of the Gründerzeit, most of them as pavilion hospitals. An interesting example is the Städtisches Krankenhaus im Friedrichshain, built between 1868 and 1874 by M. Gropius and H. Schmieden, the latter of whom evolved into one of Germany's leading hospital architects. Around 1900, the allegedly beneficial effects of nature had become only a secondary reason for clinging to this model. As medical science progressed, the architectural environment that was seen as the hospital's single most important healing feature gradually lost importance. Now, the pavilions reflected the growing specialization in the medical world, each harboring its
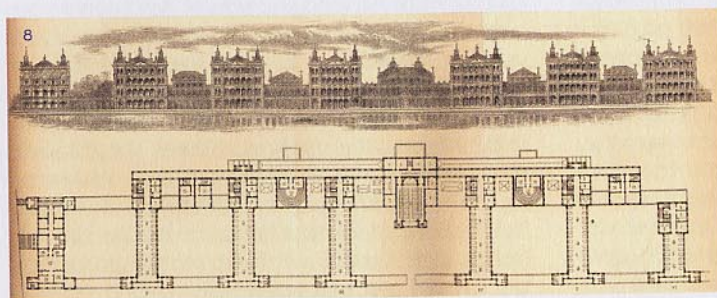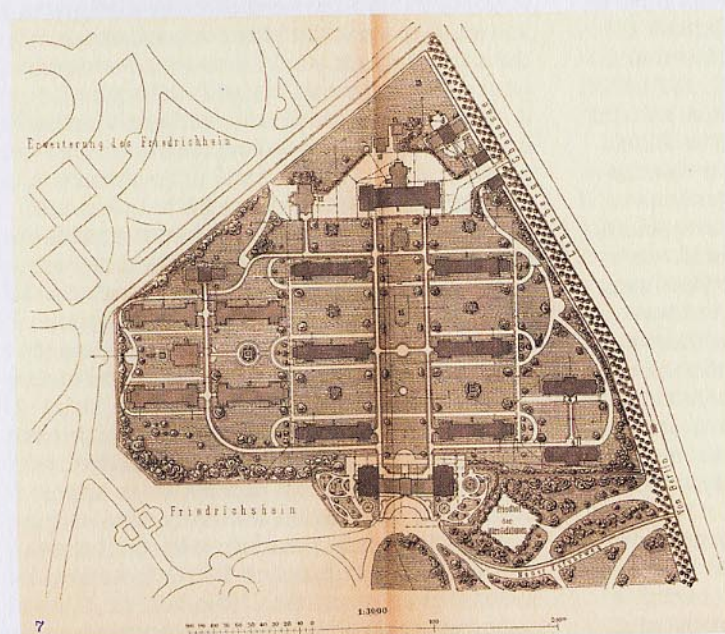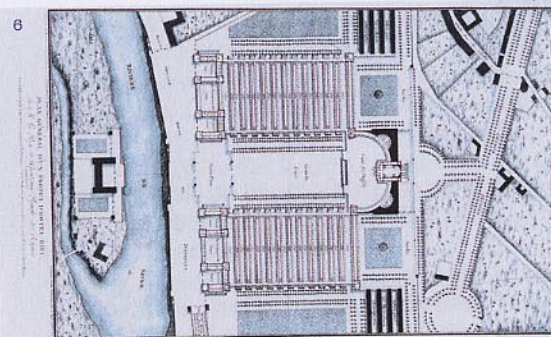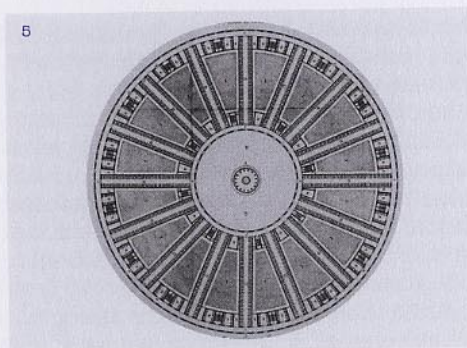
own discipline and operating as a small hospital in its own right, merely sharing collective facilities (the kitchen, for instance) with the other pavilions. Beginning in the second half of the nineteenth century, hundreds of hospitals of this type were built. Well known examples include: St. Thomas Hospital in London, built between 1861 and 1865 and designed by H. Currey; G. Gilbert's Hôtel-Dieu, which finally replaced its medieval predecessor in 1878; and, in Holland, J.J. Van Nieukerken's Algemeen Provinciaal, Stads en Academisch Ziekenhuis in Groningen. Some pavilion hospitals are real architectural beauties, the most famous of which, perhaps, are the Sant Pau in Barcelona by Lluis Domènech i Montaner (1902-1922), Otto Wagner's Steinhof Psychiatric Hospital in Vienna (1907), and Tony Garnier's Hôpital Edouard Herriot (1913).

Liberating the hospital from religion and superstition, French medical doctors, engineers and architects ushered in the first revolution, which transformed the hospital into the first functional building typology in the history of architecture. While behind the walls of hospitals, science and technology reigned supreme, outside them the church and the old aristocracy still maintained their power. That division made hospitals stand out as rational islands in a sea of religious and superstitious concepts, as symbols of progress in a world in desperate need of a revolution. The ideas that fueled this bold vision were inspired by the Enlightenment; the hospital was seen as a precursor of a complete reconstruction of society – an ideal that culminated in the French Revolution of 1789. Paradoxically, that very revolution seems to have ended the intellectual turmoil that had resulted in so many daring designs for hospitals and psychiatric clinics, and several decades had to pass before the first projects based on this vision were actually built. Even so, the way science and technology determined these plans marks the hospital as the very first modern building type, and as a symbol of revolutionary victory. In fact, in its emphasis on the influence exerted by the environment on the healing process – indeed, to the neglect of most other factors – the modern hospital of the late eighteenth century can also be seen as a precursor of Evidence Based Design, which plays such an intriguing role in contemporary hospital architecture.

Whether initiated by private parties, the church, the city or the state, hospitals were always designed as representational public buildings. They demonstrated that their clients were well aware of their responsibilities, and some of the best architects were involved in designing them. While there can be no doubt that they were seen as hospitals – institutions designed to help patients overcome health problems – they were primarily social rather than medical institutions. Wealthy patients avoided hospitals at all costs – they were almshouses for the poor.

The second revolution: medical science and technology take over

All this changed when technology made its appearance, starting with the Röntgen (X-ray) machines. Eventually this led to a social turnaround: as soon as the hospital developed into the pinnacle of medical science and technology, the services it offered became out of reach for the poorest classes that it had traditionally served. The transition from almshouses to top medical institutions was quite remarkable. Apart from their role as training institutes for doctors and nurses, hospitals had never before been in the vanguard of medical science and technology.

One of the two most important innovations to revolutionize hospital architecture also originated outside the hospital: the discovery that bacteria are the main agents spreading disease through the air. That seemed to clear up the mystery of the miasmic vapors: the concentration of bacteria was higher where the air was worst. The identification of bacteria was the first step in fighting them, and the progress made by L. Pasteur and many of his colleagues appeared to open new ways

to alleviate the danger of polluted, disease-causing air. If these promises could be realized, it was no longer necessary to build hospitals as wind machines. The medical staff and the architects alike were more than happy to abandon the pavilion type, since its disadvantages had become impossible to ignore. In big pavilion hospitals the distances between the central facilities – the kitchen for instance – and the pavilions became too long, making them very inefficient. As an architectural challenge, the pavilion type presented the architects with major obstacles: their creativity was channeled more into the distribution of separate small buildings than into the design of representational public, and potentially monumental, complexes.

The second innovation to change the character of the hospital was the great proliferation of medical technology, a trend epitomized by the invention of the X-ray machine. Since all this machinery was too expensive to be owned by individual doctors, the hospital became the logical place to concentrate it. Along with it came the medical specialists, and within a few decades the hospital developed from an almshouse into a temple of the medical world. As a consequence, it lost its traditional clientele: diseased paupers simply could not afford hospital treatment any longer. Medical doctors, the machine, and the (urban) elite now dominated the hospital.

Since the pavilion type was no longer needed, it was replaced by a far more compact type that is often referred to as the block hospital. Unlike its predecessor, the block hospital lends itself perfectly well to being designed as a big representational building. In this vein we may mention James Gamble Rogers' Columbia-Presbyterian Medical Center in New York (between 1926 and 1930) and Coolidge, Shepley, Bulfinch and Abbot's New York Hospital-Cornell Medical Center, in the same city (1933). Different in style but similar in their aspirations were the projects of two American architects who had come to France as soldiers during the First World War. P. Nelson, a student of the A. Perret, planned his huge
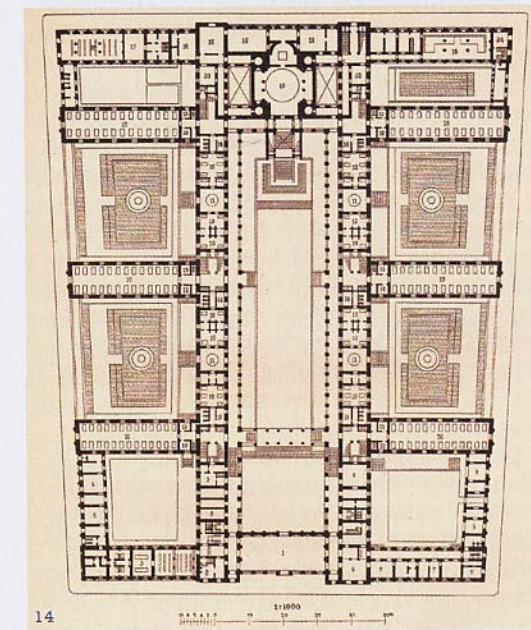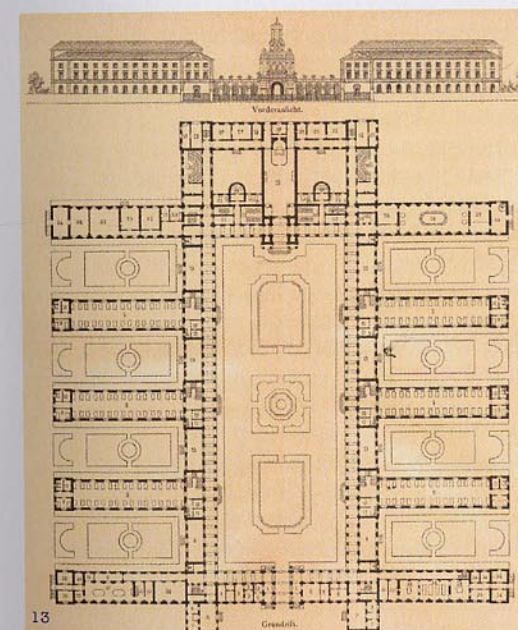
Cité Hospitalière for Lille in 1933, combining the monumentality of the New York examples with the sober modernist architectural idiom then in vogue in his new homeland. That may be one of the reasons his project could not be realized. J. Walter, also from the US, created the plan that eventually was built, which, to a certain extent, has the various departments branching off from a curved spine; and though the building is far more complex than the usual skyscraper, what it has in common with the Manhattan examples is considerable height. Joining forces with L. Plousey and U. Cassan, Walter also planned the famous Hôpital Beaujon in Clichy just outside Paris; here too, separate wings are added to a central spine. Whereas these hospitals were clearly inspired by American examples, Gedeon Gerlóczy's Magdolna Baleseti Kórháza in Budapest is a pure – and rare – example of a modern high-rise hospital. Completed in 1939, it possessed the state-of-the-art medical technology, and its original white facades expressed the buildings clinical functions very well.

Great and monumental though these hospitals could be, they lost an essential architectural feature of the older pavilion system: the ambition to create healing environments that emulated nature. The natural environment ceased to be a factor in hospital design, the only exception being the tuberculosis hospitals, for instance Alvar Aalto's Sanatorium in Paimio (1929-1933). In all other hospitals, science and technology reigned supreme – all a hospital had to do was accommodate them in an efficient and cost-effective way. Nature was reduced to the view from the bedroom windows; everything in these huge and very urban buildings is subordinated to needs of science and technology.

Echoing the mixture of social utopias and the glorification of nature characteristic of the Enlightenment, the small-scale, anti-urban commune, which was sometimes inspired by religious or socialist motives, developed into an artistic ideal. The model of Thoreau's Walden, for instance, was imitated all over

2. Lewis Mumford, *Programme for Survival*, London 1945, 9.
3. J. Hudnut, 'Architecture and the Art of Medicine', in *Journal of the American Institute of Architects*, 1947, no 4, 147.

Western Europe. The love of nature as, among other things, a healing environment was now almost a sign of opposition against the over-organized, technology ridden, anti-human establishment. Attacked in the 1950s and 1960s as one of the pillars of the establishment, modern architecture, in fact, had developed as an avant-garde counter-movement. Although they were held responsible for the design of inhuman, machinelike buildings in the decades following the Second World War, the pioneers of modernism in the 1920s and 1930s actually shared many of the views of the nature-oriented culture of the 1910s and 1920s. That probably explains why only very few modern hospitals were built before 1940. The only major exception is the wave of constructivist hospitals that spread throughout the Soviet Union – and these were very much the product of a movement that wanted to abolish the old bourgeois society. They testified to the Soviet Union's ambition to do everything possible to improve the health of its working classes, an ambition that mirrored the mercantilist policies of several centuries earlier. Echoing the philosophy of the Enlightenment, those responsible for creating the new socialist healthcare system blamed society for most, if not all of the workers' mental and physical health problems. The most efficient way to eradicate them was a complete reform of society. The constructivist hospitals were seen as precursors to this social revolution – reflecting the avant-garde status of the French revolutionary hospital designs from the late eighteenth century. Following changes in the Soviet Union's power structure, the boom in modern hospital construction gave way to populist, socialist realist buildings in the 1930s, and only very recently have the buildings of that earlier phase been rediscovered.

These brilliant but forgotten modern hospitals were very exceptional. Pompous, monumental buildings were the rule, and they appear to confirm what L. Mumford, in a different context, described as the scientist's typical ignorance of human values: 'From the standpoint of the physical scientist, as scientist, life is non-existent, and the values of life are, if anything, merely accessory to the triumphs of physical science'.[2] Though lavish decoration and a sometimes exuberant architectural finish paid lip service to the social status of their clientele, these hospitals were basically molded to the needs of the medical machine. J. Hudnut, dean of the famous Harvard Graduate School of Design, which played such a seminal role in introducing modernism to the United States, believed that this set them apart from the realm of architecture: 'No art is more widely misunderstood than the art of architecture, and no building illustrates the misunderstanding more clearly than the hospital. The hospital has become so completely a product of the technologies of medicine and of manufacture, so precisely adapted to the uses of sciences, as to become in effect a scientific instrument not essentially different from the X-ray machine or the operating-table which it encloses. It is hard for people to imagine any relationship between such a building and that great tradition whose flowers are the Parthenon and the Cathedral of Chartres. It is hard to think of hospital as a work of art.'[3] It took another revolution to turn hospital architecture upside down once more. It confronted the medical doctors, the medical machinery and the elite with the need to accommodate the 'masses' of the 'common men' once more – a revolution that coincided with the breakthrough of modernism in hospital architecture.

The third revolution: hospitals for the masses

The third revolution is a product of the Second World War and the ensuing 'social revolution' that both fostered the ideal of the Welfare State in Western Europe and the United States, and rekindled the dreams of socialism in the Soviet Union and the countries in Central and Eastern Europe that were now integrated in the socialist empire east of the Iron Curtain. On both sides of this big political divide, a complete reconstruction of society was seen as a necessary precondition to the elimination of the deeper causes of the great tragedies that had befallen Europe in the mid-twentieth century: the worst economic crisis in memory, the rise of the modern totalitarian state, large-scale violations of human rights, the virtual disappearance of democracy in Europe, and, finally, the Second World War and all it entailed, including war waged against civilian populations, the destruction of cities, and the Holocaust. This not very pleasant phase in the history of mankind was triggered by forces on the very continent that had up till then considered itself the flag bearer of high culture. Something, obviously, was fundamentally wrong. Social segregation was seen as one of the causes of the war, and, generally, of people's propensity for irrational behavior towards each other. What was needed was a social revolution and the introduction of rational, scientific methods to control and reshape society. The social revolution had already been ushered in by the war effort; and the 'managerial revolution' that was to complement it had its origins in the new planning and management sciences that had already been having a deep impact on business life since the 1920s.

Both the social and the managerial revolutions profoundly affected the hospital. Since being taken over by the medical staff and by medical technology, hospitals had become symbols of social segregation, accommodating only the wealthier strata of the population. It was especially in Europe, the continent ravaged by the war, that the hospital became part of the social revolution. Social security systems were set up in most countries, safeguarding the 'masses' of 'common men' against the consequences of unemployment, disability, old age – and illness. Retaining their position at the top of the medical and technological pyramid, hospitals also regained their role as social institutions.

Not surprisingly, this had a deep impact on their architecture, which began to manifest their aspiration to become monuments of the welfare state and the new age of scientific progress and social justice. At the same time, they epitomized the promise of science, the victory of technology, and the prospect of a successful battle against old and new diseases. What better way to express the new era than by employing the International Style? The sudden breakthrough of this American-inspired offspring of prewar, revolutionary modernism in Europe has completely changed hospital architecture since the 1950s. The rapidity of this adoption of modernism is still puzzling architectural historians today. Prewar modernism in Europe had been an avant-garde movement storming the cultural establishment of those days from the outside. It was relatively small and partly inspired by socialist revolutionary tendencies – many modern architects had worked in the Soviet Union before socialist realism forced them to leave. Is the social revolution in postwar Europe and the United States enough of a reason to explain why the International Style suddenly became *the* 'style' of the postwar establishment, first of the Welfare State in America and Western Europe, and, then, in the 1960s, of the socialist countries in Eastern Europe, as well? The New York Museum of Modern Art promoted a series of internationally circulated exhibitions that presented the International Style as representative of the new social-welfare oriented capitalism of the Western democracies. What else could have played that role? The traditional styles of the 1920s and 1930s mirrored the social condition in a society that led to the war and the Holocaust, and before Khrushchev put an end to it in 1954, socialist realism was monopolized by socialism.

Reflecting the slogan 'light, air and space' from the 1920s, the International Style reintroduced references to nature, favoring spacious locations where the patient wards could be situated on the southern facade, facing gardens or parks. Hospital architecture became 'synthetic': a combination of three functionally very distinct parts – patient
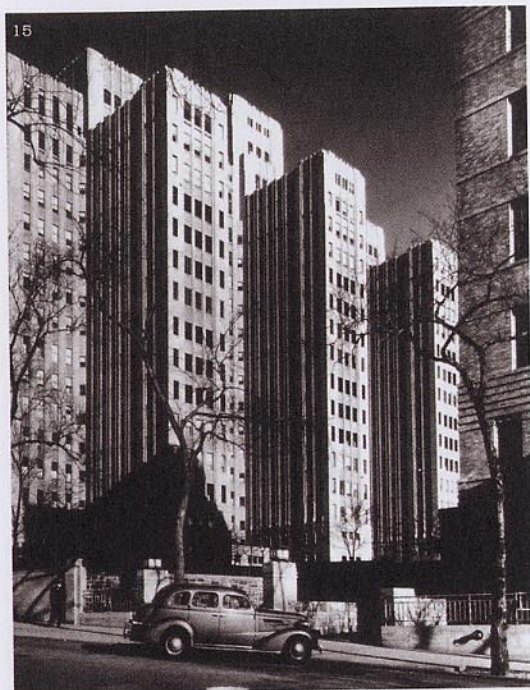
wards, a concentration of facilities for the medical treatment of the patients, and outpatient wards. Clearly expressing the functions of these different parts, the International Style in hospital architecture culminated in a series of types that are often named after the letters they resemble: the T-type, the K-type, etc. It is no coincidence that the examples inspiring this mainly European tendency originated in the two countries that had escaped the war: H. Baur's Bürgerspital in Basel (1937-1946), and H. Cederström's Södersjukhuset in Stockholm, completed in 1944. In Holland, J.P. Kloos's Diaconessenhuis in Groningen, completed in 1965, was a fine example of the K-type. The main problem architects faced was the need to adapt the hospital to the dynamics of technology. A clever strategy was first introduced in America's veterans' hospitals. As always, major wars result in the construction of military hospitals, and those built in the United States in the 1950s and 1960s ushered in the 'matchbox on a muffin' type that is better known by its German name: 'Breitfuss'. Because technologically motivated changes take place mainly in treatment facilities and outpatient wards, and because it is much easier to rebuild and redesign the ground floor than to make changes in high-rise buildings, the combination of a 'flat', spread-out building of only one or two floors and a high-rise building containing the patient wards on top of it seems an ideal solution: it allows change to occur where it is most frequently needed without disturbing the patient wards. It was introduced in Europe by Nelson in his Hôpital Mémorial France-États-Unis in Saint-Lô in 1956; probably the best Dutch example is the Rotterdam Sint-Fransiscus Gasthuis, completed in 1975 to the design of Hendriks Campman Tennekes.

When the Sint Fransiscus Hospital opened, there was a strange dichotomy between its austere exterior and the deliberate coziness of the spaces inside, which had been inspired by the views of the counterculture that sprang up in the late 1950s and flourished in the 1960s and 1970s. In its efforts to revolu-
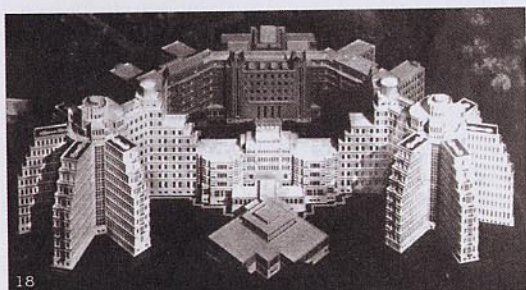
tionize society, that movement did not fail to mount an attack on the hospital as one of the pillars of a political and economic system it considered all wrong.

The fourth revolution: empowering the patient

In the 1950s and 1960s, Western Europe and the United States witnessed a boom in hospital building. Their preferred, isolated location, aloof from the hassle of modern life, represents the supremacy of medicine and technology, the benevolence of the Welfare State, and the efficiency of planning and modern management. Their awe-inspiring, bright modern architecture conveys, in addition, the rationality of a design approach that stripped buildings of everything superfluous (and therefore irrational, reminiscent of the Dark Ages that now belonged utterly to the past).

For the counter-revolutionaries, however, the hospital represented a political and economic establishment no less totalitarian than, for instance, the fascist dictatorships they liked to compare it to. Its vast bureaucracies invaded every aspect of life. Alienation, the term coined by Karl Marx, was no longer limited to the economic sphere (the upper classes robbing the lower classes of the financial gains of their work). Modern society, fully planned and controlled, appeared to limit people's personal life by subordinating almost everything to bureaucratic institutions that were run either by the state or by big business, and that, in both cases, were oblivious to the personal concerns of the people they served. In the hospital, similar attitudes prevailed. Patients were not treated as persons, but rather as a collection of possible diseases, all of which were the exclusive domain of medical specialists. In a hospital, the patient practically disappeared.

Continuing the tradition inaugurated by the Enlightenment and enacting ideas that flourished during the early phases of the Russian Revolution, the protagonists of the

4. Koos Bosma, Dorine van Hoogstraten, Martijn Vos, *Housing for the Millions: John Habraken and the SAR (1960-2000)*, Rotterdam 2000.
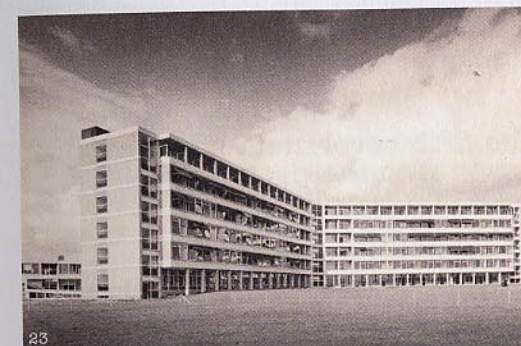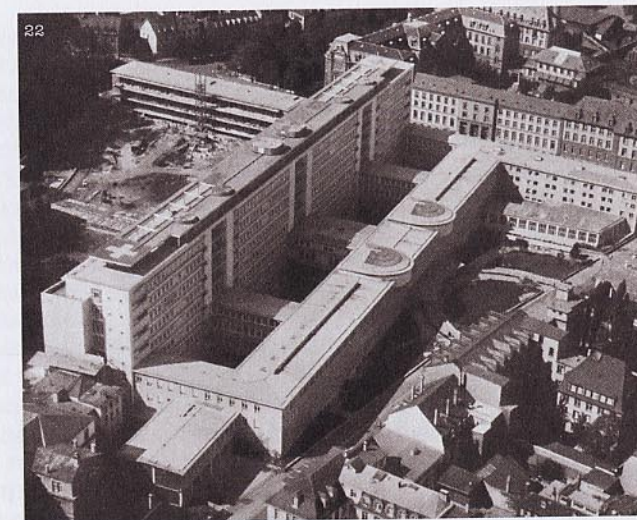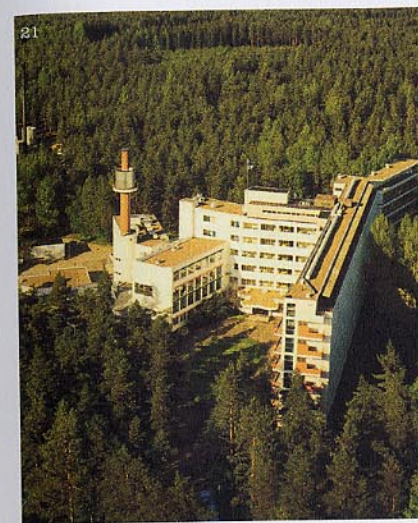
counterculture saw modern society as the main source of illness. Like their predecessors, they wanted a more natural society and stressed the overwhelming importance of the physical and social environment for the well-being of mankind. Modern society was criticized as an authoritarian machine, the modern hospital as a 'medical fortress'. A lot could be learned from people who were not infected by modern society: the nomads in Africa, for example. According to C. Muller, leader of the rebellion that shook the foundations of one of Holland's biggest psychiatric institutions, even more could be learned from our mentally handicapped fellow citizens. Most of the philosophers of the counterculture argued that society had to be rebuilt from the bottom up: starting at the level of the individual, social structures should be invented that guaranteed the individual a fair share of the control of all the institutions that impacted his or her life. In the hospital setting, this view culminated in the ideal of patient-centered care: instead of fragmenting the patient into diseases that corresponded to the various medical specialties, the hospital organization should be built around the individual patient, respecting his or her personality.

How did the fourth revolution change hospital architecture? Since a hospital embodies a conflict between the individual, who is undergoing some of life's most personal experiences, and the needs of the medical staff and equipment, it became a perfect playground for one of the most influential architectural challenges of the period: how to reconcile these two domains. The solution was the invention of neutral, industrially-built structures that acted as a framework to which more individualized components could be added. This approach originates in the work of J. Habraken, who developed his ideas in the Netherlands and then taught them in the United States.[4] Balancing the individual and the collective, his views tackled what is arguably the most important dilemma in twentieth century society, and they immediately found their way to hospital architecture.

In those countries most affected by this approach, it promoted low-rise hospitals that strove very hard not to be monuments for the medical staff and the bureaucratic welfare state. Ideally, the scale of the structural hospital grid coincided with the zoning of the surrounding city; some plans were made where the hospital is fully integrated into the urban tissue and no longer recognizable as an individual building. Whereas the main functions of the hospital were clearly expressed in the T, H and K types of the 1950s and 1960s, hospitals now became anonymous places in the larger grid. Increasing demands to make the hospital more flexible enhanced this tendency to a neutral, unexpressive architecture: if plans for a patient ward, for instance, have to anticipate its transition to a group of outpatient departments, its architecture should express neither of those two functions, but rather be as neutral as possible. An interesting Dutch example is the Sint Elisabeth Hospital in Tilburg by Roelofs Nijst Lucas, completed in 1982.

Deliberately minimizing the expressive qualities of hospital architecture, the architects of these pioneering structures paved the way for a clear distinction between the parts accommodating the hospital's core business – the medical machine – and the parts used for handling the continuous flow of patients and visitors. Unhampered by the medical and technological intricacies of the medical machine, the architectural renaissance of the 1980s and 1990s manifested itself in huge halls, large passageways, covered streets and squares filled with shops, boutiques and even restaurants. They represent a further evolution of the structural projects from the late 1970s. At the same time, they reflect the rise to power of a new type of management that sometimes embodies views seemingly inspired by the counterculture: professional, generic management took over from the medical staff, and this change occasionally resulted in a victory of the 'social' over the 'medical' model of administering healthcare.

23. J.P. Kloos, Diaconessenhuis, Groningen, 1966

24. Hendriks Campman Tennekes, Sint-Fransiscus Gasthuis, Rotterdam, completed in 1975

25. H. Cederström, Södersjukhuset, Stockholm, 1944

Since the 1980s, hospital designs centered around large halls and streets have been built by the dozens. The most extreme example in the Netherlands is the new building for the University Medical Center of Groningen (UMCG). Hailed as a revolutionary breakthrough at the time of its opening, it emulated the city by introducing covered streets, a huge hall, and many shops and restaurants. Located in the vicinity of Groningen's historic center, it partakes in the city's urban life. Whereas the 'public spaces' in this complex have been designed by Wytze Patijn, the hospital itself, designed by Kruisheer Hallink Arends and Team 4, is technically one of the finest examples of the structural approach promoted by Habraken. This design, which supposedly breaks down the walls between the hospital and society, actually brings them inside the complex: the difference between the public parts and the real hospital is indeed striking.

The fifth revolution: returning the hospital to the people

Paradoxically, the non-expressive architecture and the addition of halls and streets that only appear to disguise the hospital's function seem, in the final analysis, to underscore the machinelike qualities of most contemporary hospital architecture. The transition from a medicine-dominated to a management-dominated hospital has not curbed the process of institutionalization, and perhaps has even contributed to it. The counterculture failed to fulfill its promise: to return the hospital to the people. What this ideologically motivated movement could not accomplish now appears to be something that is beginning to be achieved by the very forces it tried to overthrow: private enterprise operating in a free market. All over the world the institutionalized healthcare systems are facing fundamental changes, allowing the hospital to thrust aside its character as an isolated, secluded fortress where the medical world reigns according to

its own rules and conventions, and to regain its status as one of the most valuable and important elements within villages, suburbs and cities. These changes are occurring simultaneously at various levels. The bureaucracies of the Welfare State everywhere are being curbed, if not dismantled: they are either transformed into more flexible and efficient management structures, or discarded altogether and replaced by the privately owned firms operating within the market economy. Promising the empowerment of the patient, the market claims it can deliver what the counterculture of the 1960s – an ideologically inspired, collective movement for the liberation of the individual personality – could not. But is the market likely to live up to its promises? Is it even conceivable that increased competition will lower the costs of healthcare, a sector where demand is largely determined by necessity? Moreover, will dismantling the Welfare State make healthcare too expensive for the less well-to-do, making them once again dependent on charity?

Technology, once the main justification for hospital architecture becoming as secluded and specific as it did, now seems to be working in the opposite direction, enabling architects to improve their grip on the design of complex buildings, at the same time making hospitals less specialized structures. Apart from certain very sophisticated machinery, technology tends to become portable, and modern information technology provides the means to communicate and multiply the results of medical tests, especially those carried out with high-tech equipment.

If neither the ability to deal with seemingly autistic bureaucracies, nor the skills to work in an environment dominated by technology can still be invoked to justify the isolated position of hospital architecture, there no longer seems to be any reason to reserve this field for specialist architects. An era of about five decades is thus drawing to a close. The fifth revolution should initiate a return to the basic principles of decent management, empowerment of the patient, de-institutionalization,

and the courage to re-conceptualize healthcare and to let it go back to its core business. In doing so, it may well contribute to containing the rising tide of populist (anti)political movements, which only underline the need for fundamental changes. Will the traditional hospital disintegrate and be decentralized, and become more aware of its real functional requirements and its position as a social institution? Will it dissolve into the urban tissue? Will it succeed in breaking down the mental barriers between necessary and recreational health promotion? Can it be transformed into a luxurious department store? There is no way to tell. The only certainty is that this is a propitious time for fundamental change. The fifth revolution has only just begun.

Hospital Futures – Humanism Versus the Machine

Stephen Verderber

The hospital as a *machine for healing* has become an anachronism. As a building type, the hospital remains a curious amalgam, with medical technology often pitted against humanist concerns. Critical discourse on the need for new, humanistic paradigms has been fragmented thus far and, ironically, remains insufficiently supported by the very institutions and government organizations that have the most to gain from a redefinition of the hospital, in architectural as well as in experiential terms. This dilemma is compounded by the enormous capital investment countries around the globe expend annually to promote the health status of their citizens.[1] There is little doubt that architecture can, and should, play a crucial role in humanizing the hospital. At first glance, this seems rather unlikely. How can architecture contribute to revolutionizing healthcare? Isn't this quite presumptuous, considering the fact that the time and money invested in solid research has remained scant in comparison to the massive capital resources invested annually around the globe in the name of improving the level of health of societies worldwide? Architectural theory is gradually evolving from a traditional reliance on historical precedent to a position informed by

critical analysis and, to some extent, scientific method. As Lang points out disciplinary activity in architecture remains, however, rather fractured and diffuse largely as a function of the continued, at times random, borrowing from allied fields in the social sciences, the humanities, and the engineering sciences.[2] In this article, we point out research on the subject of architecture for health in the context of an emerging science of architecture. Then we sketch some prognostications for the science and practice of architecture of architecture for health, and specifically, the future of the hospital for the year 2050.

The present: megahospitals – machines for healing – and the first attempts to deconstruct the machine

The science of architecture is about change brought about by decision making processes that, ideally, are based on rational insights and clear visions of the future. One of the qualities inherent in the science of architecture is its capacity to transcend history and paint a well-informed picture of the future. Rather than to analyze the methods involved

in the architectural processes of prognostication, we present a vision of healthcare in the middle of the twenty-first century. Naturally, we start with a short analysis of the present, which already contains the gems of the future even though it is only a passing stage in a never ending evolution. We started our argument by stressing the need for change. There is no better way to illustrate this need than the massive utopian megahospitals of the late 20th century. They represent the apotheosis of an unyielding belief in the power of medical science in the post-1945 era. Beginning in 1946, the race was on to construct ever larger and more complex hospitals and medical research centers, often occurring at the expense of long-established ethnic neighborhoods often disfigured in the name of urban renewal. Medical centers were transformed in a single decade (1946-56) into behemoths of unprecedented urban scale and complexity – as 'medievalist' enclaves. By the 1960s, critics assailed hospitals as frequently being obsolete from opening day. Chronic renovations, upheaval, and premature obsolescence in the face of dramatic advancements in medical science and technology gave rise to a new wave of thought.

The *interstitial* hospital was conceived as a vehicle capable of responding to the period's hyper-accelerated rate of change in the healthcare landscape. Architecture was a delimiting force in the view of many an administrator and medical chief of staff. The hospital had to become anticipatory, no longer solely reactive to external determinants. Interstitialism was to promote 'infinite' internal flexibility – universality – achieved by intermittently stacking one layer of a, say, patient care floor, with technical support floor either directly above or below. One of the largest of the megahospitals, the massive McMaster's Medical Center in Hamilton Ontario, which opened in 1972, was to represent the ultimate response to the architect's curse of accelerated facility obsolescence. Its proponents asserted the interstitial hospital was to be reinventable one hundred years or

more into the future. Soon it was learned, however, that it cost as much as 30-40% more in initial construction costs to incorporate interstitial systems. The prototype system developed for Tufts University Medical Center in Boston is shown. The Rehabilitation Institute of Chicago (1974), designed by C.F. Murphy Associates, was a high-rise machine hospital based on the theories of Mies van der Rohe. Mies had taught a number of the principles at C.F. Murphy (now Murphy/Jahn) while students at the Illinois Institute of technology. Compromises appeared such as partial interstitial systems where only one half or one third of the total floor areas per floor were served by an unoccupied support floor, such as at the St. Mary's Hospital on the Isle of Wright, in the UK. Many hospitals in developed nations which in 1980 operated 800-1000 beds by 2000 staffed hundreds fewer beds.

Most of the interstitialist machine hospitals built globally were designed and built for government client agencies. The Department of Veterans Affairs (DVA) in the United States constructed a number of gargantuan facilities during the 1980s and early 90s, such as the 900-bed replacement hospital in Houston (1984-89). Here, a series of platforms supposedly would allow for future expansion. In many respects, this hospital was obsolete the day it opened. This was mainly due its emphasis on inpatient care, at a time when the widespread cultural (albeit economically-driven) shift was well underway towards outpatient care in the U.S. This trend would become pervasive in both the government and private sectors. The DVA is now contemplating demolishing a number of its 171 acute care facilities, as acute care overcapacity is a chronic problem throughout the system. Most interstitialist hospitals have become dinosaurs, to varying degrees.

A new period in the ontology of architectural movements in healthcare appeared at the end of the 20th century, synchronous with the advent of the Internet and World Wide Web. The Internet, functioning as the

primary source of global communications over the coming decades, will foster, if properly harnessed, myriad innovations in healthcare and in architecture for health. New developments will continue to profoundly influence medical science, leading to the advent of the *empowered patient*. This will influence all places where healthcare is dispensed, and care received. New sources of inspiration will be explored, including the postmodernist sensibilities expressed in the contemporary hospice. The inpatient room will be redefined, and it will appear not unlike progressively designed hospice bedrooms, such as at the George Mark Children's Hospice (2003), near San Francisco. Site planning principles based on human scale, sustained, therapeutic contact with nature, and green materials and building technologies are being innovatively expressed in hospices, such as at the A.H.I. Hospice in Aichi Prefecture, Japan. The Bear House Children's Hospice (2003) in Manly, N.S.W. Australia has a broad exterior deck for use by residents and their families, and overlooks a garden.

The spiritual dimensions of architecture for health will experience a renaissance. The chapel, once a prominent feature of a hospital, all but disappeared in the machine megahospital. It became next to impossible to locate the chapel, as it was often reduced in size to a small waiting room. The resources invested in these spaces will increase. Again, the hospice, among other allied healthcare types, will be a source of inspiration. The chapel at Christopher House in Austin, Texas is dominated by a large stained glass mural.

The future: hospital architecture in the year 2050

By 2050, for those fortunate enough to have one, the home, not the hospital, will be the center of one's healthcare 'universe' supplemented by anyplace where one has online access to health information. Health promotion, sickness prevention education, and self-

empowerment is inhibited by a global discrepancy between high tech versus low tech societies and conflicting priorities between private and public agencies. Inequitable access and poor quality of healthcare for the poor and disenfranchised remains at critical levels on an increasingly populated planet.

The hospital and its successor institution will, as a building type, retain its timeless, essential role in the care of the most acutely ill. This is already occurring: online medical databanks and telemedicine practices are being formed in anticipation of the coming boom in home-based virtual healthcare. The dwelling is being rethought in support of its new function as a virtual *clinic*. Holographic 'consultation sessions' with one's caregiver will occur in one's family room or kitchen. The possibility exists, in theory at least, that the patient, if one has access to such resources, will have access to health information anywhere, anytime.

Artificial landscapes

Sensory immersion environments will very closely duplicate real natural landscapes. Many hospices are currently employing these humanist technologies, with positive results. A new field, design therapeutics, will explore these person-environment transactions. Artificial terrain tools and software packages will make it possible to fuse transparent linkages between human sensory modalities and the content of the experience of natural environments. Immersion landscapes, many of which are already to be found in zoos and aquariums, combine various elements of such real and virtual natural landscapes, and are able to be geared to suppress any undesirable, i.e. counter-therapeutic, content. They are fully controllable and monitored to create a desired effect such as at the Lied Jungle at the Henry Doorly Zoo in Omaha.[3] The cultural critic Umberto Eco writes of 'hyperreality' – imitations intended to be better than the originals.

3. www.vterrain.org, 2002.

11. Community health and wellness center in Narita, Japan. Designed by I. Kazuhiro (2000)

12. Balloch Children's Hospice, Scotland (completed 2005)
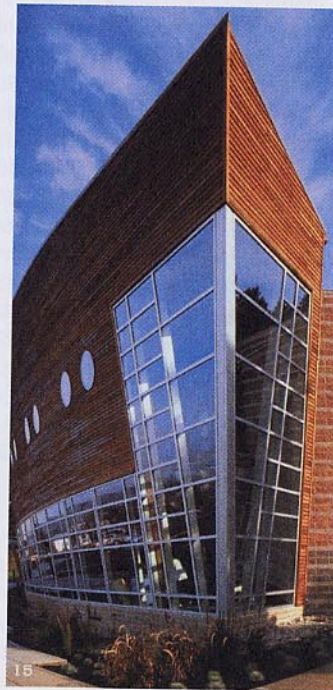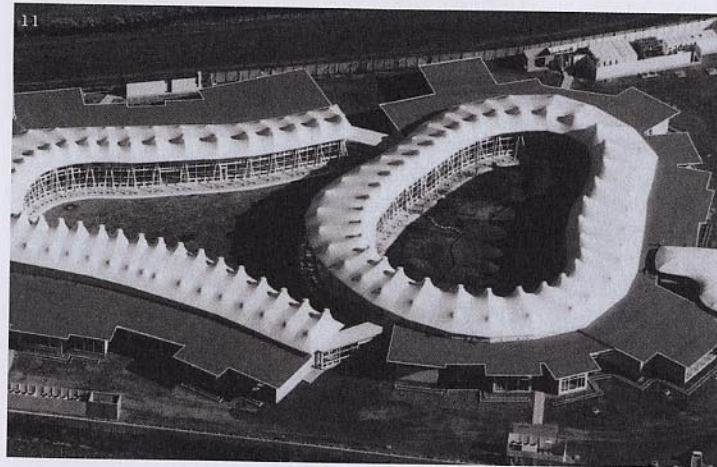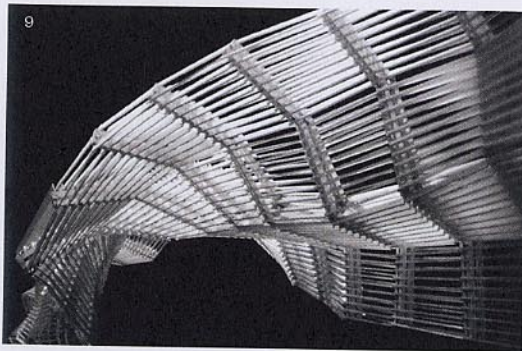
14/15. Hospitals will express new formal languages that extend far beyond the rigid orthogonality of the modern machine mega-hospital. Engaging, evocative vocabularies expressed in recent care settings designed for children should be expressed in care settings for persons of all ages

Artificial rain forests such as at the zoo in Omaha at present provide visitors a condensed version of world travel in which they experience only the most interesting and edifying features of natural places. Experiences such as this will be well integrated into the planning and design of hospital and related healthcare settings by 2050. The therapeutic effects of artificial landscape simulation in buildings will enhance the healing process. The natural environment itself will have by then been widely contaminated; all that is left will be faint recollections of the real thing, for simulations, sad as the truth is, will be the norm rather than the exception.[4]

Translucent, backlighted curvilinear wall panels replace the stoic traditional walls in the corridors of the Arizona Center for Health and Medicine. The panels transverse the color wheel, presenting a dawn to dusk panoramic progression.[5] In 2050, hospitals in dense urban settings will be able to tune out all undesirable, i.e. counter-therapeutic, stimuli (noisy traffic, smog, etc.). Active simulations will be supplemented by passive devices such as wall murals (a technique used at present in a number of institutions) and sophisticated lighting. One of the first modular patient rooms to incorporate active nature simulations is The Wellness Room. Walls and the ceiling can be specified with an aluminum lightbox housing photographic artwork. It is flush-mounted in a wood frame. Backlighting is used to activate the nature scene and to provide ambient lighting, controllable by the patient.[6] Form generative computer software will allow for these fluid form languages to be ubiquitous.

As for buildings designed for health, the 'CO$_2$,' building, its nickname derived from its plan configuration, is a community health and wellness center in Narita, Japan, near Tokyo. Designed by I. Kazuhiro (2000) this building provides one glimpse into the future as it intrinsically fuses nature and anthropomorphism in its parti. Today, hospital architects tend to think of the natural environment as itself therapeutic, yet still one step-removed form the formal language of architecture. In other words, the hospital can contain and relate to nature, but it itself is not inherently organic or biomorphic. In the CO$_2$ health center, however, nature provides more than symbolic inspiration, a backdrop, or a feature trumpeted in a slick marketing brochure. Here, actual trees from the site become part of the building's column structural system. These interior trees anchor a white fabric membrane roof system, beneath which rooms are deployed around a pair of courtyards shaped by the irregular curvature of the structure. In this manner, nature is brought into buildings as a means to protect it, to 'save' it, ironically, from 'destruction,' and to preserve its inherent beauty for future generations to admire and take cognizance of, at such a time when global deforestation will have done its irrevocable damage to the earth's forests.

Allied healthcare typologies, once again, will provide inspiration for the hospital architect. The cascading, wave-like formal vocabulary of the Balloch Children's Hospice, in Scotland (completed 2005), boldly reinterprets the relationship between the ground plane and the roof plane. Hospitals will express new formal languages that extend far beyond the rigid orthogonality of the modern machine megahospital. Engaging, evocative vocabularies expressed in recent care settings designed for children should be expressed in care settings for persons of all ages.

By 2050 the expert, empowered patient will have emerged only in those cultures wealthy enough to afford the technology to do so. In sharp contrast, the sheer volume of information available will elevate the patient and one's family to an unprecedented level of sophistication in richer societies. In poor societies the recipient (already widely referred to as the 'consumer' in rich countries) will be more acutely aware of one's plight and the available options, and therefore less (or more) empowered than at any time in history. An impediment to attaining political balance between the privileged and underprivileged in

4. Bentley, P.J. (2002). *Digital Biology: How Nature is Transforming Our Technology and Our Lives*. New York: Simon and Shuster.

5. Calmenson, D.W. (1999). 'Participatory Healing'. *ISdesignet Magazine*. March <http://www.isdesignet.com/magazine> (July 2002).

6. www.wellnessllc.com, 2002.

7. Ashton, J. (2002). 'From Sickness Treatment…to Sustainable Development'. *Green Futures*, Issue 34, May/June.
8. Green, E. and Wright, M. (2002). 'Healthy Bodies, Healthy Planet?' *Green Futures*, Issue 34, May/June.
9. Thurgood, M. (2002). 'Waste Future – 2020 Visions – and a Zero Waste World?' *Green Futures*, Issue 36, July/August.
10. Editorial (2001). 'Managing Biomedical Waste'. *Express Healthcare Management*, Issue 16, 31 April 2001.

13. Verderber, S. and Refuerzo, B. (2005). *Innovations in Hospice Architecture*. London: Routledge/Taylor & Francis.
14. Verderber, S. and Fine D.J. (2000). *Healthcare Architecture in an Era of Radical Transformation*. New Haven and London: Yale University Press.

societies will remain what is widely referred to as the *digital divide* – those with Internet access versus those without. This is no different than during the Middle Ages, where those who could afford to barter for privacy received a private room far from the hellish open ward.

Sustainability

Why is it that hospitals are often among the worst polluters in their communities? They generate excessive amounts of toxic waste, and the institution is nearly always planned and built with little regard to issues of environmental sustainability. The time has come when healthcare facilities must realize, accept, and appreciate the value of architectural sustainability.[7] At the very least they will be forced to awake to the public relations wisdom of being able to 'market' their institution from this perspective. By 2050, all healthcare providers will have been mandated to adopt 'zero waste' policies. Hospital incinerators will have been demolished, having outlived their original purpose. Where possible, site planning and building massing will be 'reinvented' in a reprise of traditional Nightingalian practices, such as in the 19th and early 20th centuries, in *microhospitals*.

The biggest problem will remain excessive resource consumption. By 2050 the notion of healthy bodies, healthy environment, will of necessity be widely accepted.[8] But by then it may be too late. In the latest *Global Environmental Outlook*, the UN Environment Program points out that one of the three pillars of sustainable development, the environment, is 'seriously listing' because of the distortions placed on it by excessively insensitive human actions. There is a paramount need to reduce the excessive consumption of the more affluent – 'as long as the richest 20% continue to account for 86% of consumption, sustainable development will never be achieved'.[9] Healthcare facilities globally will adopt the zero waste concept, following the lead taken by the man-ufacturing sector, where the initial objective was to simply reduce emission of wastewater and solid waste.

In India there are more than 5,000 small and private hospitals and nursing homes. Increasing population has caused a rapid proliferation of health facilities. India alone generates 3 million tons of medical waste annually and this figure is growing by 8% each year. Waste segregation at the source remains the number one problem, a looming crisis by 2050, yet this concept is not ingrained whatsoever in the culture, and therefore remains a low priority for administrators.[10] Around the globe, ignorance, political malfeasance, and cultural indifference will continue to hinder progress. Architects, armed with the results drawn from successful case studies, in consort with physicians, can lead in these re-education efforts in the community. Architecture and the fields of community health and social ecology will merge into a single entity as a matter of necessity.

Current best practices in sustainable hospital construction are being articulated. Architectural research on this subject will need to identify ways in which healthier healthcare facilities can be integrated with *eco-parks* in towns and neighborhoods.[11] Improved on-site management of waste from the point of site preparation and construction onward, and the establishment of materials specs on a 'fitness for purpose' basis will be mandated by law. In addition, policies will require little or no waste is created from the demolition of old buildings (as all materials will have to be rechanneled). Buildings will be designed for ease of disassembly and redeployment, with recycled first generation building materials used only when absolutely necessary. Contractors will be daily participants in centralized waste exchanges in order to stream old waste to new 'wasteless' uses.

Decentralization

The process of functional deconstruction appeared in the U.S. in 1983 with the advent of federal healthcare cost containment legislation. It has more recently begun to occur in other highly developed countries. Immense hospitals have become too expensive to staff and operate. Hospitals are being forced to reexamine their mission, scope of services, and community role. The trend toward outpatient care has resulted in a precipitous drop in the demand for inpatient beds needed for overnight stays. This process is ongoing in the U.S. and is occurring in many countries, including the UK's recent *Best Buy* hospitals, and in Japan, both of which have been loath to accept a less than singular role of the highly centralized hospital in the total scheme of things.[12] The functionally deconstructed hospital will require architectural research on its future complexion and its civic function, public and patient perceptions of its role, and its very sustainability in a resource-starved world. The movement toward smaller *residentialist* patient focused care centers is deeply rooted.

Meanwhile, the global palliative care movement, and the health promotion movement, will embrace this rejection.[13] The palliative care dispensed in hospice is a reaction against the scale and hyper-institutionality of the megahospital. As for acute care, small scaled *Critical Care Centers* (CCCs) will emerge in the coming years although large teaching hospitals attached to medical schools will always be needed.[14] The best CCCs will strike a sound balance between the machine and humanism. In the microstitial hospital and larger facilities alike, every inpatient room will possess transformable step-up or step-down technological capability at a moment's notice: from the most intensive levels of care to its use as a pre-operative dormitory room. Due to cost constraints, small-scale wards will return. Older, architecturally inflexible institutions will simply be too costly to maintain. Architectural research will be called upon to examine viable, high care, cost effective options without sacrificing humanism. Obsolete hospitals, no longer justifiable on either a quality of care or economic basis, will be demolished by the hundreds such as the shuttered Passavant Hospital in Chicago, or adapted to new uses, such as housing for the underprivileged.

Collaboration denotes openness to the necessity of sharing, of collective problem solving. New coalitions will out of sheer necessity occur with global resource management, optical imaging and holography, human genetics and biomedical engineering, chaos theorists, nanotechnologists, community health agencies, public policy experts, gerontologists and other social scientists, and specialists in many other fields. Useful architectural and environmental design research will be needed on the issue of design intervention, scenario planning, and identification of effective community-based participatory planning protocol.

The battle for healthcare

With the proliferation of HIV/AIDs and the outbreak of unforeseen plaques and epidemics in the coming decades, newly formed patients' rights groups will by default adopt extremist tactics. In a wave of anti-globalism, certain hospitals and clinics may be burned by patient care anarchists, while other factions will seek subtler means of change to the healthcare systems in their countries. Although much of this anger will be focused on the government-based systems of care around the globe, dysfunctional hospital architecture will come to represent an easy symbolic target, not dissimilar from how Middle Eastern extremists saw the World Trade Center in New York prior to 9/11. Sustainable provider-recipient partnerships will by definition be explicitly democratic, with proponents taking the view that people cannot be persuaded to care for themselves when they haven't had a voice in their own fate. Healthcare autocracies, for the less fortunate, will issue decrees as to who will live and who will die, as cost will emerge as the overarching factor in the age of (God forbid) human cloning.

11. Connor S. (2002). 'Hospitals for a Healthier Planet'. *Green Futures*, Issue 34, May/June.
12. The Nuffield Trust (2003). *Building a 2020 Vision: Future Health Care Environments*. Report. London: South Bank University/Royal Institute of British Architects;
Global University Programs in Healthcare Architecture (GUPHA). (2005). *Global Hospitals in the Year of 2050*. Tokyo: University of Tokyo/Japan Ministry of Health.

16. Tuxworth, B. (2002). 'Sit Still While I Empower You...' *Green Futures*. Issue 36, July/August.
16. Kramer, S. (1997). 'Agelessness'. *Self Help Magazine*, August; Kramer, S. (2001). *The Continuance of Existence*. Santa Barbara, CA: Creations in Consciousness.
17. More, M. (2001). 'On Becoming Posthuman'.
<http://www.maxmore.com> (July 2002).
18. Uldrich, J. (2002). 'Eleven Reasons Why Nanotechnology Will Arrive Sooner than Expected'. *Futures Research Quarterly*. Vol. 18(1).

Community development professionals have known for years that in order to engage effectively with disadvantaged groups one first must address the power imbalances that persist between them and the provider entity, i.e. the governmental agency, head-on. This practice is widely referred to as 'linking social capital'.[16] However, the digital divide will persist as a major political and practical barrier in the coming decades within the informational cognoscenti in the effective dissemination of health-related knowledge.

Superhuman

Aside from geopolitical interventions, advances in biomedical science will result in what will become known as the *agelessness* movement. The debates are already reaching a feverish pitch.[16] In an essay 'On Becoming Posthuman,' Max More describes the science of extrophy, a state attainable in, in his view, the aftermath of sweeping advancements in neurophysiology, neurochemistry, and human genetics.[17] He asserts that we have taken our first steps along this road by altering our species genetic structure to remedy nature's failures, and will soon develop a cure for cancer. We can now use Prozac, Piracetam, Hydergine, and Deprenyl to modify our physiology, enhance our concentration, and to slow brain aging. Research into more specific and powerful modifiers will accelerate as we apply new tools from molecular biology, computer assisted molecular design, and brain imaging. Health-monitoring machines are becoming more organic, self-modifying, and intelligent. Artificial life, neural networks, fuzzy logic are trends which signify the human race is beginning to incorporate its technology into ourselves. Computers and their interfaces will rapidly evolve to fit us: from mainframes and text-based interfaces to PCs and GUIs, PDAs, voice-recognition, and knowbots. How long before *nanocomputers* are implanted? We have embarked upon the road toward transmutation of the elements themselves in a bizarre quest for immortality.

Molecular nanotechnology will eventually afford total control over the structure of matter, allowing us to build anything, perfectly, atom by atom, even the reconstructed body. Some futurists believe that the abolition of aging and most involuntary death will be one result.[18] Machine intelligence researchers, roboticists, and cognitive scientists foresee even more radical possibilities. We may be able to 'upload' ourselves, our psychological outlook, memories, emotional responses, and values. This will occur just as we now do with software, only from our biological brain to our synthetic brain. Powered by these devices our cognitive mental processes could function hundreds of thousands of times faster (God forbid) than at present. This is the epochal world depicted in Steven Spielberg's futurist film *A/I* (2000). More attainable at a much earlier date will be the discovery of spinal cord regenerative medicine and of fusing the robotics with the design of the built environment, including the application of robotic personal assistants, or RPAs, for residents in long term care setting.[19] This is already occurring in Japan on a pilot case basis.[20]

Evidence Based Design

Greater diversity will be essential to the success of future research endeavors in architecture for health. This will require the broad participation of 'end user' constituencies previously shut out of the planning and design process. Evidence Based Design (EBD), initially a humanist movement, must not be allowed to be subverted or undermined by narrow, profit-driven corporate interests. It must empower those who are at present marginalized by public policy as it shapes global healthcare.

EBD originated in the United States in the 1980s as an alternative to the status quo. It was a reaction to the harsh, cold, dehumanizing atmosphere of the modern machine hospital. It sought, first and foremost, to place the patient at the center of the equation, not

19. Vikhanski, L. (2001). *In Search of the Lost Cord: Solving the Mystery of Spinal Cord Regeneration*. Washington: Joseph Henry Press; Mulhall, D. (2002). *Our Molecular Future: How Nanotechnology, Robotics, Genetics, and Artificial Intelligence will Transform Our World*. New York: Prometheus Books.
20. Stewart, A. (2002). 'A Silver Lining?' *Japan Inc*, 29:3, 6-8.
21. Bingman, A, Sanders, L and Zorach, R., Eds. (2002). *Embedded Utopias: Gender, Social Change, and the Modern Metropolis*. London: Routledge.

16/17. Transportable hospitals will be essential to serve the needs of disaster victims, globally. The accompanying illustrations depict modular systems that are transported via intermodal shipping containers via truck, rail, or plane. They can be deployed and erected in a matter of days and will in the coming years afford far more flexibility than standard fixed site, conventional hospitals.
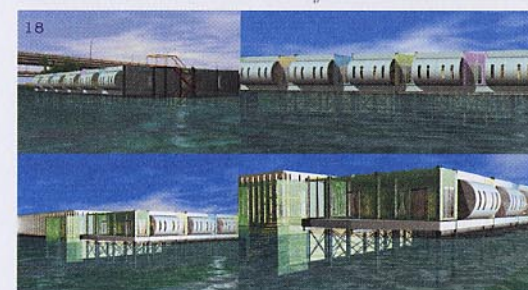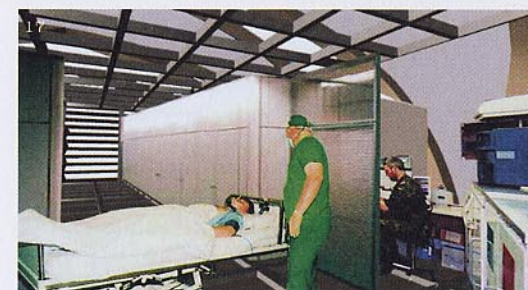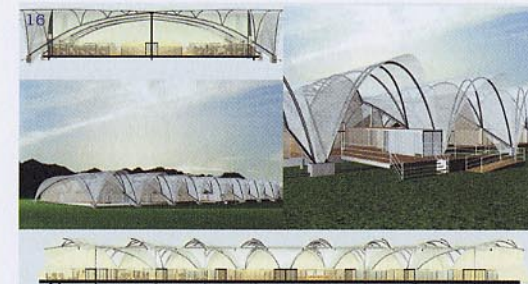18. An International Red Cross deployable special needs shelter has been developed for use in New Orleans, as part of the work of

the machine. It was therefore humanist in its origins and aims. If EBD is to flourish internationally, it must do so in a way that truly reaches persons of all walks of life and socio-economic strata, not only the wealthy and the well connected. The vast majority of work in EBD in the U.S. has occurred in private, for-profit hospitals. The present U.S. healthcare system, however, is on the verge of collapse. Nearly 47 million Americans lack comprehensive health insurance, and this number is rising. The U.S. federal government appears to have little interest in this movement. For EBD, the danger exists that it will therefore be 'taken over' by special interests in the private sector of the U.S. healthcare industry. As a result, and tragically, the probability is great that many millions of persons in the U.S. will be left out of EBD initiatives in the coming years. Despite this, a far broader spectrum of participation in EBD will be needed, including individuals and groups affected by issues of racial inequity, gender inequity, and economic and political marginalization, than at present. Others echo this theme as well.[21]

It no longer suffices for the evidence-based researcher or designer to speak only with the top decision makers of an institution or organization, or only be asked to justify its worth on the basis of how much money can be saved in hospital operational expenses. What of the poor residents of the local community? Who will represent their views? The distance between the end user, usually at the bottom of the decision making pyramid, and the leadership of an organization, usually at the top, will have to be compressed, and, in extreme cases, inverted. This emerging movement has been centered in the U.S. almost exclusively in the for-profit sector. As the EBD movement becomes more widely known beyond the U.S. it will need to be *adapted* to diverse micro-cultural contexts. For this reason, EBD may be difficult to blithely cross-culturally transfer from American case studies to universal health coverage system case studies in other countries, unless cross-

a group of architecture students at Tulane University, intended to be set up before a major hurricane event, or in the immediate aftermath of a major disaster event.
These shelters were developed long before hurricane Katrina hit New Orleans.
19. Mobile clinics also in the future, if properly funded by government sponsor agencies, will afford many transprogramatic opportunities in the provision of post-disaster healthcare in the coming decades.

22. Verderber, S. (2005). *Compassion in Architecture: Evidence-based Design for Health in Louisiana*. Lafayette, Louisiana: The Center for Louisiana Studies.

23. World Health Organization (1998). *District Health Facilities: Guidelines for Development and Operations*, and World Health Organization (2000). *Global Water Supply and Sanitation Assessment 2000 Report*. Geneva, World Health Organization.

cultural, political, economic, legal, and regulatory differences are taken into consideration. In countries with national health programs for all citizens, these pitfalls are unavoidable without built-in safeguards. An alternative EBD paradigm in the not-for-profit, governmental sector, which may be of particular interest in Europe, does exist, however. In Louisiana, a fifteen-year (and ongoing) project in EBD is perhaps the longest of its kind in the world in the not-for-profit governmental health sector.[22]

The open architectural design competition is a second, closely allied, knowledge-generative vehicle that is being underutilized at present. Through history, architects, no strangers to making future-oriented prognostications, have often worked in isolation, adopting an aloof, heroic stance. The vehicle of the design competition has fostered this predilection to a large extent. Many building proposals, in the context of competitions or otherwise, have been linked to polemical manifestos. Regardless, healthcare clients in the U.S. have generally been loath to use the design competition as a means to award commissions for their buildings.

In search of the future

Healthcare architecture, EBD program notwithstanding, must proactively anticipate new challenges in the coming decades. First, facility transprogramism defined here as ecologically sustainable, multi and poly-functional buildings and typologies, will become a far more viable design strategy. Healthcare buildings in the future will have to adapt and flex, both in real and in symbolic terms. Single-use buildings for healthcare in crowded, land-starved urban landscapes will become obsolete. Westerners, in a world of high construction costs and diminishing natural resources, will be forced to learn useful lessons from the Japanese, who have mastered transprogramism, far beyond the static concept of

fixed site 'mixed use' buildings in their densely packed cities. Similarly, anticipatory 'flex' properties of hospitals+ on a single site will allow for readily reconfigurable permutations in response to occupants' evolving daily and long term needs and aspirations.

Second, new forms of *person-nature transactions* in the healthcare milieu need to be developed: The tectonics of nature transportation and assimilation into the healthcare setting has barely been explored. Therapeutic views of nature from hospital room windows have been proven to have a positive impact on well being. This work, however, has been centered largely on the patient's access to *authentic* nature content. Much more work is needed on this facet of person-nature transactions as well as on artificial landscape representations from a multi sensory standpoint. Third, *architectural tectonicism* research will be needed on the increasing blurring of the lines intrinsically, traditionally, separating humans from buildings. Advanced technologies will enable humans to attain a far greater level of interactivity with one's setting.

From the epochal events of 11 September 2001 to the inability of a mother in Ethiopia to obtain life-saving immunizations for her infant, complex global issues loom larger than ever before. Geopolitical and population issues demand attention. The world's 6.1 billion population increases by nearly 9,000 persons each hour. Several worldwide population institutes estimate that, by 2050, between 9 and 9.5 billion people will be living on the planet.[23] Populations in need of global architectural intervention will include communities ravaged by HIV/AIDs, malaria, tuberculosis, plagues such as the virulent Ebola virus in Africa, and new strains of yellow fever. Add to this the profound pain caused by new settlements built in places where they should not, such as in low-lying coastal zones, earthquake-prone regions, and in the midst of notorious hurricane 'alleys'.

Bionics, robotic engineering, transprogramism, and anthropomorphism must be

balanced with humanist concerns. New, sustainable building materials, assembly systems, and anatomical-operational systems will have a profound influence on human well being in post-disaster situations. Transportable hospitals will be essential to serve the needs of disaster victims, globally. The accompanying illustrations depict modular systems that are transported via intermodal shipping containers via truck, rail, or plane. They can be deployed and erected in a matter of days and will in the coming years afford far more flexibility than standard fixed site, conventional hospitals. An International Red Cross deployable special needs shelter has been developed for use in New Orleans, to be set up before a major hurricane event. Mobile clinics also will afford many transprogramatic opportunities in the provision of post-disaster healthcare in the coming years. The needs of the homeless remain unmet in many parts of the world. Homelessness will increase unless architects rise to the challenge. A National Guard armory in New York City was in fact a gigantic hospital ward, as many in this overnight shelter were infected with TB. This disease runs rampant in open settings such as this makeshift, wholly inadequate, inhumane facility.

Summary

The intent of this discussion has not been to present a manifesto of any sort. It is merely a sketch of some of the many events which are unfolding now and just beyond the immediate horizon. Dismissal would be premature and unfortunate, as there is a curious, at times dismissive, attitude toward the acceptance of new research-based knowledge by the mainstream profession. Robinson (2001) writes: *'Today it is insufficient to simply assert expertise. Expertise must be backed up by a clearly defined, visible, usually linguistically described, coherent body of knowledge. Lacking this, the profession of architecture has found itself at a disadvantage relative to other fields and with questionable status as a profession... Before, the architect was simply trusted to know about building... the architect (now) must provide verbal evidence and justification for one's decisions... the existing structure of this knowledge base and of theory within architecture, however, does not easily incorporate... new forms of explicit knowledge... Rather than simply being (put) in the responsive mode, architects will have to become proactive, generating full discussion of (the) issues'.*

Futurist perspectives always run the risk of didacticism and will be viewed skeptically by some. At the very least, it is hoped, it will be of some value to specialists working in its central subject area. It is also hoped that this conceptualization and others like it can serve as stimulants for an expanded, far more generously funded set of new initiatives. The private and the public sectors need to work in tandem, becoming more active sponsors of such work. Future research must fuse all this with the timeless, enduring qualities of architecture. Humanistic qualities center on the importance of place, hierarchy, appropriate scale, harmony with context, enclosure, appropriate materiality, appropriate ornamentation, the importance of art, the need to control the trend toward excessive commercialism in architecture, and the timeless importance of community. The future of scientific discourse in healthcare architecture deserves no less. It is time to fully recognize that humanist-based research in architecture for health has so much to offer societies around the globe.

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