# Like a Certain Kind of City

An epistemology of intelligent buildings

**World literature on "intelligent buildings" seems to be rather lopsided. Compatibility with known or still unknown information processing equipment seems more important than the present and future needs and social requirements of those dwelling inside "intelligent buildings" — and outside. Furthermore, no professional consensus on what renders buildings "intelligent" is found existing. In order to deal with this Janus-like aspect, this essay was co-authored by two practitioners, an architect and an information scientist. They analyse what man expects from the environments built to meet his social needs, guided by the insight, that any building perceives the future needs today. Facing unprecedented progress of information and communication systems, we now seem to need an entirely new metaphor as we build for the least material but socially most important resource. The metaphor suggested is "a certain kind of city", to wit the city of Chioggia, near Venice, some elements of which city are fundamental characteristics of a truly intelligent building.**

## Introduction

"First we build the buildings, then the buildings build us."
*Winston S. Churchill*

The headquarters of the Hongkong and Shanghai Banking Corporation probably is the most expensive building in

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the world. Nobody knows the exact total cost of design and construction. The lowest estimate is well over U.S. $ one billion, — a realistic minimum. Total cost may have been significantly higher.

When one so substantially lightens somebody's purse, particularly a banker's, just for the sake of providing one office building for the use of one organization in the mid-eighties of this century, it is obvious that this must be labelled "smart" or "intelligent" building.

"Smart" is an intriguing word, a relative of the German-rooted "Schmerz", standing for grief, or pain. In contrast, the word "intelligent" strikes us, if associated with buildings, in a more positive vein on the etymological level. The "intel" hails from latin "inter", between, and has to do with mutuality and connectedness, while the "lig" is associated with to read, to select, to be finicky, or to collect. The great biologist *Lewis Thomas* says in his book "The Lives of a Cell", in the chapter "Living Language", "The way a word is used this year is its phenotype, but it has a deeply seated, immutable meaning, often hidden, which is the genotype." In this context, we can not want a building to be smart; it must be intelligent. Buildings inflicting pain to those dwelling in them do not fulfill their function. We are, perhaps, in search of a new genotype.

*Norman Foster,* the designer and architect of the new element within the urban structure of Hongkong Island, is British. During the design of a building e.g. in London, there is no need to consult an outsider, a magician, or a soothsayer; this requirement evaporated from the building scene in England at the end of the seventeenth century. But in this particular case Foster had to follow the advice of the Hongkong and Shanghai Banking Corporation's "fungshui" expert. "Fung-shui" literally means "wind and water"; elements of prime importance when one is living on an island. A fung-shui expert has, in Western terms, some elements of a magician. He indicates, very early in the building process, and in very broad terms, the general nature of the circulation patterns in a building, its orientation, and such niceties as the colour scheme of curtains. He is no architect, to be sure.

The fung-shui expert of the bank is the distinguished *Koo Pak Ling.* In the early design stage, he advised Foster to situate the main entrance on the North-West — and some fifteen metres above street level. Being a distinguished gentleman himself, Foster obliged, of course. Superfluous to say, shunning "fung-shui" advice is calling for trouble. Foster still uses Koo's humble little sketch while lecturing on the Hongkong project. This information is not given to poke fun at a milestone deci-

sion of an architectural process which has resulted in an innovative and esthetically pleasing urban element. What is intended is to draw attention to the undeniable fact that each addition by man to our built environment is at the beck and call of idiosyncrasies, irrationalities, artistry, traditions, considerations and objectives which transcend, by a long chalk, the requirements of the simple and straightforward task-at-hand: building a school, building a farm, building a bank. The right building has always resulted in an intelligent building. Dumb buildings simply disappear within a century or so.

The Pantheon in Rome is an intelligent building. When people build, they anticipate. Any building is meant to meet future needs as perceived in the present. In a building we physically express that view; we express fear, hope, confidence, or suspicion. "Let me see what you build, and I will tell you what you are." When intelligent buildings are degraded to mere smartness, when human communal creativity is reduced to mere mechanistic expediency, harm has been done — the type of harm you cannot put on anybody's doorstep. In the meantime we would have given to posterity our "testimonium paupertatis", the meanness of the "bottom line" and its alleged mastery over all human and rational decisions. *Speer's* buildings, or what remains of them, are among the most telling agents informing us about the kernel of values in fascist Germany. If the view of the future of those who put their hopes on information and communication-intensive high-technology is really directed at the goal of improving the destiny of mankind, the buildings associated should at least show strong roots in human tradition.

## Start of the Discussion

Intelligent buildings were not discussed by architects first. They were discussed first by computer people and real estate developers. Such origins of the discussion are not the best omen. Somewhere in his work "The City of History" the great *Lewis Mumford* defends the view, that there are only two primeval arts: dance, which defines the life of mankind from the inside; and architecture, which defines the life of mankind on the outside. Leaving the design and construction of buildings to information processing people, real estate agents, not to mention information and communication gurus, is dangerous. It is

like leaving a liquor bottle with a drunk, or the building of a temple with a priest. No good can come of it.

Furthermore, discussion has started just very recently. The very expression "intelligent building" does not seem to be older than the present decade. Some claim that the energy crisis of the 70s has created strong demand for energy management services, and that the cradle of the notion of the intelligent building belongs to that era. It is not important whether this is the case or not: the early literature emphasizes allocation of things, rather than people, in the building. Ducting, wiring, connectivity levels, pluggability, modularity, flexibility, e tutti quanti: they are all primarily associated with electronic data processing and telecommunication equipment; human beings tend to be considered as mere appendices needed to operate the systems and machines. Seen from the position of architecture as culture's main applied art, the discussions appear decidedly pedestrian. "It can be done; and we know how to do it; after all, it has been done before."

The struggle for a new architectural paradigm is strangely lacking. If it is true that the current discussion on "smart" or intelligent buildings centers much more on how to create spatial envelopes of largely unexplored machinery rather than on the people they will house, and why they will work there and how, one can certainly claim that such unwarranted and undesirable preference for equipment over people is a steady trade wind on the compass of Western industrial activity. The assembly line is older than the science of ergonomy; emergence of this science was caused by sickness and accidents. Fatigue in metals as an object of science is younger than the practice of building iron bridges; the emergence of that science was caused by collapse and disasters. Visual displays of computers were massively used before any information technocrat worried about ophtalmology and physiology. Perhaps we are still in time to avoid this kind of irrational and inhuman development — a very capital-intensive one — to happen for intelligent buildings.

This absence of fundamental discussion on the future of our office buildings is particularly strange because of the alleged revolutionary consequences of communication and information technologies for our "postindustrial society", for "the information age", for "the era of leisure" or what have you. Even if such social changes are discussed without the customary hype that is expected from systems' vendors and addicts, it is evident that the very nature of the great

troika of activities, for which we build, is changing fast: Living, working and relaxing.

Telecommunication facilities and low-cost data processing systems of great power theoretically enable a high percentage of the work force to stay home and work there; add to that a fair share of video conferencing, electronic mail and message systems, and one could just wonder why so many of us still darken the doors of our employers. The on/off premises distinction has almost ceased to exist. Many tasks, like "putting it all on paper", "you just sit down now in quiet", and "write me that application program", are even performed better in the quiet of one's own home. Even compared with the situation of ten years ago, the necessity to go to one's office has eroded further. So where is the need for an intelligent building?

## What is Housed

"Get thee to thy electronic cottage"

Too often the tacit assumption, that the main product generated in intelligent buildings is signals and data, is wrong. When we bring people together in order to work together towards certain objectives, we should realize that the information and communication patterns needed to accomplish those tasks not entirely, and sometimes hardly, depend on spoken or written language. All our senses are involved while communicating. And there is the rôle of proxemics, the study of people's use of space as a function of culture, the effect of culture on the structuring and use of space, personal distancing and the unstated rules for laying out our built environment. In the change from the traditional Japanese home, which by its very structure stressed eating, studying and sleeping together, to the American-style home, the Japanese families were on very short notice compartmentalized; children started to grow up leading "separate lives"; following *Takeo Matsuda,* the successful housing industrialist who helped to bring about this shift, the spatial break in the tradition has contributed significantly to an increased level of violence in Japanese families and schools.

One should expect the intelligent building to generate rather creativity and knowledge. It would foster and promote intelligent behaviour of those working in it. Naturally, the occupants and tenants of intelligent buildings shun routine information processing. With automation of all types of routine work, more and more activities still per-

formed by human beings will vanish into the black hole of electronic machines. Of course, there will always be the kind of person who does not mind the fact that a machine can do his job just as well, or better, than he himself. But in the end he will be more expensive than the machine. The intelligent building will function in a society which does not reward human labour any longer, which can be automated. On signal, data, and information processing levels, the intelligent building certainly does not suffer a self-inflicted scarcity. In a sense it is immaterial that it houses all the electronic goodies of today, tomorrow and of the next millennium. All the files and data bases, all the expert systems and processing power in it could be available, in principle, anywhere in the world.

What makes the intelligent building so special is that it forces, by its very structure, logistics and functioning, the people contained in it to perform in that environment all the tasks which can not be delegated to machines and which require, at the same time, in a here-and-now human community. We have, over the past forty years, completed an immense full circle as a society: once again we have endorsed slavery, the slaves being not our fellow human beings, but inanimated artefacts. The total range of individual tasks required in that society, which can only be performed by human beings, has already diminished dramatically; and the pace of that process still quickens. It will throw us back on the ultimate question: what are our truly exclusive attainments and potentials as a species? What will the machines leave to us? Where do we come in?

## Looking Back to the Future

We could recall another development, which changed the face of the human world: the discovery and subsequent endorsement of agriculture. Before the agricultural revolution society still was nomadic (Homo Sapiens' original way of life). The concept of "work" is absent in the intellectual apparatus. Of course you can go and pick roots and berries, or you can go and hunt an elephant, but you couldn't call these activities "work"; the abstract construct just wasn't there. Settling down at one spot, tilling the soil, waiting for the crop to grow, resulted in that construct, together with the possibility to employ slaves — and to build enduring buildings.

By the same token, all the elements of some 7000 years ago still are with us; the same concepts require new interpre-

tations and an entirely new positioning on our societal map. It might very well be that our building — particularly our intelligent building for the future — will develop into one of the most decisive factors of the process as a whole.

Our track record in this foresight has been far from impressive. Assuming the weirdest interconnections and cleavages between eating, sleeping, meeting others, working, relaxing and transporting our bodies, we have come up with jungles for commuters, urban wilderness, totally abandoned cities, urban sprawls of a mind-killing dullness, industrial wastelands, castrated villages, and the rape of landscape. We could have done better; and in many a century we have done far better than during the last two hundred years.

Blame it on the Industrial Revolution; blame it on anything you might think fit; but seen within the perspective outlined here it is indisputable that the intelligent building's design and construction requirements can not be limited to the hum-drum considerations of wiring and the pedestrian ins and outs of where to place our work stations and mass storage devices. We seem to need really a full-fledged epistemology of intelligent buildings.

## Models and Metaphors

It has been said that only after the invention of the wheel we could develop a notion of the structure of our solar system. Perhaps we can only understand a complicated system if we have something at hand, created by ourselves, which is in certain ways comparable with it. Computers, built by ourselves, have provided us with a new way of looking at the most complicated system of all: the human mind itself.

In the Western tradition offices have also been included among those complicated systems; so we started to compare them with other things that we made. Strangely enough there is an overwhelming tendency to compare it with notions belonging to horticulture, that other all-pervading tendency in mankind: to make gardens. In the nineteenth century one discussed "the ink pool" just as naturally as in the twentieth century the "office garden". When we now are building our science "parks", we just enlarge our metaphoric sphere of gardening. In this respect it is illuminating that even city development needs a new metaphor: the great prize announced for the design of Kawasaki City in Japan is centred around the requirement of a city identity — CI, to be sure. The wisdom of the city's gov-

ernment, and its advisors, has ordained its CI, to become the university campus. "Camping", "campagna", "les champs": fields, tilled acreage: it is nature again, now joined by the military, the entire development ending in the university campus, metaphor of a new city in Japan, resting now and forever on weak architectural hinges and conceptual foundations.

The best American campuses are eighteenth century English villages, with a bowling green, a church, housing, a pub or two, city halls, a library, meeting places and all the other accoutrements devoted to almost rural, comfortable and predictable living. This is certainly not the stuff our social future is made of. Choosing the wrong metaphor means to build on sand. For intelligent buildings we must build on sound bases. If our metaphor for them would be wrong, we ourselves and our children would have eroded and misused a legacy, which might have been unique.

"The Architects' Journal" of 1973 is probably right when it stated the following: "The concept of the office can be seen as one of the most consistent threads in any culture, for systems of government and manufacture may change beyond recognition, but in any organization of human beings which extends beyond the smallest group, the word office, and the idea it represents, emerge as stable components of language."

Why should we compare it to a garden? Why not to a piece of machinery, an assembly line? The author was not able to find full historical proof for this. An explanation could start with the observation that in 1881 there were only 7000 women clerks in England and Wales. In 1911 there were 146,000. The success story between the two dates is the story of the typewriter, that nineteenth-century text processor which got half of the potential work force of the world, women, out of the isolation and shelter of their own house and garden. Women's emancipation owes a great deal to Messrs. *Sholes, Remington, Beach* and their ilk. The office very quickly became a home away from home, and loss of one garden had to be compensated by the one of the employer.

Intimacy, quiet, wholesomeness, dilibe done: all these elements inherent in gardens and gardening might have had their counterpart in the world of the office. But one wonders whether this comparison was made in order to guild the lily of leaving the domestic environment.

Above it was shown that we must expect from an intelligent building a func-

tional range of activities which is immensely wider than the one of routine, unautomated data processing of the old style office. In our badly needed metaphor for an intelligent building we can not content ourselves with the retribution for environments we gave up, the garden, the park. Our new mataphor should inspire, not console.

Our model for the intelligent building, our conceptual metaphor of the intelligent construct, which should guide our thinking on them and which would be the compass of our design, by necessity, also is a man-made thing: the city.

## Like a City

The word "civilization" goes back to the city. (Admittedly, culture is an older notion.) On all the major crossroads on the long road of the destiny of our species in the last 7000 years, innovation and changes always expressed themselves within the physical form and structure of cities, for better or for worse. Cities have been noble and mean, inspiring and dull, simple and complicated, stubborn and flexible, just as man himself. This essay defends the view, that it is best to think of intelligent buildings in the terms of those employed for cities over the millennia, the comparison is made between two types of individualism: the one of the city we know so well and the one of the intelligent building we know so little.

Comparison of a building with a city has its history, of course. The modern roots of this line of thought were clearly expressed by the group of architects around the architectural magazine "Forum" which was worldwide influential in the early sixties of this century. In that professional context, with important names involved like *Aldo van Eyck* and *Herman Hertzberger,* a new discovery was made. The individual building ceased to be of interest to them. They were, instead, fascinated by the capability and the potential to fill in old structures and to expand existing ones. "Forum" stressed the added value of totality and communality. The "agora" of the Greeks, and the "forum" of the Romans expressed the notions that a built environment should offer both public exposure and personal seclusion, together with all transitions in between; that it should offer to those using it a wide range of potential uses and activities, the user deciding what he chooses to take in any given moment and under particular conditions.

When we start thinking under this new metaphor for intelligent buildings, the

city, about requirements like flexibility, modularity and expansion, we see that those design considerations were met, almost instinctively, by the city: a shopfront in a fashionable area can change quite a few times in a decade, together with associated functional structures of its interior. The yard thick layer of sand between a city's foundations and its street level have allowed it to adjust to new ducts, cables, and structures. But it is not only "the systems hardware" that counts. An urban structure like Rome over the millennia has housed so many populations, occupational densities, social interests, inhabitants and visitors, that it presents us with a very valuable simile of what intelligent buildings should try to attain.

The metaphor proposed is even more apt when we see it in the light of recent historic and economic research into the rôle of the historical city as it developed in our contemporary form. More clearly than ten years ago, we now understand, due to important and influential books like *Jane Jacob's* "The Wealth of Cities" that the granularity of economic progress is not the one of individual countries and nations, but rather the one of the successful city. Within such a view, Silicon Valley is a city, a focus of related activities aiming at the furtherance of a particular civilisation — and, some would argue — of a particular culture.

## The City and Diversity

Diversity is to people what light is to trees: it makes them grow. The identity, the coinciding position, is darkness. This darkness descends on us when we leave things as they are, when we allow higher and lower powers to take their course. Identity and sameness are the rule, diversity the exception. We have to earn diversity. It will not come by itself. Just as mechanical work can not be effected in the absence of a difference in entropy, meaningful human work can not be performed in the absence of diversity. We talk to each other because we differ. Clones won't talk; there's no need to. We travel, literally and metaphorically, for diversity; identity is always home.

It seems strange that both the increase of diversity and of sameness is fuelled by itself: both seem to be self-enhancing processes. When you are already rich in one, it's easier to become even richer. The only difference is that the gain in diversity can always only be achieved by an act of human will, while the will of raw natural laws sees to it, that the gain in sameness is achieved mechanically.

There is no newness, no change, no creativity, no innovation in the identical. Its ultimate result is perfect exchangeability of all individual elements in the soup as a whole; the very word "individual" then is wrong. There is no individuality left. But when we plant, nurture and nurse any seedling of the enormous family of Diversital Humanis we go against that grain. There is no space here for perfectly causal explanation: watering one particular root will cause increased vigour in the growth of quite unexpected branches; by acquiring a taste for diversity in classical music, an ensuing fresh insight in artificial intelligence might result. We need all the diversity we can get.

The closer we find ourselves to the fountainheads of diversity, the clearer we will see that the introduction of it in the intelligent building enables that building to become truly intelligent. Not only that it can be wired cheaply, and that it can assimilate new, and as yet unknown, hardware, but also, that the building itself enhances and fosters intelligence in those who dwell in it.

Turning a corner in a village will comfort your need for security and confirmation. Turning a corner in a city might mean an opportunity, meeting a stranger. It might mean a danger, too. The village can never be the metaphor for an intelligent building just like a garden can not. Turning a corner in one's garden only takes you to the levels of surprise inanimate nature is able to provide. Certainly, they are not to be sniffed at, but they cannot contribute in any imaginable way to the raison d'être of intelligent buildings. Of all things created by man, it is the city which is best equipped to fulfil the rôle of generator of diversity: in cities there will be villages, gardens, parks, nooks, crannies, plazas; "city" is just a different word for diversity.

## Like a Certain Kind of City

But it would be too general to propose any odd kind of city as a new conceptual metaphor for the intelligent building. Not just any kind of city will do. Cities have been lifeless; cities have been artificially constructed; cities have strangled themselves with the rope of their own achievements. Within the quest of our epistemological endeavour we must look for a certain kind of city.

It has been an economical and cultural ailment of many a city that it clogged, that distances became too large, that those expanding it were under the impression that growth could go on unlimited. Under the investigation of the architectural evidence of this kind of handicap, it has become clear that linearity is a superior ingredient to ward off these evils. A linear structure is incomplete, open-ended; it does not clog because of too large distances.

The linear city is almost the archetypal city. Linearity is, of course, the most direct and functional device to get from the objective to the subjective. The Cartesian grid is, in comparison, already an artificial, intellectualizing construct; three-dimensional coordinates are the domain of mathematicians. If we would rebuild New York from the flat city it is, regardless of all its skyscrapers, into a perfect mathematical sphere, while allowing to each inhabitant an unchanged number of cubic feet to work, live and dwell in, all New Yorkers would be within walking distance of one another. But the intellectual effort to get from A to B would be truely superhuman. Only when historical cities become too large, do they become non-linear. Two dimensions are already implying a loss of flexibility and ease of use. Motion is a linear phenomenon, after all.

Furthermore, excepting its functional superiority, linearity in a city is almost the city's cradle. As from its foundation and during its first beginnings, in its infancy, a linear structure in the young urban nucleus is by far the one most frequently found in urban history.

Of course, there can be many valid reasons for abandoning linearity. And many easy enticements. One of the most important is the absence of any constraints on building space. Spatial and geographic constraints have given raise, historically, to some of the most exquisite and efficient urban structures: Renaissance Venice, seventeenth century Amsterdam, twentieth century Manhattan. Obviously, all too easy possibilities of thoughtless extension do not seem to be a fertile environment for finding sound urban solutions.

It is clear that these constraints of the city in historical perspective find their equivalent in the constraints of the extension of existing buildings.

One city in particular shows all the elements of these considerations. Its structure and functions will provide the metaphor we seem to need for intelligent buildings:

The city of *Chioggia* developed its present structure over the same period that saw the birth of Venice, the seventh and eighth century. Its very first beginnings are considerably older and go back to

pre-Roman days. In the chaotic period after the collapse of the Western Roman Empire a part of the population of what is now North-Eastern Italy looked for safety and new ways of existence on the lagoons and swamps that rivers, tides and seacurrents had created in the Northern part of the Adria.

Chioggia occupies an island in the south of a lagoon which also comprises Venice. It has kept its original structure. It is a structure it shares, typologically, with the very first beginnings of Venice.

Basically Chioggia occupies one main island, 800 metres long, 400 wide, almost a rectangle, at the two longer sides locked in by two gullies of the Brenta river, the Canale Lombardo and the Canale Santo Domenico. This position determined Chioggia's shape, and the impossibility to increase its gauge and measure.

In the heart of the city (perhaps one should say along its spine) runs, almost exactly from North to South, a piazza street along the entire length of the city, the Corso del Popolo. At its east side a canal was constructed, very early in Chioggia's history, the Canale Vena.

At both sides of this one main street are high-density residential areas; the Eastern part being connected by nine bridges across the Canale Vena with the middle of the city, where all public social functions are concentrated. The seventy or so residential streets, each some 150 metres long, are at right angles with the City's spine, the Corso del Popolo. On some smaller nearby islands industry is located since the days of yore.

From the mainland Chioggia is reached via a bridge in the South. As a terminus between two types of motion, walking and sailing, the city has developed into the largest fishery of all Italy. In the Middle Ages there was also a most important production of salt; on the mainland onions provided another source of income. Owing to all this Chioggia developed into the medieval larder of Venice.

Until this very day the city's functional flexibility is amazing; modern fishing boats use the two gullies some five metres from one's front door, while the authentic small, wooden fishing boats are now found in the Canale Vena, where they carry all kinds of things: of course the fish and fruit markets are still there.

In its zenith Chioggia sheltered a population of some 20,000 souls; that is a density of some 800 people per hectare. This population accomplished the marvellous feat of building a complete city on the tiniest of surfaces, complete in itself, and containing all elements innate

in the added value of urban life. The social structure of the city has, miraculously, stayed preserved and intact, and alive. Chioggia is still the perfect machine to meet friends, colleagues, clients; if one so chooses. The balance between working and living and between companionship and solitude is optimal.

## Beyond the Look-alike

Even the most appropriate metaphor can not be translated back into the reality from which it grew in a one-to-one mapping. In this case, the conceptual, clarifying rôle of the metaphor would cease to exist. It is not a matter of mere mimicry. Each individual stone of Chioggia cannot be said to have a one-to-one relationship with each smallest unit of the intelligent building we want to construct on intellectually and culturally solid foundations. Chioggia as it stands now is not an easy, mechanistic recipe on how to build the environment we envisage.

To get back to that reality requires not so much the gifts needed to prepare a decent business long-term planning or next year's corporate budget, but instead the appropriate artistry and poetry. The reader is asked not to leave these pages instantaneously now: "artistry" is etymologically based on Latin "ars", craft, while poetry comes from the Greek for "to make".

In order to provide a potentially helpful vocabulary to enable and facilitate this less than pedestrian translation, the authors would like to present the beginnings of a body of considerations that could serve to realize the transition involved. As it behoves such a body, it is ill-assorted and loosely constructed; it invites new and additional elements. In order to express the nature of this particular type of vocabulary clearly, the individual elements will be looked into separately.

## Slow building process

General culture in the first world has alienated itself, gradually but surely, from things unfinished, not yet finished, from the experience of watching man-made objects and structures being finished not within a period of a few months or years, but within decades, a generation, a lifetime. Building in the Middle Ages a substantial Gothic structure like a cathedral, and finishing it, in sixty years, meant at the time already building at breakneck speed; a century or more, was a far more typical duration of construction. The very length of

the building process allowed new ideas and construction methods to be used, earlier flaws in design to be dissolved, while it allowed the community as a whole to relate already deeply to it, before construction was completed; many a masterpiece of historical architecture has never been formally finished.

## Functional Flexibility

A city is never finished: adjustments are constantly made, superfluous elements demolished and removed, new ones added, functionally valuable old ones restored and maintained. That this can be done at all is the consequence of what architect *Matthew Nowicki* used to call "Functional Exactness", or rather its relative absence, in the design and the building of the city as a whole. A church can become a stable under conditions like those prevailing during a period of the French Revolution; stables can become libraries; big buildings quarries. The city is functionally not very exact.

A functionally exact building allows its user only one, very well described, coherent list of activities. A nuclear energy plant is a good example. Functionally exact buildings rebel strongly against other ways of using them than those originally intended. It is not just a matter of the internal design of the building as such. Any building positioned on the North-Pole is functionally exact.

By the same token our intelligent buildings can not be but functionally inexact. By spelling out too early, in too much detail, to what particular types of usage it shall be employed we would make big mistakes on two levels: first of all we would act as if we could possibly know what exactly is going to happen in them, and we can not know that by necessity, and, secondly, we would build the embodiment of a revolutionary new paradigm on the linear extrapolation of current activities and views.

When an organization moves its headquarters from Omaha, Nebraska, to Boston, Mass., it does not expect Boston to be ready, but it expects the new building to be ready. Rooms might still be empty, but ready it must be. We hire architects, it sometimes seems, just to kick them out at a time both parties can predict and will allow. The rôle of the architect of an intelligent building as invisaged here strongly resembles the one of the traditional City Architect. A truly new kind of building, the first pyramids, the Greek temple, the Gothic cathedral, Edinburgh's "New Town" of the eighteenth century, "owing almost nothing to a blind imitation of the past", to use *Lewis Mumford's* words, that type of innovative building has al-

ways gone hand in hand with major shifts in the rôles of architect, builder and the interests ordering the building vis-à-vis one another. If the intelligent building is really far more than an empty buzzword or beguiling hype, this type of rôle adjustment is, historically seen, natural and needed.

## Changes

Watching physical man-made structures grow and change over an extended period of time — as opposed to abstract structures, the rise and fall of political power, or the progress made by fundamental scientific research; or, for that matter the biological growth of living structures like trees — might be a source of inspiration and social confidence. The vast and deep emptiness right in the middle of Paris, the old site of "Les Halles" and for the extremely long duration of constructing a new range of uses for it, clear to see for all Parisians and all visitors, must have contributed significantly to the new élan of the city of those vesting their hopes, and their money, in the French capital. Such could be the rewards of "la longue durée".

## Surroundings

Consulting the current literature on intelligent buildings they might as well be constructed anywhere: on a wharf in Hongkong, on a development site in California, somewhere in the dilapidated heart of London, or in the outskirts of Grenoble. The "genius loci" of the late *Alexander Pope,* that great poet and gardener, has no business there. Guided by our metaphor, Chioggia, we see that an intelligent building must fit within a surrounding urban landscape which enhances the building's uses and objectives. Without Venice close by, the Italy of the duecento, and the Mediterranean of the second half of the Middle Ages, the ultimate "machine à vivre" of Chioggia would not have come to pass. Likewise, an intelligent building set within an inhuman wilderness will come to nought, regardless of its mechanical and modular ingenuity. The intelligent building as suggested here could and should be positioned in a sound, strong and lasting social and urban matrix. Other intelligent buildings might be nearby.

## Aims

What have a monastery, a nuclear plant, Fort Knox, a private home, an illegal gambling house and a military air base in common? Of course they share the characteristic that those premises have a ground floor, a few molecules of Mother Earth's skin, which is not open to all. Naturally, the list can be prolonged, it sometimes really is great fun, but one element stands out: all these buildings serve aims directly opposed to, and profoundly different from, the aims of the intelligent building as suggested here.

Once again our chosen metaphor can help to guide our thinking: without all kinds of public places, in principle accessible to all, citicens and strangers alike, one can not even imagine any realistic kind of city. The same must hold true for any truly intelligent building; *Foster's* Hongkong bank reflects already this fundamental insight.

This does not mean, obviously, that within the living structure of the building there are only general access spaces; on the contrary, any vital city, and certainly Chioggia, has its dazzling array of thresholds, locks, vaults, secret rooms, seemingly forgotten nooks, often iteratively increasing in complexity of access. All kinds of fancy and simple technologies will allow us to design, and adjust over the years any centralized or decentralized, or distributed, or even random structure of seclusion and privacy for the intelligent building. But it is quite clear that we can not decide on its exact and final embodiment at all. The gamut of forms from total openness to perfect enclosure must organically grow and adapt itself during the building's life span as a whole.

## Height

"What goes up, must go down." What the human eye can differentiate, it will understand. Sight is the teacher of our senses. The two-metre difference in height between eight metres and six metres is enormous to our eyes; the same difference between 20 and 18 metres is at the edge of our perception, above that height our understanding of differences vanishes. In the horizontal plane we can do much better; left to right movements and dimensions are almost implemented within our eye sockets. As a species, trees made and housed us; trees seldom get any higher than twenty metres. But nothing will tell us whether we are on the 31st of on the 32nd floor of a skyscraper; and that difference does not add to our understanding of the world; it can not differentiate. There are only two reasons to live and work in high-raise buildings: the technology to build them at all (a technology not older than some 130 years) and the price of a square metre on the skin of Mother Earth, whether leased or owned. The very terms are ridiculous.

## Windows

The word "window" originally meant "eye to the wind". The eyes of modern office buildings are peculiar: unlike human eyes who are, following many vernacular idioms, the windows of the soul, the eyes of the modern office buildings allow only those who dwell in them to look out to the surrounding world and to those occupying its open space, but they do not allow even the tiniest glimpse of their soul to come out. Modern office buildings tend to be visually secretive about all human activity and its specific nature going on inside. The alienation of the outsider is complete with respect to those activities. The total skin of such a building does not attract, it does not beckon, it does not welcome; instead it impresses with awe or indifference, it shields off, it keeps outside. The irony is, that this skin, employing an ever higher percentage of glass, following the fashion that the face of a modern building requires increasingly more cosmetics and make-up, consists mainly of a material whose entire "raison d'être" and historical development as a building material rests in its two-way translucency and transparency. What once visually opened closed structures, now closes them completely. Such structures will certainly cause in society at large a lack of participative involvement in the tasks set to those buildings and their occupants; they could readily be viewed as strongholds of mystification hiding nameless, and possibly dangerous, activity. No intelligent building, in the fundamentalist's sense of the word, in which it is employed in this essay, can afford to present to its spatial and visual vicinity a face and outward appearance which is in reality one gigantic peephole, a mask which has not even the contours of a face.

Of course this does mean that each cubic foot of the intelligent building should be open to the gaze of any passerby. What it does imply is that an intelligent building should give to its external observer the expression in architectural terms of its aims: its servitude to human togetherness, cooperation, diversity and creativity, transformed, enhanced and partly enabled by information and communication technologies of the present and of the future.

## An Intelligent Building

By now we might have found adequate means to sketch the conceptual outline of an intelligent building expressing the ideas precited.

Plants do not reign supreme in it, unlike their régime in the average modern office building.

The intelligent building is a glass construction measuring 150 metres by 75 metres, 15 metres high, a splendid gauge and a place both for meeting people and for avoiding them.

The spine of the ground floor, possibly with parking facilities under it, is devoted to the function of culture, in its widest and deepest sense, while at the long sides the contact with nature can be realized. Work and recreation are two elements which can never be seen without one another. This level is a public place.

Within the physical skin of the structure a variety of other structures grow, housing many working groups, with the capability of endless change. This has been made possible by the presence of a structure, which never changes, the supporting building elements in a sense represent eternity and can take up temporary changes and concepts.

Work in its proper sense starts on the first floor, a functional level constructed in such a way, that all ducting, present and future, can be easily accommodated and realized. This level should provide also the possibility of audio and/or visual contact with Mother Earth, on the ground floor. In the building's heart, on the crossings of the diagonals of the rectangle and the intersections of the diagonals of both squares this audiovisual link should certainly be implemented.

Above this first level three more floors may be added, mutually independent in principle, covering the great rectangle either completely, or partially, in any pattern and coherence during each stage of growth and life of the structure of the intelligent building as a whole.

This strategy of construction allows us to house in it some ten to twenty groups of up to sixty people each, groups with an architecturally visual and cooperative independence and individuality. These sixty working closely together can share with others the visually connected first level; in addition they have the wherewithal to expand their working environment in the vertical domain as an autonomous structure, in which the level of privacy may increase while ascending, if need be. Due to development, some groups will grow, while others might shrink or disappear. The possibility to join the autonomous substructures into larger ones is provided by the provision of horizontal scaffolding to the vertical supporting elements.

The prevailing architectural conditions of the entire inner space see to it that the possibilities to fill it in (building, rebuilding, adjusting, decorating, redecorating) are architecturally simple — and

thus are inexpensive. The large space contained within its relatively small outer skin is energetically controllable easily and at low cost.

By bringing together, and keeping together for longer periods of time, several independently operating and functioning groups (development teams, young companies, think tanks) in this "city" and by way of the optimal possibilities to meet (accidentally or consciously sought) a type of added value is generated, which the "electronic cottage", working on a completely individual basis, totally lacks. That does not mean of course, that in this intelligent building the electronic cottage could not be simulated. Due to the specific balance between horizontal and vertical building elements of the structure as a whole, the entire range between fully public and totally secluded functions can be accomodated, whenever necessary, in a flexible manner.

The outlines of the intelligent building, as suggested here, take into account and reflect a few considerations which have not yet been explicitly discussed. First, there are the aspects of spatial distances, measure and scale. We have already seen that human interaction is the raison d'être of the intelligent building. For this reason it is crucial that the intelligent building should show a fundamental awareness of the spatial limits of such interaction. From many architectural studies and experiences from built environments we know, that a distance of some twenty metres is a peculiar one in human interaction as far as perceived details in facial expressions and vocal details are concerned. Beyond that distance, facial expressions almost cease to have meaning; even the trained actor's voice cannot reach much further. It is the limit of meaningful person-to-person contact. No professional theatre is significantly larger; many meeting rooms of corporate boards, built for mere prestige, are. Another spatial reality to be reckoned with is the distance of some 75 metres. Beyond it, two people are no longer in one another's psychological presence in our Western, and Westernized cultures, the two cease to have a spatial togetherness. Living in the middle of one of the residential streets of Chioggia is a social experience which differs considerably from the one of living near one of its ends, while living near the Corso del Popolo can experientially not be interchanged with living near the edge of the island. All such streets are no longer that 150 metres; Chioggia differentiates wherever it can.

Within a distance of 150 metres one can consciously or subconsciously enter the

other person's sphere of spatial togetherness — or stay outside of it on the same basis. The sheer magnitude of our intelligent building reflects this kind of thought.

Second, the notion of shared tenancy is fundamentally ingrained in the structure proposed. In the existing literature shared tenancy is predominantly seen as a necessary encumbrance. In order to provide to a relatively small group or organization all the blessings of no-break electricity, airconditioning, computers and telecommunicative power and work stations, a minimal magnitude of scale emerges there for the building which exceeds those required for the single organization.

Sociologically and psychologically it is indisputable that no group of closely cooperating individuals can be much larger than sixty people. Above that number no organization can claim "we all know each other quite well". Any intelligent building should spatially and physically reflect this upper limit set to the granularity of human and humane cooperation.

An elderly and distinguished organization, let us say a bank, counts its employees by the thousands rather than by the dozen; with young and innovative organizations the opposite holds true. An intelligent building, as metaphorized here on Chioggia, will easily house twenty groups of sixty people, and will accept, perhaps, some thirty groups.

By the same token, the careful composition of the ensemble of these groups, based on the blessings of diversity and creativity will bestow on human cooperation in its non-cuasal, non-linear and often serendipitous way, equally impredictable and valuable, establishes a less than pedestrian foundation for shared-tenancy policy and decision making. Admission to the citizenry of Chioggia was not guided and determined by the va-et-vient of indifferent and mutually exchangeable candidates, but by the City's Council judgement how the newcomer might fit in with the city's objectives. Shared tenancy is far more than a financial conditio sine qua non. It is an intellectual and humanistic conditio sine qua non.

## The Creative Implosion

We have made, and we sustain, a great many social structures — and they have made, and sustain us: our family, our neighbourhood, our city, our region, our nation, our continent, of course; but also the organizations employing us, our institutionalized religions, our

political parties, our circles and clubs, our orchestras and bands, our schools and universities, our media and providers of entertainment.

We have come to expect from each of the above an often very well defined contribution to our socioeconomical vitality and reality. To provide a shelter of privacy is no task for a political party; we do not think, that the neighbourhood we live in should contribute significantly to the improvement of our formal education.

Information and communication technologies over the past decades have adjusted and updated the boundaries between the independent elements of our complete social structures. Intelligent buildings could have comparable effects, if not deeper ones.

The number of individual agents in our social structure as a whole has increased significantly. Once upon a time there were just the family, the city, religion and not much more. After a very rapid growth of this number we find ourselves in an environment where the word "society" can easily be exchanged in practice for "nation" without loss or change of meaning.

In his book "Creativity — The Magic Synthesis", *Silvano Arieti* reaches the conclusion that some societies and cultures have enhanced and some others inhibited diversity and creativity. In his line of argument, Arieti distinguishes nine sociocultural "creativogenic" factors, which foster creativity in social groups:

1. Availability of cultural means;
2. Openness to cultural stimuli;
3. Stress on becoming and not just on being;
4. Free access to cultural media for all citizens, without discrimination;
5. Freedom, or even the retention of moderate discrimination, after severe oppression or absolute exclusion;
6. Exposure to different and even contrasting cultural stimuli;
7. Tolerance for diverging views;
8. Interaction of significant persons;
9. Promotion of incentives and awards.

Arieti gives in the part "Creativity and the Sociocultural Environment" with his list a very convincing conglomerate of examples: Athens and Rome of Antiquity, 18th Century United States, 20th Century Switzerland — and many more: a series of cities and national states. Also because of the implications of our metaphor — a certain kind of city — we ask whether Arieti's list does not provide us with all the crucial elements in the formulation of the fundamentalist's view of the tasks of an intelligent building. If our answer is affermative, what architectural list of requirements could be a more inspiring? In the past it took at least a city to generate such a creativogenic society; thanks to the unparalleled advances in technology we now are on the doorstep of an era that can perhaps condense this type of socioeconomical and cultural potential within one building.

Now that we have miniaturized vast rooms of energy-hungry information-intensive equipment into something the size of a head of a pin, on which, as is widely known, hosts of angels can dance, we should be in a position to implode the classical city into an intelligent building.

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# Bücher

### Taschenbuch für Heizung und Klimatechnik, 1988/89,

*Von Recknagel-Sprenger-Hönmann.* 1667 Seiten, Format 21×12 cm, 3 Einschlagtafeln, diverse Bilder, Diagramme und Tabellen, Verlag R. Oldenbourg GmbH, München. Preis 162.– DM.

Das regelmässig erscheinende Taschenbuch wird ab neuester, 64. Auflage von Dr. Ing. Winfried Hönmann herausgegeben. Dieser Haustechnik-Fachmann ist in den Kreisen der Heizungs- und Lüftungsingenieuren sehr gut bekannt.

Zum Inhalt: Entsprechend dem allgemeinen Trend wird neben den Berechnungs- und Ausführungsmethoden grosser Wert auf die Optimierung gelegt. Für die Wirtschaftlichkeitsberechnung sind Unterlagen veröffentlicht worden, die dem Bauherrn, Architekten und Ingenieur die Wahl der geeigneten Systeme erlaubt.

Die Aufteilung des Taschenbuches ist prinzipiell die gleiche geblieben wie in den früheren Auflagen: Grundlagen der Heizungs- und Klimatechnik / Heizung / Lüftungs- und Klimatechnik / Brauchwasserversorgung (BWV) / Industrielle Absaugungen / Kältetechnik.

Dass manches in dieser Auflage ergänzt und geändert wurde, ist selbstverständlich. Sehr interessant sind die Richtungen der Ausweitung dieses Buches. Hier einige Beispiele der Änderungen und Ergänzungen:

*Grundlagen:* Radioaktivität, Umweltbelastung durch Schadstoffe (z. B. Radon), neueste Aufstellung der MAK-Werte (Maximale Arbeitsplatz-Konzentration), Behaglichkeitskriterien nach den Neuen ISO 7730, Mikroelektronik in der Regelungstechnik.

*Heizung:* Völlig überarbeitet wurde der Abschnitt Heizkessel; der Abschnitt über die Modernisierung der Heizanlagen ist weitgehend neu gestaltet.

*Lüftungs- und Klimatechnik:* Dieser Teil folgt den aktuellen Tendenzen, wie Übernahme der einheitlichen Terminologie nach DIN 1946/; neu bearbeitet wurden die Abschnitte über Rauch- und Wärmeabzuganlagen, Brandgasventilatoren; ebenso interessant ist die Frage der nicht isothermen Strahllüftung und das Problem des Gesamtenergieverbrauches in klimatisierten Büros.

Es ist eine Fülle neuer oder neu bearbeiteter Unterlagen in der 64. Auflage zu finden. Die Einführung neuer, normalisierter Begriffe bringt eine Vereinfachung in der Zusammenarbeit verschiedener Disziplinen.

Dass dieses «Taschenbuch» (mit seinen fast 1700 Seiten!) eine Brücke zwischen verschiedenen Baufachleuten bilden soll, zeigen die informativen Abschnitte «Architekt, Bauherr, Heizung und Lüftung». Hier werden die Angaben für die Schätzung des Platzbedarfes, die Wahl der Heizungs- und Lüftungsart, die Brandschutzprobleme usw... usw. besprochen.

Dr. Ing. *W. Ziemba*, Zürich