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## **Abstract**

New frontiers of sustainability have radically changed the way of realizing architecture with regard to technological systems and formal imagine at the same time. The introduction of natural elements into architecture has become a fact, but as regard as construction teaching these materials, because of their natural substance, need a systematic approach. It is important to preview performances with natural elements, considering their flexibility and the capabilities of having different behaviours in consideration of the context. The article affords a range of problems connected with green and water as building materials and it forecasts a more scientific approach which could be useful for introducing into teaching these living materials. In order to let students formulizing not only considerations from an aesthetic point of view, the relation which bounds green and water to construction is afforded in its complex relations with the environment. The need of a computer aided simulation of different behaviours into time of these living materials is also afforded with indication of different solutions which combine water and green with building.

## **Flexibility into nature and materials**

The consideration of greenery and water as building materials encourages students first of all to consider materials in generally with a special attention to their possibility of being flexible.

Naturally we can imagine that there will be various difficulties bounded to the fact that green and water are dynamic materials into space and into time and it is complicated to think into terms of finished work. Moreover other difficulties arise from the fact that students such as architects cannot find experiences codified into handbooks.

But methodologically we don't move without any help. We could systematize already designed shapes, considering different component of context, in order to realize an agile instrument, a preview of prevailing conditions in terms of common forms.

The simulation of these variables is made possible by the elaboration of useful simulations of virtual schemes in large number with which we can value at least the preventive quantitative relation between natural elements component and traditional materials component. We on this basis could individualize common denominators of different typological combination and compare them. Naturally this preventive work should be very systematic, with relation to natural elements and traditional materials combination also in relation to various considerations like the possibilities<sup>1</sup> of having a better internal microclimate and a sufficient sustainability of building.

Different mutable prevailing conditions are given by the nature itself of natural components, which are dynamic into aggregation. And it is also true that often historic net of streets patios and plazas, with water courses and trees, is what reminds this sensation, with variable composition of areas and interconnection.

With a system of design methodologies it is possible to recreate a situation similar to historic configuration of European cities and villages with continuous alternate of entrance and exit.

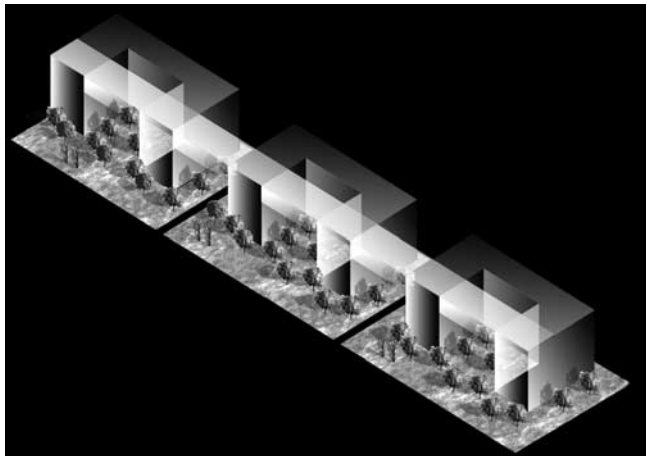
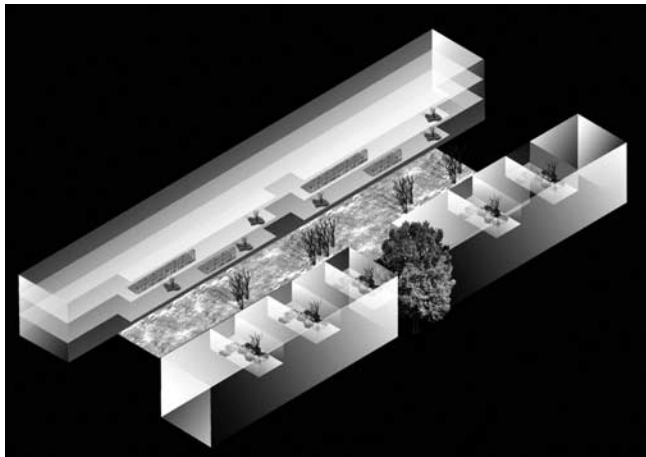
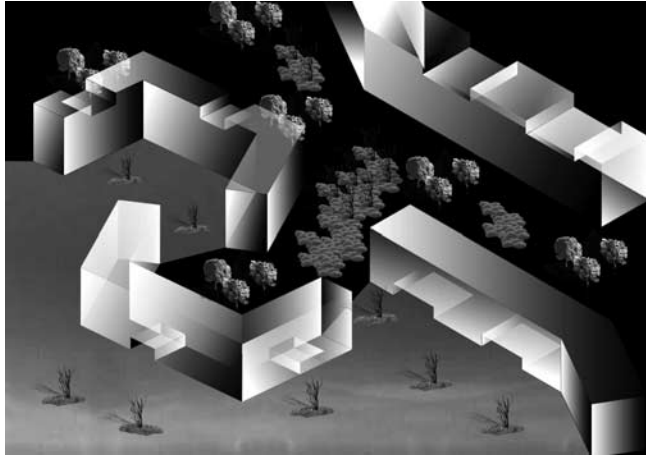


fig. 1,2,3. General schemes of aggregation of natural elements and architecture

An adequate ecologic residential model should contain the changeable composition into unique shapes realized aggregating simple elementary unities in variable way. And this fact can have consequences also in the social relation among people, as voids, green spaces and water attractions are capable of attracting a certain amount of persons.

A general management system of natural components should be correlated to a list of requirements codified into very carefully organised and well researched valuations.

Natural elements such as green, water and soil may be considered fundamental elements in order to have mental imagines of a community put together. These elements have importance not only under the aesthetic and ecological point of view, but also for the consideration of their capacity of attracting young social interest<sup>2</sup>. This is very important for teachers and for their desire of interacting with learners and young component of a society, in order to have a better collaboration in designing.

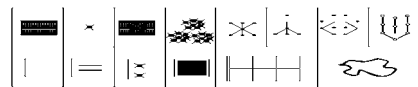


fig. 4. Green disposition, homogeneous, punctual, linear, compounded

Computer simulations need to be very much comprehensible and the quantitative data need to be understood, especially because speaking of natural elements the debate is articulated on quantitative elements, because of the difference between construction and natural elements in terms of economic results.

Contemporary architecture, even if sometimes it is spectacular, not always is able to put inhabitants together into natural space, and it obliges to a solitary contemplation. There is the need of new social interest into teaching which could correspond to an idea of collective desire for naturalism.

Fairly new technology such as a computer assessment can be used to evaluate the layout of an environment so the architectural project is not an end in itself but is considered in its relationship of revitalizing environment.

Naturally this permeability involves also the building which with its envelope closes spaces never completely and a kind of filter surface is to be studied.

Natural materials are to be introduced into traditional materials in a construction with a regular cadence so that position, characteristic, performance could be mixed. A research prospective is so open in this course.

## Water as a topic for advanced research and teaching

Through the centuries man has paid always a major attention to the design of water systems for transformation of his physical environment, which have contributed to assure a safe exploitation of land and resources of whole regions. For example one could refer to the many hydraulic works, aimed to land protection and its profitable usage, carried out from very old times, including water navigation channels, coastal

land reclamation, aqueduct constructions and polluted sites remediation.

Beside such scopes, water has also been used for mechanical energy production purposes in older times, such being the case of water mills, and electrical energy in more recent times, that being the case of hydropower plants.

With the development of knowledge and architectural technologies applications, it has become necessary to upgrade skills and capacities of facing the different aspects of water presence not limited to usage, prevention and protection, but also as an element, if not a complex component or system, in extremely diversified problems of the modern habitat.

One could cite the houses that protect themselves in case of flood emergency by a lifting, operated by mechanical systems, or houses that close hermetically any opening up to the maximum presumable level of inundation, in order to avoid penetration of water inside, as presented in some advanced building technology proposals at the recent Rotterdam biennale exhibition.

Such proposals open further perspectives, as studied by the author, which in particular deal with:

- noise barriers by water linear cascades, which mostly mask outdoor noise frequencies by modulating height, width, flow rate, impact surface at ground or at water pond;
- spray ponds which achieve evaporative cooling of condenser water coolants employed in air conditioning plants;
- storage and recycling of rain to be used for irrigation of gardens and lawns;
- seasonal energy storage by cold and hot water alternatively in underground aquifers;
- air flow humid filtration to capture polluting gases in taking air from outside and letting it pass through water spray device;
- self protected houses built with a floating capacity in case of floods.

Some details of the above mentioned items are discussed further on.

Noise barriers can be applied in motel or service areas premises along high ways to mask the steady noise of the nearby vehicular traffic, that is definitively a major disturb to the relaxing landscape and architecture that must characterize the settlement.

Spray ponds substitute mechanical cooling tower which often feature a large volume, a rough industrial shape and heavy fan noise; the efficiency of spray ponds is just a bit lower of that of towers in completely saturating air by inlet water, heated by cooling refrigeration (or heat pump) condensers (or evaporators), thus obtaining a lower outlet water temperature.

Storage and recycling of rain is obtained by draining rain water from roofs, after disposing first rain that always contains dust and other contaminants, into underground or open air tanks from which it can be distributed to an irrigations system, that is operated automatically when the soil is detected dry by a sensor.

A seasonal energy storage coupled to refrigeration equipment features water raised from an aquifer to cool condensers and pumped back down in a second well to be placed upstream, at an appropriate distance, in order to recover warmer water again in the first well for space heating purposes.

Air filtration has been sufficiently described, while floating houses must be con-

structured with naval techniques and must be anchored by capable chains to the ground to tolerate a flood lifting without being drained away by the flood stream.

All items discussed above needs a systematic approach for an effective teaching and that requires an intense work of research and application.

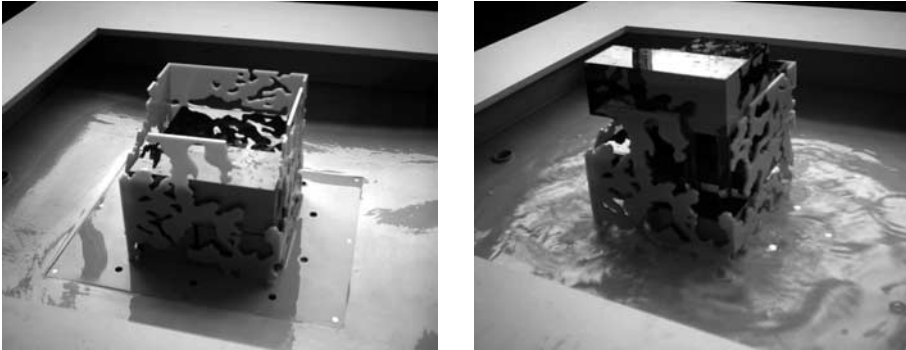


fig. 5,6. Flood resistant house seen at the Biennale of Rotterdam the Flood

### **Vegetational elements in the requalification of urban structure**

At heart of our observation there is the remark of the endless, mutual and continuous process of action and reaction between green and housing shapes: this asks for a survey on the multiform and variable relation, from which gathering operating procedures able to raise quality of life.

The resort to systematise meaningful examples, allows a confrontation to deduce an evaluation criteria for integration between vegetational elements and building. The process concerns different spatial and technological solutions, such as screening effects, ventilation ducts, shading and thermic and hygrometrical control, useful to valorise climatic and vegetation resources, distinguishing also innovative components to give back social and psychological identity to living<sup>3</sup>.

Then observation concerns green as a dispenser of multi-sensorial feelings and as an element, changing with time, of the urban scene.

About urban environment, a classification of possible approaches, also of social type, creating green spaces, goes back to 1992, when the Ecology Institute of the Technical University of Berlin (TU) together with London Ecology Unit, English section of European Academy, has defined European Community strategies of nature protection to act in the town of Berlin.<sup>4</sup>

In addition to urban parks, they have been distinguished: collective gardens, plots always conducted by small communities, typical of urban environments where vast areas to destine as parks aren't available, urban farms, typical of places with horticultural tradition, where it is desirable also to have an economical fall out, urban forestation, useful in case of need of bioclimatic benefits, road plantation of trees and green corridors, for the thermic and hygrometrical rebalance on pathways, building greening, that is the criterion to adopt vegetation as a building material, making use of bioclimatic protection features.

In parallel, the concept of urban ecosystem, reference for assessment of envi-

ronmental conditions and where different elements interact, has been introduced in the study of the contemporary town and of relations between its phenomena. This scientific approach allows to check sustainability of settlement and productive processes, as fluxes of matter and energy, to provide tools, indicators and methods for the rebalance of the general system.

It has also been defined the ecological footprint of a town, as the productive area necessary to feed its population (Rees, 1992), assessing the influence of the urban zone out of its boundaries and inductions of exploitation of resources of matter and energy.

General purpose of ecosystemic rebalance are, then, both reducing ecological footprint of towns, giving a strategic role to virtuous phenomena that is possible to activate in urban environments, and to improve the microclimate.

In this frame, for urban territories where the presence of naturalness is rarely significant, the role of the control and management of the resource of vegetation concerns the interrelation with the constructed system, pointing out the thermic, hygrometrical, acoustic and depurative changes that the vegetal system may produce on built environment.

It is required then to apply criteria able to improve environmental comfort, through regenerative capabilities of the vegetational system, stimulating them with appropriate choices; the chance is to create active systems to regulate meteorological effects, such as for example, curtains for shading or shelter from winds, bioecological corridors.

Green areas inside the town have been distinguished<sup>5</sup> into urban parks, public gardens with trees, private green with trees, rows of trees and flower-beds with bushes, assessing the contributions of different systems relating to protection from wind, noises and sun, besides of atmospheric regeneration.

Those systems are flanked by new (but old) typologies of uses directed to ecosystemic balance, such as green fronts, useful to regulate thermic exchanges of façades of new or renewing buildings, or paths with pergolas. In each one of those cases it is obviously essential to choose appropriate species for the place, as well as it is important to verify features of the roots, that may damage the surrounding superficial layout works.

Vegetational elements constitute regulation tools of urban microclimate with regard to shading, through which they can produce effects both positive (during summer) and negative (during winter).

Positive effects on soils concern protection from excessive transpiration, creation of rest areas or of refreshed paths; positive effects on walls consist in avoiding overheating opaque surfaces helping thermic comfort, or passive solar systems, that otherwise necessitate mobile screenings.

Negative effects on soils show up as obstacle to rain water evaporation, giving place to too wet areas, or in case of winter too harsh temperatures, to ice crusts; negative effects on walls are

reduction of insolation for opaque surfaces and passive solar systems, together with the chance to encourage condensation phenomena.

Shading vegetal barriers, then, must be made with trees with caducous leaves, disposed southward the building or the place to protect, to maintain positive effects in winter and eliminate negative ones in winter.

Urban microclimate may be influenced from vegetation also relating to wind, through creation of wind-break barriers, the effect of which is function of height, physical nature, distance, height from soil where speed needs to be reduced, planimetric direction of the barrier.<sup>6</sup>

Another valuable contribution is the noises reduction, for which it is efficacious to position double rows of trees, with staggered order; best results (reductions until 10 decibel) have been reached with big fences made from plants with permanent leaves.<sup>7</sup>

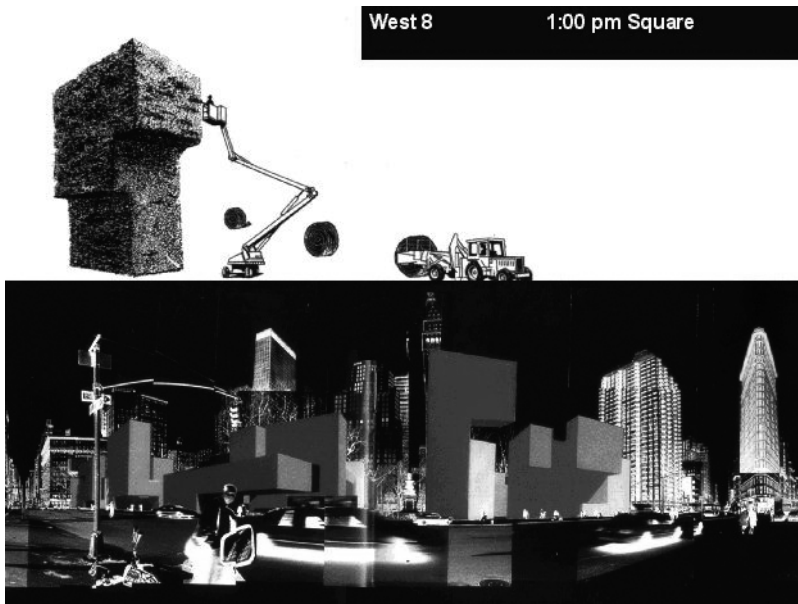


fig. 7. West 8 1:00 pm square, New York  
(From Quaderns n. 217, ed. Font y Prat, Barcelona)

Further bioclimatic contribution of green system concerns atmospherical regeneration capacity, due both to photosynthesis (chance offered in significant way from vast green extentions) and to the possibility to fix noxious dusts suspended in the atmosphere. Also this last feature is more evident in the tree vegetation, particularly when leaves move less with wind and their surface is not smooth.

Concluding, regarding to a literal interpretation of green as a construction material, two provoking proposals for greening of New York, dated 1996, by the dutch team West 8, are reported; the first of them refers to Madison Square and the second to the plot back of the Seagram Building at Park Avenue<sup>8</sup>.

Both are projects of vertical urban green, supported from a steel structure that draws the shape: natural artifices expressing an uneasiness to find formal and technological stylistic features in the intervention to requalify the town.

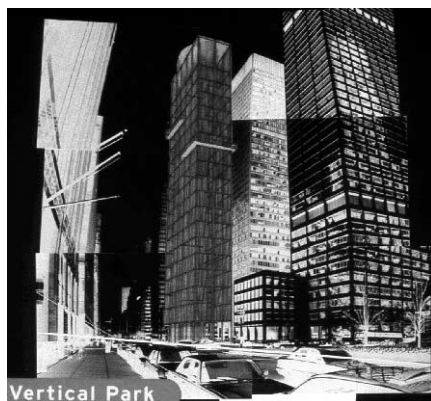


fig. 8. West 8 Vertical Park, New York  
(From Quaderns n. 217, ed. Font y Prat, Barcelona)

## References

Point 1 has been written by Isabella Amirante and Francesca Muzzillo, point 2 by Rossella Franchino, point 3 by Renata Valente

- 1 For bioclimatic considerations D. BABALIS, edited by, *Bioclimatic design, Urban Regeneration, for sustainable development*; «Edizioni Polistampa» Firenze 2003 and NICK BAKER, KOEN STEEMERS, *Energy and Environmen in Architecture. A technical Design Guide*, Taylor & Francis Group, London 2000.
- 2 A. Bosco, E. Gravina, F. Muzzillo, *Vegetation as Relevant Element of Dwelling for Inside-Outside Space*, XXXII IAHS World Congress, Sustainability of the Housing Projects, Trento 21-25 September 2004
- 3 K. Childs, *Human Centered Sustainable Design*, White Papers – Sustainable Architecture – Earth pledge, New York, Third Edition 2004
- 4 cfr. "La risorsa verde per la qualità ambientale urbana. Riflessioni progettuali sulla città di Aversa." in *Strategie di riqualificazione per l'abitare: demolizione, addizione e ristrutturazione*, a cura di I. Amirante e S. Rinaldi, ESI, Napoli 2000;
- 5 cfr. C. Benedetti, *Manuale di architettura bioclimatica*, Maggioli editore, Milano p. 78 and seg.
- 6 Cfr. M. Marocco, *Ecotecnologie per la progettazione del paesaggio*, Officina edizioni, Roma 2000
- 7 ibidem
- 8 from *Quaderns n. 217*, ed. Font y Prat, Barcelona

