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Università Iuav di Venezia

Faculty of Architecture

Graduate Degree Architecture and Sustainability

Research Area Sustainability and Urban Design

School of Doctorate Studies

blue in architecture 09

Water, Climate Change and Architecture

focus and debate on a fluid and sustainable future

symposium proceedings

edited by: Benno Albrecht, Anna Magrin

Università Iuav di Venezia
Faculty of Architecture
Graduate Degree Architecture and Sustainability
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Iuav School of Doctorate Studies



blue in architecture 09

Water, Climate Change and Architecture
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First International Symposium
September 24th_27th | 2009
Palazzo Badoer _ Sestiere San Polo 2468 | Venezia

Director and scientific coordinator: Benno Albrecht
Organization: Anna Magrin

Curators of the symposium topics: Erich Trevisiol, Giovanni Mucelli and Claudia Tessarolo, Jacopo Gaspari, Benno Albrecht, Patrizia Montini and Sergio Pascolo

blue in architecture09 _ symposium proceedings

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blue in architecture 09 has been an international symposium focused on water. It aimed at furthering the knowledge of urban, economic, environmental and technological sustainability in project design, with the goal of enhancing quality standards in planning and design processes.

blue in architecture 09 intended to promote opportunities for interdisciplinary collaboration, by enabling communication between experts, researchers, practitioners, administrations and public agencies, private companies, designers, infrastructure and service network managers, and public, private or cooperative entities involved in the planning, carrying out and management of architectural and urban projects.

blue in architecture 09 was conceived to broaden the awareness of and to support projects dealing with urban transformation, technological innovation, and synergetic development between energy and the environment. It intends to focus on issues that are now of primary importance in urban transformation and local development processes.

blue in architecture 09 has been a three-day program focused on five topics.

topic one

climate, water, energy and cities

Climate changes, water and energy influence today's and tomorrow's urban design, provoking, at one and the same time, both a lack of and an excess of water. Urban civilization has always developed around the use and control of water resources, and dependence on fossil fuels can be reduced through the use of renewable energy sources generated, once again, from natural water resources.

what we wanted _ what we asked

Historical studies, energy systems analyses, projects exploring urban history and new strategies for resource allocation that can prevent or make positive use of the climatic changes underway, so as to optimize the use of energy resources on an urban scale.

luav scientific coordinator: Erich Trevisiol

topic two

climate change and flood strategies

Climate change necessitate new emergency strategies that influence today's and tomorrow's urban design: the rising sea level and the recurring flooding of coastal and river-front cities demands new, from short to mid-

to long-term urban design strategies.

In short term, the management of housing emergency during periods of crisis and the survival of inhabited areas and rural dwellers in reaction to the catastrophic are problems that, on architectural-constructive level, involve concepts such as: provisional, reversibility and sustainability.

Assessing risk and vulnerability in medium and long term is an integrant part for sustainable urban design. New technologies for defending coastal areas and human settlements can limit the effects of extreme events, but their definition must also to be considered in developing new urban design and industrial/technological strategies.

what we wanted – what we asked

studies, analysis or projects marked for using strategies – both as immediate response to emergency or as foresight for controlling water and protecting of human settlements – that can influence today's and tomorrow's urban design.

luav scientific coordinators: Giovanni Mucelli and Claudia Tessarolo

topic three architecture in a no-water world

Climate changes involve new strategies for conserving, reusing, recycling, reclaiming and treating water resources in desert environments or areas undergoing desertification. Insufficient water supply heightens conflict

and discrimination, but can be limited by urban design policies requiring responsible resource allocation.

New technologies, new water desalination and reuse systems, and the possibility of constructing and dwelling in buildings/cities that demand responsible resource allocation can mitigate the social, political and spatial consequences of inadequate water supply in extreme climates.

what we wanted _ what we asked

Studies, analyses or projects that explore the environmental changes caused by a shortage or total lack of water. Proposals should identify new strategies, settlement guidelines, and technological solutions for inhabiting large areas of the world where the lack of water is a present and future emergency.

luav scientific coordinator: Jacopo Gaspari

topic four liquid ethics

Environmental ethics is a fundamental issue for sustainable policies, regardless of the perspective from which they are approached. The fair distribution of water resources is a pressing issue that must be met with new political, legal and cultural regulations capable of avoiding new conflicts, injustice and human drama.

what we wanted _ what we asked

Studies, analyses and projects engaged in reassessing the ways in which planning and management processes are approached in world in which water, in short supply, is becoming a bone of contention or a source of fear and destruction.

luav scientific coordinator: Benno Albrecht

topic five amphibian architecture

Climate changes are constantly producing new land patterns, defining vulnerable, often temporary regions: ambiguous border zones that call for a new approach to design and new architectural possibilities. Amphibian architecture provides a solution in water and in the places where land and water meet, imposing a conscious use of resources.

what we wanted – what we asked

Studies, analyses or projects exploring alterations in water environments and those areas where land and water meet. Proposals should identify new location strategies and ways of altering the environment that are capable of making conscious use of alternative energy.

luav scientific coordinators: Patrizia Montini Zimolo and Sergio Pascolo



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keywords

Sustainable,
Water,
Architecture,
Innovation,
Expo.

ABSTRACT

Today's propulsive push towards the 3th millennium, driven forward by technological innovation, needs to grapple with an economic and environmental global crisis. Generally speaking water is synonymous with life; in bio-climatic architecture it is synonymous with thermal comfort, since water is able to regulate the micro-climate of various interiors, help solar radiation and brighten up internal spaces. There is more, however. In certain cases, water becomes an actual building element: thanks to the considerable power of its thermal mass, it can be used in passive solar systems (with the "drum wall" in place of stone, brick or concrete walls), through the

employment of the "trombe" wall, or the "roof radiation trap", widely theorized and tested by Baruch Givoni. It is necessary to consider the importance and the role that water plays in our lives, and reaffirm the technologies of the pre-industrial period: phito-purification, passive water-cooling, the use of permeable paving, etc.

This is basically a cultural issue that concerns all operators and disciplines contributing to the definition of the building process. This note describes a series of recent interventions in which water becomes the central, symbolic and material element.

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Architecture springing up over the last twenty years, especially that of ArchiStar, is characterised by the proliferation of innovative technology, the utilisation of novel materials (whose features are modified right down to nano-scale), but also by purely semantic issues, in which the formal gesture often prevails over the function and the actual use of the constructed item. How much of what we observe is sensitive to the eco-system in which it is located? Which are the renewable energy resources being employed to combat CO2 emissions? Which are the ecological technologies being used to safeguard the environment and natural resources? Today's propulsive push towards the third millennium, driven forward by continual technological innovation, more than ever before, needs to grapple with an economic and environmental global crisis. Of all natural resources it is water that today provokes the greatest unease, either through its scarcity or through its over-abundance. It therefore seems obvious that there needs to be increased rationing of an element so fundamental to the life of Man. The importance and role that water plays in our daily life needs to be re-assessed, along with a re-affirmation of the ecological technologies that characterised the pre-industrial age, including phito-purification, passive water-cooling, the use of permeable paving, etc. This is fundamentally a cultural issue concerning all operators and disciplines involved in the building process. Just as in a general sense water is synonymous with life, in bio-climatic architecture it is synonymous with thermal comfort, which can regulate the micro-climate of enclosed spaces. It can be deployed opportunely in the vicinity of a building contributing towards the fulfilment of other necessities such as solar radiation or the illumination of interiors. There is more, however. In certain cases, water can become an actual building element, on a par with more usual, traditional elements; the considerable power of its thermal mass allows it to be employed in passive solar

systems, with "drum walls" in place of stone, brick or concrete walls, in accordance with the normal functioning of any "trombe" wall, or for roofing in accordance with the solar-pond system in general or the "roof radiation trap" (as widely theorized and tested by Baruch Givoni). An elaborate example of the "drum wall" that should be mentioned both for its flexibility of use and for figurative-type values, is provided by a Steve Bauer project for a Mexican residential dwelling, whose functioning mechanism is quite elementary and extremely cheap to run. The water-containers, stacked one on top of another, and with their outsides painted black, are deployed in the vicinity of a glass wall, which in its turn is screened by an insulated panel that can be regulated from the inside when the need arises; the inner surface of the panel is coated with a reflecting material. During the winter months, the opening of the external panel contributes to an increase in solar radiation on the "wall of water", which releases its heat internally during night-time hours. In the summer months, on the other hand, closing the adjustable panel limits over-heating of the internal spaces and avoids dispersion in the absence of solar radiation. Solar ponds are bio-climatic systems based on the same principle as thermal collector walls; however, in this case, the ponds are located on the sunroof. In the winter months, during the day-time, solar radiation heats the water, transferring the heat, via the metal roofing, to the internal spaces below, whereas, during the night-time, the solar pond is covered with an insulating panel that restricts external thermal loss. In the summer this functions in reverse manner and follows the principal of the afore-mentioned "drum wall". This system necessitates an increase in size of the roofing in accordance with the greater load of the pond, and becomes less efficient the smaller the size of the pond. Gifoni resolves the problem by devising an attic with a sloping roof, the outer surface of which is painted black and the window frames have

insulated shutters. The British Pavilion for Expo 92 in Seville, on the theme of "The Age of Discovery" by Nicholas Grimshaw, is a structure built in perfect coherence with the competition's winning design; the initial proposal put forward the idea of a place where one might pass the time of day, perhaps with a bite to eat, something which was in stark contrast to Expo's more bizarre and Disney-like creations. The Pavilion's innovative and characterising elements, however, are neither the steel structure, nor the double-skinned façade (acting when required, upon the climatic conditions inside) but, once again, the employment of water as a building element. The eastern side, 65 metres wide by 18 metres in height, stands out as the main façade of the structure, a dynamic sculpture (the work of William Pye) that flows over the outside and brings about a cooling of the interior; modest pressure forces the water up across the surface, and from there it cascades down, flowing across the extended façade to be eventually collected in a stainless steel gutter, before once more beginning its cycle. However the employment of water in this construction appears to be of greater importance on the western side of the building, where Grimshaw re-proposes a novel concept of "drum wall" built out of 1.20 m deep steel containers, covered in polyester, filled with water and stacked up in order to obtain greater thermal inertia; in this way the "wall of water" taps heat during the day and releases it during the night. There are few examples of architecture renouncing pure formal virtuosity, but, in spite of this, it is possible to find in many of these a series of common characteristics, which, paradoxically, transform them into stereo-types or worse; this has come to the fore recently in the manifest pretensions of certain European contexts, wrapped up in attracting attention to illusory or artificial aspects. In the countries of Asia architecture is expressed via two prevailing tendencies: minimalism, exalting to an exaggerated degree empty spaces, and

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hyper-technology, mirroring the frenetic vitality of the metropolis, with that sense of disorientation that seems to find relief in the illusory conviction that the precarious nature of buildings might be exorcised through hi-tech consumerism. There are only a few architects, "casually" distinguishable among those belonging to the latest generation, tackling new issues and relating to the context in which they are operating. Among these, for example, Kengo Kuma, employs very few basic geometric shapes to create architecture that is not so much "semantic" as firmly based around relationships with light, nature and the surrounding environment.

The Water/Glass House, constructed along the Atami coast in 1995, is a *dépandance* of the Huga Villa, an icon of the Modern movement, designed by Bruno Taut. Inspired by the theories of the expressionist architect of the thirties, Kuma offers up architecture that is aiming to conceal itself; though formally simple it is at the same time replete with precious detail. The Japanese architect transforms the water into a decisive building element, which, with fluid and shifting surfaces, constitutes a continuation of the floor of the living space stretching out to be united with the nearby Pacific Ocean, thus providing a particular experience that is principally one of contemplation. The top floor of the building is surrounded by a mirror of water 15 cm deep and the building thus seems to be suspended between air and water, without impinging decisively on the landscape and at the same time giving form to the transparency of the vertical closures. Considered in its entirety the design provides us with a clear example of a balanced relationship between form and materials, between architectural character and poetry; all the materials used, from glass to steel, from concrete to marble, are clearly chosen for the ultimate aim, which is the appreciation of landscape viewed as an indispensable element in itself.

The latest studies and applications have attracted considerable interest at recent International Exhibitions. In the exhibition held in Saragossa in 2008, on the theme of "Water and Sustainable Development", the

most representative work was certainly the Spanish Pavilion, designed by the architect Francisco Mangado. Although at first sight this building might suggest something ephemeral, there is a surface area of over ten thousand square metres built with traditional materials such as wood, cork, terracotta, galvanised steel and crystal, the whole being supported by thin columns sunk into an expanse of water and giving to the beholder the impression of a dense wood.

The Pavilion was designed in accordance with the principles of sustainable architecture; it develops 2008's guiding theme, water and ecology, employing a cooling-system based on the recovery of rain-water. Vertical columns rise from the pool of water; around their metal cores they have terracotta cylinders, one on top of the other, and these absorb water on contact, eventually conditioning the micro-climate via a cooling effect. The lay-out of the colonnade ensures the building's structural unity, basing itself on the principle used in nurseries to keep the stems of plants vertical. The large roofing slab, with its recycled wood (chipboard) panels, collects the rainwater to be re-utilised at ground level and is fitted out with the most evolved plant engineering technology, geared towards energy production via photovoltaic cells; at the same time, the bulk of the roof acts as a screen for the glass below, modulating the light via reflections on the surface of the water and providing respite for visitors from the torrid summer heat of Saragossa.

Expo 2008 provides us with another novel interpretation for the use of water as a construction element: a sort of fluid, dynamic curtain wall, a generator of flexible spaces and modulator of light, and can interact with both the onlooker and the micro-climate. The Digital Water Pavilion is the outcome of co-operation between Carlo Ratti and MIT on the Paseo del Agua. Over an area of 400 sq m, two modest structures, the Info Point and the Café, are juxtaposed and incorporated under a single mobile roof; this thin slab filled with water

has openings varying in size, two of which coincide with the afore-mentioned service structures. Twelve hydraulic pistons raise or lower the horizontal roof, thus eliminating completely the internal space when the level of the roof coincides with that of the ground. The pavilion is an extreme example of the relationship between space and structure, between solids and empty space, between the inside and outside; digitally-controlled, high-frequency spouts of water enable the vertical closures to apparently dissolve into diaphragms of water, producing a variety of patterns in space. A contemporary version of futuristic architecture, the Pavilion is characterised by its capacity to communicate; the digitally-controlled spouting water below the roof provides for the creation of graphical displays, text and patterns in the water curtains, which with their time-regulated empty spaces continually transform the whole work.

The National Aquatics Center or Water Cube, constructed in Beijing for the 2008 Olympic Games, fully represents the concept of eco-friendly architecture, both in terms of material engineering and the technology employed to limit energy consumption and to safeguard of water resources. The design took the form of two separate structures: one internal, the other external. The Arup studio's steel internal structure, based on the geometrical form of biological cells or soap bubbles, provides an effective response to the anti-seismic requirements dictated by the particular features of the area. The semi-opaque external structure of the Water Cube was built with a membrane of EFTE (Ethylene of Tetrafluoroethylene) which, though guaranteeing the passing of light, absorbs the solar radiation and reduces thermal loss, employing the heat to warm up the interior and to maintain the water temperature in the swimming pool at a constant 28°C. The blue bubbles constituting the building's external envelope bring to mind, with their theatrical effect, the chemical structure of water; they are made from over 3,000 air-cushions, seen from the

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outside as a single entity, although, in reality, each of these is absolutely independent in order, in the event of necessity, to facilitate maintenance operations.

The state of the art ETFE consented the most effective screening solution for the illumination; with traditional materials such as glass, with controlled costs, this would not have been possible. Therefore water takes on a central role within the project, not only in relation to that which is contained, but above all in relation to the container; according to John Bimon, head of PTW Architects, the transparency of water, together with the mysterious effect produced by bubbles, inevitably leads whoever is outside or inside the structure to pause and reflect on their own personal experience of water.

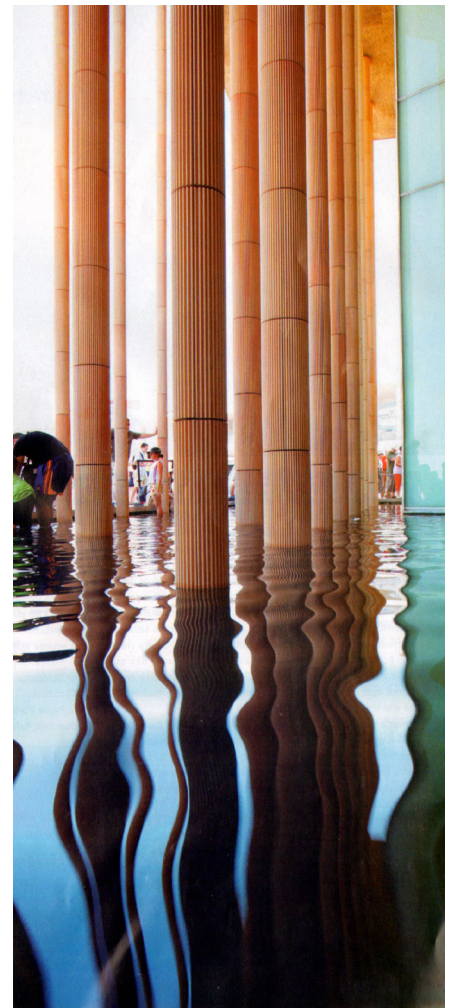


1 - 2 . The British Pavilion in Seville (1992)



3. Water Glass/House (1995)

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4 - 5 . Spanish Pavilion in Saragossa (2008)

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6 . The Digital Water Pavilion in Saragossa (2008)



7 . Water Cube (2008)

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