Ecologically Sensitive Event Space in Urban Landscape

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Abstract. The paper describes the condition of public space in cities in the face of climate change. To provide social integration, cities must have an attractive public space that activates people. The starting point for the conducted research is Bernard Tschumi theory of „event cities”. According to Tschumi, architecture is a discourse about the spaces and events that take place in it. In this theory, the essence of space is to animate the movement and actions, which strengthens the social and political dimension of architecture. Today, we often encounter the crisis of urban space, which is unattractive, unhealthy and does not favour the activity of the inhabitants. Environmental changes have a significant impact on this fact. The aim of the research is to present the possibility of using architectural events in the process of improving the space quality and the microclimate prevailing in it. According to the research results, ecologically sensitive pavilions may play an important role in this context. Problems of water shortage, air pollution and temperature rise are taken in many pavilions in a practical way. Temporary pavilions become in this sense a field of scientific experiments, indicating the possibilities of using new pro-ecological solutions in the city. The aim of the research is to classify this type of examples. The selected examples were divided due to their role, technologies used, as well as the relationship with city space. According to the research results, these objects can perform a number of functions in the urban space. They stimulate social relations, play an educational role, improve the climate in the city and make the surrounding space more attractive. An important common element of these facilities is the use of renewable energy and a zero energy balance. The presented examples lead to the conclusion that pavilions can play a significant role in improving the quality of contemporary urban space.

1. Introduction
Modern cities evolve in a dynamic way, and with them public space as well. Some of the commercial functions originally associated with public space have weakened today. So how can we attract people to use urban spaces to fill them with their activities? The answer may be temporary functions that appear suddenly in space, triggering the interest and curiosity of their users. The surprise effect that accompanies them brings them closer to the concept of an "event". This architecture is devoid of Vitruvian durability, but it can be easily adapted to the rapidly changing requirements of users. In this context, however, the question arises: how does the mobile and variable architecture respond to sustainability factors? Does the dynamic exchange of architectural matter negatively affect our ecosystem? The presented examples show that in order to reduce the negative impact on the environment, a number of pro-ecological solutions are applied to temporary architectural objects. The methods of secondary use of materials and technologies enabling self-sufficiency of energy, which were mastered here. Thanks to this, temporary architecture not only becomes an activator of urban spaces but introduces precursory pro-ecological solutions to the public discussion.
2. What the term "architectural event" means in urban space
Temporary architectural objects are often considered in terms of "incident", i.e. a situation that appears suddenly, by surprise and lasts very shortly. Temporary architecture in comparison to traditional buildings can indeed be attributed to the nature of the event. Thus, apart from the flows of people and images, architecture becomes a unit of a kinetic city, as Ewa Rewers points out [1]. Ewelina Woźniak-Szpakiewicz defines the event as "temporary, changeable, surprising, focused on temporary duration in the urban interior [2]. Bernard Tschumi has introduced the concept of architectural event on a large scale to architectural discourse. For him, architecture in present times is not so much a discourse about form and function, but also, and even above all about events. "Flows instead of places, strength instead of forms," wrote Tschumi, stressing the fleeting and dynamic nature of architecture [3]. In his concept, architecture has the ability to activate space by stimulating people to act. Tschumi realized the idea of an architectural event in the design of the La Villette park in Paris, where pavilions - folies, located on a modular grid, form a structure of spatial events [4]. At the same time, their open form and unspecified function enables the occurrence of various unforeseen events within them. In La Villete, people ultimately define the function of architecture through their activity, the architect defines only a certain framework of this activity through the construction of the program. As Tschumi wrote, "Interaction between space, movement and event. There is no architecture without a program, there is no architecture without traffic, this is the motive of our work presented here" [5]. Today, the experiment conducted by Tschumi in the park La Villette has entered a completely new phase. Increasingly, architecture becomes interactive today and interacts with its users, but also with the surroundings. Architectural events fill various urban spaces, contributing to their activation, thus becoming a tool for urban acupuncture. Their primary purpose is in this case to introduce a positive change in the urban space. To achieve this goal, temporary architecture draws from the repertoire of the latest material and technological achievements. As a result, objects with extremely attractive forms and innovative character are created. More and more often, temporary objects represent sensitivity to environmental issues and climate change, and enrich the spaces created in this way with a completely new dimension of experience.

3. Research for implementation of the eco-pavilions in creating attractive urban space
The main goal of the research is to present the possibilities of using pro-ecological solutions in architectural objects and installations located in urban space as integral elements activating space and users. Modern examples show that objects that are sensitive to environmental issues can significantly contribute to the attractiveness and functionality of urban space. Currently, in cities we can meet primarily the problem of increasing pollution, as well as the effect of excessive heating of space. Both of these factors do not favour the use of public space. So how can we make urban space more attractive. Modern technologies are helpful, as well as solutions that have been tested for centuries. Elements that will always improve the comfort of being in space are green - improving air quality, as well as water that cools the urban space or their users. Currently, these solutions can also be supported by air-purifying materials.

4. Results and discussion
The above issues are represented in numerous examples of temporary objects to which we can include:

- Water facilities and installations recovering rainwater
- Facilities and installations creating new biological surfaces
- Facilities using local construction and recycling materials
- Facilities using renewable energy for their own needs
- Facilities that have air cleaning properties

In the further part of the article, according to the presented division, which has an ordinal character, examples of specific objects will be presented.
4.1 Water installations and objects

Water installations belong to a significant group of facilities that favour the activation of urban space and improve the comfort of its users. For centuries, fountains have been making the urban space more attractive, but today they are becoming very energy-consuming. A much more responsible way of introducing water into the urban space is the reuse of rainwater. The use of water through the facility for irrigation and humidification of the environment prevents loading of rainwater drainage systems, as well as wasting this vital resource. At the same time, water occurring in the urban space is usually a phenomenon that activates its users. Thanks to it, they interact with the existing space and between themselves.

For 20 years, the issues of public space activation through water facilities and installations have been undertaken by MOMA PS1 in New York under the Yang Architects Program (YAP). Each time the main issue of the competition is the „opportunity to design and construct a temporary, outdoor installation that provides shade, seating, and water”, [6]. The installation should take up sustainable development issues by using and promoting technological solutions that improve the condition of the environment. In 2012, the Young Architects Program (YAP) won the HWKN office (Matthias Hollwich and Marc Kushner), which designed the "Wendy" installation (figure 1.). The modular steel structure has a spiked form with a blue nylon shell. The material was previously covered with a special layer of spray breaking the titanium oxide nanoparticles (TiO₂), which neutralize air pollution. In addition to this invisible operation, the installation also triggers a number of phenomena that affect potential users. A special propeller turbine creates a gust of wind and, in combination with water, creates an artificial mist. Thus, the installation provides users with a range of sensory experiences. "Wendy" shows "How far can you extend the boundaries of architecture to create an ecological and social effect" [7].

The idea of the “Wendy” installation is continued by the “COSMO” Water Purifier installation made by Andesa Jaque, who won the cycle in 2015 (figure 1.). The project was inspired by the fact that 2 billion gallons of water are circulating every day in the underground water distribution system in New York. Installation by visualizing the pipe system introduces a new awareness regarding water consumption, while the plant filters and purifies 3,000 gallons of water in a four-day cycle, eliminating suspended particles and increasing the amount of oxygen in the water. The installation is also a prototype that can be used in other countries. Thus, it responds to the challenge of limited access to water in many countries, where obtaining it from the rain through cleaning can be a helpful solution. In this case, contaminated water is supplied to the installation by the New York City Environmental Department. Plants that form part of the installation are involved in water purification. These important tasks that the installation performs, however, are not its only function. The installation is so attractive that it creates a friendly space to stay in the shade and among greenery [8].

Both installations combine the issue of interactivity. They make a certain contact with the participants. For example, COSMO at the moment of completion of the water purification process starts to light up informing about this fact. Through this fact, the improvement of the environment becomes a kind of event. Wendy, on the other hand, stimulates to activity, the water which is introduced in this installation in the form of fog and the pool encourages to use it and the fun that fills the courtyard of Moma PS1

Another example showing the interesting use of rainwater is the Water Cathedral installation designed by Gun Architects created in Santiago (figure 1.). The building consists of a steel modular structure that creates a shed. Its roofing is a net on which conical elements are hung. During rain, they are filled with water, which then drips freely into concrete cone forms placed in the ground. The installation brings to mind associations with natural forms of stalactites and stalagmites that we can find in caves. This special form of roofing at the same time gives shadow to users as well as cools the environment [9].
4.2 Green irrigation systems

Another problem observed in modern cities is the increase of impervious concrete pavements. They block the proper circulation of water in the environment and strengthen the effect of overheating of urban spaces. Thus, they are not conducive to the presence of users in them. The method of activation of these spaces may be the introduction of environmentally friendly installations that provide the unfavourable environment for plant vegetation. An example of this type of installation placed in an empty and undefined space in Montreal can be the “Fountain House” by the Raumlabor studio (figure 2.). It is a cylindrical form, constructed of wood. The pavilion creates a social space around the inner fountain and a source of drinking water. Such places in cities have always been a place of social interaction because they gave chill and respite on hot days, similarly in this case. Users enter the interior of the pavilion where the water condenses from above into a small pool, while dispersing the fog. The interior of the pavilion gives coolness and shade, and the circulation of water is accompanied by sound and visual phenomena that evoke the mood of contemplation. As the authors write: „Besides being a public place of interaction and interchange, the fountain house is a place to celebrate life. It lives with the water, the fundamental element of all” [11]. An important element of the pavilion is also the outer shell formed by the vegetative layer. Humidity of the air that is produced in the pavilion favors the vegetation of plants and fungi that during the operation of the facility covered its external walls, creating a vertical garden on a small patch of the concrete jungle area of the center of Montreal.

A similar idea accompanied the creation of a “Living Pavilion” designed by BEHIN + HA on the island of Governors in New York (figure 2.). Here, we can see a creation of space for meeting and shelter from the sun, which would bring positive ecological values to the environment. The pavilion was located on a vast clearing. It’s interesting curvilinear structure was created from milk boxes formed on a special frame. In these boxes plants have been placed. The form of the object has been shaped in such a way as to optimize the cultivation process of particular plants in relation to daily sun exposure. The idea that accompanies this object is also recycling. Secondary and unnecessary materials were used here which after dismantling the pavilion can be used again. It was decided that boxes with already planted plants can be redistributed to residents [12].

The low-budget “Rotterdam Watersched” project, designed by “Doepel Strijkers” takes the above-mentioned issues with a pinch of salt (figure 2.). Its idea is to promote pro-ecological solutions in contemporary cities. The pavilion was created from used PVC pipes. In 50% of them plants were planted, which create the impression of a green house. A part of the pipes at the bottom ends with a perforation through which rainwater flows. Then it gets to the pool located under the roof. This is a fun space in which we can "walk on water" on concrete slabs. The pavilion shows that rainwater can also be used to create a casual recreation space while maintaining educational values [13].
4.3 Recycled installations

Another issue often taken in the examples of temporary pavilions is the issue of recycling materials or the use of local materials. A special role in this case is played, for example, by the rediscovery of the possibilities of using local varieties of wood. An example of which the goal is to promote the sustainable use of wood in architecture can be “Lantern Pavilion” built by Atelier Oslo & AWP in the Norwegian city of Sandnes (figure 3.). The oak structure of the pavilion in a creative way develops Norwegian experience in erecting wooden structures, at the same time referring to the archetypal form of the house. Drawing from the local building tradition and local materials is a distinct manifestation of considering pro-ecological solutions. The pavilion itself serves as a meeting place, organization of fairs or various cultural events. At night it shines like a lantern, because the wooden structure from the outside has been covered only with glass. Thus, it has become a distinctive and recognizable point in the city center, with which the local community identifies [14].

A similar approach is represented by the Glowing Bamboo Pavilion built in another part of the world in Kowloon Bay by builders from the College of Architecture of the Chinese University in Honkong (figure 3.). The object was designed using Cantonese scaffolding techniques. For its construction, 475 bamboo poles connected with metal wire were used. The supporting structure is covered with a stretchy, transparent fabric that allows light to penetrate the interior during the day and emanate the illuminated interior to the outside at night. The very structure of the object resembling a shell was generated using digital design tools. The most important aspect of the project, however, is the use of bamboo as a material. This material is widely available in the Asia-Pacific region, environmentally friendly and renewable. Here, as in the case of the Lantern Pavilion, it is important to use local material but also to refer to local building traditions. Bamboo is a material often used in this region when constructing temporary scaffolds for theaters and religious festivals. One of the properties of this material is also capturing CO2 and converting it into oxygen. These properties reinforce the pro-ecological profile of the project. He also reveals the rich possibilities of using bamboo in modern construction, based on his exceptional bending strength with lightness and ease of processing. Glowing Bamboo Pavilion fully uses these properties to create a spectacular urban space for 200 people, promoting an innovative, ecological public space in the city [15].

A more radical and provocative approach to the recycling of materials is represented by the installation "The Big Crunch" designed by Raumlabor Berlin which was created as part of the architectural "Stadtfinden" in Darmstadt at Georg-Büchner-Platz (figure 3.). This spectacular installation creates a cloud of rejected products of civilization that is stopped in motion - old windows, doors, elements of home appliances. This cloud goes through the square towards the theater building. Users can be drawn into this vortex of objects by going inside, where the creators have foreseen a meeting place for discussion. The pavilion uses unnecessary building elements and objects, giving them a second life and a new role. This aspect of the installation, however, is not the most important. "The
Big Crunch" is primarily a powerful incentive for critical reflection on our civilization, which has significant educational values. Questions to which we are prompted may be: at what pace we litter our planet through the lack of secondary use of existing materials and how often we exchange them. Is it really necessary. The scale and pace of production of garbage and unnecessary material goods is so large that it reminds the speeding whirlpool, which ultimately may lead to a violation of our orderly reality [16].

**Figure 3.** From the left side: “Lantern Pavilion” [18], “Glowing Bamboo Pavilion” [15]; “The Big Crunch” [16]

### 4.4 Synthesis of solutions

The above examples often focus on one of the issues of environmental protection, this review can be summarized by one example which includes many pro-ecological activities. The prototype project "Epiphyte" designed by “Bart/Bratke” (figure 4.) was defined by the authors as a complete, self-sufficient summer pavilion. Its aim is to present several modern ecological systems in one architectural object that could travel around the world and visit different cities. The Pavilion coating is covered with anatase-shaped TiO₂ layer of nanofibers, which allows to purify the air around it, as well as lamellar photovoltaic cells. Rainwater is collected in three vessels, and then it enters the core where it is filtered, purified and evaporated, by creating a mist to cool the environment. Thanks to this, the pavilion is energetically self-sufficient and leaves no ecological footprint. The energy produced by photovoltaic cells is used to supply events in the pavilion, organized exhibitions or multimedia projections. Appropriate cooling of the pavilion's space was also provided by the shape of the pavilion and the use of purified rainwater. As a result, the pavilion creates an independent social space conducive to integration [17].

**Figure 4.** "Epiphyte" [17]

### 5. Conclusions

The examples of pavilions presented here constitute only a fraction of a wide spectrum of such objects in modern cities. However, taking into account the above group, it is possible to make observations
regarding this interesting phenomenon (table 1.). Many of the presented examples combine the use of recyclable materials. Currently, it is the common denominator of the vast majority of temporary ecological pavilions. The overriding goal here is to leave a zero footprint in the environment. At the same time, in many examples we can note the use of innovative materials or technologies, among which there are TiO₂ membranes that eliminate air pollution or membranes with integrated photovoltaic cells. For innovative technologies, we can also include those involving biological treatment of water. In the case of presented pavilions, also digital technologies are important, which enable the use of traditional materials for the construction of contemporary refined structures with organic shapes. Thanks to this, pavilions become a field for material and technological experiments and show how architecture can respond to climate change.

| Table 1. The use of new technologies and recycled materials in shown examples |
|---------------------------------------------------------------|
| **The use of new technologies and materials** | **Use of low-cost or recycled materials** |
| Wendy | TiO₂ membranes | use of steel scaffoldings |
| COSMO Water Purifier | biological water purification | secondary use of PVC pipes |
| Water Cathedral | X | X |
| The Fountain House | X | wood as a recyclable material |
| Living Pavilion | digital design tools | secondary use of milk boxes |
| Rotterdam Watershed | X | secondary use of PVC pipes |
| The Lantern Pavilion | X | wood as a recyclable material |
| The Glowing Bamboo | digital design tools | wood as a recyclable material |
| The Big Crunch | X | use of waste |
| Epiphyte | digital design tools, water purification, TiO₂ membranes, photovoltaic cells | X |

The examples presented above also play the role of public education in ecological matters, and also create an ecological public space (table 2).

| Table 2. Education and environmental protection and social activation in shown examples |
|---------------------------------------------------------------|
| **Education and environmental protection** | **Social activation** |
| Wendy | Issues of air pollution | Meeting and recreation space |
| COSMO Water Purifier | Issues of access to drinking water and water pollution | Meeting and recreation space |
| Water Cathedral | The use of rainwater | Meeting and recreation space |
| The Fountain House | The use of rainwater | Meeting and recreation space |
| Living Pavilion | The use of rainwater, recycling and biologically active surfaces | Meeting and recreation space |
| Rotterdam Watershed | The use of rainwater, recycling and biologically active surfaces | Meeting and recreation space |
| The Lantern Pavilion | Recycling in architecture | Meeting space, cultural events, fairs |
| The Glowing Bamboo | Recycling in architecture, air pollution | Meeting space, multifunctional space |
| The Big Crunch | Recycling, waste problem, the use of renewable energy | Meeting and discussion space |
| Epiphyte | the use of rainwater, the use of renewable energy | Meeting and recreation space |

In accordance with the division presented earlier, issues of access to drinking water and possibilities of reusing rainwater, issues of air pollution as well as recycling are discussed here. There is also the issue of increasing biologically active areas in cities in places that are inaccessible, by integrating
greenery with architecture. The effect of this is creating a public space that is friendly to its users. It is a space that can offer shading through architectural treatments as well as cold as a result of the use of water and natural ventilation, as well as clean air. Thus, eco-pavilions significantly improve the quality of life in the city and foster the activity of residents in public space.

The presented examples prove that ecological pavilions play an important role in modern cities. Their property is to achieve synergy between improving the natural environment and increasing the quality and functionality of public space. People want to live and stay in a healthy environment, as well as draw from the possibilities of being in a public space, open to various activities. Opposite these expectations, eco-pavilions are coming out. They are often placed in degraded or empty spaces, previously deprived of attractive properties. This action makes the city changeable, provides new stimuli to the residents, while being sensitive to sustainable development and climate protection. These temporary installations and objects do not impose a negative stigma on the environment, and try to improve them if possible. Eco-pavilions create in the urban landscape an ecologically sensitive space that entertains and educates. As a result, a community of residents arises where environmental issues are not indifferent.

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