

Rain in Architecture and Urban Design

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The theme of water in architecture and urban design immediately conjures up waterfront developments, bridges, houses on pillars and floating islands. Rainfall is the source of some of the water in rivers and lakes, but I am not going to talk about the water that is already present on the ground and is already an integral part of the soil. My theme is water that is actually in the process of falling down from the sky as rain in the whole range of all its forms at the very moment when it meets the earth. The part that this natural phenomenon plays in our forming of cities and buildings will be my chosen focus.

Rain features

From the beginnings of human life on Earth rain has fascinated us. People have tried for ages to imagine what it could be that was falling down on their heads from heaven and soon aimed to explore its mystery by developing a scientific approach to it.

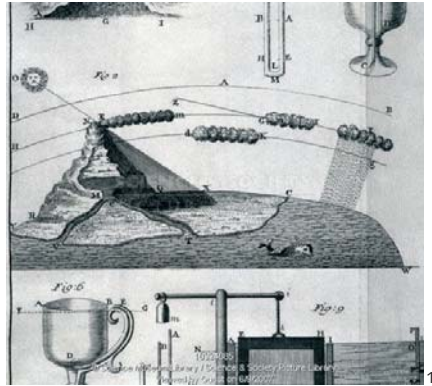
Today we know quite a lot about this meteorological phenomenon. Rain is a part of the hydrological cycle in which moisture from the Earth's surface evaporates, turns into clouds, then condenses into bubbles and again in due course returns to the Earth in the form of droplets of water to repeat the whole cycle. The key to understanding the role that rainwater plays in architecture is to understand the architecture of the water itself – what physical laws govern its surface and how the liquid acts and reacts with our senses.

Two forces act to form the horizontal surface of water:

adhesion, or the attraction between water molecules and other materials, and
cohesion, or the attraction of water molecules for one another. (fig.1, fig.2)

The force which acts mutually between particles of matter tends to draw them together thereby resisting their separation. Molecules join on the surface of water to form a tension that always creates as small a surface as possible for a body of still water. When water moves, however, its dynamics are controlled by complex interactions of forces, displacements and energies. Sprays, rapids, trickles, drops, plops, floods and deluges are all kinetic performances choreographed by this invisible order.

Drops of falling rainwater adopt different characteristics. They may fall as a drizzle, a warm



spring rain, or heavy Summer or Autumnal rains, as a storm, a downpour, a long and persistent monsoon or a cutting rain, all of which, in a dispersed way, may form mist, fog or dew and emerge on the surface of soil in puddles, pools and damp areas. Precipitation may also take place in a range of frozen forms, such as: snow, blizzard or hail, which forms into snowdrifts, (slush, mounds, mush, and slop), snow-melts and icicles.

Even though the science of rain chemistry and the physics of rain dictate all manner of imaginable water action and whilst environmental circumstances give rise to profound interpretations of the vast range of manifestations that water is shaped into, rain has also been a vast source of inspiration for artists and architects. Not only can we observe it in its natural surroundings, but also in numerous man-made forms such as fountains, artificial streams, ponds, jets and cascades.

Here, not only rainwater as liquid, but also ice and steam are forms of water available to designers.

Between these three conditions, water may move within itself, lie still, flow, steam, freeze in icicles, billow up in a light mist or heavy fog, fall down, spout up, or flake. Liquid is used most often, but solid ice and vaporous steam should also be considered, since they are commonly present in architecture as a part of the built environment. In fact, a complete pictorial catalogue of water phenomena would include most of the world's scenery.

Rain may be harvested, or it may be used as so called "grey water" (not drinkable, yet usable, both in households and gardens). We must remember though that nowadays rainwater is rarely pure as acid rains occur quite commonly. Still it may be collected for some utilitarian purposes. We may expect that sooner or later the problem of acidity and impurity of rain water will be solved giving us a chance to re-use it more intensely.

Perception of rain

The way we perceive rain affects our conception of city space. When raining, the image of a city suddenly changes – it gets dark, drops of water blur the edges of shapes, obscuring our vision, reflexes emerge and intensify faded colours, and the air itself becomes humid and cool. The atmosphere changes – it gets fresher, or cooler, often heralding the approach of a new season.

Rain transforms the cityscape into watercolour mirages. The silent surfaces of temporary ponds and puddles reflect the sky and shapes of buildings, reinterpreting vertical lines of trees and architecture in their many horizontal repetitions. Fog rolls over streets and buildings, creating shadowy mirages and phantoms.

The scent during and immediately after rain many people find especially pleasant or distinctive. The air smells like the ozone we inhale after a thunder storm. The source of this effect is petrichor, oil produced by plants, then absorbed by rocks and soil and later released into the air during a rainfall. After rain, clean air abounds and things seem renewed and quieter. The city itself gains a fleeting new cleanliness, with refreshed streets and rinsed sidewalks where glittering drops of water shine in the sunlight. It won't last long and soon it will disappear – until the next rain.

We tend to like rain, apart from times when it rains dangerously too long. It strongly influences our perception of environment. The feeling is the more intense as we feel it directly on our skin. We watch as rain overflows streets and makes puddles. We are glad when it waters our plants; we know it refreshes and moisturizes air, washes dust off pavements, streets and cars. Through soft, damp and humid air and a smell of wet earth, we perceive well-known space in a new way that is appealing to our other senses of smell and touch beyond just sight.

Attitude to rain – avoiding / seeking

Cultural attitudes towards rain differ across the world. However, irrespective of where we live, it does affect our behavior in many ways, not only practical. We can distinguish two characteristic attitudes of man's behavior towards the rain: seeking it (that is, encouraging our exposure to it) or avoiding it (looking for a shelter from it). Due to its miscellaneous aspects, rain may evoke various emotions, often opposite.

Though the traditional notion of rain in our culture is negative rather than positive, nevertheless we do know that rain can also bring joy and many of us consider it to be soothing or enjoy the aesthetic appeal of it. In the Western world, rain, metaphorically, has a sad and negative connotation, unlike bright, happy and sunny weather. Yet, it's known for a fact that while rain can have a depressing effect on some people awakening their sadness, melancholy, fear, or a need to escape, by others it may be seen as romantic, evoking joy and motivating fun. In dry areas rain is treated as a sheer matter of survival, which is why it is prayed for, greeted with euphoria and celebrated by dancing when it eventually comes. In short, cold and wet can be seen as bad weather hostile to health, but it may also be much desired, especially after a dry period.

Many people prefer to stay inside on rainy days. When caught by the rain in the city they seek shelter under roofs, eaves, and trees; escape under newspapers, waterproof jackets including the famous macintosh, capes, hats and wellingtons and above all beneath the simple and common umbrella to try to avoid getting wet. The umbrellas used currently have many features that traditional umbrellas have lacked. For example, there are now umbrellas that are designed so that they do not invert in very windy conditions.

There are golf umbrellas as big as a tent. There are "talking" umbrellas that will tell you the weather forecast, "hands free" umbrellas that give you more freedom to do other things than just protecting yourself from getting wet and even umbrellas that will not drip water on the floor when folded in. There are also clear "bubble" umbrellas which allow for greater vision while keeping you completely dry.

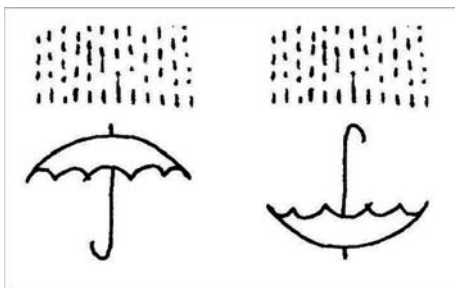
Besides its primary purpose as protection in bad weather conditions, opening an umbrella may bring a closer relation between people hiding underneath. Some people go even further, finding the umbrella an attribute with sexual connotations (Zola).

When looking at umbrellas as a feature that along with each rainfall reappears regularly in the streets, we realize how much they enrich the cityscape with colour, movement and variability. Thus it is an important scenographic prop in any urban space. When falling on the city, rain changes space into a

sheer spectacle, creating both unusual scenery and sensations. Wetness shines, shimmering colours of rainbow appear all around, the sound of raindrops blurs other noises with the drone of streams of water falling down and thumping on different surfaces, and the touch of raindrops on our bodies clarifies and strengthens our emotions. Spurts of rain pouring under our collar may be quite unpleasant, but, after first attempts to run away and shelter in order to avoid getting wet, we give up and with this resignation comes a feeling of liberation well-known from childhood, evoking joy and fun, making us break out from the routine of daily life. Together with this sensation of a "return to childhood" we are overwhelmed with the will to play. Like children again, we would like to run little paper boats along and stir up mud, splashing, shouting, and ...singing and dancing in the rain. It feels very liberating to just let loose and dance and sing in the rain as Gene Kelly demonstrated in the film under the same title. Common play breaks restraints; shared experience brings people together and helps us to get used to experiencing public space together.

Rain in the city

Not only does rainwater provide a crucial source of life, but also affects our life in the city. This is not a mere perception's factor, as described above, with two main opposing attitudes of avoiding-and-seeking, for it also influences strongly the very urban structure, as well as landscape architecture, buildings and street furniture. On the one hand the above are shaped to protect against the rain and enable drainage of rain water runoff. On the other hand, there is a need of rain water usage and storage. (fig.3)



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In most cases rainwater in our towns is partly or entirely hidden: in paved areas it runs underground in sewers; water reservoirs are covered and fenced off. Sometimes the process of the flow is slowed down in order to use rainwater in some particular way. It may be used for cleansing and nourishing or for aesthetic reasons and for the celebration of the element as a source of fun. A wide range of objects can be built and / or added to existing space that would connect people with the collection and run-off of rainwater.

Water may be collected and reused and in order to make this possible, we have to learn how to deal with:

- collection and recycling of roof rainwater, and

- means and ways of penetration of rainwater into the ground.

The storage and penetration of rainwater can reduce the increased storm run-off due to urbanization, delay the concentration time, loosen the load on the sewage system and play an important role in disaster prevention, reducing the risk of over flood. At the same time, it can also retain underground water and prevent ground settling.

the maintenance of a full supply of water, the source of life, is a constant anxiety which we all share. The reasonable use of rainwater may prevent water shortage in the future. Careful treatment of rainwater will not only solve the water shortage in cities but also provide better conditions for creating an ecological environment. Cleansing streets and pavements, as well as watering green areas is one of the most important uses of rainwater in our cities. Rainwater as it is, without any pre-treatment, may be used also directly for evaporative coolers, toilets, car washing, chlorinated swimming pools and surface irrigation. For other uses, such as in the household, it is advisable that rainwater be disinfected.

City surfaces: roofs and floors (pavements, roads and terraces) are appropriately shaped to let the rainwater flow down under control or to keep it for future purposes. Cities should have absorptive pavements to enable soaking, in order to decrease the amount of water overflowing a sewerage system. In the Ruhr Area (Germany), for example, a rule was introduced making the requirement of absorptivity obligatory.

Rain changes the desire lines that pedestrians take to walk in the city. They may take special "rainy circulation routes", like walking "dry head" along arcades which are a common urban structure for most of European historical towns. (fig.4, fig.5, fig.6)



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These covered walkways forming an inter-space that connects the building interior with public space have been developed mainly as a protection against the sun in southern European towns, like those in Spain, Portugal, France and Italy, to mention but a few. No wonder, then, that they are also useful when rain comes. In modern cities a "dry head" circulation is incorporated with covered passages, malls, underground subways and parking lots.

We need daily access to water, whether we live in a small village or a big city. Therefore it should be well exposed in the city public space. Water as a part of the cityscape may be an attractive feature of social life. Its ever changing dynamics may be used in a range of scales and processes. Rain, although unpredictable and uncontrolled, may be a good source of water supply for such purposes. Shallow ponds, cascades, reservoirs, fountains and streams and canals along public pedestrian paths should be included in both urban planning and architectural designing. Whenever it is possible, the rainwater should be collected in open gutters thus allowing it to flow on the surface of the ground. Rainwater can be also collected from rooftops into small pools and then distributed into streams running throughout the

city, where it can be seen and enjoyed, as well as re-used in many ways. (fig.7, fig.8, fig.9)



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In almost every city we encounter various forms of reservoirs and fountains. Most often they aim at rendering different aspects of rain into man-made forms. Along with the technological development not only water in its liquid form is used, but also its other forms, like vapor or mist. In The Tanner Mist Fountain in Harvard for example, the stone meanders disappear in a cloud of mist or

steam. In Marugame Station Plaza, Japan, the quiet veils of falling water that form the fountain evoke the translucent quality of traditional shoji screens, and provide cool relief during hot Summer months.

Throughout the ages, even more significantly than urban structure, rainwater has influenced the shape of buildings. This notion naturally applies also to the form of the roof itself as a surface sheltering the interiors from precipitation, forming "a hat" or "an umbrella" for the building. The need for security and shelter makes a solid roof one of the main objectives and an important architectural feature in many a traditional building. A roof can be a simple one, meant as a basic means to keep the precipitation off the dwelling interiors. The most primitive buildings are nothing but a roof. A roof may also be an expression of the traditional handcraft, imagination and creativity of local people. It may become an artistic statement of an architect forming a strongly defined part of the whole concept. (fig.10, fig.11, fig.12)



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In ancient Rome, water played an important part in the houses. The atrium, with its central impluvium (rainwater pool), was the first space to be encountered on entering. Under the compluvium (the opening that let the rain in), the impluvium was more than just a cistern, for the image of the sky was caught in it, and the outer sun and moonlight, as well as reaching the roof and surrounding rooms from



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above, was caught by the water surface and thus reflected upwards and towards them. Water and fresh air, luminosity and humidity, outer and inner space, volume and structure were all thus intimately related. The same pattern was then repeated through the ages, for example in the form of a Christian cloister's inner court (hortus clausus) that served as an opening linking earth with heaven in the otherwise enclosed space of a monastic life. Thus traditional architecture carefully operated with the rainwater in order to re-use it in some way or other.

While traditional architecture naturally celebrated rain, modern architecture for decades has shown disinterest in the sloped roof, using flat surfaces instead on top of buildings. This horizontal shape (a kind of "lack of roof") has become one of the main characteristics in the architecture of the last century, oblivious, it may seem, to demands of natural weather conditions. The only case where rain has to some extent been welcomed has been in roof-gardens or in glass-covered Winter gardens. (fig.13, fig.14)



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Solutions and concepts presented by more recent contemporary architecture show a great come-back to nature. Once again, rainwater is brought back to into the limelight, its importance restored, influencing both the technological and aesthetic aspects of buildings. Advanced technology of glass roofs has made it possible to cover large volumes of space with just a membrane between the outside and inside world, enabling people inside to be aware of weather conditions, to see and hear the rain.



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In New Court at The Fitzwilliam College, at University of Cambridge the rainwater comes down from the roof by way of iron chains, nourishing plants grown underneath in containers. In the Peckham Library in London, UK, the large top floor of the building is designed so that it protects the entrance square from the rain. We find this same prototype of protection in a number of public historic buildings all over Europe, for example, in Windsor Town Hall, UK, Ciudad Rodrigo, Spain, and in Castelo de Vide in Portugal. The construction of the Lisbon Utopia Pavilion at Expo'98 is shaped in a way that provides shelter above the entrance. (fig.15, fig.16, fig.17)



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All sorts of shelters may protect people against the rain in a public space: stalls, tents, canopies, marquees, a large tent set up for outdoor parties, receptions, or exhibitions. All these more or less temporary and portable constructions, made from



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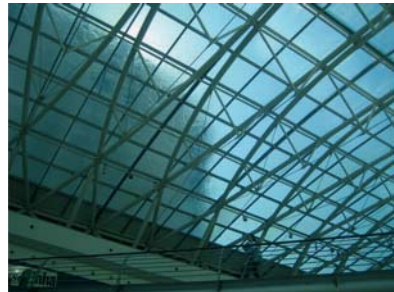
light materials, easy to dismantle and move from one place to another, add attraction, colour and charm to city public spaces, often strongly contrasting with the surrounding massive buildings. Many of these constructions protect equally against rain and sun. (fig.18, fig.19, fig.20)



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Rainwater is nowadays often used also to obtain special effects. An effect of raining sometimes is artificially produced in order to cool buildings with a film of water overflowing glass roofs. The glass roof of the Vasco da Gama Shopping Centre in Lisbon is subsequently sprayed. It brings the presence of nature to mind, adding yet another layer to our daily life experience of the environment. In Ostfildern town Hall in Germany the rainwater collected and processed on the roof is then returned to the city in the form of artificial rain. Digitally generated programmes of rain patterns control the drops of water falling from small holes in the bottom of the stand-off roof over the front facade. These drops perform various shapes like sinusoids, zigzags, or rays.

There are also extreme cases of dealing with rainwater in architecture. On the one hand, all over the world there are a great number of buildings with internal public spaces almost entirely isolated from or even literally cut off from the natural environment, like big shopping centres (malls) offices and cinemas. On the other hand, there is a more and more artificially made "natural" environment created, with ponds, springs and brooks, fountains and waterfalls. This fashion comes from the nowadays commonly encountered approach of modern architecture which tends to protect its users against the unpredictability of weather conditions introducing a denaturalized nature into interiors, creating within an artificial environment a quasi-natural landscape. Here, again, we have malls and offices, but this time carefully shaped along alleys and around green areas. Water circulates in both horizontal and vertical streams and cascades fall from ceilings and walls.

In some projects the effect of rain is a main feature in forming the architectural environment, as it is in the Blur Building – a media pavilion constructed for the Swiss Expo 2002. It is an inhabitable cloud whirling above a lake built with rain, fog and wind. In the preparatory research for Gdansk Workshop Andreia Sousa from UBI, Covilhã, Portugal, tried to explore the possibilities of the rainbow effect in constructing the architectural space by illuminating the rain in a particular manner.

This formless, featureless, surfaceless and dimensionless architecture makes us question where the border line is between architecture and non-architecture... And if there is no such line and no difference, then what is architecture?

Conclusion

The manifold different ways in which rain may be incorporated in the cityscape might help to bring city spaces closer to nature, helping an understanding of the water-cycle in our environment.

The question how to deal with phenomena of rain and rainwater in all its forms can stimulate the creativity of architects and students of architecture on

all kinds of levels from architecture to urban design and planning.

These are some of the design issues and questions: How could modern architecture and urban design celebrate rain? How might rainwater be incorporated into architecture as

- a cleansing element,
- a climate control and ecological balance element,
- a visually refreshing element,
- a spiritual element,
- a nourishing element of refreshment?

However, as we attempt to control the rain and to protect from it, we should keep its natural value, in order not to lose the positive therapeutic effect and the joy it brings. Rainwater can be used to echo and intensify any human emotion from awe to the light-hearted pleasures of folly and the comforts of domesticity. Whenever architects think about how to deal with rainwater in their compositions, they can launch their conceptions from and beyond its mere physical properties, and by so doing they can plunge into a treasure chest of legends and allegories to influence and enhance their designs.

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Images:

- fig. 1. The water cycle, 1729. Credit: Science Museum Library
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