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THE MAGIC OF SHADOW
IN FUN WITH ARCHITECTUREMAGIA CIENIA W ZABAWIE
Z ARCHITEKTURĄ

Abstract

Light is at its best in the presence of darkness. Information about the object illuminated by the light is conveyed by two kinds of shadows, its own and those cast. Shadows come into play with architecture in the form of chiaroscuro created by a solid object or some other additional elements constructed especially for this purpose. The cast shadow, which is very susceptible to deformation, can also be used to create some fun projections on surfaces.

Keywords: natural light, chiaroscuro, shadow

Streszczenie

Światło wyeksponowane jest najlepiej w obecności ciemności. Informacje o oświetlanym obiekcie przekazywane są przez światło i dwa rodzaje cienia, własny i rzucony. Cienie wchodzą w grę z architekturą w postaci światłocienia uzyskiwanego od bryły obiektu lub elementów dodatkowych, specjalnie w tym celu konstruowanych. Cień rzucony, jako podatny na deformacje, może być ponadto wykorzystywany do tworzenia zabawnych projekcji na płaszczyznach.

Słowa kluczowe: światło naturalne, światłocień, cień

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Louis Kahn said that *the crumpled mass called material casts a shadow, and the shadow belongs to light*. Rudolf Arnheim pointed out that *light and shadow are no longer applied to the objects but constitute them*. [1. p. 328]. Indeed, without light and shadow the perception of surroundings is impossible. Light and shadow, though often cited as adversaries, do not stand in relation to each other in opposition; on the contrary, they are complementary. Light loses its strength without shadow and only in the presence of shadows and darkness does it become clear and can therefore be appreciated. The shadow, understood as the absence of light area, is always present as an absolute darkness, gloom, and as a shadow of objects from the aforementioned matter. When planning illumination, many people focus their attention on the light, meanwhile it is shadows which determine the success or failure of illumination. The ordinary observer looks at an object through the shadows, the artist-designer focuses on the shadows [2, p. 39–47].

Darkness and semi-darkness are usually used to expose and accentuate light. Artists use the maximum contrast between these two phenomena. Transmitted and surrounded by darkness, light carries immense effect, it creates a mood and affects emotions; it can also evoke mystery and incredible drama. Such an effect can be found by observing the light penetrating into the interiors of the Church of Light by Tadao Ando and whilst standing in Louis Khan's Yale University Art Gallery. Light exposure accentuated by shade was used masterfully by Le Corbusier in the Chapel in Ronchamp, as well as in the monastery of La Tourette. In the crematorium designed by Axel Schultes, shadow has become a symbol of sadness and light penetrating into the interior has become a sign of hope [photo a]. The darkness in these cases underlines the importance of light and gives the opportunity to create a theatre of light and brightness.

Darkness is a state that significantly impedes perception of the surroundings. Only brightening clarity defines the space. Light always appears accompanied by two different kinds of shadow – its own and those cast, which provide information about the illuminated object. The object's own shadow, also known as shading or attached shadow, contains a message about the material and spatial characteristics of the illuminated object. This shadow is an inherent, integral part of the illuminated object. The range of space shrouded by this shadow depends on the shape of the illuminated object, on the direction of light incidence and, to a lesser extent, on the distance from the source of light. This kind of shadow is not susceptible to modification or distortion. Intensity of shading depends on the colour of the subject and the background on which it is located.

The second form is more expressive – it is the cast shadow, which is an area of darkness formed behind the object's own shadow. It is a kind of a 'lump' of darkness that pervades the space, and appears only at the time of contact with the surface on which it is cast. This shadow can be very intense, almost black, although its colour to a large extent depends on the colour of the base on which it falls. Due to the phenomenon of diffraction – the flexure of light waves at the edges – the shape of the shadow may be variable depending on the distance from the light source. The more distant the light source is, the more blurred it becomes. It is exactly this kind of shadow that is used for numerous artistic endeavours, introducing the game of light and shadow into architecture, including the creation of 'spatial jokes'.

Shadow Magic is created using two types of illumination: natural and artificial. The use of artificial light in order to obtain intended lighting effects is much easier than the use of natural light for the same purpose. Artificial illumination is used usually at twilight, when the exposure of light is perfectly visible. Designers arrange lighting fixtures in order to achieve

the desired effect. In case of natural solar lighting it is the illuminated object that needs to be adjusted accordingly to the light.

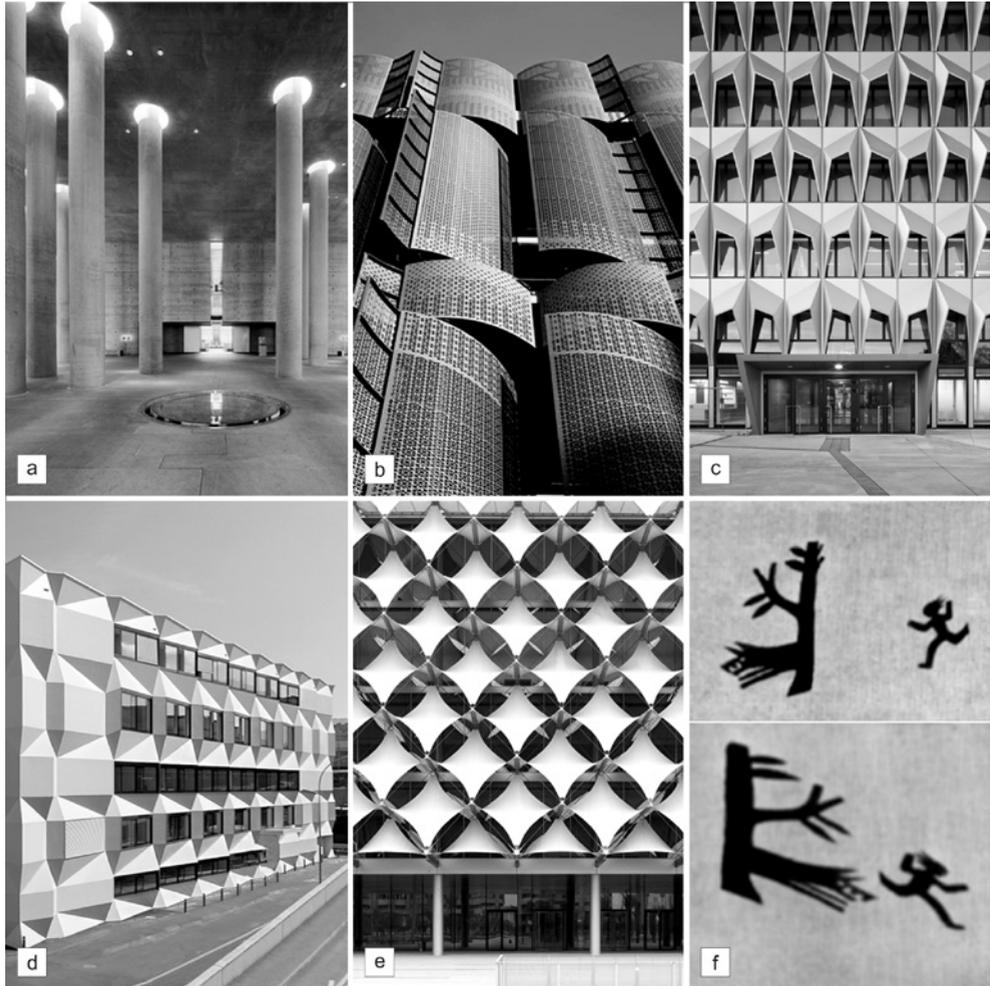
Creating light effects using the Sun is not a new idea; it has been used for centuries. One famous example is the temple in Abu Simbel. This temple, built during the reign of Ramses II, is positioned in such a way that a ray of sunshine on the specific mornings of 19 February and 21 October illuminates the faces of the statues of the sun god Amun-Ra, Ramses II and the god of the early sunshine Re-Horakhty, for about 20 minutes, yet it never fell on the statue of the god of afterlife and darkness, Ptah. Later on, architects of Christian churches used the phenomenon of natural light by filtering it through stained glass windows, creating colourful 'paintings' on the floors and walls of churches.

Even today sunlight can be used in different ways, revealing shadows that further highlight:

- The shapes of illuminated objects.
- The interdependencies and spatial relationships between solids.
- The texture of surfaces – from the unintended marking of uneven plaster relief to a very detailed accentuation of a designed relief.
- The plasticity of architectural detail
- The outline of a structure by projecting light onto the illuminated object.

Surfaces lit up by the rays of the sun are in constant motion, changing at different times of the day, rippling under the influence of the motion of warm air, overcast by clouds. Lighting changes every day, it creates long, sculptured and sharp shadows on the facades in June, whilst in December the shadows are flat and short. This variability should be taken into consideration when creating sunlit facades, especially by those designers who consciously try to play with sunlight. Many glass facades of modern buildings have not been designed to use the chiaroscuro effect and ultimately act as rather large mirrors, redirecting light to other, less well-lit areas, which is nevertheless also important in increasingly crowded city centres. A conceptual project to create a skyscraper without shadow was proposed by the London-based NBBJ. In this case, two buildings are planned according to the yearly sun path algorithms of the site, one of the buildings would have surfaces designed in such a way as to make the reflected rays of the sun light up the shadow cast from the second skyscraper. [3]

The idea seems rather difficult to implement, but the assumptions are quite interesting. Modern buildings are not furnished with much intricate detail, unlike e.g. Baroque buildings; there are no window frames, advanced cornices, nor ornaments, which could add a varied array of shadows and light to the facades. However, even nowadays it is possible to take advantage of the shadow/light interplay in order to design attractive architecture and not solely use it as a method of form generation. For example, when it comes to glazed buildings shadow can be used to give protection from excessive sunlight and to create a sophisticated chiaroscuro on the glass and in the interiors. Increasingly common is the use of 'light breakers' on the facades, usually horizontal, located above windows. Because of the angle of sunlight incidence in Poland, these often play a more decorative rather than functional role. However, they could be used to create a shaded image on the surfaces of the walls and windows, as well as to direct light beams to the interiors. Alternatively, vertical elements could be used. These fulfil the role of shutting off light that is too strong to a much better extent. The artistic and chiaroscuro effect of an elevation depends on the shape of these horizontal or vertical 'breaker' elements. Typically these are vertical rectangles often called 'razor blades', although one can also find examples of rounded forms



- III. A. Interior of Baumschulenweg Crematorium, project: Axel Schultes, Charlotte Frank from Berlin, 1998, photo by Mattias Hamren, <http://arquitectura.estudioquagliata.com>, 06.07.2015
- III. B. Shutting off light, Global Change Institute at the University of Queensland in Brisbane, project: HASSELL, 2013, photo by Peter Bennetts, <http://www.architectureanddesign.com.au>, 06.07.2015
- III. C. Hochhaus C10 in Darmstadt, project: Staab Architekten from Berlin, 2011, photo by Werner Hutmacher, <http://www.dai.org>, 06.07.2015
- III. D. University of Luzern, project: Enzmann&Fischer from Zurich, 2009, photo by Kurt Hofmann, <http://www.fotocommunity.de>, 06.07.2015
- III. E. The National Library of King Fahad in Saudi Arabia, project: Gerber Architekten from Dortmund, 2010, photo by Christian Richers, <http://www.designboom.com>, 06.07.2015
- III. F. The use of *vertical shadow projectors*, Twarowski, M, *Słońce w architekturze*, Arkady, Warszawa, wyd. 4, 1996, p. 149

such as in the building of the Global Change Institute at the University of Queensland in Brisbane [Ill. B.] (2013, HASSELL). These ‘breakers’ are usually open, screen-like, as their main task is to filter and scatter light, whilst still creating the effect of chiaroscuro on the facades of the building. Other elements which seem to be becoming fashionable again include full window shutters. Also, ‘curtain walls’ are being mounted on buildings. These contain movable, light, secure, rotating, folding or sliding screens. If the window screening (shutting and opening) process is not fully automatic, the users can themselves decide about the appearance of the facade, which thus becomes a transformable form, such as is the housing unit in Manresa, Spain (2008, Narch). Permanently installed concrete open-work curtain walls, such as on the facades of CNK Bialystok Technical University building (2012, aa_studio, Wroclaw) are yet another example of vertical screening elements. This project is also an example of the use of folk paper cut-out patterns, initiated in the building of the Polish Pavilion at EXPO 2010 in Shanghai (2010, W. Kakowski, M. Mostafa, N. Paszkowska, Warsaw). Naturally, these elements serve to protect from light. All of them not only perform a light filtering function, but also cast a shadow corresponding to the pattern which they carry. Devising a design for such a pattern can become an inspiring form of play with the building’s overall architecture and as well as with its users.

Sunscreens permanently fixed to glazed facades are yet another, often more complex, structure that is coming into use. Interestingly, such projects (with the addition of screens) are also implemented on existing buildings, e.g. the 1956 C10 Hochhaus in Darmstadt [Ill. C.] (2011, Staab Architekten, Berlin). The National Library of King Fahad in Saudi Arabia [Ill. E.] (2010, Gerber Architekten, Dortmund) presents an interesting example of enveloping a historic building in a new glazed form with an incredibly expressive sunscreen. Another design route was followed by the University of Luzern facade creators [Ill. D.] (2009, Enzmann & Fischer, Zurich). In this case the rebuilt wall became a geometric relief, which forms an expressive play of light and shadow.

Another, separate idea that may lead to creating impressive visual effects in architecture is to create designed shadows to be cast onto the buildings. The result is similar to the frequently seen outlines of trees or other buildings on facades. In this instance, physical elements are deliberately set at a certain distance in order to cast a shadow of a certain contour and rhythm. Pergolas and trellises create similar effects when in full sunlight. Projected shadows are created by various lattices, meshes, rods, and artistic screens. Another way of accentuating or distorting the form of the cast shadow can be achieved by casting it on slanted or uneven surfaces. Due to the deformation of shadows this can create interesting additive effects. Such shadow effects can often become visually more prominent than the illuminated objects themselves.

The least used seem to be the idea of playful effects – ‘jokes’ – created with the help of shadows. As an example of this type of intervention and shadow play we might cite Twarowski’s idea, which involves creating various narratives (historical stories) on the facades. Twarowski proposed the use of *vertical shadow projectors* [6, p. 149] and a play in which, depending on the time of the day, a silhouette of child is chasing a wolf or is escaping from it. In such a case the creative possibilities are very rich, and the principle is to rely on the experience gained from the theatre of shadows [Ill. F.]. The individual components, at a specified time, complete a carefully planned image created by the shadows cast. This play with light is very interesting, but also quite difficult to manage due to the variability of the light source. Undeniably, it is certainly worth trying.

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