

Shifting and unstable: The role of colour and light in affording multiple readings of architecture

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The paper will explore the transformative capabilities of colour and light in architecture through selected projects from contemporary architectural practices and designers. Colour, which is generated through the play of light, is never static, and has the capability to be used as an instrument to tune and transform architectural space. Through the constantly changing conditions of daylight, coloured filters, projected images, and technological developments in the control of light sources, multiple readings of space are generated. Drawing on an interview with Ben van Berkel and Caroline Bos of UNStudio, based in Amsterdam, and considering the work of the American architect, Steven Holl, alongside an emerging field of architect-designers, the paper argues that the metaphysical properties reflected and projected coloured light can be seen as instrumental to the synergic design of architectural space [1].

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Introduction

Ecstatic colour

The controlled use of light in architecture is fundamental to the user's phenomenological experience of space. It can clarify the architectonic intentions, or overlay the material construction with layers of ephemeral and situation specific stimuli. It reinforces a transcendental reading of space that is constantly in a state of transformation, an architecture that is essentially transitional—both by the individual moving through space, and by the metamorphosis of the physical form through the dynamic and elastic properties of colour.

The randomly patterned, stained glass window at Cologne Cathedral (2007) (Figure 1), by the highly influential contemporary German artist Gerhard Richter (1932) draws on his long fascination with colour and chance composition exemplified in his *Colour Chart* paintings, a series, which he began in 1966, and in a more recent iteration, *4900 Colours* (2007) [2]. Unlike traditional figurative windows where the colour is part of the image, the abstract, chequered composition of pure colour and light offers no specific interpretation, yet taps into a reservoir of cultural, religious and social associations that fuse light with symbolic power. Similarly, the pierced rotunda of the multi-denominational Meeting House (1966) (Figure 2) at Sussex University campus in England, by Sir Basil Spence (1907–1976) and Partners, tends to have a profound effect on the visitor [3]. The coloured glass inserts in the honeycomb wall employed by Spence and his assistant Anthony Blee, echoed the colour gradation of the Baptistry window designed by John Piper for Spence's Coventry Cathedral (1958-62). The vagaries of daylight, orientation and weather combine to create a constantly changing, immersive and dynamic space. The colour appears diffused through the space and casts intense pools of coloured light.

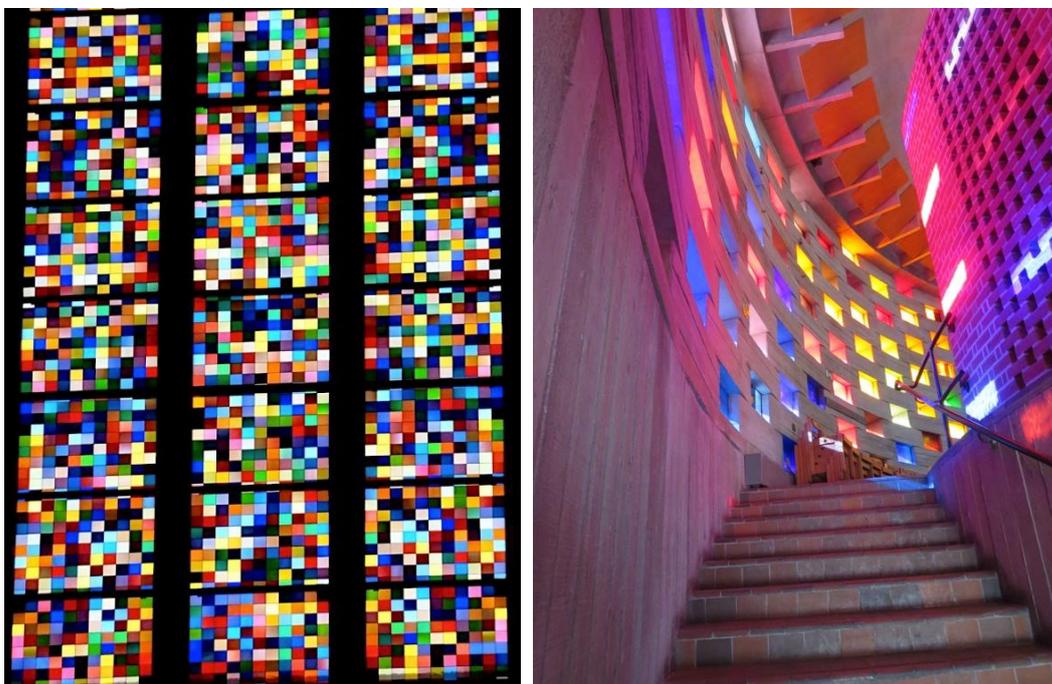


Figure 1 (left): Gerhard Richter, *Stained Glass Window at Cologne Cathedral*, 2007.

Figure 2 (right): Basil Spence and Partners, *Meeting House, Sussex University*, 1966.

Discussion

Colour is, of course, a product of light. It is generated as a reflection of a particular set of wavelengths from the surface of an object, or by modifying a light source through a filter, or as emitted by a particular artificial light source. In every instance, there would be no perceived colour without light, and the appearance of everything we see is therefore completely dependant on the ambient light and applied, artificial light sources. These are further modified by our personal physiological, psychological and cultural characteristics. Light is essential to the functioning and experience of space and to the well-being of its occupants. The play and the quality of light is also one of the most poetic means through which an interior space can be enlivened. Colour, which we experience as radiant light energy, is

ephemeral and elusive and will shift in appearance with the quality and quantity of light. It can therefore be a very powerful metaphysical tool to transform and modify internal spaces.

The work of New York based architect, Steven Holl, makes specific use of colour and light and the interaction between them [4-5]. His Chapel of St. Ignatius, Seattle (1997) adopts textured white interiors, tempered by the use of roof-lit funnels, which gently tinge the internal surfaces as the external lighting conditions change. The perception of the space is transformed as light bounces against the curved surfaces, capturing the different qualities of light from north, south, east and west by a series of angled roof lights. Colour is generated by a pairing a pure coloured glass lens in each window with its complementary colour painted on the surface of a baffle set opposite the window. Only the reflected colour is visible from within the chapel. The volumes are shaped to further modify the internal experiences as one moves through the church, and simultaneously correspond to specific aspects of Jesuit Catholic worship [6]. Holl's analogy is of bottles acting as containers in which light is captured and stored, with each volume differentiated in form and the interactions of the reflected light (Figure 3).

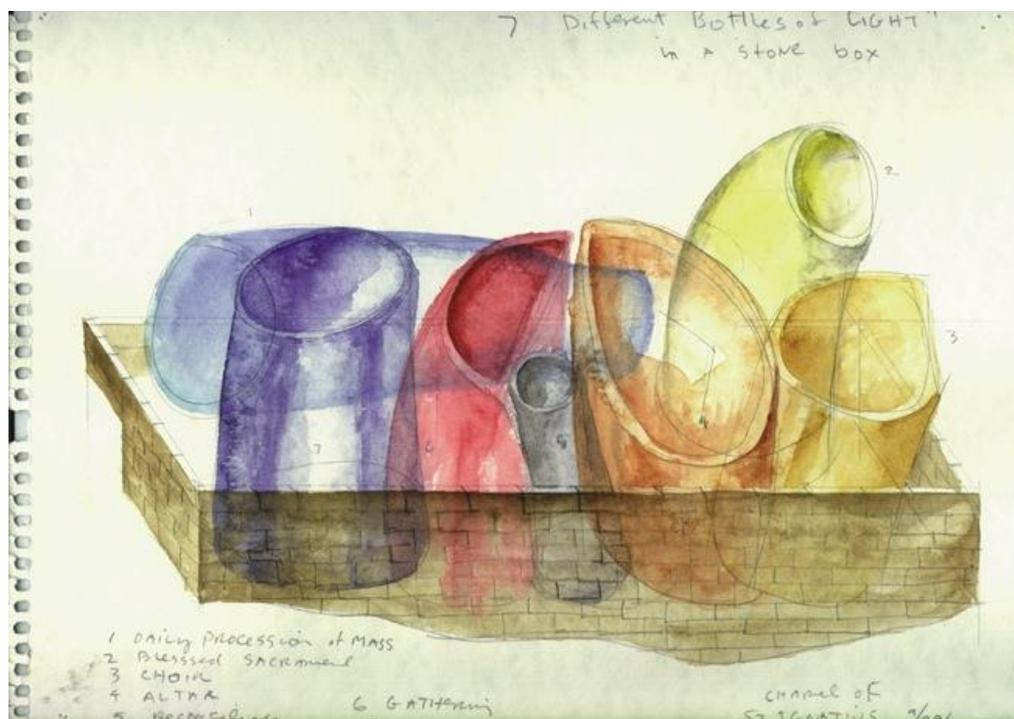


Figure 3: Steven Holl: Chapel of St Ignatius, Seattle, 1997. Watercolour © Steven Holl Architects.

Yet such immersive, sublime experiences that are designed to evoke an ecstatic response are rarely appropriate to the everyday spaces of work. In the majority of architectural spaces, a more restrained use of light is generally required.

Diffused colour

In one of Holl's best-known small buildings, in the Sarphatistraat, Amsterdam (2000), reflected light from a pigmented surface, which is deliberately concealed, is activated by the play of light. The same technique was used in his 'Colour Reflecting House' at the Makuhari complex, Japan (1992-6). Such devices project softly tinted light that moves across both space and surface. The colour attracts the eye, and obliquely reveals a hidden space beyond that which is immediately experienced, adding a layer of ambiguity. Holl further celebrates this element of doubt by using layers of different materials, some

being perforated and some solid, some translucent and some clear. The layers seldom entirely align, and are sandwiched in different combinations, to distort the surfaces and indicate depth. Rather than introducing strong colour, the effect of this technique is very subtle, and shifts in appearance as the sun moves round the sky. Colour produced indirectly in this manner is more unstable, temporal and intriguing than the direct use of pigmented or painted surfaces. Colour and light are therefore employed as part of an experiential, multi-sensory architecture, the architect deliberately abdicating a degree of authority to natural phenomena.

The direction of natural daylight is well known to have an effect on the perception of applied colour within a space. Maud Hårleman's research demonstrates that, in the northern hemisphere, subjects experience yellow painted walls in a north facing room as more bluish in appearance than the same yellow used in a south oriented room. The yellow appears to increase in chromaticness when combined with daylight from the south [7]. Similar observations of daylight colour and orientation were expounded in David R. Hay's 1836 treatise *The Laws of Harmonious Colouring: adapted to interior decorations, manufactures, and other useful purposes* [8], offering advice based on his experience as a 'house painter', for example.

"Apartments lighted from the south and west, particularly in a summer residence, should be cool in their colouring; but apartments of a town house ought to all approach towards a warm tone; as also such apartments as are lighted from the north and east of a country residence."
[8 p26]

Daylight, orientation and colour temperature

Daylight is an essential factor in the design of space and in the articulation of form. For the most part, however, the potentiality of varying colour of daylight is under utilised. Steven Holl is also known for heightening the experience of the temporal nature of daylight through a range of different instruments (for example the careful positioning of apertures that are designed to celebrate the variance in sun angle, and orientation) [9]. In his Knut Hamsun Centre, Norway (2009), the extreme northern latitude, above the Arctic Circle, is accentuated with light and dark contrasts in the materials, and the positioning of windows to celebrate the exceptionally low summer sun from the north. These devices anchor the building, not only in its physical context, but also experientially. More recently, the deep conical voids of the Reid Building at the Glasgow School of Art (2014) provide a series of three framed oculi, the only colour being that of the sky itself, or from sunlight that moves around these 'driven voids'. (Figure 4) [10] Sectional drawings of the project make a direct link between the angle of the sun at key points in the academic calendar, for example the start of the September semester, or the final June degree show [11] The six metre diameter voids are tilted 12 degrees to the south to capture the soft, low Scottish sun. Although the white paint on the walls and ceilings is the only applied colour, combined with grey exposed concrete floors, the experience of the elongated circulation route, which is threaded through and alongside the voids, is moderated by the colour temperature of the natural light as it varies by day and season. The circulation space is therefore animated in contrast to the blueish, more stable daylight of the north-facing studios.

The entrance hall at the University of Cranbrook's Institute of Science (1998) similarly uses no colour other than that produced by the effects of light distorted through many different types of glass. Here the constantly changing effects are of sunlight and shade, of streaks, informal patterns and an occasional spectral projection. These work in concert to animate the volume as part of a highly experiential series of internal and external spaces. In the Philosophy Department at New York University (2007), Holl takes this one step further by the use of panels of prismatic film, set against the windows and suspended

in the stairwell, to generate ephemeral rainbows that move across the white surfaces only when the sun penetrates the dense urban context and falls on the façade (Figure 5). The effect is invigorating and sensual. It might have been overly distracting in working rooms, but by focussing the transient phenomena in the vertical circulation space, it is experienced while in transit and acts as a stimulus to contemplation, to dislocate the mind from mundane activities, albeit fleetingly.



Figure 4 (left): Steven Holl Architects, Reid Building, Glasgow School of Art, 2014.

Figure 5 (right): Steven Holl Architects, Philosophy Department, New York University, 2007.

A key principle of Steven Holl's architecture is the 'spatial energy' generated by the interaction of the body moving through space [12-14]. Central to this is his ambiguous use of colour and light, which allows each work to be open to interpretation by the mood and perception of the user. The experience is therefore not as predictable or under the control of the architect as would be more the case using directly pigmented surfaces. One might argue that Holl's buildings are tuned to the nomadic nature of light. Sunlight is controlled, follows predictable paths, returns to expected places, configuring and re-configuring, but is experienced in multiple ways by the users as they move through the spaces.

Holl's built works offer a response to Juhani Pallasmaa concerns [15] regarding the visual hegemony in contemporary architectural representation.

"We can distinguish between an architecture that offers less in its real material encounter than its images promise and an architecture that opens up new layers of experience and meaning when confronted in its built, contextual, and full reality." [15 p333]

Architecture is multi-dimensional, although inherently stable; it is experienced in a transient way and should allow multiple subjective readings and experiences. Gilles Deleuze considered the role of space to be more than fixed geometry, more than simple built form [16]. This is especially the case with a designed interaction of colour and light that is only apparent in context, in the real situation, and over the passage of time, because of its metaphysical properties.

Application of technical developments

The Dutch architectural practice, UNStudio, an interdisciplinary practice led by Ben van Berkel and Caroline Bos, has employed the reflective properties of light and colour in a collaboration with adhesive manufacturer 3M (the originators of ‘yellow stickies’). 3M had developed a product (now known as 3M Radiant Colour/Light Film), originally intended for wrapping perfume bottles, but it had not turned out as expected, and was lying idle in their laboratory. The architects used the material, embedded into layers of glass, to wrap the courtyard surfaces of their La Defense office development in the new town of Almere, north of Amsterdam (2004). The surface of this material, similar to the surface of a Compact Disk, is ribbed in microscopic ridges that bounce natural light across and between the minute spaces in the surface. The resulting film shimmers like the wing of a butterfly. Further, and most notably, the perception of the reflected colour is altered dramatically depending on the angle of the viewer and the ambient light conditions.

While the surfaces of the buildings at the perimeter of an urban block are clad in a shiny but plain grey aluminium, the plan form uses oblique slashes across the centre of the urban block to reveal a highly colourful series of voids snaking through the centre of the site. The building appears inside out, bland and homogenous on the outside, vibrant and astonishingly dynamic on the inner faces (Figures 6 and 7). The entrances to most of the individual buildings are set inside the block, forcing the visitor to penetrate the exterior and discover the colours within. Inside the buildings, now occupied by Social Security and Tax offices, the coloured light bounces around the faces of the courtyard and into the edges of the rooms. Spaces adjacent to the courtyard are flooded with ever-changing, softly tinged light. This is very effective in the white painted reception and waiting areas, creating constantly changing colours as the sun moves and clouds pass, but may be distracting in working offices, which are therefore predominately placed around the external perimeter. Although the drama of this may fade if seen every day, it is a powerful illustration of the ordinary experiences of everyday urban life heightened beyond the norm.



Figure 6 (left): Front view of UNStudio, La Defense Offices in Almere, Netherlands, 2004.

Figure 7 (right): Side view of UNStudio, La Defense Offices in Almere, Netherlands, 2004.

The building skin is an experiment into the interaction of colour and light. Walking through the exterior courtyard, the surfaces appear to change from vivid red to blue, green, orange and yellow, completely transforming the appearance of the building within a few paces. Viewed perpendicular to

the skin, a clear deep red may change to a green, yellow or blue when seen obliquely. It is hard for the mind to accept that this is a single material. A secondary effect is observed on the pavement immediately adjacent to the cladding. In strong sunlight, the reflected light from the panels is itself so intense that it is diffused across the pavements and internal courtyard surfaces, heightening the transformative effect. Coloured light is reflected onto the bland concrete resulting in magical orange, red and yellow pools.

Without the material, and the resultant colour, one could argue that this is a fairly soulless perimeter office building. The courts are barren, without any form of softening landscape. It is a disconcerting experience to dwell in the voids, feeling as if being constantly observed by acres of mirrored sunglasses. The reflected colour activates and transforms the appearance of the building, through the movement of clouds, light and the position of the viewer.

Coloured light sources

There has been a recent growth in the use of coloured light sources to transform architecture externally, spurred on by the ability to programme complex lighting combinations digitally. UNStudio has completed two department stores, the Galleria Department Store in Seoul, South Korea (2004) and Star Place, Kaohsiung Taiwan (2008). In both, projected light is used directly to distort and modify the appearance of the building at night, through timed pulses. Ben van Berkel relates the changing colour to the seasonal pulse of fashion in clothes, using the same metaphor of dressing for a proposed apartment building wrapped in ribbons of steel in New York. In the case of the department stores however, the pulse is much faster than any seasonal variation in clothes. Through the constantly changing light, the authority of the building image is placed in some doubt. Who is in control of the image? Is it the architect or the computer programmer?

Van Berkel admits that they had not initially understood how easy it would be for the client to change the appearance, and so for the second building, the practice constrained the lighting design through a tighter contractual agreement, effectively legislating the colours and thereby ensuring their authorship [17]. There are inherent dangers for architecture in this drift towards brand and image over substance and materiality. Taken to its limits, architecture becomes mere lifeless surface by day, and by night, a 'brandscape' for projected colour and light. It may still be experiential, but only in a cinematic sense and is easily open to manipulation [18]. Increasingly, designers are making use of projected image, supergraphics, text and coloured light in interiors. Digital projectors can produce static and moving images, either very subtly, or immersively, for example the installation *The Big Picture Show* in Daniel Libeskind's Imperial War Museum in Manchester that uses 1500 archive photographs and surround-sound, plunging the visitor into an unavoidable sensorial and spatial experience. These technologies introduce opportunities, but also bring new dilemmas for architects more accustomed to a sense of permanence, durability and stability.

The influence of artists and designers

We experience the complex properties of light every day, but we may simply not notice these effects unless our senses are heightened. Artists force us to look at the commonplace in a new way, to stimulate a deeper comprehension of ordinary experience and provide inspiration. For example, Daniel Buren's large-scale installations, notably *Excentrique(s)* (2012) at the Grand Palais in Paris [19-20], or the installation *Catch as catch can* (2014) at the Baltic Art Gallery in Gateshead [21], use daylight filtered through transparent coloured vinyl. In Paris, the vinyl was stretched over a network of circular frames. In Gateshead, the film was applied directly to existing rooflights, with floor mounted mirrors used to create stunning temporal patterns of light across the gallery. It is expected that each visitor will have a

different experience and see the space in a different way. The kinetic artist, Carlos Cruz-Diez has spent a lifetime exploring the properties of colour in his three-dimensional artworks. One example is his *Psychromie* series, undertaken between 1959 and the present, in which layers of colour are set behind vertical stripes [22]. The space between is infected by reflected coloured light, and the resultant image formed in the eye and mind is entirely dependent on the angle of view. The work produces startling effects as the viewer moves through space.

A new breed of architect-designers is emerging, whose work lies at the intersection of art, digital media and architecture. Jason Bruges Studio is an interdisciplinary practice that uses coloured light and robotics in interactive, and often site-specific installations, which engage the audience directly through motion and touch sensors, and with digitally programmed lighting (Figure 8) [23]. Although more specifically seen as the territory of lighting designers, the potential of the advances in, and accessibility of, low cost, low energy, LED lights mean that coloured light sources are becoming more common in interior design and can be used to great effect to heighten the sensual experience of space or to construct illusions more frequently associated with stage design, events or exhibitions. The Italian design practice, Carnovsky, is known for its experimentation with RGB coloured lights to reveal hidden layers of superimposed images within complex printed patterns of wallpaper and textiles [24]. When the room is bathed in a single coloured filter—red, green or blue—one printed layer of a CMYK composition appears isolated. First shown in an exhibition during Milan Design Week 2010, human forms are visible either fully clad in skin, or skeletal, or with muscles exposed as each coloured light is dominant [25]. In white light the tangle of images appears confused. Their work suggests that there is a relatively untapped potential to create spaces with surfaces that will appear radically different at the touch of a button or when activated by human engagement.



Figure 8: Jason Bruges Studio, *21st Century Light Space Modulator*, RIBA, London, 2012.

Conclusions

The use of colour and light heightens our emotional engagement with the environment and has long been used to suggest meaning, to act in concert with form, and to enhance the atmosphere of interior space. Aided by the technological development of materials and artificial lighting, architects and designers are increasingly using coloured light to invigorate spaces and surfaces. With less commitment than pigmented materials, and the ease of accommodating future change, coloured light, whether

projected or reflected, becomes a further tool in the design of space, and has released architects to experiment with colour, surface and the sensory experience of space.

At its most subtle, as seen in the examples from Steven Holl Architects, dynamic interactions of colour and light demonstrate an awareness of the affordances provided by daylight—its orientation, colour temperature and the use of softly tinted light reflected from hidden pigmented surfaces.

Unlike the examples of computer programmed, projected displays on the buildings by UNStudio in Seoul and Kaohsiung, the joy of the reflected colours on their offices at Almere, is that it is generated entirely by daylight. Although the extraordinary cladding produces highly concentrated coloured light, it is ambiguous, less controlled, not formulated, but entirely contingent on the vagaries of natural light.

In the projects considered in this paper, colour and light activate and transform space and surface. Here, architecture is heterogeneous, moving rather than static, constantly changing, de-materialising and re-constituting. The examples demonstrate the potential power of the well-considered application of colour and light in elevating architecture beyond ‘simple built form’ and engaging occupants in a form of transcendental aesthetic [26].

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