Colour and lighting technologies for media facade

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ABSTRACT
Inside the research “Colour and light in architecture” at IUAV University, one of the main topics is to study the role of chromatic and luminous technologies in media-architecture.
The contemporary environment and architecture seems to replace any architectural project not identified by information and electronic technologies in order to realise dynamic and advertising architectural surfaces. The use of some software and digital displays in the architectural façade is completely changing the meant and the perception of the architecture in many point of view: architectural, urbanistic, sociological, etc.
In this architectural outline, which role will be able to have the urban-screen? Which will be the materials and the technologies involved on the realization of colour? And, especially, which capacities/competence will be necessaries, besides those of the architect, for this new trade?
Another important question is relative to the used materials and the visibility of the architectures: which kind are the colours for the realisation of these urban screens: colours of the additive or subtractive sintesys – RGB, CMYK? And, which type of image is it transmitted high/low resolution, 2D/3D? The scope of this paper is report some research goals in relation of the realization of media surfaces and, therefore, to analyze the variability of their perception and visibility related to the environmental effects, of the technologies and materials.
Keywords: mediabuilding, light architecture, urban screen

Introduction
The architectural skin of contemporary architecture has the role of communicative boundary between indoors and outdoors, as an interface. For this, its can have different functional performance and take many meanings that can grow with the application of high technology innovation solutions.
In projects of modern and contemporary architecture made already by Mies van der Rohe, then by Jean Nouvel, Toyo Ito, Bernard Tschumi, etc., is clearly a very precise research in innovation and façade construction systems that characterize the project. These measures shall take account of figurative and value of colour, texture, surfaces of perceptual quality of external covering. In particular, they play with the structural lightness, transparency and reflection, i.e. with those details that contribute to and complement the architecture in his place, through materials and technologies, interference-causing reactions and interactions.
The information age, in which we are immersed already from the last century, influence our daily lives and also figured architecture through a combination of factors that can be summarized into Immateriality, that it's identify in lightness and transparency concepts, into “tachia”, relation to the notion of speed and time reduction; the multimediality, linked
to the multiplication of supports and the *transformability* or *mutability* linked to the *sensoriality*.

In particular, the multimediality is “the factor by which expresses the information age” and can display messages on a variety of media that you can integrate in architecture to the construction, particularly to its envelope.

**HIGH AND LOW RESOLUTION TECHNOLOGIES FOR COLOUR AND LIGHT IN MEDIA ARCHITECTURE**

With the spread of electronic sensor and processor applied within housing and with the applications of digital displays on buildings facades, the contemporary buildings seem to be becoming increasingly in electronic cold bodies. Many of these applications identify one type of media surfaces that could be described as “low resolution”, both for the technologies, both for the Visual effect achieved. I remember, for example, the experimentations of the CCC (Chaos Computer Club) at the Bibliothèque Nationale de France (2002). In this project, the CCC transformed the Tower T2 library in a large computer screen. With an array of 20X26 windows (a total of 520 pixels) and a total size of 3370 mq, the installation called “Arcade” became the biggest screen of computer ever seen. Arcade stood at the time as a true low-definition luminous screen.

Another famous project was KPN Telecom Office Tower in Rotterdam by Renzo Piano (1997-2000). The facade (whose size is about 37, 8x72 m) is covered with laminated glass panels placed in an aluminium frame and pvf2 coated grey. These divide the façade in a mesh of approximately 1.8 mq each cell. Each centre is located a long lamp life controlled by a software that handles the lighting and animation effects. The façade becomes a “screen that looks at the square”, it can to project graphic animations, visual messages and information about events going on until two kilometres away.

**The role of technology and materials**

Then the media-action of architecture can be realized with different technologies and products, according to the effect that you want to reach, costs and expected economic investments, the place and, above all, the project you have in mind. Another key factor in the choice of components to be used is relative to the media perception of surface: static or dynamic. Does it mean if the average building is functional to a dynamic communication realized with mechanical-electronic systems or transmits messages written and figured as in the printed paper.

The examples described realize a low-resolution surface, where the transmitted images are composed of a many large physical pixels, who identify in each lamp installed. As for example the circular fluorescent lamps Bix system of Kunstmuseum Graz or Spot facade in Berlin. The media-effects which is realized with electrical technology and components such as lamps, used for decades. Nothing new.

The novelty in this case lies in iteration of other systems and technologies with electric technology. These allow you to program both the management of the lighting system, both of perception. In this way a media facade is realized that, for the size of the pixels-lamp that compose it, allow the perception of the final image only at great distances. This effect transforms these architectures in totem to urban dimension in urban signals visible in urban land.

Another type of scientific and design transversality can be seen in the application of serigraphs to shield or colored glass panels that enclose the lamps, or in the realization of an envelope with coloured polymer panels that hide the
component bright and allow the light to shine forth from under the Panel (e.g. Allianz Arena, Herzog & DeMeuron).
This is also known technologies and components for many time, but applied in synergy in other sector than the original.
A research by myself some time ago (at the Doctorate in Building Technology) about the media-envelope and technologies to make it happen, it was found that most of these projects is built with the contribution of different scientific and technical fields. The most concerned are those of the electrical, electronics, hydraulics and chemistry technologies. Usually each of these is integrated with information technology, which in recent years has assumed a central role in the management planning and maintaining the architectural envelope.

THE COLOUR PRODUCED BY THE CHEMICAL OR NANOTECH TECHNOLOGIES
Contemporary urban space has become a place to experiment with all kinds of technology to communicate: polychrome adhesive coatings (decorative films applied to building facades), the advertising-panels that line the scaffolding for constructions side.
The new report that has formed between the residential function and information assumed by certain contemporary architecture is becoming a significant phenomenon. With the proliferation of mediabuilding, the informative function tends to prevail over the residential function and “architecture is becoming (...) an information medium, not to say advertising support in the broad sense, a media-support” (Virilio P., 2000).
Over the past decade we have witnessed the spread of real media yards, where the outfitting of scaffolding has assumed the function of supporting major advertising events. Often these scaffolding remain mounted indefinitely for the enormous economic gain that billboard produce. In fact many restorations are possible thanks to these receipts (fig.1-1a). The images on advertising-panels are manufactured with a varnish applied with digital printing methods and with inks made from pigments and a vehicle or water based, solvent or oil.
For digital printing on polymeric panels (PVC) using solvent inks why it adhere better to the support. So in many cases you avoid the lamination process.
Finally there are UV inks, solvent cheaper because the UV radiation polymerize almost immediately the ink or paint film and dry completely. Usually the UV inks are made by four components: monomers, oligomers, pigments (and other adhesives) and photoinitiators. The only optical “active” element is the photoinitiator that reacts to specific wavelengths of UV light. When a photon or UV radiation affects a molecule photoinitiator triggers the reaction hardener.
The use of these inks and varnishes also responds to the needs of environmental sustainability because it eliminates the use of solvents considered harmful (that contain VOC) to the environment and health.
The realization of the image to be printed is a project of advertising done with graphics software and set to print according to parameters of process color CMYK (Cyan, Magenta, Yellow, black). Are the colors of the four inks used in typography and color printers.

THE BINOMIAL COLOR-LIGHT IN THE REALIZATION OF INTERACTIVE ENVELOPE
The electronic revolution in video installations begins with the apparitions of the first experiments video of Nam June Paik. He was responsible for the creative use of the first portable video recorders and cameras of Sony, the
popular “portapak” with a contextual translation of the contents of the shots (a. Ladaga, Mantiega s., 2006). The videoinstallation actively involves the spectator in spatial location of opera, simulated space that questions the physical place where proceedings are taking place.

Today’s digital technologies allow you to recreate diversified spaces and multifarious installations with the use of LCD (Liquid Crystal Display), micromonitor, architectural surfaces projections, holographic screens, reflective films, capable of operating a veritable visual metamorphosis (or video) of physical space. Space in this manner seems to multiply, magnified or fragmented. The instruments to obtain this mutation perceptual space are located on two different types of tools: projection tools (bright headlights) emitting images or beams of light colored walls, or electronic monitor.

Monitor developments in mediabuilding is realized, where the technological revolution has transformed the screens into real architectural structures or, if the reverse is also true, has turned some architectures into real media events. Well known examples can be as the installation of Piazza Duomo in Milan entitled “Milano in Alto”, as the screen led the Nasdaq in New York. In the contemporary time it seems that all the building becomes a media surface, an interface that receives and transmits data and images in a continuous flow: from New York, electronic Akihabara district of Tokyo, up to Piccadilly Circus in London (fig.2).

Urban projection technology has evolved by binding to specific events and leveraging existing buildings surfaces into screens, making the interaction between the projected images and
architectural elements. An example are the multi-projections temporary realized in Italy and abroad by emerging multivision designers. A recent example is the German firm UrbanScreen installations, among them that looks very interesting the 555Kubik Facade Projection (fig. 3).

**THE COLOR PRODUCED BY THE LUMINOUS AND ELECTRONICS TECHNOLOGY**

The colour isn’t an intrinsic feature of objects, but the result of the interaction between the light emitted from a source, physical properties of the surface of reflection and eye apparatus of the observer. In fact, usually uses the term “sensation of colour” because no electromagnetic waves to be colored, but it’s our perceptive apparatus that interprets the difference of the wavelength of light as colour diversity (Ravizza D., 2001).

The colours that characterize electronic screens and lights are those of additive synthesis of RGB as for computer monitors. This is the pattern of additive colours: Red (Red), green (Green) and blue (Blue), which screened and stacked in the correct proportions shall transmit the white light. The same effect is achieved in the application of led lighting systems. The crossing of the red light with the green light transmits the yellow light, green with blue transmits the cyan and red with blue transmits the Magenta (a kind of purple).

In order to transfer an video-image you must also send a sync signal that provide information about when to start an image (vertical sync) and when starts a line of the picture (horizontal sync). These two synchronisation can be combined into a single timing (composite synchronisation).

Architectural projections, for example, are made with different projectors manufacture, shape and potentialities, that eventually are combinations of coloured LEDs. You can use projectors of small dimensions, for example, consist of a circular plate with 18 led RGB, propelled by a power of 5 watts, with a high luminous efficiency, or you can adopt systems defined “speakers”, to use primarily architectural, incorporating 40 led whose combination lets you get all kinds of desired gradation, avoiding discontinuity or grey areas in the projected image. While the first, places at a distance of 5 meters from the projection surface shall forward a final image of the surface of 150 cm, with a viewing angle of 14°, in the second case at a distance of 6 metres it is already possible to achieve a surface projection of 4 meters in diameter, with a viewing angle of 37°.

Very often in place of projectors are used electronic surfaces consisting of panels of various sizes (depending on the technology used and the manufacturer) and materials, when are installed the leds.

Electronic panels that transmit live images over the television studios, for example, or concerts are formed by the composition of a series of panels or electronic tiles approximately 50 cm, composed of 256 led mounted on a metal grill and covered by a glass panel. These electronic tiles are characterised by a high refresh rate to 30 Hz and can be used both vertically and horizontally.

In fact, to support the loads, are sized for a maximum load of 300 kg/mq.

The Crown Fontaine of Chicago is coated with around 294 high-resolution led panels for a total of 903168 pixels on facades where are projected images. Each Panel is composed of over 3,000 LEDs. Sides are lighting with 70 Colorblast 12 led headlights, of Barco. Fountain panels ensure a horizontal viewing angle of 120 ° and 60 ° vertical.

It is increasingly widespread use of large-scale OLED technology and on larger surfaces. So far were limited to testing on microdisplay. The lighting concept and transmission of color is the same of the LEDs, but are organic led.
OLED, in fact, it stands for Organic Light Emitting Diode. Is a technology that allows making colour display with the ability to issue brilliance: Unlike LCD, OLED display do not require additional components to be illuminated (the liquid crystal display is illuminated by an external source of light), but produce brilliance; this allows making display much thinner, leaflets and you can scroll. They're requiring less energy to operate.
Due to the monopolar nature layers of organic material, the OLED display current lead only in one direction, then behaving like a diode, hence the name of O-LED, for similarity with LEDs.

CONCLUSIONS
Theories and discussions regarding the use of light and colour in the architecture have remote sources and jagged, aesthetic choices from a social or political needs up to economic needs. In an age where research centres, Faculty of architecture, architects and urban planners undertake to study and prepare plans of colour in major Italian cities and not only that, it makes one wonder what role can take these posters at urban level and what will be the architect's contribution in this transformation that is investing the architectural project.
The use of software and digital displays applied to facades of buildings, whether they be glass, plastic or metal, is changing radically the meaning of architecture.
Tend to prevail informational and commercial factor and new figures other than that of the architect are by mandating the configuration of urban face, among them advertising agencies and producers of communications systems. An aspect not to be underestimated this, closely related to the profession of architect. The fact that the debate, research and applications involving the architecture you are developing on the sidelines and often outside its scope should reflect. Under the influence of a phenomenon whose potential could change radically the way in which we perceive the reality, how to evolve the look of cities, buildings and dwellings? What will be the new faces, materials, colours that will hire architectural surfaces in the near future?

References
Gasparini K., Design in superficie. Tecnologie dell’involucro architettonico mediatico, FrancoAngeli, Milano, 2009
Ladaga A., Mantiega S., Strati Mobili. Video contestuale dell’Arte e nell’Architettura, Edilstampa, Roma, 2006
Ravizza D., Progettare con la luce, FrancoAngeli, Milano, 2001
Virilio P., “Dal Media Building alla città globale: i nuovi campi d’azione dell’architettura e dell’urbanistica contemporanea”, Cross-
sing, n.1, 2000, pp.7-8
Zennaro P., La qualità rarefatta, FrancoAngeli, Milano, 2000
www.aic-colour.org
www.evolight.it
www.paoloburoni.it
www.stark1200.com
www.urbanscreen.com
www.urbanscreen.net