Color-Shading Software: New Tools for Chromatic Integration Between Shading Systems and Built Environment

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ABSTRACT
Between 2008 and 2010 as a part of a PhD research in Architectural Technology I had the opportunity to develop a project of software for integrating sunscreens and buildings facades from an environmental, chromatic and typological point of view. The need for such a tool arose primarily from two factors: the solar shading systems, with their presence, they can affect chromatically places; the solar shading systems are too often applied without a project. A first phase development of the tool has concerned the association between specific types of sunscreens and facade systems according to some ideal colour combinations derived from the analysis of a sample of over one hundred case studies of contemporary architecture. Now the software is undergoing a second phase of deepening and development that I intend to present at this conference.

Keywords: shading systems, colour, environmental quality

1. INTRODUCTION: COLOUR AND BUILT ENVIRONMENT, THE RESEARCH TOOLS
The research was designed primarily to acquire a body of knowledge on the relationship between sunscreen types, the colours, the buildings facades and the context, into a sample of case studies of contemporary international architecture. The acquisition of these data was made through a system of cataloging actions. The study sample included more than 100 buildings. The board was divided into three parts. The first sets out the basic details of the intervention and a brief description of the housing and the sunscreen. The next two forms contain the essential tools of the research. The second form relates to the sunscreen: it contains data on its location, type, the overriding material and size of the screen. The third form contains data on the relationship between sunscreen and facade and the environment. In particular, it picks the colour and the texture of the sunscreen and of the vertical closure of the building and then the resulting colour combination inside and outside the building and the prevailing colour in the context. As regards the chromatic aspects, the subsequent elaboration of these data had resulted in a prevalence of combinations of shades of gray, roughly in all areas investigated: sunscreens and facade, individually and then combined. The analysis of the context seemed to indicate a prevalence of gray (Fig.1). The results appeared to show a kind of generalized fear against the use of colour, denied only by some case studies. What kind of answer could be given to these results? The original idea of producing an instrument that could be a guidance in the colour-design of the facade in combination with sunscreens, was growing up. The idea was to start with some pilot cases that could constitute a data base for the work. The hardest part, however,
did not appear the colour combination, but to associate the types of facade with the types of sunscreens: it was necessary to arrive at a schematic solution. We therefore resorted to a classification of the facades according to the size of the openings (and the size of the screens).

2. RELATIONSHIPS BETWEEN FAÇADES AND SUNSCREENS: THE GUIDELINES

During the research we have recorded the size of the sunscreens into three categories: large (80% plus of the façade), medium (between 30% and 80%) and small (under 30%). Intending to start from the type of the façade and to further simplify the work, in the final guidelines we have taken just two categories: facades with small openings and facades with large openings. The facades with small openings has been associated with the material that makes up the opaque surface; the facades with large openings have been classified by construction type. The result is as follow.

2.1 Facades with small openings: plastered masonry

This kind of buildings, usually of residential use, is characterized by small and medium-sized windows and by plain surfaces in various colours. The type of sunscreens that seems more appropriate in this case are the curtains. They may be vertical blinds with brackets, applied directly on the bearing walls or inside the window hole. You can select fabrics in white or light gray, or a monochromatic combination with the colour of the walls or a two colours-combination. In Fuksas ILOT Cantargel building in Paris, there are orange vertical blinds over white background walls. In other cases, especially in office buildings, you can use Venetian blinds with slats or aluminium metal. In buildings with galleries or balconies, you can also use screens with sliding doors in folding metal or etched glass.

Fig.1
Charts: percentage incidence of colours in the façades with sunscreens and their environment
2.2 Facades with small openings: brick-face view
In the facades with brick walls face-view, the contemporary architects seem to prefer vertical blinds or awnings with extendable arms in white or possibly blue and white stripes. We can cite as example the Municipality of Enschede, De Wijk and De Ruyter of Cie Architects of Amsterdam.

2.3 Facades with small openings: stone coated
The stone claddings can have different colours. In this kind of building, contemporary architects seem to prefer vertical awnings with brackets, generally integrated in windows holes. If the stone is white you can find solutions in single colour with white curtains, or try a combination of colours with different colour curtains. In the Apollo Office Building by S.O.M. Architects, there are green curtains over the white stone surface. In the Westin Grand Hotel there are orange tents over beige stone surface.

2.4 Facades with small openings: wood paneled
In wooden surfaces the trend seems to use wooden sunscreen with slats of the same colour. In the case of buildings with balconies and galleries you can use screens with sliding doors or folding screens in wood.

2.5 Facades with small openings: concrete masonry
In this type of buildings you can use coloured awnings also trying to counter the gray colour of the concrete. Alternatively you can take white or gray curtains. You can also use aluminium venetian blinds or brise-soleil slatted in metal.

2.6 Facades with small openings: metal coated
In the metal surfaces, metal sunscreens seem to fit particularly well. You can use aluminium venetian blinds in gray or silver, or painted. In the ECAL School of Art by Tschumi, the silver surface of the corrugated metal sheet is combined with the use of venetian blinds coloured in yellow, red and blue. You can also use blinds with slats or aluminium louvers. The colour combinations can play on monochromatic themes or on two or three colours combinations.

2.7 Facades with large openings: curtain-wall
In this kind of facade you can use a huge variety of different screening systems. You can use vertical awnings. They may be gray or white as in Herzog & de Meuron Roche Pharma Research Center or in Nouvel Fondation Cartier, to reproduce a neutral effect that contributes to the dematerialization of the architecture. They can be green as those of the Sole24Ore Headquarters by Piano or yellow like those of the Daimler Chrysler Office and Retail by Rogers. In each different colour combinations you can find colours of other elements of the facade or the context. In office buildings, as demonstrated by Behnisch & Partners, aluminium venetian blinds seem to fit very well. Large glass surfaces can be shielded with aluminium sunshade blades in gray or white as in the Carré d’Art by Foster. You can use sunscreen in perforated sheets of silver metal as those of S.O.M. in Changi Airport, or red like those of the Museum Quai Branly Nouvel, adapted to cover the entire building structure. You can also use louvers in etched glass. In residential housings
you can use sliding doors or folding wooden or metal such as Herzog & de Meuron in Paris or etched glass as those Baumshlager & Eberle in Switzerland. You can use sliding panels in metallic fabric, such as those of Perrault. In other situations you can choose materials and colours that fit the context as in the case of the brick louvers chosen by Rogers for the facade of the Millennium Point in Birmingham, inspired by the brick facades of the surrounding buildings.

2.8 Facades with large openings: double-skin
In double skin facades the architects seem to prefer two separate solutions. In the first one, the outer layer consists of a glass skin that doubles as an adjustable brise-soleil. The blades can be in etched or stained glass as in the Fire Station by Sauerbruch & Hutton. You can also use glass sunscreen with integrated photovoltaic. The second solution is the installation of brise-soleil in the technical space between the two skins (Fig.2). You can choose sunscreens in silvery-white metal for a monochromatic effect, or as in the GSW building by Sauerbruch & Hutton, you can use blades in different colours, looking for specific colour combinations.

3. COLOR-SHADING SOFTWARE PROJECT
The information contained in the guidelines were transferred to a software project. The need to develop this software stemmed from the lack of an instrument of this type on the market, having a scientific basis.
The instrument was designed with the structure of a website, a basic html page and a java engine that controls the management of images and text. The project title is “Color-Shading” and the language is English.
The layout of the main page of welcome is characterized by title and subtitle: Color-Shading, visual simulation of
shading systems on building façades. At the center of the page there is an animation of a dynamic sunscreen that provides different chromatic perception of itself, after opening and closing. On the left side there is the operational menu. Under "select your window type" you can choose between "small windows" and "big windows". Small windows refers to the facades with small openings (i.e. prevalence of opaque surface); big windows refers to the facades with large transparent or translucent surfaces.

Clicking on "small windows" it opens a dropdown menu that lets you choose different types of surface (because in the facades with small openings opaque surface is prevalent): plaster, brick, stone, wood, concrete, metal. Clicking on "big windows", where the prevailing surface is transparent, you can select four different options: curtain-wall type 1 (with fixtures positioned between the two floors), curtain-wall type 2 (with fixtures mounted in front of the floors), double skin and double skin with balconies.

Clicking on any of the options available, such as “facade | plaster”, you can access the page from displaying combinations. The first thing you notice is the heading “Small windows: surface plaster”. This option was chosen to remind us what we are viewing. On the left there are a series of icons that allow you to see different combinations, both for types of shielding, both for colours. On the left side, the first image that appears is the standard building, without sunscreens. It consists of two views: one in prospectus and the other in perspective. At the center of the page there is Itten’s colour circle implemented with the gray scale in its center. The circle is completed by several arrows that indicate each time the colour combination that you are viewing. Clicking on an icon on the left you can see a solution in the database. For example you can select a yellow plaster facade with blue vertical blinds. Itten’s circle indicates the two colour combination. At the bottom right, the button “Show Caption” opens a box in which you can see the information about the selected solution. For the case with yellow plaster and blue curtains: Shielding system: vertical awnings; Material: screen tissue; Colour combination: 2 colours, Colours: yellow-blue.

Clicking in the top center, the button “Play slideshow”, you can see all the combinations of that category in sequence. Each category has several possible solutions (Fig.3). They can be implemented at any time. For Curtain-Wall type 1 we have identified the following options: aluminium brise-soleil; horizontal brise-soleil in aluminium; vertical brise-soleil in aluminium; bronze sliding doors, vertical awnings in screen tissue; venetian blinds in aluminium; glass brise-soleil with integrated photovoltaic mounted on an independent structure.

The image allows you to see the effect achieved by installing a kind of screen: in terms of composition, in terms of colour and shadows it generates on the other elements of the facade.

All the models are constructed and rendered by a 3D modeling software while the final images are made with a photo editing software.

4. CONCLUSIONS: EVOLVING THE SOFTWARE

Our intent is to transform this visualizing database in an interactive tool. The next developments of the software are: the ability to integrate the iconographic database with your own achievements and the ability to combine and verify the models you have customized. The project is to make the software capable of receiving user models while providing a database of sunscreens for these models. The solution is to provide parameters for the realization of the model
in a free software like Google SketchUp. The evolved version of “Color Shading” will then be able to import inside itself these models and integrate them with the shielding in the database, thus providing the user full ability to customize your project. “Color Shading” is thus becoming a tool to be used in the planning definition phase of the building facades. Only after its use, you can verify the project with other software, such as energy-performance tools.

REFERENCES