Strategies in colour choice for architectural built environment

Pietro Zennaro

Department of Design and Planning in Complex Environments, University Iuav of Venice, Italy
Email: pietro.zennaro@iuav.it

In the realisation of a colour design, or of a colour plan, every designer should have the availability of a set of basic tools to prevent him or her from performing prejudicial operations in the territory, in the landscape, in the city, in the neighbourhood, and in the individual building. The same designer should then know some rules in the colour choice that will enhance the built environment. The approach to colour selection depends on many factors, for example the building size and function, the combination of spaces, the urban form, the dimensions of streets, alleys, plazas, squares and so on, but especially the specificity of the place. By this we mean the history, traditions, culture, geographical location, the qualities and weaknesses, the range of possible design/conservation options and all those characteristics that distinguish one place from another. So it should be clear to the designer who faces a chromatic project, that he or she primarily needs a dedicated strategy, different from case to case, specific to each place. The diversity of the places establishes the richness of traditions and customs that should be preserved and/or possibly updated.

Introduction

"Starting the study of perception, we find in the language the concept of sensation, which seems immediate and clear: I have the sensation of red, blue, hot, cold. [1]"

The perception of space is a complex phenomenon. It takes into account not only the detection and appearance of the surroundings, but also involves the viewer in terms of synaesthesia, memory, personal experiences, moods, physical and psychological conditions, age, sex and a thousand other aspects that would be long even to list. In turn, the same perception produces innumerable and complex reactions, highly dependent from subject to subject. "We approach the variability of the outer world at several levels of experience simultaneously, partly naturally by ecologically based counterbalances in perception and body and partly through conscious actions, personal or cultural, through appropriate behaviours or through technical adaptability. [2]"

Therefore anyone who wants to deal with the design of buildings cannot be unfamiliar with some basic knowledge that will enable the limitation of damage caused by his actions. Architectural design is a complex kind of work that has the purpose to aesthetically qualify the environment. Even just dealing with chromatic aspects in the project is not a minor thing. In fact, the colour of the planet is made up of infinitely many aspects that are certainly not easy to approach.

Colour exerts a strong influence on the perception and interpretation of the surroundings. Colour affects mood and health. "In perceiving a colour we experience the objective meaning. Each colour is then an emotional precisely determined signal that is experienced unconsciously. The colour signals are therefore an emotional language understood at a subconscious level. [3]"

In social terms, for human beings colour is basically a means of communication and cultural transmission. "For many reasons (historical, economic, religious, military) the West has too well understood this law: all the cities are concentric; but, in accordance with the same movement of Western metaphysics, for which each centre is the location of truth, the centre of our city is always full: a marked place, where we collect and condense the values of civilisation: spirituality (with churches), power (with offices), money (with banks), the goods (with department stores), the word (with «agorà»: coffee and walks). [4]" Analogously Western urban centres are a collection and a condensation of colours. Each city centre tends to show emblematic colours, representing the level of civilisation. Commonly the colours used in historical urban centres are often low in saturation. The newer cultures, preferring to live in a techno-scientific environment, are more attracted by highly-saturated colours.

On the other hand, in the oriental culture we see empty urban centres. Considering Japan, in Tokyo the historical city is concentric and the centre is empty. It is occupied by the heart of the nation: the religious and political power. The Emperor, Japan's religious and political leader, occupies this big empty space. So the colours used are those of the tradition: red, gold and white. Similarly in the Chinese culture the urban centre is an empty space. In Beijing, the Forbidden City was exactly this kind of concentration of non-physical elements: power and religion. The colours used also in this case were those of the Emperor. After the Communist revolution red became the main colour in China. But the tradition persists and the main colours are those of the five elements: Wood, Fire, Earth, Metal, and Water. In China, there are five very specific colours (i.e. blue-green, red, yellow, white, black) resonating with meaning through every layer of traditional and modern life, representing emotional, physical, spiritual and directional forces.

As synthetically expressed, transmitting a culture not only requires knowing technical aspects, but also other aspects affecting a society and its evolution. Having care of colours is not only a personal pleasure but in architecture concerns the whole community. Everybody is influenced by colour and it seems necessary that designers should be provided with some basic information. The architectural profession also involves such tasks.

What's discussed in the following is the result of research experience at the University Iuav of Venice, in leading the Research Unit "Colour and Light in Architecture", and in the professional activity of colour design and planning for villages/towns with historical centres, expansion zones, sprawl, isolated

houses or industrial areas. The focus on the improvement of such places through the appropriate use of colour is determined by the need for upgrading the man-land, and by putting in place suitable low-impact factors.

Discussion

In the perception of our surroundings, the colours are seen differently depending on weather conditions, seasonal, direct or indirect radiation, by reflection, by source of natural or artificial lighting and in many other aspects. The perception of the surroundings takes place in terms of synaesthesia, involving all the senses of the observer.

Analysing the behaviour of colour and light in built places, there is no more emblematic experience than the evaluation on site or by pictures of what happens in a common sunny day. For convenience we have taken a Venetian example, where the presence of water and the density of the built façades more easily shows the interaction of light with the facing fronts. The presence of water, also, increasing the mirror effect of the canal that is less evident in common roads, shows better the transfer of a colour from an illuminated wall to the opposite one in shadow.
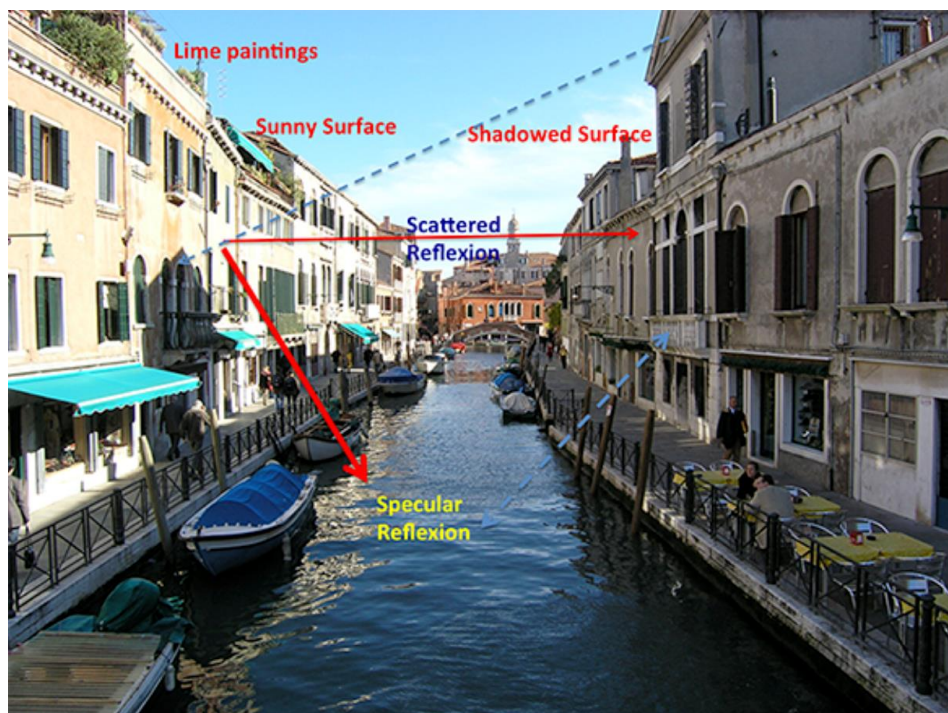

Figure 1: Rio del Magazen: Fondamenta Minotto (left) and Fondamenta Gaffaro (right).
The colours are reflected between the walls and the water (© P Zennaro).

In the scene of Figure 1, the left front is less exposed to bad weather than the right one. Since the colours painted on the walls are based on lime they have the tendency to wash out easily. In fact, the opposite façade at right is completely washed out and then shows a grey plaster. The sun, beating on the walls of Fondamenta Minotto (left), affords a transfer of the yellow colour by reflection over the water surface of the Rio Magazen to the shadowed opposite walls. Then a double phenomenon occurs, the specular reflection from the coloured wall to the water and its transfer onto the grey wall is added to the diffused reflection coming directly from the illuminated yellow wall. Another clue comes from the reflection of sunlight on the windows bouncing directly partly on the pavement and partly on the walls

of Fondamenta Gaffaro (right). In turn, the wall in shadow casts its silhouette on the opposite façade darkening the yellow colour. The shape of the tympanum makes an almost grey shaded space. On the days when the sky is covered, the difference in brightness between the two walls is considerably more noticeable, darkening the grey to a greater degree and making the yellow less expressive.

It is easy to understand that the materials used in building's construction have intrinsic chromatic behaviour and considering a built system like that described above, their relationship with the surroundings can also modify their chromatic expressiveness. Moreover in the perception of the surroundings, built forms are perceived differently depending on: seasons, weather conditions, direct or indirect radiation, reflection, natural or artificial light source, and many other aspects.

So the minimum designer's tools for colour design, necessary to avoid prejudicial operations, are:

- To know that perception of the surroundings takes place in terms of synaesthesia (vision is only one of the five senses);
- To have a cultural understanding of design and colour essentials;
- To know the basic rules of colour combination and colour harmony in the built environment;
- To know the history, traditions, culture, geographical location, the qualities and weaknesses and the range of possible options of the site/city/environment...;
- To know the characteristics that distinguish one place from another;
- To formulate a dedicated strategy different from case to case, specific to each place;
- To make continuous iterations between theory, project and realisation.

This list could be expanded, progressing from the basic to the more sophisticated level, where detailed study gives more information to the professional, finally to attain sufficient experience on the approach to colour design. Translating the above list into knowledge requires specific instruction on a topic that usually is little practised at universities where architecture design is taught. In these academies, the training of architectural design is still almost exclusively based on the knowledge of shape and dimensionality, as if a building were an abstract living sculpture. In fact, if we analyse critically the majority of the latest works having a strong appeal to contemporary academic and the professional world we would have more than a few doubts in distinguishing sculptures from architecture [5].

But, without digression, it is perhaps enough to tell someone who works in the world of architecture that a simple action of painting on the walls of buildings can completely disrupt the interpretation of the shape. So it could be necessary to clarify to the reader, that knowing how to use the colour, starting from the design phase, can help to counteract changes to the original project conception, as well as provide new tools to modify a lot of buildings born speculatively or following ideologies with currently indigestible forms. For example, the buildings of the former socialist countries generally need requalification for energy consumption. Architects working around the problems in repetitive mega structures are also facing a lack in aesthetic quality. The use of colour design on the refurbishment of façades, in some cases, has given excellent results.

But how can we approach the chromatic choice in architecture? The answer depends on diverse aspects such as:

- The size and typology of the building's façades;
- The type and scale of aggregation;
- The dimensions of streets, roads, alleys, squares and so on;
- The dominant colours and accent colours, contrasts, architectural unity, etc.;

- The colour project/planning strategy adopted;
- The congruence with the environment and with local history and culture;
- The presence/absence of colour harmony and chromatic cacophonies.

We could add many other aspects in a kind of journey from the general to the particular, until we define every detail. Obviously this list cannot provide useful tools for colour selection, but can supply some precautions to be noted at the time of decisions and choices.

In the perception of the surroundings, built forms are perceived differently depending on weather, seasonal conditions, direct or indirect radiation, by reflection or by natural or artificial light source, and by many other factors. The shape/colour ratio is also influenced by a series of secondary effects such as:

- Distance: far, from afar, close, very close;
- Space: very large, large, medium, small, very small;
- Environment: wet, dry, humid, windy;
- Light: on, off, sunny, shady, bright, dark;
- Weight: light, heavy;
- Time: short, medium, long;
- Thermal: cold, hot and lukewarm;
- Psychology: depressive, relaxing, soothing, stimulating, exciting, very exciting, exhilarating.

Some of these effects depend on the wavelengths, colour hue/tone/saturation and other optical phenomena. The feeling of space, according to ponderable and temporal terms, changes with the wavelengths and varies according to the hue and intensity. Other effects depend on the combination of closeness/distance and the overall design or perceived detail. Others are consequences of physical, electrical, optical, physiological features and combinations.

The selection of colours to paint walls and other parts of buildings must reference general guidelines when treating for example:

- Narrow streets;
- Wide Roads;
- Squares and plazas;
- Sprawl houses;
- Farmhouses;
- Buildings in barren, arid, stony fields;
- Continuous façades;
- Tall buildings;
- Public buildings;
- Industrial buildings;
- Others.

Figure 2 shows a narrow calle (Venetian street) in Burano Island on a sunny day after a rain shower. In these conditions of light, colours seem much more saturated when the walls are not washed out. The chromatic cadence is based almost exclusively on warm colours, if one excludes the green façade that can be seen on the right. On the basis of the list above we can say that the distance effect is between close and very close; the environmental effect is wet; the light effect is sunny and shady; the weight

effect is heavy going to light; the thermal effect is lukewarm/hot; and the psychological effect is stimulating.

Burano island is a particular case of the use of colour in the façades of buildings, a case begun around the 1960s with the sale of synthetic materials for painting of external façades. The colour choice was left to the discretion of individual owners who, in order to stand out in relation to their neighbours, have engaged in an uncontrollable competition by using different colours for their properties. A new reality has thus exploded with a considerable increase of the saturation of colours and the birth of combinations without rules. The recent widespread marketing of siloxane paints has further increased such saturation and the duration of colours. Also the application techniques have changed considerably and, if previously the wall painting was carried out directly by the owners, now there are professional painters who apply the products and often give advice on the choice of colours.

Figure 2: Burano Island (Venice): Narrow street. A sunny day after a storm (© P Zennaro).

In the Italian mainland this random choice of the colour of the exterior of buildings has had the effect of creating a visual chaos that impinges on the usability of the places and the possibility of preserving or repurposing many historical centres. Some civic administrations, however, are equipping their planning instruments with colour schemes. These local regulations are producing contrasting effects. On the one hand there are restorers who tend to set a standard epoch that serves as a model for all buildings even though they connote very different epochs; others argue for a kind of scientific restoration, that is practised to recover the buildings according to their date of construction or their period of maximum glory; others are inclined to make choices coinciding with their personal taste, legitimising the colour choices on the basis of derivation from natural local elements; others are based

on statistics, considering the prevailing colours and formalising a project that doesn't deviate much from the state of fact; others behave with reasoning difficult to interpret. In short, the plans/projects of colour, at least in Italian society, are made by professionals who may have only a vague knowledge of colour (engineers, architects, planners, restorers, industrial designers, etc.). Of course all these different people adopt different approaches, producing results that are not always congruent with the places where they perform the colour plan. The one positive thing that can be said is that most of the colour designs are implemented through paint, and fortunately the paintings don't have long durability. Usually time is a gentleman and erases many design hysteric results.

Conclusions

This paper arose from what the author has written in one of his recent books in the Italian language. In fact the motivation for transmitting some knowledge to colleagues (especially architects) was born from the consideration that a good part of the practice of Italian professionals is devoid of even minimal knowledge of the use of colour. Many times they use it in an ideological manner.

"Light and colour together form our visual image of the surrounding world. Despite this, colour and light are too often treated as two distinct fields of knowledge. Colour specialists often lack knowledge about light, and light specialists often do not know enough about colour. Knowledge of both colour and light are separated between different professional and academic areas, each with its own set of theories, concepts and methods. Those who want to find their own understanding and be able to apply it in their work could easily get lost in all of this – with the result that only a small proportion of existing knowledge will be used in practice. [6]"

During the investigation we found that only those who have attended schools with an artistic orientation that enable access to the university had some notions about the use of colour. The others, who are the vast majority, are fixed to either childhood or adolescent education, and are therefore not sufficiently familiar with knowledge about chromatic mechanisms. Hence there is a need to produce manuals on the proper use of colour and colour harmony. Even the colour collection handbooks showing standard solutions often seem useful, to be taken as they are and transferred to the reality. But this is not colour design. I think that promoting colour culture towards Architects is a mission for those who deal in terms of training, skills and knowledge.

What is proposed is a modest "Toolbox", with instruments to design buildings knowing from the outset which colours will be chosen. The earlier we know the chromatic directions, the better we can check the quality of form, embedding it in the thought processes inherent in planning. In the "Toolbox" there are various tools and techniques, which depart from the general and extend up to the particular. Obviously equipment is useful and often necessary, but sometimes it can also be cumbersome [7]. It becomes worthless at the moment in which the designer has matured his own poetic impulses and is equipped with an exclusive personal set of instruments. For example, in the world of painting, the colours of the paints are always the same, but the artworks they realise are absolutely different from artist to artist. The colour choices are personal, as well as the combinations, harmony and anything else the artist considers necessary to express his or her thoughts on the canvas [8]. This ability sets apart the great painters. In the case of amateurs however, it often happens that when they begin to mix colours on the palette the result ends up as muddy brown, despite good intentions.

Thus this paper aims to avoid amateurism in design and to provide some guidance to those who build up architectures, colour plans, furniture, objects and so on, without knowing anything about colour and its impact on the environment and the human psyche.

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