

# Glazed Tiles as an Improving Element for Environmental Quality in Urban Landscape

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## Summary

Cities are complex entities where multi-functional and multi-layered data intersect each other and integrate into the urban landscape. The emotional and practical purposes of everyday life takes place within that physical network, i.e. the city, and should be seen as something that interacts with the citizens in a meaningful aesthetic, social and cultural relationship. Our senses are continuously alert, providing us with relevant perceptual facts about our environment, allowing us to make numerous conscious and unconscious choices and connecting all the sensations of each moment to others in our previous experiences. Throughout this process, the tactile and colourful presence of glazed tiles are of enormous importance, being capable of transforming urban surface texture to something memorable, recognisable, perceptual rich, historically-rooted and with great value on sustainable grounds. These aspects should give urban designers new insights into the use of glazed tiles as an important element for the quality and diversity of urban landscapes.

## Introduction

The chromatic environment has a fundamental role in our emotional response to urban spaces. As we walk through our cities, we feel an emotional atmosphere conveyed by our senses resulting in a positive or negative subjective judgement. The built environment establishes an artificial extension of nature providing a new ground for perception. As colour planning begins to be regarded as a necessary tool to improve the quality of the overall urban and site planning, it is crucial to consider ecological and sustainable materials that could be important vehicles for colour in the urban environment. In this study, a case study was conducted on azulejo (Portuguese glazed tile) to describe and define the potential of this kind of wall covering as an important element for the quality and diversity of the urban space perception (Figure 1).

There are systematic variations in the perception of our environment as we move through an urban landscape, due to light and observation conditions. Glazed tiles play a distinct role in colour perception due to their specific visual stimuli: in an urban scale the first impression will be to understand its colour as a uniform veil. At a certain distance we don't perceive its tactile qualities, patterns or tile dimensions but we can detect a specific quality that differentiates itself from other surfaces that surround it: how it receives, reflects or transports light. As we



**Figure 1** Glazed tiled surfaces used as visual references in an urban landscape (Braga, Portugal)

come closer, we notice that the colour is not uniform. Instead, there are subtle variations and we can discover a new level of complexity: texture, a grid that dresses architecture's form, tailored to its shape but at the same time transcending the surface through reflection adding virtual depth. Finally, we can perceive the tactile quality, the pattern and the dimensions of



**Figure 2** Light, colour and matter (Caldas da Rainha, Portugal)

a single tile that are being repeated almost countless times like the scales on a fish. When looking up, it might be surprising to see the tile's colour mix with the light and the sky reflection and possibly with other buildings and also other colours, in an inevitable chromatic integration with the atmosphere surrounding it (Figure 2).

These diachronic perception aspects of glazed tile cladding are the reason of its importance as a dynamic element in urban chromatic environment.

This study aims to establish the key concepts involving glazed tiles use and application that could contribute to the aesthetic, ergonomic, visual orientation and overall environmental quality improvement in the urban landscape. We intend to clarify and develop these concepts in order to understand how we can use this material, with its very specific intrinsic and extrinsic qualities, within ecological balance and under a contemporary perspective.

## Methodology

The methodology of this study is based on a multidisciplinary bibliographic review in the fields of colour, light, perception, architecture and design, together with the previous research work of both authors, having in common a concern on perceptual colour variations due to different observing conditions [1,2]. This theoretical approach is complemented by important data brought by professional experience of the authors, both in specific knowledge of glazed tiles production and application, as well as in colour studies in urban rehabilitation.

In order to organise this study, nine main concepts of glazed tiles' appearance are outlined that could contribute to environmental quality, which are explained and discussed in the next section: chromatic environment/emotional atmosphere; observer in motion; unity/complexity/rule/exception; angle of view/scale/distance; intrinsic/extrinsic features; light/reflection; space orientation/organisation/identity; integration/interaction; and ecological balance.

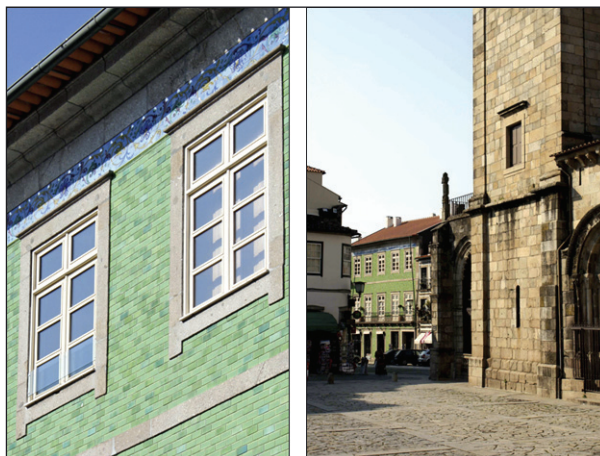
## Main Concepts

Light and colour are truly the main issues at stake in our research and professional work and their importance is revealed in every concept that follows. Light as cause and colour as the result of its interplay with the matter are transversal to this and to every study that concerns human visual perception.

### Chromatic environment/emotional atmosphere

Chromatic environment provides the keys to understand and organise the world that surrounds us. Colour in public urban space should also convey information that we could use to perceive and identify the fundamental elements that will structure our idea of a place (Figure 3).

But colour is after all a sensation; a synaesthetic feeling that communicates an immediate emotion, an emotional atmosphere. Zumthor [3] defines this atmosphere as something related to our emotional perception, which is the instinctive perception that the human being needs to survive. Colour plays a prominent role on the process involving the transmission of sensorial information from our environment to our brain, and consequently on the immediate emotional connection.



**Figure 3** Socio-cultural heritage of glazed tiles as a reference in urban environment (Braga, Portugal)



**Figure 4** Colour through glazed tiles creates an unmistakable emotional atmosphere (Lisbon, Portugal)

The walls that physically define our built environment are elements of great importance for visual and physical contact with citizens. Keil [4] stated that people do not see the walls, but feel them, and that's the main issue; Swirnoff [5] and Lynch [6] state that the daily compensation people receive from their environment depends largely on the readability and the emotional confidence it provides. In addition to its functional aspect, the fact that azulejos are an important socio-cultural heritage in Portugal allow the citizens to find recognisable and familiar elements in urban spaces, a code system that form a web of relations between matter and memory, evoking images that give them an identity (Figure 4).

### Observer in motion

The knowledge of our environment is always the result of a movement (eye, head, shoulders, body) that detects differences in our visual perceptive field.

Cullen [7] states that urban landscape appears to us as a succession of surprises or sudden revelations: a serial vision. Accordingly, Gibson [8] considers two forms of vision: ambient vision and ambulatory vision. The first describes the possibility of looking around at a given point of observation and the second one from different points of observation. These concepts have one thing in common: movement, or diachronic perception, instead of snapshot or fixed vision, as it is usually referred to on some perception texts. Similarly, Zumthor [3] said that architecture is a temporal art like music: as we drift through the space there are things that draw our attention, like a light that appears in a special way, for instance. He compares this experience to a journey of discovery between serenity and seduction, between silence and sound. In the same sense, glazed tiles are always surprising and very rich in its perception, due to its great potential for diachronic transformation (Figure 5). In urban environment first we tend to recognise its typical brightness and mirroring capacities detaching it from other adjacent areas, and as we move or look around, we recognise a modular coloured pattern, repeated all over the covered surface like a textile covering the building.

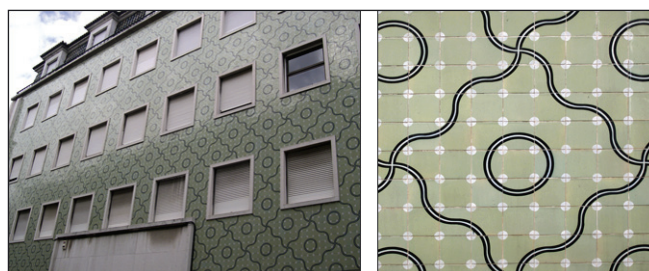


**Figure 5** Glazed tiles have great potential for diachronic metamorphosis in perception (Lisbon, Portugal)

### Unity/complexity/rule/exception

While describing the elements that are fundamental to an image (picture) of our visual environment, Gibson [8] said that there is an array of persisting visual elements that could be considered as a structure, underling the transformation, emerging clearer when they detach themselves from the changing properties. In the same way, we can state that the richness and essence of the perception of glazed tile cladding relies on the interplay of some permanent elements that originate a rule (its intrinsic properties, dimensions and systematic modular repetition) and non-permanent elements that brings exception to that rule (light and observing conditions) (Figure 6). Accordingly, Venturi [9] states that when there is an exception to the rule, the meaning could be reinforced: exception indicates the presence of a rule, as contrast supports the meaning.

The unity and complexity balance, also presented in azulejos, is very important for Mahnke [10] who states that there must be colours in changing degrees of lightness, temperature and intensity, in the environment. The possibly strong colours of glazed



**Figure 6** Unity, complexity, rule and exception in glazed tiles perception (Lisbon, Portugal)



**Figure 7** Complex composition solutions, create different readings without losing the ensemble perception (Lisbon, Portugal)

tiles are always dematerialised by the continuous change in viewing conditions. The modular nature of the tile allows us to create complex solutions without losing the clarity of the entire ensemble perception, either through patterns purposely designed to create different readings from different viewing points or by breaking the rule introducing other visual elements (Figure 7).

### Angle of view/scale/distance

Like any other visual texture, glazed ceramic tiles have different appearances according to the viewing angle, light and distance, which are enhanced by its typical modular surface, strong colours and glaze finish. As distance increases we lose formal and detail definitions, and the result is an optical colour mixture.

The size of the glazed tile cladding area on overall visual field is very important because of its perceptive dominance. Unlike other surfaces, like Lancaster [11]

states that glazed tiles can be used in large areas without being monotonous due to its constant perceptual variation.

This feature could be used to convey dynamic to urban space perception at different visual distances, like Chermayeff did in the Oceanário building in Lisbon (Figure 8). In this case, each pattern represents a degree of brightness of cobalt blue, and the images are composed using tiles as pixels, like in a digital image. The change of perception varies with distance, viewing angle and scale variation, provided by the quality of the tile surface: texture and brightness, the variety of patterns and the area of application. This is an example of how we can use specific characteristics of glazed tiles cladding in a contemporary way.



**Figure 8** Different degrees of glazed tiles' perception with distance variation and interesting visual elements (Lisbon, Portugal)

### Intrinsic/extrinsic features

The emotional atmospheres created by the array of colours in our visual perceptive field have physical properties depending on the intrinsic qualities of materials and surfaces that define our environment. Those materials are the body of architecture, like a membrane or textile surrounding us [12], and the result should seek aesthetic pleasure as well as human comfort and ergonomic concerns.

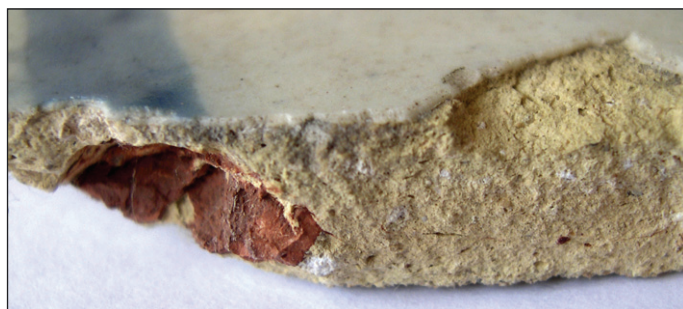
Jorge Luis Borges said that the taste of the apple lies in the contact of the fruit with the palate and not in the fruit itself [12]. We can say accordingly that we should consider the perception of the cladding surface, rather than studying a single tile for its own qualities. But the perception of the extrinsic sensorial and emotional aspects is only possible due to the complexity and variability of its intrinsic features: glazed tiles are the result of an alchemy of matter, gloss and colour, and that's what distinguishes them from other cladding materials.

The ceramic glazed tiles consist on a ceramic body covered by a layer of glaze. The combination of these two elements and their specific characteristics result in dramatically different visual appearance.

### *Ceramic body*

The tile's ceramic body allows a variety of differentiated moulding in terms of surface qualities (irregularities, textures, volumes) and could present numerous colour possibilities related with its material nature (Figure 9 and Figure 10).

The ceramic body's colour is determined by the nature of its compounds and its firing conditions and temperature, ranging from white to terracotta red.



**Figure 9** Azulejo's composition

**Figure 10** White stoneware, porcelain and terracotta

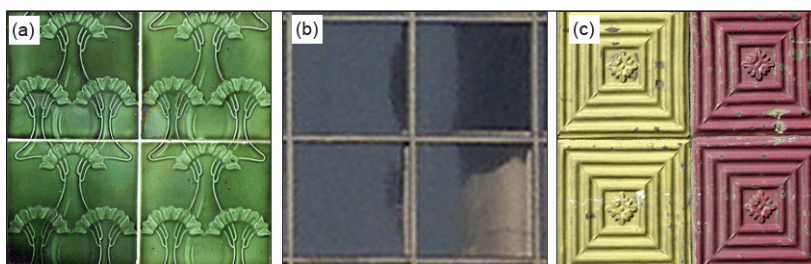


### *Glazed layer*

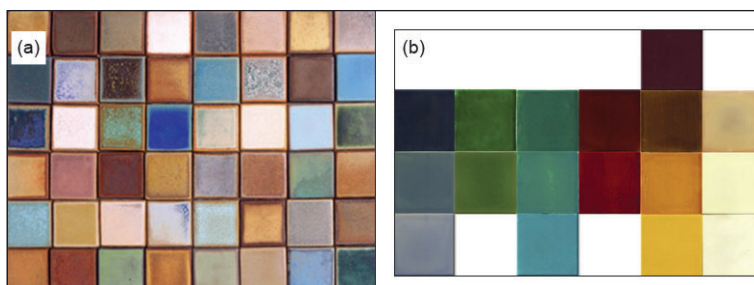
The quality of the glaze – transparent, opaque, matte or glossy – is also fundamental for the tile's colour:

- transparent: the incident light will get through it reaching the ceramic body and the perceived colour will be the result of both the ceramic body and the glaze's colour [13]
- opaque: the incident light is not absorbed, refracted or transmitted through the glaze, for the colour of the tile is the colour of the glaze
- matte: its surface scatters the light, enhancing colour brightness and decreasing colour saturation
- glossy: the result would be the opposite (decreases the colours brightness and enhances its saturation) (Figure 11).

The colour of the glaze varies in hue and saturation when the colorant is added to either a matte glaze or a glossy glaze [14]. The glaze's thickness and the evenness of the layer determine its



**Figure 11** Different glaze qualities: (a) transparent glossy; (b) opaque glossy; and (c) opaque matte



**Figure 12** (a) Low firing and (b) high firing temperature colour palette

inherent colour. For instance, a very thin layer of glaze will desaturate its colour. The firing temperature also influences the glaze's chromatic palette: as the temperature rises and the firing atmosphere changes, the chromatic diversity decreases (Figure 12).

### Light/reflection

Light is a fundamental theme in architecture, not the light in an abstract way, but the relationship between light and matter, the light over things, as Zumthor said [3]. That is: colour.

Glazed tiles cladding have a dramatic effect staging the circadian circle in our everyday life's environment: its variations surpasses the common role of illuminated or shadowed surfaces bringing ambiguity while reflecting other features of the chromatic environment and surrounding light conditions (Figure 13). With glossy glazed tiles, under certain observation conditions, the reflection does not allow us to see its colour, but any variation of the point of view and/or the light's angle of incidence can minimise or dilute the effect (Holtzschue) [15],



**Figure 13** Ambiguity and transcendence brought by light and reflection on glazed tiles surface (Lisbon, Portugal)

resulting in a darker and saturated colour on the surface (Dalal and Natale-Hoffman [16] and Benavente *et al.* [17]).

The surface of the glazed tile cladding is formed by an array of juxtaposed pieces. The tile laying provides multiple variations, resulting in an irregular surface that receives the light and reflects it in multiple directions. The mirror or reflection qualities are not improving elements in the urban space for themselves. We know from the scaleless glass walls of some buildings that it doesn't bring any human comfort to our cities. Opposite

to that, ceramic cladding is a complex material that mixes together rigour, dimension, scale and repetition together with the ambiguity brought by its transparency and reflection properties. We can say that it's a poetical material because of its emotional expression, creating subtle changing sensations of movement and light underlying beyond its surface (Figure 14). Pallasmaa [12] states that architectural space is a living space rather than a physical one, and living spaces always transcend geometry and measurability.

### Space orientation/organisation/identity

Perceptive organisation in our environment is a determinant for human comfort. Accordingly, Lynch [6] said that structuring and identifying our environment is a vital activity for all movable animals. Lancaster [11] states that colour appearance in the environment depends on three variables: light, surface and distance. Considering these variables, glazed tiles are important elements of space orientation in urban landscape, with great perceptive prominence due to its perceptive changes (Figure 15).



Figure 14 Modern use of light / reflection glazed tiles characteristics (Lisbon, Portugal)



Figure 15 Glazed tiled surfaces used as visual references in urban landscape (Lisbon, Portugal)

We have as many colours in our cities as in any tropical jungle. Simultaneous contrast effect is a crucial element in perception but when there are so many colour accentuations in the chromatic environment it's hard to get some prominence. Glazed tiles cladding on architecture are always visual references for space orientation in urban landscape since their perceived colour is always subjected to dramatic changes. For instance, we cannot forget the remarkable visual experience of the effect of natural light reflection on glazed tiles surfaces, in some streets. A glazed tile cladding, through its glossy surface, distinguishes itself from other adjacent painted surfaces, causing continuous changes in colour perception and therefore catching our attention.



## Integration/interaction

Glazed tiles cladding have a rich and complex relationship with architecture. Tiles have their own dimensions that could be adapted for architecture's metric purposes or, on the contrary, architectural dimensions could be created based on tile dimensions (Figure 16). The articulation and contrast of the glazed tiles' bright colours with shadowed elements presented in building façades, such as windows and doors, bring a dynamic composition to architecture (Figure 17). Glazed tiles can also be used to dematerialise the solidity of architecture and also act as an integration factor. The glazed surface of the tile reflects both the light and the images of the surrounding landscape, broadening the perspective of the visual field (Figure 18). The space augmentation happens with the introduction of what we can call the 'absent present': the tile surface acts as a mirror reflecting the surrounding environment, and bringing back to us the landscape that the normal visual field does not cover. This phenomenon of reflection of the adjacent image contributes not only to a dematerialisation of the tile materiality and architectural block, but also to the integration of the cladding surface in the surrounding urban fabric.

In some contemporary architecture, as referred by Pallasmaa [12], there's a loss of tactility, measures and details crafted for the human body. Glazed tiles bring a transversal scale perception from the tactile potentiality of its surface into its understanding as an architectural and urban element.



**Figure 16** Relationship between pattern, tile dimension and architecture



**Figure 17** Dynamic harmony with other architectural elements (Lisbon, Portugal)



**Figure 18** Complexity of glazed tiles relationship with architecture (Lisbon, Portugal)

## Ecological balance

The glazed tile cladding brings a quality for building surfaces: it assures a good appearance over time, unlike painted plaster. Lancaster [11] states that differences in texture can be crucial in the distinction between the old and the new. As glazed tiles don't deteriorate like other surfaces, being self-washable, they give buildings a renewed look amongst others, of the same construction date (Figure 19).

Natural materials like ceramic transmit their age and history, as well as the story of their origins and human use. With the introduction of new production technologies, the manufacture of tiles evolved from manual to industrial, thus increasing its potential for use without loss of its formal and plastic qualities. Although in essence the production processes for ceramic tiles have remained mostly unchanged over the years, the constant technical innovations, a deeper knowledge on the properties of the materials and the prohibition to use toxic materials has significantly changed the tiles' appearance. The exclusion of lead on the glazes' composition has decreased the gloss and colour depth, altering cycles and firing temperatures, resulting in new possibilities for chromatic palettes altogether.

For the strength, durability and longevity of its features and the stability of its colour appearance, the glazed tile presents itself as an increasing viable solution on sustainability: its composition usually consists of native materials; its maintenance involves no chemical treatments; it has a natural ageing appearance not deteriorating with time; it has a long life cycle; and it will disintegrate itself in the form of anti-allergenic dust. The colour change of glazed ceramic in colorimetric terms was considered insignificant: there was no change of values higher than 0.5 units CIELab, which is not expressive [18] (Figure 20).



**Figure 19** Glazed tiles have a superior durability comparing with traditional plaster with paint coating



**Figure 20** Stability of colour on glazed ceramic (Braga, Portugal)

## Conclusion

In this paper, the importance of glazed tiles phenomenological presence in urban landscape is acknowledged, as well as its role in space orientation, way finding, urban identity, aesthetic complement to architecture features, architecture integration and ecological balance.

It is concluded that light, together with the observation conditions, is the starting point in defining the appearance of glazed tiles. Any change in those factors has a dramatic effect in surface perception and produce the unique dynamic metamorphosis characteristic of this material. As we consider the observer as an active viewer, like stated by Gibson [8], and movement as the cause of perceptive variation, we conclude that glazed tile cladding is a potential stimulator of sensations and emotions and therefore should be used to improve the quality of our urban landscape.

It is also concluded that glazed tiles' extrinsic perception characteristics are the result of their specific intrinsic qualities that were described and interrelated: glaze or matte finish, for instance, will alter completely the surface perception and its relationship with the environment.

The importance of glazed tiles is acknowledged when used in the interrelation with architecture and its specific elements, both as a powerful aesthetic feature as well as an important element to its conservation: there is a huge difference in the costs of maintenance between a cladded tile surface or a painted one, leading inevitably to the issues of economy and sustainability.

Finally, we conclude that this material has unique characteristics that could bring an important aesthetic contribution to urban space. We agree with Pallasmaa [12] when he states that our task in the future will be to re-sensualise architecture through a strengthened sense of materiality and haptic features, texture and weight, density of space and materialised light. The use of glazed tiles cladding could be a powerful tool to reach this goal.

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