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The Effect of Visual Pollution on the Bases of the Visual Formation of the Collective Dwellings' Facades Case Study: The Evolutionary Neighbourhood – Batna, Algeria

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This paper aims to study the aspects of visual pollution, which is one of the most important problems that many cities in the world suffer from. Through careful analytical studies of urban fabrics and architectural patterns prevailing in cities in general and Algerian cities in particular, it is possible to deduce a set of manifestations of visual pollution, which have contributed and are still contributing significantly to the confusion and pollution of the urban and visual image. The city of Batna, as one of these cities, contains many architectural elements added to its facades that form extraneous, asymmetric, and irregular elements and contribute to confusing the viewer. From this city, we chose a study sample represented in collective housing, specifically the evolutionary neighbourhood. One of the most important results of the study is that users' infringements on facades caused an undesirable change in the elements of the built environment, leading to visual pollution, which generates what is called visual distortion or the occurrence of duplication in the perception of the visual image, as a dual meaning of the architectural facades.

Key words: visual pollution, users 'infringements, Batna, facade, architectural meaning.

INTRODUCTION

Architecture is considered as the silent symbolic language with which the designer communicates with the users, where the architect tries to formulate a set of meanings based on previous values and mental impressions to form a specific message to the user. The added elements are considered as aspects of infringements on the architecture generated by the users, which impose a new meaning on the actual reality rather than contributing to the formulation of architectural meaning intended by the designer. Every form of infringement by users may lead to the loss of the architectural meaning and the borrowing of another architectural one. Thus, we can consider that users' infringements on the design after occupation cause an undesirable change in the elements of the built environment, which leads to its breach. This is called visual pollution (Desouki, 2015).

The set of architectural vocabulary, principles, and ideas creates multiple meanings that the architect uses as needed. Once the users add elements, they direct the user's mind to something else far from the real architectural meaning that the architect intended. Thus, we are faced with several messages, including what is intended by the architect and the meaning conveyed through infringements by users. These two messages affect each other and thus generate what is called visual distortion or duplication in the perception of the visual image, including duplication of meaning (Djessam, 2018).

Study Problem

The study problem is based on the following questions:

• Do the elements added to the building lead to the duplication of the architectural meaning in the facades, which distorts them?

Are the added elements of the facades' visual pollutants?

Hypotheses

To answer the questions raised in the problem, the study was based on the following hypotheses:

- The elements added to the building lead directly to the creation of a duplication of architectural meaning in the facades, which distorts them.
- The added elements of the facades are the main visual pollutants.

Objectives of the Study

The study aims to achieve a set of objectives, which are:

- To develop a mechanism to clarify the extent to which the aspects of visual pollution affect the aesthetic values that make up the architectural meaning of facades, to maintain and control the visual image of building facades.
- To study the aspects of visual pollution in the facades of buildings, to know the causes that led to this type of
 pollution and derive methods to be followed to preserve a sound urban landscape, to imagine the future of a city
 without visual pollution.
- To access an environment with a unified architectural language, free from the aspects of visual pollution.

Importance of the Study

This research is based on several considerations, the most important of which are:

- Building facades represent one of the most important foundations upon which the architectural and urban formation is based. Therefore, studies related to them are extremely important.
- Architectural formation has a fundamental role in determining the aesthetic level leading to the architectural meaning of the facades of buildings, where the architectural identity is determined. Since all infringements made by users affect the formation and identity of the architectural facades, this can result in a negative image represented in visual pollution.
- Indifference to the external appearance of buildings on the part of the population, through their practices of infringements on the facades, has become a real danger to urban landscapes, and practical solutions must be found to repel it.

THEORETICAL BACKGROUND

Definition of Visual Pollution

Visual pollution in its simplest form and definition is the introduction of foreign elements into the elements of an environment, which causes a change in the quality of the latter (Mohammed, 2005). In other words, it is an undesirable change in one of the elements of the environment, leading to a disruption of its balance, as it is linked to a loss of sense of beauty (Ghazi, 2021). The collapse of aesthetic values, satisfaction, and acceptance of ugly images spread until the visual scale became an existing custom and law, and the matter became more dangerous the more the eye got used to it (Al-Shamiya, 2013). It can also be defined as the feeling of aversion upon seeing anaesthetic or unpleasant scenes in the elements of the urban environment and as those distorting elements of the buildings and the surrounding environment that society sees as repulsive (Adeeb, 2017).

Types of Visual Pollution

Visual pollution in a city can be classified as follows:

Moving visual pollution

This is the moving elements that are not fixed and harm the beholder (Al-Damiri, 2000), represented by street vendors who sleep on the ground to sell products, which results in random and irregular movement.

Static visual pollution

This is the elements that contain changes that distort the mass and the urban blocks those pollute the urban space and repel the surroundings, whether this dissonance is in use or in the structural condition (Al-Damiri, 2000).

Elements of Visual Pollution

Many elements led to visual pollution aggravating and tampering with the city's landscape, among which the following can be mentioned:

Urban chaos and architectural violations

This is the unpleasant that afflicts our architecture (The Coward, 2015). Examples of this are:

- The facades of buildings in which architectural styles have been mixed, modern and old. They have values that
 do not fit or harmonise with each other, but rather contradict each other and do not consider privacy or weather
 factors.
- Buildings with heights that do not recognise the urban laws and do not respect the organisational foundations or the width of the organised streets.
- Random elements that were added to the facades, such as building and closing balconies, adding advertising spaces on discordant-coloured roofs, or painting part of the facades but not the rest.

Unlawful Infringements on Urbanisation

This is represented by the hidden infringements committed by some, without respecting the law, even though they are usually temporary; however, due to their abundance and diversity, they appear as integral parts of the city (Elleithi, 2015), for instance:

- Kiosks and random places of sale are scattered on the roads, sidewalks, and streets.
- The rubbish in the streets, squares, and residential neighbourhoods is endless.

Concrete Infringements on the Void

The general appearance of the urban facades has become a permanent workshop for concrete works. In addition, the state turned to buildings to solve traffic problems from the main gathering points, which are not compatible with the nature of the climate of our environment, nor with the space around them. The city has been distorted, and its buildings have been polluted, especially the archaeological and heritage buildings, by images that are incompatible with the surrounding environment (Jassim, 2018).

Elements of Visual Formation of Facades

Facades are realised by recognising the elements of their visual formation, through which the aesthetic value and the final perceived expression can be judged, and the misuse of these elements leads to the loss of their aesthetic values (Elleithi, 2015). The elements in the visual formation of facades can be identified through several points, namely:

The Study of the Architectural Surface

This depends mainly on the texture and its effect on the visual weight, the reflections of light, and the degree of colour contrast between it and what is around it, where the effects of the architectural texture of the surfaces and the extent of its impact on the architectural work and how it contributes to achieving visual pleasure must be taken into account. This is an honest expression of the true architectural meaning and the design thought behind this process (Nabil, 2010). The architectural surface includes:

Texture

The texture must confirm the functional and technical nature of the building's component surfaces, and therefore the material used must conform to the conditions of its use. Also, the material must be environmentally compatible and consider the climatic factors to which it is exposed. Therefore, texture confirms or negates the intended architectural meaning, the design idea to be expressed, and the feelings to be communicated (Nabil, 2010).

Colour

The colour often expresses the identity and function of the building and indicates the smallness of the building or its grandeur, or the distance and proximity of other buildings. Colour is one of the important characteristics of things, as

it describes, defines, and distinguishes them (Elleithi, 2015). Colour gives people some emotions and sensory effects because of visual experiences.

Study of the Architectural Form

This is related to the boundaries, dimensions, and overlap of the blocks, which also relate to the boundaries and ends of the building. The characteristics of the form can be identified through:

Proportions

The proportions act as an important element to achieve beauty, as it is the relationship between two or more elements that achieves compatibility and confirms the design goal (Al-Fattah, 2006). Étienne-Louis Boullée said, «It is one of the greatest principles of beauty in architecture.» The proportions play an important role in the overall construction of the building and give it its aesthetic character.

Rhythm

Rhythm is a repetition of an element for a certain period, which generates a sense of regular spatial or visual movement within the framework of the design content, leading to determining the directions of movement (Al-Fattah, 2006).

Balance

The value in the architectural beauty of the facades is related to the process of equilibrium, which is achieved through the constituent elements or the vocabulary of the facades, to achieve a kind of stability and technical balance for them (Elleithi, 2015).

The Study of Openings (Windows and Doors)

The openings allow daylight and air to enter the building, and they are a meeting point between the interior and the exterior and a point of visual contact between them (Belarbi, 1998). The positioning of the window opening on the facade wall takes different forms that are based on innovative technologies. The openings in classical architecture represented an aesthetic element in themselves, while in modern architecture, the openings are aware of their relationship to the whole. The openings play an influential role in the visual formation and the aesthetic perception of the facades (Belarabi, 1998).

THE CASE STUDY

Introducing the City

The city of Batna, the capital of the Aures and the centre of the province, is 425 km from the capital of Algeria (Assassi A, 2021), located between latitudes 35°-45° north and 6°-19° east, at an elevation of 821 miles (Mebarki A et al., 2022) The city's climate is hot and semi-arid in summer and cold in winter with an average maximum of 36.5 °C in July and 12.3°C in January. The relative humidity changes dramatically, as the minimum relative humidity is 40 in July and 73 in December. The city of Batna, with its semi-arid climate, does not receive more than 7.42 mm of precipitation during July, which is a dry month and rain is rare, while the heaviest month is April, at a rate of 52.92 mm, but precipitation remains infrequent and unstable (Elleithi 2015).



Figure 1: Geographical location of the city of Batna Source: https://ar.wikipedia.org

Introducing the Evolutionary Neighbourhood

The evolutionary neighbourhood is in the centre of the city of Batna. It is bordered on the north by the vocational training centre and individual residences, on the south by the Kamouni neighbourhood, on the east by the neighbourhood of 158 individual residences and the Al-Zamala neighbourhood, and on the west by the Al-Nasr neighbourhood.



Figure 2. The evolutionary neighbourhood site Source: Google Earth 01/01/2022

The evolutionary neighbourhood is in the city of Batna. It was completed in the French plan in 1959 as a residential area for the soldiers of the French occupation. It consists of four collective residential compounds with buildings with a character (I + 2), each group having four buildings overlooking a square.

The neighbourhood has 16 buildings with a total of 192 dwellings; each floor contains four dwellings, so each floor contains the following:

- The ground floor has an entrance to the small garden, followed by the entrance to the residence, a hall, a room, and a toilet.
- The first and second floors have a hallway as wide as the bloc whose function is to link the housing together, whereby each dwelling consists of an entrance, a hall, a room, and a toilet.

Criteria and Basis for Selecting Facade Samples in the Evolutionary Neighbourhood

The research samples were selected by observing 16 buildings under study, where a sample (facade) was taken to study the aspects of visual pollution. After comparing the total of the rear facades of the buildings under study regarding the largest spread of visual pollutants at the level of surface, shape, and openings, the most visually polluted facade among the rear facades of the evolutionary neighbourhood is the back facade of Building No. 15.



Figure 3. Identification of study samples in the evolutionary neighbourhood Source: Google Earth 01/01/2022

3. 4. The aspects of visual pollution on the rear facade of Building No. 15

The sample is analysed by displaying an illustration of the facade before the interventions (infringements) of users (the original design of the facade by the architectural designer) and comparing it with the illustration of the facade after the intervention (infringements) of users, to clarify the patterns of visual pollution and the effect of visual pollution on the bases of the visual formation of the facade.



Figure 4. The design of the original facade of Building No. 15, Source: Authors 21/05/2022



Figure 5. The design of the facade of Building No. 15 after user interventions (infringements). Source: Authors 21/05/2022

On the rear facade of Building No. 15 in the evolutionary neighbourhood of Batna, aspects of visual pollution are represented by:

- Random and irregular spreading of concave antennas of different sizes and colours in places that are not designated for them.
- Spreading of air conditioners placed chaotically on the facades.
- Changing the material for windows from wood to aluminium, plastic, and glass, thus differing in colour, texture, and appearance.
- Creating new windows that are not like the old ones in terms of shape, dimensions, or colours.
- Adding iron guards to the windows that are different from the windows in terms of shape and dimensions.
- Closing the balconies and including them inside.
- Changing the finishing materials when closing the balconies.
- Installing electrical connections and other cables on the facades for air conditioners and concave antennas.
- Creating an area for irregularly drying clothes.
- Hanging curtains of different shapes and colours on windows.
- Transforming balconies into shops.
- Taking out channels to drain the wastewater pouring directly outside.



Figure 6. Photo presenting the aspects of visual pollution on the facade of Building No. 15. Source: Authors 21/05/2022

The Effect of Visual Pollution Aspects on the Bases of Visual Formation

The shapes, surfaces, and materials of the openings were changed by different users. These infringements led to the emergence of new textures, colours, proportions, and rhythms, different to the original design of the facade, which do not consider the bases of the visual formation of the facade but rather negatively impact the suggestive meanings perceived from the compositions.

Also, the spread of longitudinal connections such as power cables or concave antennas, in addition to external air conditioning units, created a kind of imbalance in the facade and gave it negative meanings.

The changes that occurred in the facade also appear in the proportions of the windows and the addition of other windows contrary to the original design, which changed the perceived colour tones, creating a state of visual imbalance and affecting the surface and the shape of the openings.

A change in the facade surface can be realised by changing the colour of the elements and the texture of their materials from the original design, with the addition of shops as solid interior elements instead of empty surfaces. All these affected the rhythm and proportions of the facade elements.

ANALYSIS OF THE STUDY SAMPLE RESULTS

After distributing and collecting the questionnaires that were given to the users of Building No. 15, the results were analysed via the visual pollution measurement matrix as follows:

Table 01. The visual pollution measurement matrix indicating the effect of visual pollution on the bases of the visual formation of the facade (The study sample: Building No. 15)

		Th	e bases	of visual for	mation of	architectur	The relationship				
The basics of visual formation of architectural facades	Surface		Forme			Openings			and the users		
	Impact on color	Impact on texture	Impact on height	Impact on proportions	Impact on facade balance	Impact on the rhythm of the openings	Impact on proportions of the openings	Impact on the color of the openings	Negative meanings	Positive meanings	Relative weight
	1	1	1	1	1	1	1	1	8	8	24/24
Addition of conditioner	1	1	1	1	1	1	1	1	6	3	17

Addition of concave antennas	1	1	1	1	1	1	1	1	8	2	18
Addition of iron guards to windows and doors	1	1	1	1	1	1	1	1	5	3	16
Change in the dimensions of windows or doors	1	1	1	1	1	1	1	1	6	2	16
Change in the material of windows and doors	1	1	1	1	1	1	1	1	6	1	15
Addition of new windows	1	1	1	1	1	1	1	1	8	8	24
Presence of wires and connections of waterways on the facade	1	1	1	1	1	1	1	1	8	3	19
Changing the colors of parts of the facades after treatment	1	1	1	1	1	1	1	1	8	2	18
Changing the colors of parts of the facades after treatment	1	1	1	1	1	1	1	1	5	4	17
Include balconies for homes and close them without treatment	1	1	1	1	1	1	1	1	6	3	17
Changing the treatment of the ground floor from the original facade	1	1	1	1	1	1	1	1	6	4	18

Where, if the calculating result of the relative weigth is:

- Less than 7: The visual pollution affects architectural meaning to a small degree that can be ignored.

- From 8 to 11: The visual pollution affects the architectural meaning to a small degree.

- From 12 to 15: The visual pollution affects the architectural meaning to a moderate degree.

- From 16 to 24: The visual pollution affects the architectural meaning to a large extent.



Measurements of the Aspects of Visual Pollution on the Surface (Colour and Texture)

Figure 7. Effect of the aspects of visual pollution on the surface (colour and texture)

Chart Analysis (Figure 7): Most of the changes that take place at the level of the surface (colour and texture) affect the original colour of the facade, like the use of concave antennas, conditioners, or iron windows of various colours, and conceal parts of the facade, thus altering the surface area of the visible exposure of the facade, followed by the effect on the viewer.

The changing of the colour of the windows on the facade or closing of the balconies changes the effect of the rhythm of the openings and the perception of their proportions and creates a state of dispersal and visual chaos in the facade.



The Effect of Visual Pollution Aspects on the Form (Rhythm, Proportions, and Balance)

Figure 8. Effect of the aspects of visual pollution on form (rhythm, proportions, and balance)

Chart analysis (Figure 8): Any changes in the level of the surface or the shape would affect the proportions, rhythm, and balance of the facade. The presence of irregularly and randomly distributed air conditioning breaks the rhythm of the openings due to the proximity of the dimensions of the air conditioning units to the dimensions of the windows. The inclusion of balconies inside changes the rhythm of the facade as a whole to irregular shapes. Changing the ground floor into shops changes the dimensions and texture of the facade to a formation completely different from the original.



The Effect of Visual Pollution Aspects on the Architectural Meaning (Positive and Negative)

Figure 9: Effect of the aspects of visual pollution on the architectural meaning (positive and negative)

Chart analysis (Figure 9): The graphs indicate that the user is affected by metaphysical meanings, most of which are characterised by high rates of negative meanings because of the presence of aspects of visual pollution on the facades, where most of the additions represent undesirable changes and the transfer of positive meanings. The design of the original interfaces without the intervention of users to reach meanings of regularity, order, consistency, compatibility, and balance.

Table 2. The monitoring and documentation of visual pollution aspects.

	•	Deficiencies in the architectural design (architectural designer) Absence of laws and legislation			
		(administrative considerations)	Causes of visual pollution		
	•	Users' infringements			
	•	Moving visual pollution			
Photo No. 01: The back facade	•	Static visual pollution	Type of visual pollution		
of Building No. 15 - The	•	Coexisting visual pollution			
evolutionary neighbourhood -	•	Self			
Batna	•	Environmental	Sources of visual pollution		
	•	Mutual	Sources of visual pollution		
	•	Point			
	•	Linear	Dimonsions of visual pollution		
	•	Level	Dimensions of visual pollution		
	•	Surface: colour, texture			
	•	Shape: blocks, voids	Places of visual pollution		
	•	Openings: doors, windows, balconies			

FINDINGS

The research aims to study the phenomenon of visual pollution in collective housing resulting from infringements by users that affect the original design of the facade:

• The first hypothesis was confirmed: The elements added to the building create a duplication of the architectural meaning in the facades, which distorts them, and they are the main visual pollutants.

- Elements added to interfaces by users, ill-advised declarations, or the absence of rules cause users to disapprove of the interface design.
- The aspects of visual pollution are inversely proportional to the foundations of visual formation with facades.
- Land pollution aspects cause duplication of meaning in the facades and the arrival of meanings that differ from the meanings targeted by the architectural designer.
- Visual pollution affects the morphology of the facades and the design of the external architectural body by adding, deleting, accumulating, repeating, grouping, transforming, or any of these, undesirably.
- Visual pollutants are inversely proportional to the structure and facade details. The more pollutants, the fewer the architectural details of the facade.

CONCLUSION

The phenomenon of visual pollution has spread to tampering with all aspects of the urban environment, including aspects of our daily behaviour, and tampering with all aesthetic aspects. Man and reflection on his various activities, where visual pollution dominated the Algerian city, and to meet the challenges of rapid expansion, the conflict between the old and the modern and the additions and changes that led to the disruption of the social, economic, and cultural structure that led to the loss of identity and the rejection of inherited values intensified.

After the theoretical and field study, this paper proposes a set of solutions and suggestions to reduce visual pollution, as follows:

- Involve users in the design process by asking them about their needs before starting the process of designing their projects, to reduce their infringements in the future.
- Consider the change in the psychological and social needs of the users over time, as it is necessary when designing the facades to consider the places and forms of possible additions and what the final form of the facades might look like after the users' infringements.
- Design interfaces in a way that helps to adapt to the inevitable change accompanying the development process, within a limited and clearly defined framework.
- The role of the architectural designer does not end upon receiving the project, but it is necessary to continue to provide the user with the necessary instructions when he needs to make an addition or change at the level of the facades.

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