

Enhancing the visual quality of building facades to achieve sustainable urban development from the perspective of citizens' visual preferences

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Abstract

Many building facades in urban environments lack desirable visual quality, which can negatively impact sustainable urban development. Therefore, identifying and incorporating citizens' visual preferences into facade design can be an effective step toward improving visual quality and urban sustainability. This study aims to enhance the visual quality of building facades to achieve sustainable urban development from the perspective of citizens' visual preferences. This research is applied in nature due to its objective and employs a descriptive-survey method for data collection. Initially, a theoretical foundation was examined using a qualitative, content analysis-based approach. In the following step, quantitative data and statistical information were extracted, compared, and analyzed in charts and tables. The statistical population of this study includes citizens from districts 1, 6, and 12 of Tehran metropolis, with a non-probabilistic, quota sampling method applied. Data were analyzed using MAXQDA and SMART PLS software. The research results are presented as a localized model of elements and components to enhance the visual quality of building facades for sustainable urban development. This model demonstrated suitable validity, reliability, and fit within the studied community. The findings support the theory that enhancing the visual quality of building facades and considering citizens' visual preferences can lead to sustainable urban development, which not only enhances the

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aesthetic appeal of the living environment but also strengthens the sense of belonging and social satisfaction.

Keywords: Visual Quality, Building Facade, Sustainable Urban Development, Citizens' Visual Preferences.

1. Introduction

With the rapid growth of urbanization and increasing population in urban areas, the issue of harmonizing and beautifying building facades has gained greater importance (Achhsani et al., 2020). Building facades serve not only as the external face of a structure but also as a crucial element in shaping the urban landscape and urban cultural identity (Hashemi et al., 2023). The visual quality of facades can have a profound impact on citizens' emotions and daily behaviors, playing a significant role in enhancing or diminishing urban life quality (Mosipour, 2023; Wang et al., 2023). Amidst this context, the concept of sustainable urban development, which seeks to balance economic, social, and environmental needs, is emerging as a strategic approach in urban planning and design (Badami, 2022). An essential aspect of this development is considering the visual quality of urban environments and aligning it with the preferences and expectations of the community (Jaglars, 2023). Neglecting this issue can result in spaces that lack aesthetic appeal and lead to a diminished sense of belonging and collective identity among citizens (May et al., 2023). Cities, as spaces for social and cultural interactions, should be able to showcase a blend of beauty and functionality in their spaces (Kampir et al., 2021). This goal can be achieved through active citizen participation in the process of facade design and decision-making (Pouya & Poulet, 2023). Citizen participation brings diverse perspectives, fostering a sense of ownership and responsibility in preserving the urban environment.

In the current era, with expanding urbanization and rapid changes in construction, a new challenge confronts urban managers and designers: maintaining visual identity while aligning it with principles of sustainable urban development (Ping et al., 2022). Building facades, as key elements and the visible face of cities, influence not only the visual appeal but also social function, cultural interactions, and even environmental sustainability of cities. However, facade design decisions are often based on economic and technical considerations, while citizens' visual preferences—the primary audience of these spaces—are frequently overlooked (Nigen et al., 2020). Ignoring citizens' visual preferences can lead to urban spaces where discord and a lack of identity prevail (Yan et al., 2022). This misalignment may reduce the quality of urban life, as citizens find themselves living in spaces that are not attuned to their tastes and needs (Wang et al., 2023). This can, in turn, erode pride in local and national urban identity (Mirabi et al., 2020). Additionally, dissatisfaction with urban spaces may lead to migration from those areas or reduced citizen engagement in maintaining urban spaces (Li et al., 2024). Building facades, with their direct impact on the visual and cultural appeal of cities, play a vital role in preserving and reinforcing environmental identity (Sak et al., 2019). While the principles of sustainable development emphasize a balance among social, economic, and environmental elements, the current lack of alignment between facade designs and citizens' visual preferences has impeded the full realization of these principles (Pearson et al., 2017). Thus, harmonizing aesthetic needs with sustainable values can enhance social engagement, improve quality of life, and protect cultural and natural resources. This underscores the importance of investigating and understanding citizens' visual preferences in urban facade design. Incorporating these preferences not only enhances urban aesthetics but also increases citizen satisfaction and prevents cultural and environmental

degradation (Bekl, 2021). Utilizing methods such as surveys, field analyses, and public consultations can provide valuable insights for planners and designers, guiding them toward sustainable urban design (Kampir et al., 2021; Nozari et al., 2024). Ultimately, the goal of addressing this issue is to create foundations where architectural and urban design align with citizens' perspectives and expectations. Achieving this goal can result in cities that are not only visually appealing but also foster a sense of belonging and citizen participation, thereby paving the way toward sustainable urban development.

In research on building facade design for sustainable urban development, while extensive studies have been conducted on the technical and economic principles of design and construction, significant gaps remain in understanding and explaining the relationship between citizens' visual preferences and urban facade design. This gap is particularly evident in cities in Iran and other developing countries experiencing rapid urban growth and social change. A primary research gap is the lack of interdisciplinary studies that simultaneously examine the social, cultural, and aesthetic impacts of building facades on the urban environment. Most research has focused on the technical and engineering aspects of facades, with less attention to how sociological and environmental psychology perspectives can be incorporated into urban design. Additionally, there is a need to develop new and innovative research methods for identifying citizens' visual preferences. Traditional survey and qualitative analysis methods have often been criticized for lacking comprehensiveness or accuracy, and they may not adequately capture the diverse and dynamic preferences within varied urban populations. Employing new techniques such as big data analysis and virtual reality can provide a better understanding of citizens' visual expectations and needs. Moreover, a shortage of comparative studies across cities and regions with different cultural and social characteristics is another gap. Studies that analyze and compare successful or unsuccessful experiences in other cities can offer effective models and strategies for improving the visual quality of facades. Finally, it is essential to examine the long-term impacts of changes in urban facade design on social behavior, cultural interactions, and environmental effects. These aspects can help policymakers and designers to better balance current needs with long-term sustainability goals.

Research on citizens' visual preferences in urban facade design is of high importance and necessity. Given the rapid and unpredictable changes in urbanization and construction, the need for beautiful and efficient cities that address citizens' social, cultural, and environmental needs is felt more than ever (Jakobik & Reinhard, 2016). In this regard, a transparent examination and analysis of visual preferences, as a key factor in the facade design process, can help enhance urban quality of life and preserve cultural and social identity. One of the primary reasons for the importance of this research is the profound impact of building facades on citizens' sense of belonging and identity. Urban facades not only reflect the cultural and social characteristics of areas but also affect citizens' moods (Giarma et al., 2021; Fallah et al., 2021). Visually appealing and attractive spaces can strengthen individuals' sense of satisfaction and community, thereby increasing their engagement in social and cultural activities.

Additionally, in an era of globalization and intense competition among cities, the visual quality of facades can be a crucial factor in attracting tourists and investors. Cities that emphasize beautiful, citizen-centered designs can become attractive tourist destinations, thereby economically

benefiting as well (Shafoui et al., 2020). Thus, recognizing and focusing on visual preferences can lead to economic prosperity and sustainable urban development.

Furthermore, given the environmental challenges of the present century, including climate change and the need to reduce the negative environmental impacts of construction, exploring the link between facade design and sustainability principles deserves more attention. Research in this field can offer practical solutions for designing facades that are not only beautiful and appealing but also contribute to conserving natural resources and reducing environmental pollution.

Finally, an accurate understanding of citizens' visual preferences and needs can help urban managers and designers make better decisions and create better public spaces. This can lead to effective synergy between community needs and the demands of modern architecture, bridging the gap between sustainable development and cultural tastes. Thus, research in this area is recognized as an undeniable necessity, which can lead to improved citizen quality of life and sustainable growth and flourishing of cities.

2. Literature Review

2.1. Visual Quality of Building Facades

2.1.1. Visual Perception

More than eighty percent of our sensory inputs are visual, and for this reason, when we talk about perception, we often mean visual perception. This is because, aside from cultural reasons, our sense of sight is more tangible and its quality is more controllable compared to our other senses (Douglas Porteous, 2003, p. 31).

According to Matlock, our perception of the world is spatial and three-dimensional. Gibson, in his book "The Perception of the Visual World," writes that we perceive this three-dimensional reality through perspective, which connects with us via stimulating stimuli, their structures, and the sensory changes we receive (Gibson, 1950). Perception is primarily visual, and visual perception is primarily spatial. By moving through space, we experience the world around us as a sequence of visual stimuli and perceive spaces, environments, and landscapes in all their various dimensions. When we alter our spatial or emotional position within an environment, new aspects of the setting become apparent. Essentially, "our sensory understanding of a place is largely visual and, more specifically, spatial."

"When sensory stimuli activate hidden information in the mind, they create mental entities; therefore, if visual stimuli are removed or changed, our perception of a place, scale, size, color, texture, solidity, and other characteristics will fundamentally change" (Matlock, 2000, p. 245).

Hedman, highlighting the importance of visual experience in people's perception of space, warns that in urban design projects, it is crucial to consider that people perceive their surroundings far more than we might expect. People enjoy revisiting spaces with visually appealing features and those that consistently seem to offer new spatial relationships and effects (Hedman & Jaszewski, 2008, p. 71). To distinguish one space from others in the observer's mind, using attractive elements

emphasizing specific local features can be very effective. For improved perception, it's important to consider the role of aesthetics and people's visual preferences toward their surrounding environment, as this is critical in strengthening the reciprocal human-environment relationship to maintain and enhance the quality of such spaces (Masnavi & Fathi, 2011, p. 80).

2.2. Human-Environment Relations in Mental Imaging

In human-environment interactions, we can generally examine the environment from three aspects:

1. The environment as something independent of the observer, always present and offering information about itself, whether this information is received or not (form).
2. The part of the environment that we perceive and that influences our behavior (view) (Trieb, 1974, p. 71).
3. The mental image of the perceived space we imagine in our mind and based on which we act (mental image) (Pakzad & Bozorg, 2012, p. 202).

Humans recall much of the information stored in memory as images because they record it visually (Sternberg, 2008, p. 282). This image, called the "mental image," contains both the physical and non-physical features of the phenomena and places around us. It includes meanings and emotions that are evoked when the phenomenon is recalled in our minds (McAndrew, 2008, p. 47).

2.3. Aesthetic Perception in Building Facades

Aesthetic perception has long been considered a relative principle, influenced by individual circumstances and surroundings. Kant (1724-1804) believed that only taste distinguishes beauty from ugliness (Makhtarpour et al., 2016, p. 78).

In general, many theorists have considered beauty a characteristic of objects that leads to a pleasurable experience for perceivers. Aristotle believed beauty is defined by harmony and order (Tatarkiewicz, 2002). Alternatively, in various aesthetic schools that emerged during the Renaissance, rules of rhythm, symmetry, a harmonious relationship between the whole and its parts, and unity in diversity were all regarded as beauty principles. In contrast, some theorists argue that anything can be beautiful if it pleases human senses, suggesting that beauty is unconsciously a function of the perceiver's sensory qualities. In newer analyses, taking an interactive perspective, theorists believe that the sense of beauty stems from the patterns that connect people and objects. Consequently, in these interpretations, the concept of beauty is intertwined with notions like pleasure and perception, making beauty a part of the perceiver's cognitive and emotional processing experience, arising from the interaction between stimulus characteristics and the perceiver's cognitive and emotional processes (Pakzad & Saki, 2014; Nozari & Szmelter-Jarosz, 2021).

According to research at University College London, although the beauty of an object may be influenced by environmental conditions, culture, education, and an individual's life experiences, the brain's way of perceiving and appreciating beauty is similar in all humans. Thus, even though

it may be impossible to design a building universally perceived as beautiful, beauty and ugliness of a building generate similar effects in the brains of all viewers, regardless of experience. Additionally, how the brain perceives the surroundings, directions, location, and dimensions of space produces different impacts, affecting how pleasing a building facade might seem. According to information theory, the semantic information of a message engages the human mind, while aesthetic information addresses human emotions. Therefore, a facade is considered beautiful if it contains enough informational load; specifically, it should have just enough innovation so that its aesthetic content slightly exceeds maximum mental comprehension. Through this, the receiver is compelled to create a schema, thus prompting the mind toward higher-level perception. The degree of novelty should be just above the brain's maximum cognitive capacity (Makhtarpour et al., 2016, pp. 78-79). Satisfaction of the aesthetic sense (at least partially) occurs when the mind finds a relative order within a seemingly chaotic set of stimuli (Groeter, 1996, p. 97).

Definitions of aesthetics are grounded in analyzing the reciprocal relationship between humans and the environment. Thus, understanding the aesthetic components of facades can be a crucial step in assessing and analyzing Iranian architectural facades, which may also lead to appropriate strategies for organizing building facades. Our perception of beauty directly impacts artistic and architectural creation. Generally, aesthetics reflects a phenomenon that, after being perceived by the senses and conveyed to the center of thought, elicits responses in the perceiver based on accumulated experiences. Beauty has always been accompanied by human admiration and seems deeply embedded in human nature, making it inseparable from the complex mental life that distinguishes humans from animals. The need for beauty is among the most enigmatic human needs. Like any other phenomenon, beauty includes three fundamental components: form, function, and meaning. Form encompasses shape, structure, weight, and volume; function refers to its use for humanity; and meaning connects us to the world and beyond. One of the most significant aspects of modern buildings is their primary facades facing streets and urban thoroughfares. These facades collectively shape the physical image and landscape of cities (Mahanfar et al., 2020).

2.4. Urban Sustainable Development

A sustainable city is one that creates, implements, and supports operational infrastructure to meet the growing demands of urbanization without causing negative economic, environmental, and social impacts (Pocono & Kapbesbal, 2023). Urban sustainable development is notable for its long-term benefits, including increased income, improved quality of life, and reduced environmental impact (Padmabrava et al., 2021). By funding sustainable projects, cities can generate employment and growth while simultaneously reducing energy consumption, waste, and pollution. Additionally, sustainable development can improve living conditions and facilitate social inclusion for different community groups. As cities grow larger and more populated, the demand for urban infrastructure rises (Iyorigi et al., 2022). When cities allocate their budgets to innovative, practical, and sustainable methods, these practices can also become more environmentally friendly and efficient over time. This can have a significant impact on the environment, helping to reduce both waste and energy consumption. Furthermore, by improving public transportation, cities can enhance air quality, reduce traffic congestion and noise pollution, and lower residents' cost of living (Heger, 2023).

Moreover, sustainable urban development is crucial to ensure that all citizens enjoy a better quality of life. Funding public projects and initiatives such as green spaces, better transportation, and public safety can benefit those with lower incomes who otherwise face challenges in participating in urban life; this enhances their opportunities and provides greater mobility options (Rodriguez & Lange, 2023). In a dynamically developed city, residents also have better access to employment and educational opportunities, enhancing their social standing. Sustainable design for a smart city involves focusing on various perspectives, including social, environmental, economic, cultural, and technological aspects. Economic, environmental, and social considerations are fundamental components of sustainable development within a smart city. People are at the center of smart cities, and technology plays a key role in accelerating and enhancing sustainable development. The goal of sustainable design in a smart city is to promote the harmonious and sustainable development of the "human-environment-community-economy-culture" ecosystem through detailed planning (Gao et al., 2023; Nozari & Aliahmadi, 2022). Several perspectives on sustainability in a smart city include:

- Economic
- Operational
- Social
- Environmental (Ahoonimi et al., 2017; Aguirre & An, 2020; Laval et al., 2020; Gharachorloo et al., 2022).

In the literature, economic sustainability is often defined as the ability of an economic system to meet current demands without compromising the ability of future generations to meet their own needs (Basiagio, 1999). This requires maintaining a balance between the economic, social, and environmental aspects of development to promote sustainable and resilient growth. Economic sustainability also involves market growth, creating an environment conducive to economic activity, entrepreneurship, and innovation. It emphasizes sustainable, inclusive, and balanced economic expansion that benefits both individuals and society. Another target element of economic sustainability is the creation of job opportunities. The goal of sustainable economic development is to create quality jobs that provide fair wages, suitable working conditions, and opportunities for growth and advancement. As a subset of economic sustainability, operational sustainability assesses whether a business can maintain its current practices without jeopardizing potential future resources. "Sustainable operations" can also be defined as those that meet current needs without compromising the ability to meet future needs. The aim is to create supply chains that perform well economically, socially, and environmentally (Team Scale, 2023). Social sustainability is defined as the identification and management of the positive and negative impacts of systems, processes, organizations, and activities on people and social life (Balaman, 2018). This includes equitable access to quality services and facilities, social interaction and networks, public safety, participation in organized activities, a sense of pride and community attachment, and community stability (Dempsey, 2011). Environmental sustainability is defined as the capacity to improve the quality of human life within the limits of the Earth's ecosystem's ability to sustain it (Evans, 2020). Environmental sustainability aims to preserve and safeguard the surrounding environment to ensure sustainable use of natural resources and reduce negative impacts on ecosystems and biodiversity (Parkadi, 2021).

2.5. Sustainable Facade

In urban sustainable development, another factor considered in the selection of building facade materials is facade sustainability, especially the compatibility of materials used in the facade with the environment. Three key principles of sustainable facades include durability, aesthetics, and utility. Sustainable facade design aims to respect these three principles: durability and resistance, meaning minimal damage from natural and non-natural disasters; sustainability, meaning the ability to reuse in other constructions; and beauty, meaning compatibility with citizens' spirits. Notably, the use of smart materials and nanomaterials can be important strategies in this area. The building's facade acts as a thermal and cooling insulator, preventing energy loss from heating and cooling systems and, depending on its material, color, and surface area, can deflect and reflect heat in summer, especially in warm regions, while performing the opposite function in winter by absorbing solar energy and warming buildings in colder areas. Other features of nanomaterials include enhancing the durability and resilience of buildings against adverse weather and environmental conditions, reducing overall building costs by minimizing energy loss, and thereby reducing fuel costs, as well as reducing material and chemical pollutant consumption and lowering repair and maintenance costs for facade materials (Elhaj, 2012). In general, nanotechnology aims to produce materials with minimal negative environmental impacts and maximum environmental benefits (Ahadi, 2012). Thus, the type of materials and their application in the facade can influence the sustainability of the facade.

3. Research Methodology

The methodology of the present study is applied in nature, given its purpose, and is classified as a descriptive-survey research method based on data collection techniques. Initially, this approach involves examining relevant aspects and subjects related to the research topic, as well as reviewing similar studies and research on the topic. Following this, hypotheses are developed through field studies to align with the study's goals and objectives. This research employs a mixed-method (qualitative and quantitative) approach, using an exploratory design based on an instrument development model. In the qualitative phase, grounded theory techniques are utilized, while in the quantitative phase, factor analysis and modeling techniques are applied. A mixed-method approach combines quantitative and qualitative techniques simultaneously and is also known in domestic studies as an exploratory mixed research design.

3.1. Library Studies:

The library research process includes a step-by-step approach to gathering information for writing a research paper, article, presentation, or project completion.

3.2. Field Studies:

Survey research is defined as "collecting information from a sample of individuals through their responses to questions." This type of research allows for various methods of engaging respondents, gathering data, and using different measurement tools.

3.3. Population of the Study:

The study population is divided into two sections:

1. The qualitative section includes architects and urban planners residing in districts 1, 6, and 12 of Tehran, who are experts and have experience relevant to the research topic. Given the limited population size, a census approach was applied to 15 individuals, considering the entire population as the sample.
2. The quantitative section includes residents of districts 1, 6, and 12 in Tehran. Due to the large population in these areas, the sample size in this section is considered unlimited.

A random sampling technique was used in the present research, and the sample size was determined by the following formula:

Cochran's Formula:
$$n = \frac{z^2 pq}{d^2}$$

Where:

- **Confidence level** = 95% ($Z = 1.96$),
- **p = q** = 0.5,
- **Population size (N)** = Unlimited,
- **Margin of error (d)** = 0.05.

Based on this formula, the calculated sample size was 384 individuals. Accordingly, 384 questionnaires were distributed among the sample population, with 345 completed questionnaires collected and used for the final analysis.

In the qualitative section, qualitative content analysis was applied, while in the quantitative section, correlation analysis was used. Given the descriptive and exploratory nature of the research objectives, data analysis was conducted through coding and factor analysis. For coding, MAXQDA software was used, and for factor analysis, Smart PLS software was employed.

4. Data Analysis

Coding and Component Identification

To achieve the predetermined objectives of the study, the researcher must first identify the dimensions of the visual preference model related to the perception of building facades in the metropolitan area of Tehran. The final results from the three coding techniques were classified into several significant dimensions.

In the open coding phase, implemented analysis and summarization were conducted. The table below presents the initial codes derived from the content of the research interviews. This section includes, based on open coding, the main concepts resulting from the content analysis of identified codes relevant to the study. These include 90 concepts presented in Table 1:

Table 1: Initial Coding

Identified Components					
a1	Skyline	a31	Harmony	a61	Creativity
a2	Ground Line	a32	Tension	a62	Style
a3	Background	a33	Proportions	a63	Engineering Nature
a4	Window	a34	Symmetry	a64	Beauty
a5	Entrance	a35	Hierarchy	a65	Proportion of Part to Whole
a6	Balcony	a36	Similarity	a66	Contrast
a7	Staircase	a37	Simplicity	a67	Divergence
a8	Volumetric Porosity	a38	Sense of Place	a68	Edge
a9	Opening	a39	Clarity	a69	Granularity
a10	Materials	a40	Signification & Meaning	a70	Distinction
a11	Lines	a41	Sense of Dynamics & Movement	a71	Harmony
a12	Width of Parts	a42	Sense of Time	a72	Softness and Fluidity
a13	Color	a43	Protection & Sense of Safety	a73	Multidimensionality
a14	Texture	a44	Psychological Space & Emotions	a74	Association
a15	Console	a45	Naturalness	a75	Composition
a16	Pattern and Rhythm	a46	Historical Significance	a76	Strength
a17	Light and Shadow	a47	Legibility	a77	Cleanliness
a18	Transparency & Reflection	a48	Mystical Quality	a78	Sustainability & Eco-friendliness
a19	Interaction with Nature & Vegetation	a49	Coherence	a79	Connection with Urban Life
a20	Details and Decoration	a50	Unity	a80	Climate Compatibility
a21	Geometric Order	a51	Form	a81	Sense of Discovery & Innovation
a22	Corner	a52	Geometry	a82	Adaptability for Different Uses
a23	Connection with Public & Open Spaces	a53	Islamic Architecture Elements	a83	Link with Technology
a24	Height Changes & Diverse Surfaces	a54	Continuity	a84	Multisensory Experience
a25	Complexity	a55	Diversity in Color, Materials, Elements & Form	a85	Modifiability
a26	Balance	a56	Elegance	a86	Social Interaction & Space for Community
a27	Contrast	a57	Repetition	a87	Interaction with Urban Nature
a28	Homogeneity	a58	Pleasantness	a88	Use of Natural Light
a29	Contrast	a59	Spirituality	a89	Sense of Inviting
a30	Display of Weights	a60	Identity	a90	Human Proportions

In the next step, similar and concurrent categories were replaced in the main theme. Based on the conceptual similarities that the categories shared, themes were extracted. Considering the overall goal of the research, the main themes were identified, and in the final analysis of the initial concepts, efforts were made to create a satisfactory map of the themes by gaining sufficient understanding of which themes exist, how they relate to each other, and the overall narrative they tell about the data. In the next phase, during the axial coding, we are faced with an organized set of codes and initial concepts, which is the result of a thorough and detailed examination of the codes identified in the open coding phase. The focus of this stage is more on the codes and concepts, rather than the data. Although new codes or concepts may emerge at this stage, the

primary task is to review and examine the initial codes. Therefore, the themes that emerged in the axial coding phase of this research are as follows:

Table 2: First-stage themes extracted from the research

Main Themes	Sub-Themes
b1. Interaction with Nature and Environmental Friendliness	.a19 Interaction with nature and vegetation
	.a87 Interaction with urban nature
	.a78 Sustainability and environmental friendliness
	.a80 Climatic compatibility
b2. Transparency, Reflection, and Natural Light	.a18 Transparency and reflection
	.a17 Light and shadow
	.a88 Use of natural light
b3. Connection with Public Spaces and Urban Life	.a23 Connection with public and open spaces
	.a79 Connection with urban life
	.a86 Social interaction and space organization for community
b4. Lines and Borders	.a1 Skyline
	.a2 Ground line
	.a22 Corner
	.a68 Edge
	.a11 Lines
b5. Proportions, Symmetry, and Geometric Order	.a21 Geometric order
	.a33 Proportions
	.a34 Symmetry
	.a65 Part-to-whole proportion
	.a90 Human proportions
b6. Sense of Place and Local Identity	.a38 Sense of place
	.a60 Identity
	.a59 Spirituality
	.a53 Elements of Islamic architecture
b7. Volume Changes and Dynamism	.a24 Height changes and diverse surfaces
	.a8 Spatial porosity
	.a85 Adaptability
	.a41 Sense of dynamism and movement

b8. Association of Meanings and Signification	.a40 Signification and meaning
	.a74 Association
	.a42 Sense of time
	.a43 Protection and sense of security
b9. Texture and Materials	.a14 Texture
	.a10 Materials
	.a69 Granulation
b10. Color and Contrast	.a13 Color
	.a66 Contrast
	.a67 Antithesis
b11. Geometry and Form	.a52 Geometry
	.a51 Form
	.a73 Multiplicity
b12. Repetition and Patterns	.a16 Pattern and rhythm
	.a57 Repetition
b13. Aesthetics and Pleasingness	.a64 Beauty
	.a58 Pleasingness
	.a56 Refinement
b14. Balance and Contrast	.a26 Balance
	.a27 Contrast
	.a29 Antithesis
b15. Creativity and Innovation	.a61 Creativity
	.a81 Sense of discovery and innovation
	.a48 Mysteriousness
b16. Connection with Technology and Engineering	.a83 Connection with technology
	.a63 Engineering quality
b17. Structural Strength and Stability	.a76 Strength
b18. Connection with History and Spirituality	.a46 Historical significance
	.a59 Spirituality
b19. Interaction with Space and Architectural Form	.a5 Entrance
	.a4 Window
	.a6 Balcony
	.a7 Staircase
b20. Diversity and Unity in Architectural Elements	.a55 Diversity in color, materials, elements, and form
	.a50 Unity
	.a49 Coherence
b21. Composition and Continuity	.a75 Composition
	.a54 Continuity
b22. Sense of Invitation and Accessibility	.a89 Sense of invitation
	.a35 Hierarchy and accessibility
b23. Simplicity and Clarity	.a37 Simplicity

	.a39 Clarity
	.a77 Cleanliness
	.a47 Readability
b24. Homogeneity and Harmony	.a28 Homogeneity
	.a31 Coordination
	.a71 Harmony
b25. Style and Visual Identity	.a62 Style
	.a60 Identity
b26. Multisensory Experience	.a84 Multisensory experience
	.a44 Psychological space and emotions

In the final section, the extracted final themes have been combined. The 26 above-mentioned themes have been integrated into 9 other themes as follows:

Table :3 Second Stage Themes Extracted from the Research

Main Themes	Sub-themes
c1 Sustainable Development and Connection with the Natural and Urban Environment	.b1 Interaction with Nature and Environmental Friendliness
	.b3 Interaction with Public Spaces and Urban Life
	.b19 Interaction with Space and Architectural Form
	.b22 Sense of Invitation and Accessibility
c2 Transparency and Light	.b2 Transparency, Reflection, and Natural Light
	.b10 Color and Contrast
c3 Proportions, Order, and Geometry	.b5 Proportions, Symmetry, and Geometric Order
	.b4 Lines and Boundaries
	.b11 Geometry and Form
c4 Identity, Culture, and Spirituality	.b6 Sense of Place and Native Identity
	.b8 Symbolism and Meaningful Associations
	.b18 Connection with History and Spirituality
	.b25 Style and Visual Identity
c5 Aesthetics and Visual Harmony	.b13 Aesthetics and Pleasantness
	.b24 Harmony and Unity
	.b23 Simplicity and Clarity
	.b26 Multisensory Experience
c6 Diversity and Creativity in Form and Details	.b15 Creativity and Innovation
	.b20 Diversity and Unity in Architectural Elements
	.b12 Repetition and Patterns
	.b21 Composition and Continuity
c7 Balance, Dynamics, and Contrast	.b14 Balance and Contrast
	.b7 Volume Changes and Dynamism
c8 Texture and Structural Materials	.b9 Texture and Materials
	.b17 Structural Strength and Stability

Next, the 8 aforementioned themes have been merged into 3 final main themes, as indicated in the table below:

Table 4: Final Stage Themes Extracted from the Research

Main Themes	Sub-Themes
d1 Physical	c3 Proportions, Order, and Geometry
	c8 Texture and Structural Materials
	c7 Balance, Dynamics, and Contrast
	c6 Diversity and Creativity in Form and Details
d2 Meaningful	c4 Identity, Culture, and Spirituality
	c5 Aesthetics and Visual Harmony
d3 Environmental	c1 Sustainable Development and Connection with Natural and Urban Environment
	c2 Transparency and Light

In this research, axial coding was carried out based on the use of the main model. Therefore, the subcategories are related to the main category according to the desired model, and the main objective is to enable the researcher to think systematically about the data and how to relate them. The main category (such as a core idea or event) is defined as the central phenomenon, and other categories are connected to this main category. Based on this, after analyzing the codes, 3 main components and 8 subcomponents were counted.

Subsequently, a questionnaire was distributed among 115 experts, and descriptive statistics and sample characteristics are presented below.

4.1. Testing the Model Using Structured Linear Relationships

In this phase, in order to evaluate the conceptual model of the research and to verify the existence or absence of a causal relationship between the research variables and assess the fit of the observed data with the conceptual model, the research's indigenous model was also tested using structural equation modeling. The results of the model test are reflected in the following charts.

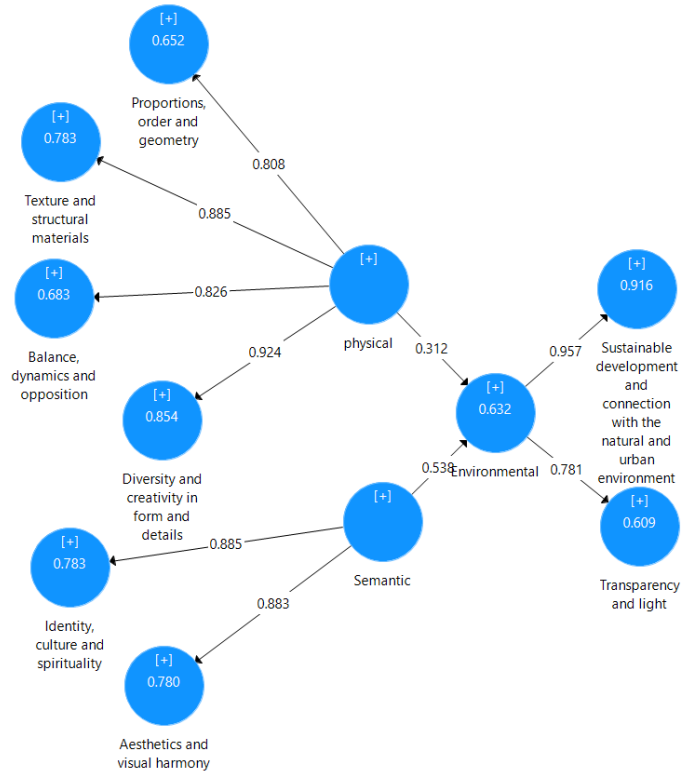


Figure 1: Measurement of the overall model in the standard state

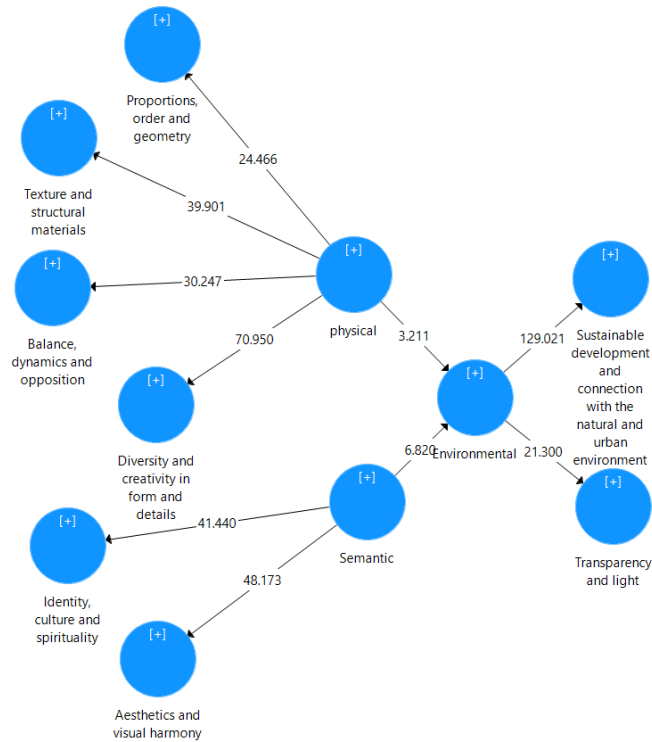


Figure 2: Measurement of the overall model in the meaningful state

To measure reliability, Cronbach's alpha and composite reliability were used, and for assessing validity, convergent validity was applied. For model fit evaluation, the GOF index was used:

Table 5: Reliability and Validity of the External Models

Variable	CR	AVE	MSV	GOF	Fornell-Larcker Matrix				
					1	2	3	4	5
Structural	0.787	0.552	0.193	0.62	0.743				
Semantic	0.844	0.644	0.478		0.342	0.803			
Sustainable Development	0.918	0.651	0.423		0.331	0.47	0.807		
Transparency and Light	0.885	0.72	0.478		0.44	0.692	0.65	0.849	
Environmental	0.96	0.649	0.149		0.066	0.259	0.213	0.386	0.806

Cronbach's Alpha value above 0.7 indicates acceptable reliability.

If the CR value for each construct is above 0.7, it indicates adequate internal consistency for the measurement model.

An AVE value above 0.5 indicates acceptable convergent validity.

Given the three values 0.01, 0.25, and 0.36 as weak, moderate, and strong values for GOF, a result of 0.62 indicates a strong model fit.

5. Conclusion

In Tehran, the visual perception of building facades is heavily influenced by the structural components. One of the most important components is proportions, order, and geometry. Facades that have logical and proportionate order and geometry aligned with the urban fabric transmit a greater sense of harmony and calmness to the citizens. On the contrary, facades that use disproportionate proportions or irregular geometries can create a sense of disorder in the visual perception of the citizens. This issue becomes more significant in the densely populated urban areas of Tehran, where tall buildings and dense facades may lead to visual chaos. The structural components influencing visual preferences in the perception of building facades show that citizens prefer facades that are balanced and coordinated while also having dynamic creativity in their form and details. This combination makes facades aesthetically appealing and compatible with the urban environment. Additionally, the use of appropriate texture and structural materials that are environmentally and culturally compatible with the region can increase visual satisfaction for citizens. Therefore, paying attention to structural components in the design of building facades not only improves the aesthetic experience of citizens but also contributes to sustainability and harmony with the natural and urban environment. The results of this study align with similar studies conducted in other metropolitan cities, including research in Shanghai and New York. In these metropolises, components such as proportions, order, and geometry also rank highly in the visual preferences of citizens. However, compared to these cities, Tehran has a rich architectural culture and history that leads citizens to place more value on creativity and local details in facade design. For this reason, integrating creative and unique local elements into the facade designs of Tehran can create a significant distinction from other cities and contribute to enhancing the urban visual identity.

In Tehran, semantic components in the visual perception of building facades are highly important, especially in relation to identity, culture, and spirituality. Building facades can symbolize urban culture and identity and play an important role in the visual connection between citizens and the urban environment. Facades that incorporate traditional architectural elements or Iranian cultural symbols are symbolically linked to the values and beliefs of society and can strengthen citizens' sense of belonging to a place. These facades not only respond to cultural and spiritual aspects but also create a deeper connection with the collective memory and history of the city. Research findings show that Tehran's citizens are more attracted to building facades that have high aesthetic and visual coordination while also incorporating elements of identity and culture. Facades that, in addition to visual beauty, make use of local architectural principles and cultural symbols can enhance the sense of calm and belonging to a place and strengthen the integration between buildings and the social-cultural fabric of the environment. This indicates that designing facades that focus only on modern and functional aspects cannot meet the spiritual and cultural needs of citizens in the urban environment. Comparing studies in Tehran with other cities shows that visual perception of building facades related to cultural and spiritual components is also important in cities like Cairo and Istanbul. However, compared to Tehran, these cities emphasize religious and traditional elements more in their facades. In Tehran, there is a combination of modernity and tradition, which leads citizens to prefer facades that not only reflect identity and spirituality but also align with modern aesthetic principles. This unique cultural and spiritual combination can distinguish Tehran's visual identity from other metropolitan cities in the region.

Environmental components in the visual perception of building facades in Tehran, especially sustainable development and the connection with the natural and urban environment, are of great importance. Sustainable development not only improves the quality of the environment but also affects the visual perceptions of citizens. Facades that utilize sustainability principles, such as the use of recycled materials, solar panels, and green facades, can contribute to reducing pollution and improving the urban environment. Additionally, these facades play an important role in creating a visual and semantic link between the natural and artificial environments, resulting in a sense of harmony and balance in the urban space. The use of transparency and light in facades is significant not only from a visual perspective but also from an environmental standpoint. Facades that effectively incorporate thermal-insulating glass and open designs that allow more natural light can help reduce energy consumption and improve the quality of life for residents. These facades can also enhance the visual experiences of citizens and promote a sense of openness and clarity, which is particularly important in the densely populated metropolitan areas of Tehran. As a result, focusing on these components can lead to the creation of more beautiful and sustainable spaces. Comparing Tehran with other global metropolises, such as Tokyo and Singapore, shows that in these cities, environmental components in the design of building facades are also highly prioritized. In Singapore, green facades and the use of natural light are key sustainability strategies in urban development. However, in Tehran, due to specific climatic conditions and urban limitations, there is a greater need for creative solutions to manage energy consumption and foster interaction between buildings and the natural environment. Consequently, although environmental principles are similar worldwide, adapting these principles to the local context is crucial.

Moreover, the results of the study showed that structural and semantic factors play a significant role in the visual perception of building facades in Tehran, especially in the environmental context. Sustainable development, as a key approach in urban design, makes considering environmental

aspects, including structural components, an essential factor in creating sustainable and efficient urban spaces. The use of eco-friendly materials and innovative technologies in facade design can help reduce negative environmental impacts and improve residents' quality of life. Additionally, effective connections between buildings and the natural environment, particularly in a metropolis like Tehran, which faces numerous environmental challenges, can reinforce cultural and spiritual identity in urban designs. Ultimately, lighting and transparency in facade design are not only important for aesthetic reasons but also for environmental purposes. Facades that effectively bring natural light into interior spaces can contribute to reducing energy consumption and improving residents' living conditions. In this regard, integrating structural and semantic components with environmental principles can create a cohesive and sustainable space where residents experience a stronger sense of belonging and tranquility. These studies can help urban designers and planners offer solutions to enhance the quality of urban life. Comparing the visual perception of building facades in Tehran with other global metropolises indicates that attention to environmental factors and improving the connection with the natural environment in urban design is a key consideration in many cities. For instance, in cities like Copenhagen and Barcelona, sustainable design and optimal use of natural light are considered essential strategies for urban development. However, in Tehran, due to specific climatic and social conditions, there is a need to adapt these principles to the local context and urban culture. Ultimately, balancing structural, semantic, and environmental factors in building facade design can enhance the visual and environmental quality of Tehran.

Suggestions for Future Research

- Investigating the Impact of Social and Cultural Factors on the Visual Preferences of Tehran Citizens: Future studies could explore how factors such as age, gender, social class, and education level influence citizens' visual preferences in building facade design. This research could help develop more detailed and targeted models that better reflect the needs and expectations of different demographic groups.
- Comparative Study of Different Regions of Tehran: It is suggested to conduct research to examine visual preferences in different regions of Tehran to explore the cultural and architectural diversity across the city. The architectural differences and local characteristics in the northern, central, and southern parts of Tehran might lead to different visual preferences.
- Comparative Analysis of Visual Preferences in Tehran and Other Iranian Metropolises: A comparison of visual preferences in Tehran with other Iranian metropolises (such as Isfahan, Mashhad, Shiraz, and Tabriz) could help identify common factors or differences related to culture, architecture, and urban environment across the country. This research could contribute to developing coordinated design policies at the national level.
- Investigating the Impact of Modern Technologies and Smart Designs on Visual Preferences: Studies on the impact of modern technologies, such as smart facades, solar panels, and modern building materials, on visual preferences of citizens could be conducted. Given the technological advances in facade design and construction, examining citizens' acceptance and visual responses to these technologies is important.
- Analyzing the Impact of Building Facades on Citizens' Emotions and Mental Health: It is suggested to conduct research to examine how facade design and visual aesthetics influence citizens' emotions, mental health, and overall well-being in Tehran. This research

could show how facade designs can improve urban quality of life and reduce stress in high-pressure environments.

- Historical-Cultural Study of Changes in Visual Preferences Over Time: A study examining the changes in visual preferences of Tehran citizens over time, considering cultural, social, and economic transformations, could lead to a deeper understanding of the dynamics of these preferences. This research could analyze how architectural changes and urban development have influenced citizens' visual perceptions in different periods.
- Examining the Role of Other Factors Influencing Visual Preferences in the Perception of Building Facades in Metropolises.
- Conducting the Present Study in Other Statistical Populations and Comparing It with the Findings of This Research.
- Investigating the Consequences of Visual Preferences in Building Facade Perception in Tehran Metropolis.

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