Volume 1, No. 4
WINTER 2023
ISSN Online :
2821-1928

Samanid Goblet, 9th - 10th Centuries,
Abgineh Museum

Journal of Archaeology and Archaeometry

Published Quarterly by Department of Achaeology
Islamic Azad University of Varamin - Pishva, Tehran, Iran
HTTPS://JAA.VARAMIN.IAU.IR

JOURNAL OF ARCHAEOLOGY AND ARCHAEOMETRY (JAA)

License Holder & Publisher:
Islamic Azad University of Varamin-Pishva
Director-in-Charge: Dr. Bita Sodaei
Editor-in-Chief: Dr. Reza Rezalou
Managing Editor: Dr. Rouhollah Yousefi Zoshk
Page Deisgner: Somayeh Astani
Saeed Baghizadeh
Graphist: Navid Shamiani

ISSN:
Website of JAA: **https://jaa.varamin.iau.ir**
Email of JAA: **jaa@iauvaramin.ac.ir**

Figure of Front Cover

Samanid Pottery, 9th-10th Centuries,
Khalili Private Collection

Figure of Back Cover

Samanid Goblet, 9th-10th Centuries,
Abgineh Museum

The ***Journal of Archaeology and Archaeometry***, the journal of the Department of Archaeology, Islamic Azad University of Varamin-Pishva, Tehran, Iran, was founded in 2021. The **JAA** is published **Quarterly** in electronic formats and is available through subscription access options. **The Journal of Archaeology and Archaeometry** deals with the entire multicultural world of Western Asian archaeology and in particular Iran. The journal publishes material that deals with all aspects of **Archaeology** and **Archaeometry**. We also encourage contributions dealing with inter-disciplinary approaches to Archaeology.
JAA welcomes manuscripts from any period of Western Asia prehistory and history, from the Paleolithic to the Early Modern. The geographical focus of **JAA** is the ancient Iran and Mesopotamia and the lands or regions that border from Southern Turkmenistan, Afghanistan in the East, to Syria, and regions by the Mediterranean Sea in the West.

Journal of Archaeology and Archaeometry

Guidelines for Authors

The type of articles accepted at JAA falls within the following categories:

Research Article:

A presentation of fully documented and interpreted significant findings from original research in fields of Western Asia and particularly Iran (maximum 30 pages).

***Research report*:**

A presentation of preliminary but significant findings from original research in progress for which full documentation is not yet available; or brief studies (maximum 15 pages).

Excavation Report:

A report on the archaeological excavation of archaeological sites that may also contain archaeometric issues (maximum 30 pages).

Application:

A report on the major findings, breakthrough results, and/or major advances of established methods and interpretations of scientific data (maximum 15 pages).

Discussion:

Opinion articles that focus on a particular published paper or study. It allows the authors to interpret, analyze, and evaluate a theory or hypothesis backed by evidence or new material to establish their points (max of 10 pages).

Authorship of the Paper:

should be limited to those who have made a significant contribution to the conception, design, execution, or interpretation of the reported study. All those who have made significant contributions should be listed as co-authors. Where others have participated in certain substantive aspects of the research project, they should be acknowledged or listed as contributors.

The corresponding author should ensure that all appropriate co-authors and no inappropriate co-authors are included on the paper and that all co-authors have seen and approved the final version of the paper and have agreed to its submission for publication. For research articles with several authors, a short paragraph specifying their contributions must be provided.

Reporting Standards:

Authors of reports of original research should present an accurate account of the work performed as well as an objective discussion of its significance. Underlying data should be represented accurately in the paper. A paper should contain sufficient detail and references to permit others to replicate the work. Fraudulent or knowingly inaccurate statements constitute unethical behavior and are unacceptable.

Data Access and Retention:

Authors are asked to provide the raw data in connection with a paper for editorial review, should be prepared to provide public access to such data, if practicable, and should, in any event, be prepared to retain such data for a reasonable time after publication.

Originality and Plagiarism:

The authors should ensure that they have written entirely original works, and if the authors have used the work and/or words of others, that this has been appropriately cited or quoted.

Multiple, Redundant or Concurrent Publication:

An author should not, in general, publish manuscripts describing essentially the same research in more than one journal or primary publication. Submitting the same manuscript to more than one journal concurrently constitutes unethical publishing behavior and is unacceptable.

Legal and Ethical criteria:

If the work involves cultural assets the author must identify these in the manuscript and state official permit granted and/or disclose illicit trafficking objects according to UNESCO standards.

Manuscript Submission and Review:

All manuscripts should be uploaded directly to the Website of Journal and, if their scope and quality seem appropriate, they are forwarded to at least two referees for peer review. Papers are normally published in order of acceptance in final form, without preference for particular Western Asia regions, chronological periods, or topics. The review procedure usually takes at least 2 months.

Submission of an article can ONLY be made via electronic procedure following the Template format. It is recommended the suggestion of up to four referees (names, affiliations, emails) related to the content of their paper. Suggested reviewers should NOT be at the same institution, and should have some expertise in your content area/method. Authors should NOT have substantially worked with the reviewer in the past few years, and in particular, this should not be someone who has already reviewed or otherwise contributed to the manuscript.

Manuscript Format:

All manuscripts should be carefully edited to eliminate redundancy. All abbreviated terms should be explained on the first occurrence. Manuscripts should begin with an **Abstract of up to 250 words** that contains concise factual information on objectives, Materials and Methods, Results, and Conclusions. Opinions, vague terms, and jargon should be avoided. **Keywords** should follow a maximum of **6 Keywords**. Avoid words that are mentioned in the title. The body of the text should include **Introduction**, **Materials** and **Methods**, **Results**, **Discussion**, and **Conclusion** sections, followed by **Acknowledgements** (if necessary) and **References**.

References:

Proper acknowledgment of the work of others must always be given. Authors should cite publications that have been influential in determining the nature of the reported work. A list of the cited references in alphabetical order started by the surname of the first author must be included at the end of the manuscript, and each reference includes the names of all contributing authors.

In the text, referring is following as the author's name (without initials), the year of publication, and the page/pages:

1. Darabi, 2015: no. of page/pages;
2. Majidzadeh & Pittman, 2008: no. of page/pages;
3. Pollock et al., 2014: no. of page/pages.

If the same author(s) is cited in more than one publication in the same year, lower case letters (a, b, c...) are appended to the year in the first and succeeding citations. Footnotes at the end of each page and/or at the reference list are not allowed, but only at the end of the paper before References. References should be in English, French, German, and Spanish or translated from any other language into English.

References should be given as in the following examples, for books, articles in journals, papers in contributed volume or proceedings of conferences and reports:

1. **Referring to a book**:

   One Author:

   Darabi, H.

   2015 *An Introduction to the Neolithic Revolution of the Central Zagros, Iran*, with a preface by Peder Mortensen, BAR International Series, London.

   Two Authors:

   De Blois, L. & R. J. Van Der Spek

   2019 *An Introduction to the Ancient World*, Third Edition, Routledge Taylor & Francis Group, London & New York.

   Three or More Authors:

   Pollock, S., et al.

   2019 *Looking Closely, Excavations at Monjukli Depe, Turkmenistan, 2010-2014*, Volume 1, Sidestone Press, Leiden.

2. **Referring to a Journal Paper**:

   One Author:

   Maziar, S.

   2021 "Geographical proximity and material culture; the interplay between Syunik and the southern part of the Araxes river basin in the 6th to the 3rd millennium BC", *Quaternary International* 579, Elsevier, pp. 42-58.

   Two Anuthors:

   Madjidzadeh, Y. & H. Pittmann

   2008 "Excavations at Konar Sandal in the region of Jiroft in the Halil Basin: first preliminary report (2002–2008)", *Iran* 46, BISP, pp. 69–103.

Three or More Authors:

Eskandari, N., et al.

2021 "The Bronze Age Center of Shahdad, South-East Iran: "Hollow" vs. Nucleated Early Urban Processes", *East and West* 61, no. 1, pp. 31-47.

3. **Referring to a Book Chapter**:

   Hopper, K.

   2017 "Connectivity on a Sasanian Frontier: Route Systems in the Gorgan Plain of North-East Iran", in E. W. Sauer (ed.), *Sasanian Persia: Between Rome and the Steppes of Eurasia*, Edinburgh University Press, pp. 126-150.

4. **Referring to an unpublished Dissertation:**

   Frame, L.

   2004 *Investigations at Tal-I Iblis: Evidence for Copper Smelting during Chalcolithic Period*, M.S Dissertation, Massachusetts Institute of Technology, (Unpublished).

Tables, Photos, and Figures:

Tabular or graphical data should be adequately discussed **in the text**. In particular, similar data should not be presented in both figures and tables.

Tables should be concise and contain only the information essential to the text. Columns containing few entries or full columns of data that vary only slightly should be avoided. Judicious use of table footnotes can greatly simplify the presentation.

Graphs should be used to support correlations or illustrate points made in the text, not merely to present data. Legends identifying curves should be contained within the graphs, not in the captions. Graphs and line drawings should be drawn carefully and must be large enough for clarity. All graphs and figures should be of sufficient quality (at least **300 dpi**). Photographs should be limited to those essential to an adequate understanding of the text and should be of high-resolution colored or black-and-white.

Figures, *Photos,* and *Tables* should be incorporated into the main body of the text of the Template.

Units:

All data in the text, figures, and tables must be reported in metric notation and International System of Units (SI) nomenclature. Conversion of any non-metric data will be requested from the author before publication.

Equations:

Equations and formulas should be numbered separately and sequentially throughout the text. All variables and special symbols, such as Greek letters, must be identified and explained, including units when appropriate.

Nomenclature:

It should conform to what is most frequently used in the archaeological sciences field concerned.

Page Proofs:

It will be sent to the corresponding for checking. Corrections to the proofs must be restricted to printer errors. Any substantial alterations other than these may be charged to the author. Authors are particularly requested to return their corrected proofs as quickly as possible to facilitate rapid publication. Please note that authors are urged to check their proofs carefully before returning. The corresponding author will receive a PDF file of his/her paper.

Publication Costs: **There is no Article Processing Charge**

Copyright/ Open Access:

The journal publishes original papers which should comprise previously unpublished data, interpretation, or syntheses concerning all aspects of science and technology for Western Asia archaeology and archaeometry. The editors will not consider manuscripts that are under consideration by other publishers. It is assumed that once you have submitted an article to this journal, it will not be sent to other publishers until a decision about inclusion has been made. By submitting your article to JAA, you agree that any articles published by JAA will be Open Access articles. The copyright in the material contained on the JAA site belongs to JAA Islamic Azad University of Varamin-pishva. By submitting articles for publication or other content for posting on the JAA site, you agree to:

1. comply with these Terms of Use.
2. have the Creative Commons Attribution (CC BY) license applied to the material you submit.
3. provide any information required by JAA during or as part of the submission process.
4. You are responsible for all content that you submit for posting or publication on the JAA site.

Contents

Articles

JAA 2023

Explaining the Effectiveness of Human Visual Perception in the Architectural Environment of Golden and Geometric Proportions in the Sense of Belonging to the Place

Rezvaneh Mansouri
Department of Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran. https://orcid.org/0000-0003-2035-9793.

Farah Habib
Department of Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran. https://orcid.org/0000-0001-8052-6229.

Azadeh Shahcheraghi
Department of Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran. https://orcid.org/0000-0003-1947-2772.

Article Information
Received 25/12/2022
Revision Accepted 02/02/2023
Available Online 11/03/2023

Abstract: The ability to recognize and compare shapes and understand the concept of proportions is one of the first human findings from environmental geometric data. And certainly, the formation of geometry as a science of recognizing the arrangement of lines, shapes, levels, and proportions leads to the definition of golden proportions in the mathematical sciences as a new way of organizing shapes and forms. Golden and geometric proportions are effective as a determining element in the scale of spatial forms, and the formation of spatial forms by not using or misuse of geometric proportions is due to functional and psychological interactions on human perception and cognition. Which causes the construction and formation of scales and proportions of the environment and the emergence of psychological effects due to human activities in the environment. And then the abnormal effects and environmental dysfunction on the saccade system of the human eye and as a result the feeling of fear and lack of belonging to the place interacts. On the other hand, nature is the raw material of creation, and the principal and mother of man, which causes him to model the proportions in nature. Understanding the laws governing the relationships between elements and spatial shapes leads to the formation of geometric and golden proportions in the spending of space. Because knowing the symbol of shapes, proportions, and scales in the world of meaning and kingdom are reminiscent of the divine order in all dimensions of the world (even in astronomy). Therefore, evaluating the values of spatial proportions in nature as the bedrock of human life and the pattern of psychological perceptions leads

* Corresponding Author
Email Address: f.habib@srbiau.ac.ir *(Farah Habib)*

to adopting human activities. Also, the study of human needs on a mental and psychological scale from the perception of the environment causes the recognition of scales and dimensions by human visual senses, which leads to the perception of the correct golden and geometric proportions through Sakadi eye movements and psychophysical sciences. . Certain ratios can also be observed in the creation and design of various shapes in nature. These relations are those geometric relations that have immaterial roots and follow spiritual and supernatural principles, believe their subject is sacred, and have symbolic language and spiritual characteristics. In the traditional world, geometry was inseparable from the other four Pythagorean sciences, namely arithmetic, music, and astronomy. And traditional geometry is also associated with the symbolic composition and shapes of space. To this end, the study of the effect of golden and geometric proportions on human visual perception of the architectural environment based on the sense of belonging to the place, causes visual quality to increase the sensory richness of the place and achieve human values and criteria in the sense of belonging to the place and human needs. To be considered by the architect. In this research, with the perspective of this identity and the interaction of geometric and golden proportions and the sense of belonging to the place, the criteria, and indicators of the research have been studied and the results have been presented in the form of tables and diagrams.

Keywords: *Golden Proportions, Geometric Proportions, Visual Perception, Sense of Belonging to Place, Sense of Place*.

Introduction

Nature, as the primary material of creation, is the origin and mother of man, which causes him to imitate the proportions in nature. Understanding the rules governing the relationships between elements and spatial forms leads to the formation of geometric and golden proportions in the use of space. Because Knowing the symbol of shapes, proportions, and scale in the world of meaning and kingdom is a reminder of divine order in all dimensions of the world (even in astronomy). Therefore, evaluating the values of spatial proportions in nature as the basis of human life and the model of mental impressions leads to adopting human activities. Also, the examination of human needs in his mental and psychological scale from the perception of the surrounding environment leads to the recognition of scales and dimensions through human visual senses, which causes the perception of the correct relationships of golden and geometric proportions through saccadic eye movements and psychophysical sciences. Certain ratios can be observed in the creation and design of various shapes in nature. These ratios are those geometric relationships that have an immaterial origin and follow spiritual and supernatural principles with the belief in the sacredness of their subject and have symbolic language and spiritual characteristics. In the traditional world, geometry was inseparable from the other four Pythagorean sciences, i.e. arithmetic (number), music, and astronomy. And traditional geometry is also related to the combinations and symbolic shapes of the space (Najafkalipour et al., 2015).

The physical environment and its effects on people's daily life are issues that have been analyzed and investigated by many experts in recent years (Canter, 1977; Cooper, 1974). By recognizing the void in environmental design disciplines, designers and architects turned to in-

terdisciplinary methods to identify these environmental meanings and emotions. Therefore, architects, designers, and researchers have sought to recognize the semantic differences between themselves and the users in the designed collections in a collaborative way, to minimize the gap between the designer and the user and achieve quality environments (Motalabi, 2010). The connection between the issues of perception and knowledge of space with geometric and golden proportions in architecture can have a two-way effect on the sense of place and the interpretation of the meaning of place in the mind of the audience.

Research Method

This research has been done using the descriptive-analytical research method and logical reasoning, relying on the literature and the theoretical foundations of the research based on valid sources. The nature of the research qualitatively describes the available information and the inductive analysis of the part and the whole in the topics of theoretical foundations including geometric and golden proportions, the hierarchy of sense of place, perception, and recognition of stimuli in the environment. The method of collecting information, first of all, in a library style, relying on authentic documents, using the method of logical analysis, describes and analyzes theoretical propositions. Then the scientific propositions have been categorized and analyzed from the perspective of the research approach. In this stage, the method of logical reasoning and comparative study was carried out through continuous engagement, integration, research, and revision of items until the saturation stage of the components in structured processes. The main goal of this research is to explain the effect of golden and geometric proportions on human visual perception of the architectural environment based on the feeling of belonging to the place. Finally, through the description of the available information and the qualitative analysis of the part and the whole in the content of the research, the analysis of findings, conclusions, and final diagrams have been achieved.

Research Background

The word geometry in Persian and Arabic language comes from the Pahlavi word measure, and, by translating Pahlavi texts into Arabic, size became the Arabic form of geometry. Geometry, which means geometry or size, means the knowledge related to the determination of sizes. According to Mohammad Karim Pirnia, in the Dari Farsi dialect, geometry means hands or measure. Proportion is also a relative and comparative relationship between different components and the whole of an element. Measuring the size of two things produces a ratio, and harmony or proportion is called the equality of these ratios. Proportion is sometimes created through discovery, intuition, and insight, and sometimes through the application of mathematical proportions (Bamanian et al., 2010: 16). The urban space is felt and perceived through various senses, and the more the sensory organs are stimulated in the space perception, the more the space will be influenced and the more complete and deeper the understanding of the space will be. The mental model of the relationship between man and the environment shows that there are two-way connections between the characteristics of the urban environment on the one hand and perception, cognition, evaluation, and human behavior on the other hand (Golkar, 2008: 98). In the following table, to review the literature and background of the research, the basics and content related to the research topic and the differences and similarities of the sources and authentic documents have been collected and presented.

Mutual Influence of Geometry and Proportions in Architecture

Conceptually, geometry means size and shape. It is one of the mathematical sciences and it

Table 1: An overview of the literature and research background				
Title	**Researchers**	**Year & Publications**	**Discussion to be studied**	**Aspects of similarities and differences with the subject of research**
Figure (Book)	Dr. Farah Habib	Image Radiation Publications 2010	+Explaining how and the factors causing the emergence of roles in different historical periods +A brief reference to a role that has a special place in architecture and urban planning +Emphasis on the role of culture and cultural variables in architectural decorations as a communication field that transmits data to the user of the space.	+Similarity: Examining motifs in the architecture of Iranian spaces based on cultural and social variables derived from the individual perception of the audience +Difference: Examining upcoming research in form and spatial approaches from the perspective of golden proportions and psychophysical sciences
Surrounded by the Environment (Book)	Dr. Azadeh Shahcheraghi And Dr. Alireza Bandarabad	Academic Jihad Publications 2017	+ Includes practical, complete, and effective basics and resources in the field of application of environmental psychology in architecture and urban planning in the interdisciplinary field, investigating how the environment affects the human spirit and psyche, and how to change the tension in cities to calmness in urban life, Because man is surrounded by the environment. +Presenting the findings of environmental psychology in the two branches of behavioral sciences and perception and cognition and suggestions for their application in the architectural environment.	+Similarity: Explanation of the theoretical foundations of the topics of perception and knowledge of the environment, sense of place, belonging to a place, psychophysical sciences, visual senses, saccadic eye movements, gestalt +Difference: Creating a connection in the upcoming research between golden and geometric proportions with visual senses and saccadic eye movements to create a sense of belonging to a place
Golden Ratio and Fibonacci Numbers (Book)	By Richard A. Dan Lepp, Translated by: Mansour Motamadi	Isfahan House of Mathematics 2006	+Explanation of numerical and mathematical formulas and relationships in golden ratios + How to draw and recognize proportions in geometric shapes	+Similarity: Explanation of formulas and geometrical and golden proportions, preferably +Difference: Lack of investigation from the perspective of psychophysics and visual senses based on the feeling of belonging to the place
The Concept of a Sense of Belonging to a Place and its Constituent Factors (Article)	Dr. Ali Javan Faruzandeh Dr. Qasim Melabi	City Identity 2011	+ Examining the meanings of the sense of belonging as one of the effective meanings in the relationship between man and the environment with an ontological and epistemological approach +Expressing a specific definition of meaning and its constituent elements +Examining physical characteristics such as the form and relationships of body parts	+Similarity: The characteristics of belonging to a place and the theoretical foundations of the formation of a sense of belonging to a place +Difference: Lack of investigation in terms of applying golden and geometric ratios and psychophysical principles
Introducing the Freiburg Test as a New and Accessible Psychophysical Method to Evaluate Contrast Sensitivity (Article)	Zahra Ghorbani Dr. Ali Mirzajani Dr. Ebrahim Jafarzadehpour	Journal of Mashhad Medical System 2013	Measuring eye sensitivity to contrast by the Freiburg test of psychophysical methods in different directions and with variation in different spatial frequency levels at different far, near, and intermediate distances.	+Similarity: investigating the reaction of the audience's eyes in the context of contrast levels +Difference: lack of investigation from the perspective of environmental psychology and perception of the environment and the effects of the golden ratio
Architectural graphics (Book)	Written by Francis D.K. Ching Translation: Mohammad Ahmadinejad	Soil Distribution 2004	How to draw and the methods of various types of architectural drawings based on the use of proportions in the field of spatial and perspective studies and the explanation of multi-view and paraline drawings.	+ Similarity: Explanation of architectural graphics based on the structural and spatial approach in the environment and how to draw based on the observance of proportions in the drawing tool +Difference: lack of examination of the golden ratio and its impact on the sciences of perception and cognition
The Concept of Sense of Place and its Shaping Factors (Article)	Dr. Mohammad Sadegh Falahat	Beautiful Arts 2006	+Paying the meaning of the sense of place and its meaning from different perspectives and explaining the different levels and the factors that shape it +Presenting the model of the effects of those factors in an understandable and practical way	+Similarity: expression of indicators of the sense of place and its levels +Difference: lack of investigation from the perspective of the effects of golden proportions on psychophysical sciences and visual senses in creating belonging to a place

Table 1: An overview of the literature and research background				
Golden Proportions and the System of Iranian-Islamic Proportions in Qain Grand Mosque (Article)	Mohammad Hasan Ziyai Nia Hassan Hashemi Zarrajabad	Restoration and Architecture of Iran 2015	Using reverse engineering on architecture, plan, façade, and cross-section, Qain Grand Mosque has been subjected to detailed geometric analysis. According to the Iranian-Islamic system of proportions based on proper numbers and the geometric properties of square and double square	+Similitude: Explanation of the creation of visual balance of elements such as the porch and the main entrance and the location of the northwest entrance +Difference: Lack of investigation from the point of view of psychophysical issues and saccadic eye movements and creating a sense of belonging to the place
Human Perceptual Interaction with Spatial-Geometrical Ideas in Architecture (Book)	Abdulhamid Noghrehkar	Amir Kabir 2014	Explaining the relationship between the school of Islam and the philosophy of art, spatial-geometric ideas in interaction with human perception, and his relationship with the surrounding environment from the perspective of epistemology and anthropology, and examining the self-founding effects of architects.	+Similarity: investigation of human geometric spatial perception +Difference: lack of investigation from the point of view of golden and geometric proportions from the perspective of visual perception and psychophysical sciences in saccadic eye movements
Geometry in architecture (Book)	Mohammad Karim Pirnia Zohra Bozorgmehri	Cultural Heritage and Tourism Organization	Clarifying how to draw Niarash in Iranian architecture based on geometric principles and the changes of each of the architectural elements in the wide spectrum of culture and national mental balance	+Similarity: examining spatial elements from a geometric point of view +Difference: lack of explanation in the field of golden proportions and its connection with the human visual perception of the environment

is a science in which the study of space, shapes, and objects can be imagined in this space. This knowledge, along with arithmetic, is one of the two oldest branches of mathematics. The science of geometry, like all other sciences, comes from observation and experience and has a serious relationship with the economic needs of mankind. Proportions are also a mathematical concept that implies the proper relationship between the components of each other and with the whole work. Almost all works of art are created based on some kind of proportion. For this reason, proportion is one of the basic principles of the work of art, which expresses the harmonious relationship between its components (Bamanian et al., 2010: 15).

The position of geometry knowledge in ancient architecture has been such that Abolufa Bozjani (330-380 A.H.) held national meetings and workshops in Baghdad, where half of the participants were architects and the other half were mathematicians. In these meetings, he has tried to create a connection between art and mathematics by challenging artists and mathematicians with a common design. Bernard Okin's research shows that they use the knowledge of geometry and scaling systems and networks in the design of buildings and their implementation. On the other hand, this mixture is so much that various treatises and books have been written in this field, among which we can refer to the book Miftah al-Hasab by Ghiyasuddin Jamshid Kashani, which is about the measurement of dimensions, surface, and volume in It is architecture. In all stages of the creation of an architectural work, the close relationship between geometry and its needs can be seen (Abul Qasmi, 2006: 366).

Manifestation of geometry and proportions in Iranian architecture

The emphasis of Iranian architecture is focused on beauty, and the science of geometry is a powerful expression that has enabled Iranian architecture to measure spatial proportions and create balance, order, and beauty on the ground. Since the purpose of architecture was to capture the soul and intellect, geometry became a tool in the hands of Iranian architects to develop forms of plants and animals that were sacred in their essence. In the historical monument of architecture, all sizes are interrelated in their perfection and their constituent parts (including

surface geometric patterns) and have never been separated from geometry. In this way, the art of geometry is the key to establishing a connection between the building and the ideas the builder has in mind. In other words, geometry has been part of the manifestation of the concept of beauty in Iranian architecture (Silvaye, et al. 2013: 57).

Certain proportions can be observed in the creation and design of various forms in nature. These ratios are those geometric relationships that have an immaterial origin and follow spiritual and supernatural principles with the belief in the sacredness of their subject and have symbolic language and spiritual characteristics. In the traditional world, geometry was inseparable from the other four Pythagorean sciences, i.e. arithmetic (number), music, and astronomy. Traditional geometry is related to the combinations and symbolic shapes of space. Geometric shapes such as triangles, squares, and various regular polygons, spirals, and circles in the traditional perspective, like traditional numbers, are considered faces of multiplicity in unity. Geometry and proportions are an integral part of architecture. One of the most interesting geometric features of many historical buildings is the presence of golden proportions in them. However, many historical monuments in our country have not been studied geometrically. Architecture has been the creator of the place of sanctification for millennia, and man has tried to provide himself with a kind of heavenly manifestation through it. Iranian architecture has always emphasized beauty, and Iranians have tried to use proportions in the dimensions of the building to manifest the cosmic reflection on the earth (Najfaqalipur Kalantari et al. 2015: 478).

Patterns of Golden Proportions in Architecture

The application of geometry in art and architecture can be considered on two levels. The first level includes geometric shapes that are crystallized in the general structure of the plan and are a very important factor in unification (Soleimani and Mandaghari, 2015: 105). They are components such as rectangles, squares, and regular polygons that can be seen in the plan and views. The second level is also a set of non-obvious lines that are not easily visible in the shape structure of the design, but they have a significant effect on the formation of other forms of the building (Rezazade Ardebili and Sabit Fard, 2012: 37; Tabatabai Zavareh et al., 2017: 105).

Golden proportions

Golden proportions have many types, such as golden divisions, golden numbers, golden man, golden ratio, and sacred proportions (Markowsky, 1992: 2); which can be their presence; observed in magnificent buildings such as the Parthenon, the Egyptian pyramids, as well as in human organs and other objects in nature (Abbas, 2017: 11). A golden ratio is a special number in the sciences of art, architecture, and design, which has been significant to many artists since

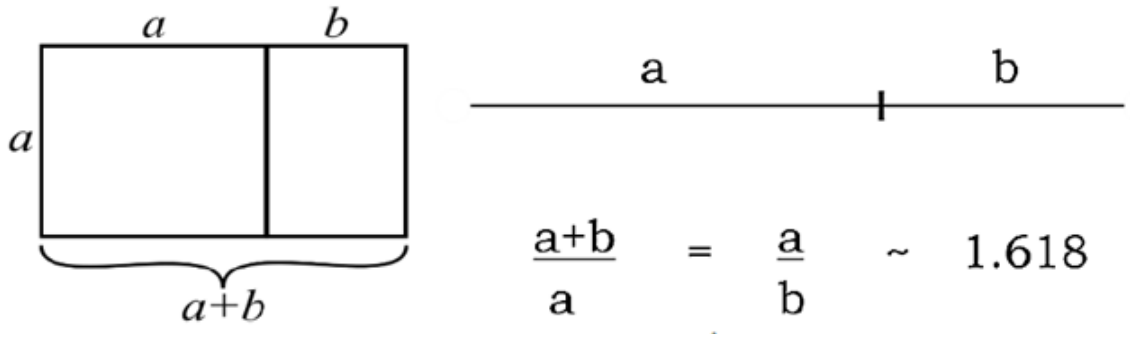

Fig. 1: Golden Rectangle Ratio (Posamentier & Lehmann, 2012: 8).

the distant past. The golden ratio is the division of a line segment into two parts in such a way that the ratio of the length of the segment is larger. The length of the entire line segment is equal to the length of the smaller segment to the larger segment and its decimal equivalent is about 1.618 (Lu et al, 2007: 1108). The golden ratio is also called the Phi number (Putz, 1995: 275).

Golden ratio

In the Qur'an, which is the main and most original source of Islamic thought, the physical and structural form of the world is expressed in the form of one of the keywords of the Islamic worldview, which is Qadr (Balkhari, 2010: 391). In the Tafsir of this verse, it is stated: God has created what He has created with a specific size and limits, both in His essence and in His attributes and His work. In other meanings, God says this: "And I am not a treasure except in our hands, and we do not send it down except to a known extent" (Tabatabayi, Vol. 20: Surah 87). The first and most important proof of the connection between Qadr and geometry is the hadith of the 8th Imam of the Shiites, who considers geometry to be Qadr. Ali bin Musa al-Reza (a.s.) said in a hadith mentioned in "Usul Kafi" addressed to Yunus bin Abdul Rahman: Do you know what value is? He answers no, the Holy Prophet says: Hey geometry and limitation of survival and extinction, Qadr is the same as geometry and demarcation, like survival and the time of destruction (Balkhari, 2010: 393). Geometry is simple in terms of shape and form, but difficult to recognize in terms of meaning and theme. For example, in addition to the three-sided shape, the triangle is the beginning of creation and the symbol of the descent from the sky and the descent of man to the earth, the square is the symbol of man and nature, and the circle is the symbol of the divine, the heavenly and the generative (Lawler, 1995: 15). For this reason, the Muslim artist has studied and considered all the geometric shapes related to the divisions of trigonometry, square, and circle (Sadati, 2009: 89). The expansion and development of geometric patterns in Islam began with the translation of texts from Greek and Sanskrit. Of course, this happened about three centuries after the advent of Islam, and we can say that we are witnessing a gap in the growth and development of geometry in buildings from the beginning of the seventh century to the end of the ninth century; that the first examples of geometric arrangement of buildings were created in Islamic kingdoms (Abdullahi & Bin Embi, 2013: 244). Of course, regarding the land of Iran, the expansion and development of geometric patterns, in addition to the translation of works by native architects, have been transferred to the Islamic period. This has caused the principles of geometry and the proportional system used in the Islamic period in Iran, like other sciences, to be under the title of Islamic Iranian (Ziyania and Hashemi Zarrajabad, 2015: 91).

Perception and recognition of stimuli in the environment

Before defining sensory perception, one must define "stimulus". In a brief definition, according to Gibson, a stimulus is a perceptible change in the environment. The transmission of the stimulus effect from the sensory receptor to the central nervous system, which can be tracked objectively, is called sensation (Shafii and Sharifi Daramadi, 2015: 31). Humans need to receive and understand this information to establish proper communication and interaction with the surrounding physical environment. Perception of the environment is a process through which humans select the necessary data based on the need of the surrounding environment (Sharghi and others, 2016: 78). Concerning the process of human interaction with the environment, Ulrich Neisser provides a definition called the process of understanding meaning. The model presented by Neisser shows the role of schema or mental schema (drafts) and environmental capabilities in the process of perception and finally spatial behavior. Therefore, he considers meaning to be one of the characteristics of schema and believes that what remains in the memory and

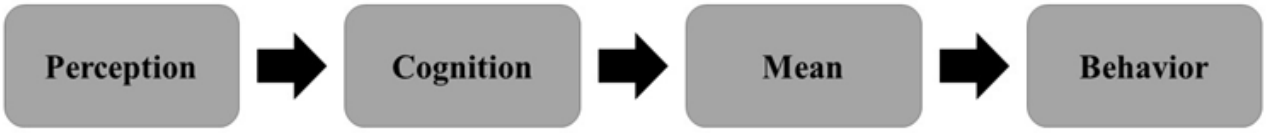

Fig. 2: The Process of Human Communication and Interaction with the Environment (Bruner & Postman, 2012: 8).

mind is an object, scene, or event that is perceived by the guiding role of schema, and schema is somehow involved in the use or modification (Neisser, 1997: 20).

Saccadic Eye Movements on the Stimuli to Perceive the Environment

The mechanism of saccadic eye movements (jumping and interrupted movements) means a type of eye movement that focuses on important and contrasting points to search and check the environment and get the necessary information from it to send to the brain. Saccadic eye movements are influenced by the illumination of the desired phenomenon, its size, composition, and shape, the content and number of elements that make up the image, and the structure of the shape, diversity, and density of its constituent elements (Pour Jafar and Alavi Baalmani, 2011). Form and structure are more important than color and brightness in drawing the eye's attention to the image (Fillin, 1998: 94-100). According to Fillin, the effect of the environment on the vision mechanism (according to the degree of compatibility of the visual environment and vision mechanisms in the artificial environment) in three categories:

1. Homogeneous environment: recognition at a glance (uniformity, few details, sufficient element information).
2. Comfortable environment: an eye-pleasing environment and matches the physiology of vision like a natural environment (desirability despite the presence of various elements).

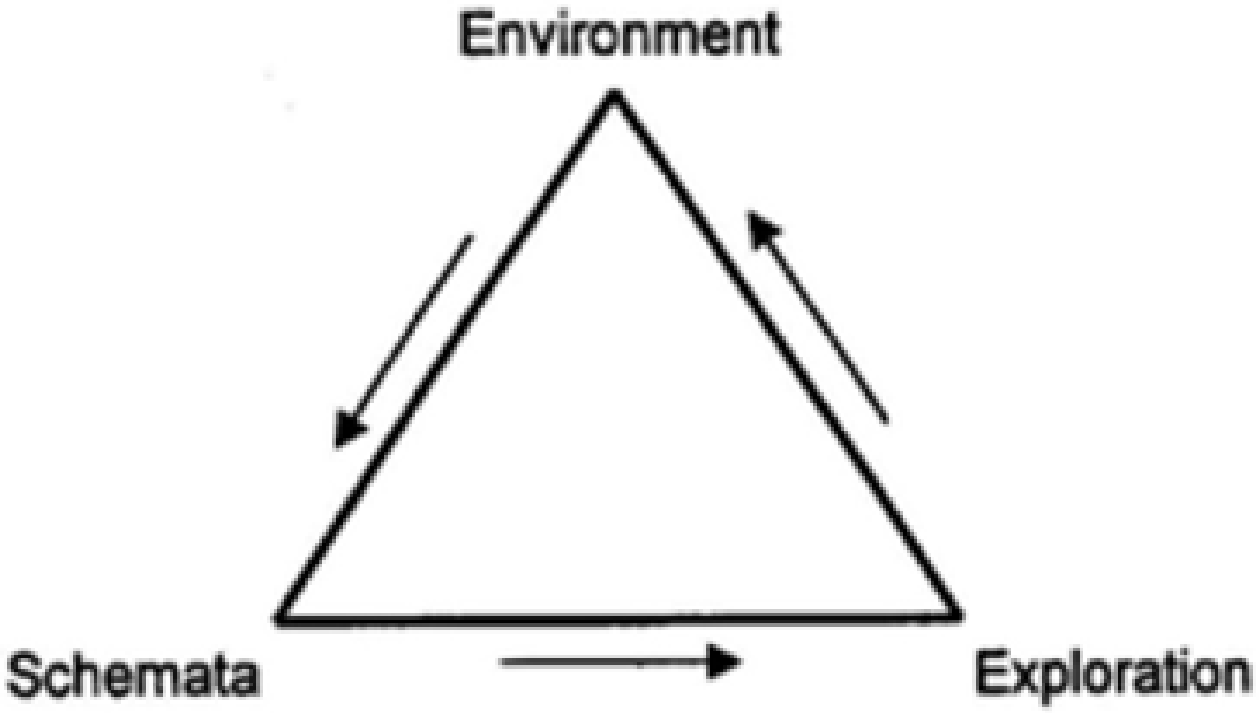

Fig. 3: The Proposal of the Meaning Cycle and Understanding of the Environment by Ulrich Nayser (Qala Navii et al., 2014: 59).

3. Aggressive environment: double pressure on the saccade system and pressure on the eye nerves (a large number of similar elements) (Shahcheraghi and Bandarabad, 2016).

Gestalt and Perception of Stimuli

Gestalt brings concepts and data to the human mind with a general view. Gestalt laws are explained in the form of isomorphism, which is a theoretical balance between neural processes and perceptual experience (Kohler, 1929). Rudolf Arnheim (1965) believes that the forces experienced when looking at visual objects can be equivalent to Psychological biological forces active in the brain's vision center are considered. Although these processes occur biologically in the brain, they are the characteristics of perceived objects. All human perceptions in organized forms such as lines, surfaces, and objects as a dynamic combination give rise to concepts of movement, heaviness or lightness, and happiness or unhappiness. Also, the homogeneity of perceptual experience and human neurocognitive processes is the basis of Gestalt theory in art and architecture, which gives priority to the perception of composition (absence of mental images of visual composition) and determines the real experience of dynamic and meaningful aspects, which Doubt is the strongest and most essential feature of perception (Arnheim, 1968; Levi, 1974).

The Mutual Influence of the Manifestation of Geometric and Golden Proportions in the Perception of the Architectural Environment

Geometric and golden proportions have a relative relationship between the part and the whole, which is influenced by the structure of nature's organs; It is also affected by mathematical practices. The perception of the shape of the physical body happens through the human visual sense. The form is simple but considered complex in terms of meaning and concept. Therefore, human perception and recognition of the environment take place through the presence of stimuli in the environment. It means that the stimulus is transferred from the sensory receptor to the central nervous system, and the same information and data entry into the nervous system of the brain occurs through the human senses. In the field of receiving data, the science of NLP and the science of psychophysics establish a mutual relationship with multi-sensory architecture.

Visual senses, including saccadic eye movements, which occur through a jumpy and discontinuous mechanism, cause humans to process and identify environmental stimuli; the effect of the environment on the vision mechanism includes the classification of a homogeneous environment, comfortable environment, and aggressive environment. On the other hand, gestalt, which is the introduction of concepts and data with a general view of the human mind (various principles), can bring various concepts to the audience's mind through the vision mechanism that was mentioned, and in the creation of architectural forms from the position has an important For this purpose, the audience's relationship with the physical environment by focusing on activities and understanding the meaning of space can be an abstract scope that is effective for creating a link with the environment. The physical characteristics that exist in the environment as influencing stimuli are considered to be the central core and the effective factor in enhancing the sense of belonging to the place, and the quality components of the sense of place with geometric and golden proportions in the body and shape of the environment have These are the same.

In the following, these effective components have been examined from the perspective of Dr. Manouchehr Mazini's classification, and the research criteria have been presented in the form of a table 2.

Analysis of findings

Based on the investigations carried out on the factors affecting the subject of the research, the findings were classified into two separate groups, and in the first group, different funds were

Table 2: Examining the effective components of the subject of research from the point of view of Dr. Manouchehr Mazini based on theoretical indicators in the discussion of space, time, and architecture, (Source: Authors).

Ethics in architecture	Development of the effective elements of aesthetics	Space and time In public arenas	Space and time In the body and form of the building	Indicators of space, time Research components
The architect's independent and bold planning without imitating classical proportions and previous periods	Using simple surfaces to create unity and balance between lines in the composition of elements	The formation of proportions of routes and city maps based on social and cultural aspects	The emergence of the optical revolution and the importance of volume in the formation of outer space	**Golden and geometric proportions**
The use of aesthetic elements in the confinement of morality and artistic dignity in the components of appearance	Designing houses based on the needs and requirements of daily life and the relationship of man with his living space	+ Correct understanding of the city as a measure of the architect's knowledge + Coordination and unity of the elements of the city	The unity of thought and feeling and the lack of perception by the two halves of the characters	**Human perception and knowledge of the environment**
+ Flexible and usable design for all audiences of the space + The audience's independent use of space	+ Use of natural elements and water + The use of glass and transparent elements in the overall understanding of the space	+ Limiting eye sight to a calculable point in perspective + Defining a certain distance in perspective	The effect of historical background on the audience's schema of the five senses and vision from space	**Psychophysics**
Placement of building elements in front of the point of view in an obvious way	Use of special shapes in design	Using components to create speed and movement in visual space	Introduction of the concept of movement in the form of perspective principles in the point of view	**Saccadic eye movements**
The formation of undamaged space with the design of extensive spatial elements	Induction of huge and stable forces by means of volume and proportion	+ Using an unrestricted map + Combination of innovative building materials	Giving importance to the point of view of the person commenting through the principles of perspective	**Gestalt topics**
The use of new building materials to transmit spatial data to the audience's senses in pure forms	Freeing from external forms and realizing the concept and meaning	Bringing the artistic feeling of the environment from the mind of the designer and transferring it to the feeling of the audience of the space	Giving importance to the point of view of the person commenting through the principles of perspective	**NLP science and visual senses**

classified into 4 groups of criteria, and each of them has indicators in its subset. were, that the categories of criteria include aspects of proportions, semantic aspects, physical existence, and perceptual aspects.

• Aspects of proportions:

Spirit, Soul, Body

• Semantic aspects:

Monotheism, Justice, Unity in plurality, and Plurality in unity.

• Perceptual aspects:

Order and Harmony (Balance, Rhythm, Parallelism, etc.)

• Physical funds:

Size and Shape which has been discussed in a wider way in the form of a diagram:

The classification of findings second group was classified into 4 groups of criteria from different dimensions, and each of them had indicators in their subset, which category of criteria includes emotional dimensions of perception, cognitive dimensions of perception, interpretation of perception, and valuation of perception.

• Cognitive dimension of perception:

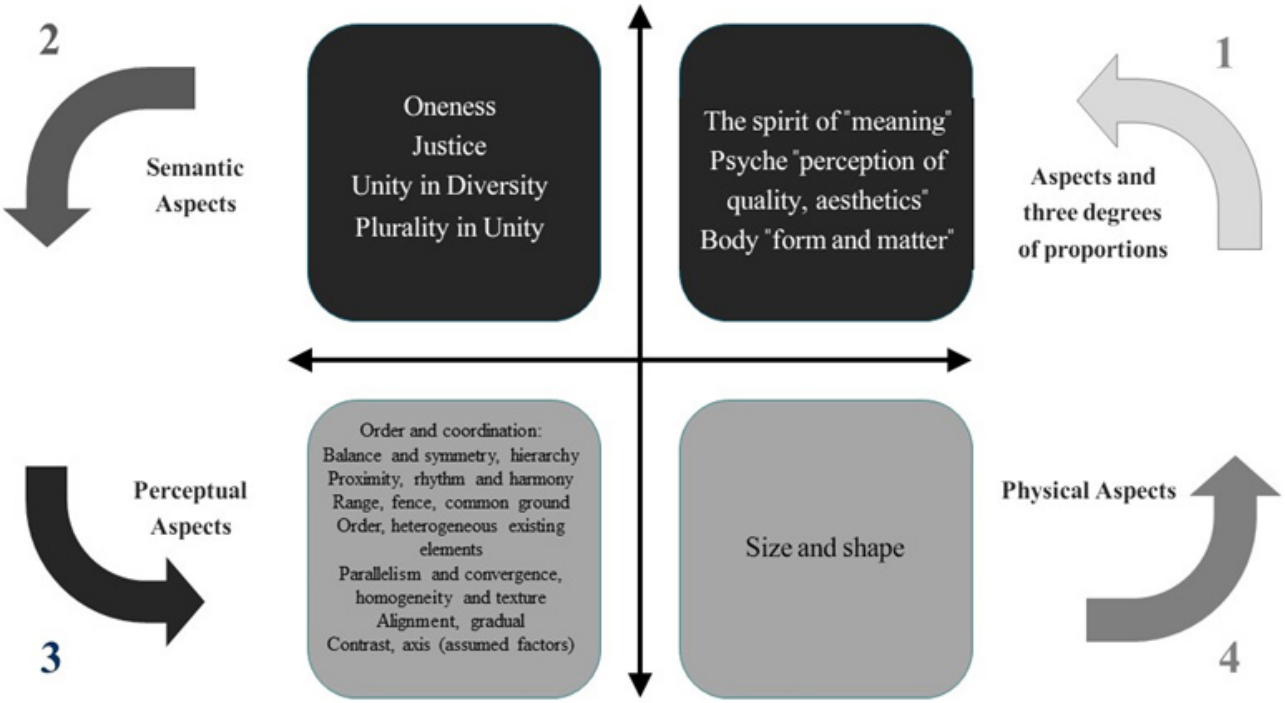

Fig. 4: Examining the presence of various semantic, perceptual, proportions and bodies in the two-way relationship between the perception of the environment and proportions in architecture, (Source: Authors).

Space form, Shape, Size

- Emotional dimension of perception:

Unity, Diversity, Harmony

- Interpretive dimension of perception:

Beauty, Attractiveness of space, Social interactions

- Perception valuation dimension:

Association of meaning, Readability, Orientation which has been discussed in a wider way in the form of a diagram.

The derived criteria in the category of the first group are generally examined from physical aspects and related to proportions, but since the same external aspects are related to psychological dimensions and sense of place, they also have semantic dimensions in their indicators. It brings these characteristics to the audience's mind the classification of criteria in the second group has been investigated to address these psychological and hidden dimensions in the sense of place.

From the point of view of golden and geometrical proportions, from the aspects of the body and the form of the building, this same perception and knowledge of the human being from the environment can be presented in such a way that the unity of thought, feeling and non-perception by the bisected characters can exist in the space. And the correct understanding of the city is very important as a measure of the architect's knowledge (Mansouri & Habib, 2021). Also, the design of houses should be based on the needs and requirements of daily life and the relationship of humans with their living space. Because the use of aesthetic elements in the confinement of morality and artistic dignity in the components of appearance is very important. Understanding the depth, distance, and scale in the space through the visual senses causes the artistic feeling of the environment from the mind of the designer and transfers it to the feeling of the audience; Because it is very important to get rid of external forms and understand the

concept and meaning.

Conclusion

Every phenomenon has two aspects: the perceptual and structural aspects. The structural aspect is simple, and obvious and can be identified without cultural and social ties, while the perceptual aspect is not only complex and non-obvious but also intertwined with cultural relationships and affected by many social and individual factors. And this importance comes to the fore in the function of the architecture of public arenas. In the meantime, architecture gains meaning by stepping into the second dimension, which is perception. When we talk about perception in art in general, it means that we pay attention to the content of art, that is, what should be understood by its audience. For this purpose, in the research process, after examining different aspects of the theoretical structure of the research with inductive analysis, including golden and geometric proportions, human perception and knowledge of the environment, psychophysics, saccadic eye movements, Gestalt topics, NLP science, and spatial perceptions of the audience from the point of view. And it was investigated with the aesthetic point of view in visual perception (shape approach) and the point of view of space and time in the visual perception of geometric proportions (spatial approach).

Then, the effective components in the subject of the research were presented based on the studies, based on which the unity of thought and feeling in the five senses, deep understanding of scale and distance, unity and balance in simple levels, flexibility in the independent projection of elements, dynamism visual and sensory rhythm and creating movement, harmony between subject and object, deciphering the spectrum and contrast in proportions, complexity at the same time simplicity (unity in multiplicity), the system of organizing components for eye reaction, balance in the contrast of colors in front of the vision mechanism, Respecting the artistic dignity in the appearance of the arrays, the continuity of the semantic aspect in the gestalt of the elements, among the findings extracted from the studies, have been proposed in order to solve the problems related to the lack of appropriate visual qualities based on the correct proportions in the environmental elements that affect human perception. are effective and then humans will shape it reciprocally, and the need for a conceptual model of architecture based on the use of golden geometric proportions in the qualities of visual senses to create a sense of belonging to a place is effective and to be effective in explaining it.

In the continuation of categorizing the needs of the audience affected by spatial perception, the conclusion of the research has been presented in the form of a diagram, which has addressed the different rights of the audience from the point of view of observing proportions and creating a sense of place. which includes the following categories:

- People's psychological rights
- Physical rights of people
- Social rights of individuals

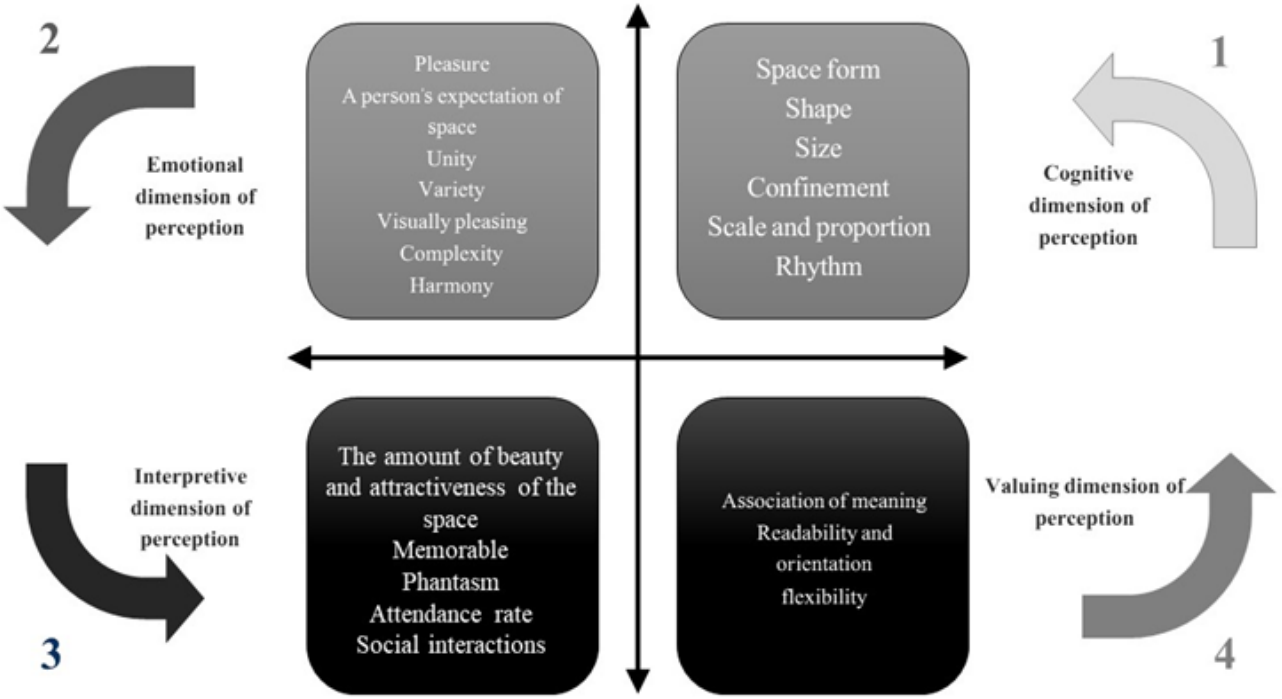

Figure 5: Examining the different dimensions of perception from emotional, interpretive, valuing, and cognitive perspectives, (Source: Authors).

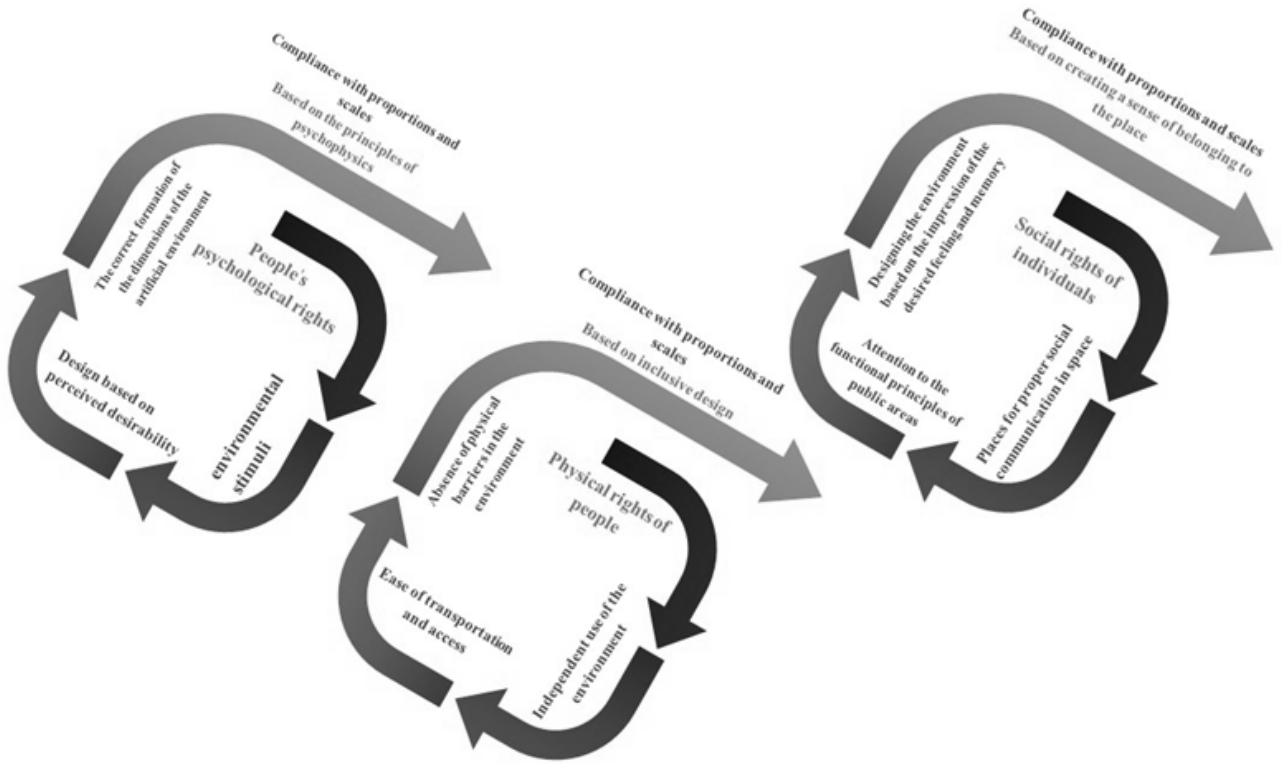

Fig. 6: Categorizing the needs of the audience in the architectural environment based on the observance of proportions with the mutual influence of spatial perception, (Source: Authors).

Bibliographical References

Abbas, S.

2017 "Golden ratio", *Resonance* 22(1), pp. 51-60.

Abdullahi, Y. & Bin Embi, M. R.

2013 "Evolution of Islamic Geometric Patterns", *Frontiers of Architectural Research* 2 (2), pp. 243-251.

Abolghasemi, Latif,

2006 *Norm of Shaping Iran's Islamic Architecture*, by the efforts of Mohammad Yusuf Kiani. Organization of studying and compiling humanities books of universities, Tehran.

Arnheim, Rudolf

1949 "The Gestalt Theory of Expression", Psychological Review 56: pp. 156-171.

Balkhari, Hassan

2011 *The mystical foundations of Islamic art and architecture*, 2nd edition, Tehran: Surah Mehr affiliated with the art field.

Bamanian, Mohammadreza

2008 "an introduction to the role and use of peymon in Iranian architecture", *Modares Art Magazine*, No. 1, Fall, pp. 1-10.

Canter, David

1977 *The Psychology of Place*, London: Architectural Press.

Cooper Marcus, C.

1974" The house is a symbol of the self", In J. Lang, C. Burnett, W. Moleski and D. Vachon (eds) *Designing for Human Behavior: Architecture and the Behavioral Sciences*, Stroudsburg, Pa.: Dowden, Hutchinson & Ross, pp. 130-46.

Fillin, Vasility

1998 *Videoecology*, published TASS-REKLAMA, Moscow.

Ghale Nui, Mahmoud; Majid Salehinia and Sepideh Peymanfar,

2014 "Design policies of the urban space of Jobaze Isfahan with an approach to the meaning of the environment in two spectrums", *Muslim and Jewish, Iranian Islamic City Studies Quarterly*, No. 21, Paizi, Tehran.

Golkar, Koresh

2007 "the visual environment of the city; Evolution from a decorative approach to a sustainable approach", *Journal of Environmental Sciences*, Year 5, Number 4, Tehran.

Kohler, Wolfgang

1929 *Gestalt Psychology*, New York: Liveright.

Lawler, Robert

1989 *Sacred Geometry,* Translated by Haideh Meiri, Tehran: Scientific and Cultural.

Levi, David

1974 "The Gestalt Psychology of Expression in Architecture", in Jon Lang et al., eds., *Designing for Human Behavior: Architecture and the Behavioral Sciences*, Stroudsburg, Pa, Downden, Hutchinson and Ross, pp. 111-119.

Lu, P. J., & Steinhardt, P. J.

2007 "Decagonal and Quasi-Crystalline Tilings in Medieval Islamic Architecture", *Science* 315 (5815), pp. 1106-1110.

Mansouri, Rezvaneh; Habib, Farah

2021 *Explaining the effect of golden and geometric proportions on human visual perception of the architectural environment based on the feeling of belonging to the place*, Soyman National Conference on Urban Planning and Architecture Danesh Banyan, University of Science and Research, Tehran, Iran.

Markowsky, G.

1992 "Misconceptions about the Golden Ratio", *The College Mathematics Journal* 23(1), p. 2.

Motalebi, Qasim

2016 "Recognizing the ratio of form and function in architecture", *Fine Arts Magazine* 25, pp. 55-64.

Najafkalipur Kalantari, Nasim; Etesam, Iraj; Habib, Farah

2016 "investigation of geometry and golden proportions in Iranian architecture (case study: traditional houses of Tabriz city)", *Shahri Management Journal* 46, pp. 477-491.

Neisser, U.

1977 *Cognition and Reality*, San Francisco: Freeman.

Posamentier, A. S., & Lehmann, I.

2012 *The glorious golden ratio*, Amherst, N.Y: Prometheus Books.

Pourjafar, Mohammad Reza, and Maryam Alavi Ba-Ma'ani,

2012 *extracting the criteria of coordination and inconsistency of building facades with the visual system according to the principles of visual ecology*, scientific-research publication of the Scientific Association of Architecture and Urban Planning of Iran, spring and summer, number 4, Tehran.

Putz, J. F.

1995 *The Golden Section and the Piano Sonatas of Mozart, Mathematics Magazine* 68(4), p. 275.

Rezazade Ardabili, Mojtabi; Sabet Fard, Mojtabi,

2012 "Recognizing the application of geometrical principles in traditional architecture, a case study: Qasr Khurshid and its hidden geometry", *Fine Arts-Architecture, and Urban Development Journal* 1, pp. 29-44.

Sadati, Nasser

2008 "comparative study of geometry in the art system of the East (Iranian painting) and the art of the West (Cubism)", *Book of Art Month* 136, pp. 88-91.

Shafiei, Roshanak, and Parviz Sharifi Amadadi
2006 "Blindness and Environmental Perception", first edition, Sepahan Publishing House, Tehran.

Shahcheraghi, Azadeh and Alireza Bandarabad,
2016 *Mohat Dar Mohit*, Jihad University Publications, 3rd edition, Tehran.

Sharghi, Ali; Matuf, Sharaf; Asadi, Saeedeh,
2016 "Analysis of the role of risk perception on environmental behavior during an earthquake in Ganj Ali Khan Complex and Kerman Bazaar", *Iranian Islamic City Studies Quarterly* 28, Summer, Tehran.

Silvaye, Sonia; Daneshjoo, Khosrow; Farahin Farahani, Saeed
2012 "Geometry in pre-Islamic Iranian architecture and its manifestation in contemporary Iranian architecture", *Naqsh Jahan Scientific Research Journal*, Third period, number 1, p. 57.

Soleimani, Maryam; Mandgari, Kazem
2014 "recognizing the principles of traditional houses in Yazd in responding to basic psychological needs; Based on the theory arising from the context", *Journal of Fine Arts - Architecture and Urbanism*, No. 4, pp. 99-109.

Tabatabai Zavareh, Seyyed Maryam; Vali Beg, Nima; Azimi, Maryam; Shahbazi Chegani, Behrooz,
2017 "comparison of the four-row body and the traditional cistern of Zavareh city", *Warm and Dry Climate Journal* 7, pp. 101-125.

Ziyai Nia, Mohammad Hassan; Hashemi Zarrajabad, Hassan,
2015 "Golden proportions and the system of Iranian-Islamic proportions in Qain Mosque", *two scientific research quarterly journals of restoration and architecture of Iran*, year 6, number 11, spring and summer.

Journal of Archaeology and Archaeometry

Samanid Pottery, 9th- 10th Centuries,
Khalili Private Collection

Volume 1, No. 4
ISSN Online :

WINTER 2023
2821-1928

Published Quarterly by Department of Achaeology
Islamic Azad University of Varamin - Pishva, Tehran, Iran