CONTENTS

Volume 13, Number 4, Autumn 2023

ISSN: 2228-7396

Content for insert

Aims and Scope

International journal of Architecture and Urban Development (IJAUD) is an interdisciplinary scholarly publication of architecture, Urbanism, and built environment studies that published and archived by Science and Research Branch, Islamic Azad University, Tehran,Iran.

The journal aims at establishing a bridge between theory and practice in the fields of architectural and design research, urban design, urban planning, urban development and built environment studies.

It reports on the latest research findings innovative approaches for creating responsive environments. A broad outline of the journals scope includes; peer reviewed original research articles, case and technical reports, reviews and analyses papers, short communications and notes to the editor, in interdisciplinary information on the practice and status of research in architecture, urban planning, urban design, urban development, interior design, landscape architecture and built environment.

FAQ

Help for authors

How can I post or submit my article?

You have to submit the version of your article in Word processing format electronically through the IJAUD website online submission.

How do I obtain copyright transfer form?

You can print out a copyright by clicking the download icon on the Journal website. You will then fill the form and have to forward it to the IJAUD Editorial Office.

Why does IJAUD request transfer of copyright?

IJAUD wants to ensure that it has the exclusive distribution right, for all media. Such a right can be obtained through an exclusive license from authors, but there is virtually no difference between transfer and exclusive license. Given that there is virtually no difference, it seems to us that transfer does give an advantage in the elimination of any ambiguity or uncertainty about IJAUD's ability to distribute or sublicense.

I have some questions regarding my paper processing.
You can consult through IJAUD2013@gmail.com or contact to the Executive managing editor.

Online Manuscript inquiries?

If you have questions on the status of your paper and need to trace your paper process, or have questions regarding an ongoing subscription, you can trace it through the online manuscript tracking or search it.

How can I submit an article?

You must definitely submit your manuscript through the online submission form at the IJAUD website.

How can I acknowledge about the author instruction?

The note for authors is printed out at the end of journal. However, you can acknowledge through the note for authors link at the Journal website.

How can I be as a member of IJAUD?

You can refer to the subscription form and fill the form. You will then be received the Journal issues regularly.

How can I order off prints of a journal article?

For off prints order, you can follow the instruction which is on the Journal subscription form.

Contact us

International Journal of Architecture and Urban Development Department of Art and Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran.

P.O.Box: 14515-775, Tehran, Iran.
Zip Code: 1477893855

Tel: (+9821) 4791 2412
Fax: (+9821) 4786 1791
Emails: IJAUD2013@gmail.com

COPYRIGHT RELEASE

Title of Manuscript:

Author (s):

I (we) hereby assign and transfer all copyrights to the manuscript named above, in all forms and media of expression now known or later developed, to the effective if and when it is accepted for publication in the International Journal of Architecture and Urban Development (IJAUD) by the Iranian Department of Art and Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran.

I (we) also confirm that the manuscript is not in the public domain and is original on my (our) part except for such excerpts copyrighted works as may be included with the written permission of the copyright owners. I (we) further warrant that the manuscript contains no libelous, obscene, or unlawful statements and does not infringe upon or violate any copyright, trademark, other right or the privacy of others. I warrant that, in the case of sole authorship, I am the sole owner of the manuscript and all copyrights therein and have full power and authorities to register all copyrights therein and to make this agreement, and that, in the case of multiple authorships, these powers of ownership are shared with all other contributing authors. I (we) acknowledge that the International Journal of Architecture and Urban Development is relying on this release in publishing this manuscript in the Journal. Regarding the conflicts of interest, submitted manuscript must be accompanied with a statement from the authors disclosing all financial and personnel relationships that might be as their work, if any. Besides, the authors are requested to evident whether impending conflicts do or do not exist. This should cover the proclamation and if there are further details, it could be mentioned in the copyright. If an organization encompasses any financial interest in the outcome of the study, the authors are appealed to provide a declaration that have full access to all the data in the study and take complete responsibility for the integrity of the data and the accuracy of the data analysis.

The corresponding author are requested to sign this form upon acceptance of the manuscript on behalf of all the authors and email or fax it to the IJAUD Editorial Office. It is preferable to be scanned and then submitted through the Journal emails.

Corresponding Author Signature Print Name Date

The sole responsibility for the whole content (s) of the article remains only with the corresponding author.

PLEASE NOTE: Manuscripts cannot be processed for publication until the publisher has received this signed form. If the manuscript is not published in the Journal, this release will not take effect.

RETURN TO:

Editorial Office,
International Journal of Architecture and Urban Development (IJAUD)
Department of Art and Architecture,
Science and Research Branch, Islamic Azad University, Tehran, Iran
P. O. Box 14515-775,
Tehran, Iran.

Tel.: (+9821) 47912412
Fax: (+9821) 4486 1791

Email: IJAUD2013@gmail.com **Website:** http://ijaud.srbiau.ac.ir

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 5-18 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI: 10.30495/IJAUD.2023.73482.1686

Deleuze's Philosophy and its Impact on Late 20th Century Architectural Theory: A Study of ANY Magazine

Ehsan Kakhani[1], *Zohreh Tafazzoli*[2*]

[1] *Department of Architecture, Faculty of Architecture and Urban Planning, Shahid Beheshti University, Tehran, Iran.*
[2 *] *Department of Architecture, Faculty of Architecture and Urban Planning, Shahid Beheshti University, Tehran, Iran.*

Recieved 2023.05.30; Accepted 2023.08.29

ABSTRACT: Throughout history, the relationship between architecture and philosophy has been intricately intertwined. In the 1990s, architectural theory witnessed a significant influx of theoretical and critical debates influenced by French philosophy. This scholarly article delves into the intricate connection between architecture and philosophy, specifically focusing on transforming architectural discourse from theoretical and critical debates by French philosophy to an antitheoretical standpoint. Emphasizing the emergence of (neo-)pragmatism within architectural theory, it closely examines the pivotal role played by translating philosophical concepts, particularly those derived from the works of Deleuze and Guattari, in this paradigm shift. Employing a research methodology centered around thematic analysis, the study explores the multifaceted relationship between architecture and philosophy, shedding light on Deleuze's philosophical framework as evident in the publications of the esteemed Anyone Corporation. The theoretical framework serves as a lens through which the difference, transformation, and change within the translation of Deleuze's ideas into architectural theory are meticulously examined. The findings conclude that architects selectively incorporate certain significant tenets from Deleuze's philosophy, such as smooth spaces, the fold, and the diagram. Furthermore, while the interaction between philosophy and architecture fosters fruitful exchanges, it also gives rise to criticisms for instrumentalizing philosophy and utilizing buzzwords without fully grasping their intended contexts. Ultimately, this article underscores architecture and philosophy's reciprocal dependence and interconnectedness as distinct yet interdependent disciplines, emphasizing the significance of transdisciplinarity and disciplinary constitution.

Keywords: *ANY Magazine, Gilles Deleuze, Architectural Theory, Autonomy of Architecture, Bruno Latour.*

INTRODUCTION

The historical record reveals a profound and interconnected association between architecture and philosophy. Prominent philosophers, such as Plato and Heidegger, have significantly contributed to comprehending built environments' fundamental nature and operational characteristics (Tarasova, 2020). The architectural discourse during the 1990s was marked by theoretical and critical debates informed by French philosophy. However, a shift occurred from the 20th to the 21st century, where an antitheoretical and anti-critical stance became prevalent. The proliferation of French post-structuralism as a predominant point of reference is not the sole factor contributing to the emergence of antitheoretical and anti-critical movements. There are indications in the architectural discourse of the 1990s that suggest a shift towards practice and (neo) pragmatism, as opposed to criticism and (critical) (Heynen, 2020).

A thorough analysis is necessary to comprehend the correlation between the transfer of Deleuze's (and Guattari's) philosophical ideas to architectural-theoretical writings in any magazine and the lasting impact of the French philosopher Deleuze on the practice and theory of architecture. Since the 1980s, architecture has embraced Deleuze's philosophy, which has influenced a generation of architectural thinking and the design of contemporary built environments on a global scale. Concepts such as the process of "folding," the distinctions between "smooth" and "striated" space, and the incorporation

*Corresponding Author Email: z_tafazzoli@sbu.ac.ir

of notions like "immanence" and "virtual" in digital architecture demonstrate the wide-reaching influence of Deleuzian philosophy. Furthermore, Deleuze and Guattari's work has also directed architectural discourse toward addressing major ecological, political, and social issues. Therefore, a critical examination of the translation of these philosophical concepts into architectural discourse during the 1990s is essential for a comprehensive understanding of this relationship (Frichot & Loo, 2013).

Deleuze's philosophy has significantly impacted the field of architecture, not only evident in secondary sources but also explicitly mentioned in the inaugural issue of ANY magazine by Davidson and Eisenman (Davidson, 1993). Deleuze's concepts were first introduced to architectural theory by scholar Sola-Morales during the initial conference in 1993 (De Sola-Morales, 1995). Subsequently, authors have extensively employed these concepts in the 27 publication editions. Therefore, there is a legitimate need to explore the implications and applications of these concepts in architectural theory. This article presents a compilation of concepts derived from the works of Deleuze and Guattari, including smooth spaces, folds, and diagrams. Theory, with some voices citing Deleuze's concepts. A thorough analysis of the translation of philosophical concepts into architectural discourse during the 1990s is necessary to comprehend this correlation.

Presenting a compilation of concepts derived from the works of Deleuze and Guattari, including smooth spaces, folds, and diagrams, this article centers on the examination of the complexity of concepts derived from the philosophical works of Deleuze and Guattari, as well as how these concepts were assimilated into American architecture through ANY publications during the 1990s. Initially, the inquiry regarding methodology arose from depicting the appropriation and incorporation procedures. The utilization of translation concepts is employed for this objective. This article does not discuss the application or layout of these periodicals; it is concerned with the medium of text and how it is presented in writings on architecture.

MATERIALS AND METHODS

Addressing the central inquiry of the study, which pertains to the transference and contextual application of Deleuze's philosophical concepts to the realm of architectural theory in the United States, this research examines the phenomenon through a lens informed by the theoretical framework established by Bruno Latour. A critical facet in understanding this transference is the concept of metaphor, which establishes connections between two distinct fields that exhibit similarities and disparities (Braun & Clarke, 2006). The "Difference" denotes areas of convergence between the two disciplines, fostering communication and connection. However, this transfer is not entirely precise or literal; rather, introducing an idea into a new context activates the unique characteristics of that context and permits a degree of “transformation” and modification of concepts and their interrelationships. Conversely, in the "Change," the disparities between the realms become more apparent, and the significance of these differences sometimes impedes accurate thought transmission despite initial resemblances (Draude, 2017).

This theoretical framework aptly describes the transfer and translation of thought, as it effectively encompasses both similarities and differences while facilitating the amalgamation of concepts from both fields. Embracing this framework necessitates dividing the research into three distinct phases to address three corresponding questions. The first phase delves into elucidating the similarity/difference or communication zone and discusses the shared attributes or potential avenues for establishing communication between the two domains. This phase employs a combination of textual interpretation and documentation as its research methodology. Subsequently, the second phase engages in a discourse surrounding the assimilation of selected Deleuzean concepts and their subsequent alterations within architectural theory. By closely examining interconnected texts, this phase utilizes thematic analysis to identify the key concepts that constitute the focal points of Deleuze's architectural thought. These findings are then compared to Deleuze's original ideas. The third phase delves into the change zone by systematically reviewing criticisms against this thought transfer. The primary areas of contention within this change are identified and thoroughly explored by undertaking such an assessment. (Fig. 1)

Literature Review

Kari Jormakka categorizes architectural theory into three distinct types, one of which is called architectural philosophy. The subject matter pertains to fundamental inquiries, such as design theory conditions or architectural criticism's fundamental laws. Design theory establishes principles for designers, as exemplified by the works of Vitruvius or Le Corbusier. Meanwhile, architectural interpretation elucidates buildings by comparing established theories (Jormak ka, 2008).

Nadir Lahiji, in his books, The Missed Encounter of Radical Philosophy with Architecture (2014) and Adventures with the Theory of the Baroque and French Philosophy (2016), has an important contribution to a clear critical analysis of the Deleuzian-influenced architects. However, Lahiji's study is not primarily focused on the 1990s or Anyone Corporation's publications. Instead, he focuses on works by Frank Gehry, Alejandro Zaera-Polo from Foreign Office Architects (FOA), Zaha Hadid, and Patrik Schumacher that were produced in 2000 and later. In both books, Lahiji claims that Deleuze's ideas were reductively introduced into the architectural discourse without understanding the context in which they first appeared. As a result, the political-critical component was lost in favor of a

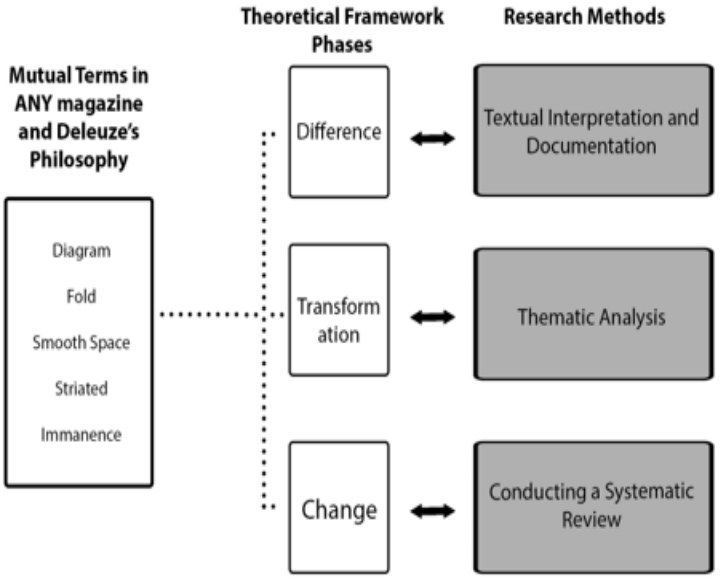


Fig. 1: Process of conducting the research

strictly instrumental application (Lahiji, 2014 & 2016).

In his investigation of "Architectural Deleuzism," a word he borrows from Ian Buchanan, architectural theorist Douglas Spencer makes similar arguments to those of Lahiji. Although, Spencer, in contrast to Lahiji, uses it negatively to criticize an instrumental reading of Deleuze by an elitist group of architects who do not start with a naive and formal application of individual philosophical concepts to architecture and thus surrender to neoliberalism (Spencer, 2011). Spencer, like Lahiji, is less focused on the 1990s and the Anyone Corporation than on the 21st century and designers like Hadid and Schumacher, FOA, and Reiser + Umemoto.

The anti-critical perspectives observed in the architectural discourse examined by Spencer during the period surrounding the turn of the millennium underwent notable evolution stemming from the discourse of the Anyone Corporation and the assimilation of Deleuze's (and Guattari's) concepts that occurred therein. The present appropriation is approached methodologically through the utilization of the concepts of translation suggested by Bruno Latour.

Theoretical Framework

The recognition of translation as an essential practice within a globally interconnected world has led to the emergence of a translational turn in cultural studies. Translation serves not only as a cultural technique but also as a tool to analyze intercultural and interdisciplinary phenomena, uncovering disparities, power dynamics, and opportunities for intervention. This shift in perspective allows for the deconstruction of traditional narratives into distinct stages of comprehension, mediation, and resistance (Köhler, 2020).

However, it is important to stress that the meaning of 'translation' in this context surpasses the linguistic interpretation. It means 'displacement, drift, invention, mediation, creation of a new link that did not exist before and modifies in part the two agents.' (Latour, 1993). The fact that translation is "detached from the linguistic-textual paradigm and acknowledged as an indispensable practice in a world of mutual dependencies and networks" has resulted in the proclamation of a "translational turn" in cultural studies. The translation is a cultural technique, a condition of global exchange processes, and an analytical category for revealing intercultural and interdisciplinary phenomena's differences, power imbalances, and latitude for action (Bachmann-Medick, 2016). In his latest theory, Latour has shifted his scholarly focus from ontologies towards the study of the communication process, resulting in the formulation of a translation theory. To establish more stable networks of interaction, actors employ "intermediaries" that facilitate the transfer of "definitions" (i.e., an actor's perspective and associated meanings) between

different actors. These "inter-media" often include non-human elements such as roundtable discussions, public declarations, texts, technical objects, embodied skills, and currencies. Similar to the concept of "social facts" in classical social theory, these material mediums serve to solidify and sustain meaning by providing enduring connections between individuals that extend beyond any single interaction (Draude, 2017):

"Each person in the chain is doing something essential for the existence and maintenance of the token [that which is translated]. The chain is made of actors – not patients – and since the token is in everyone's hands, everyone shapes it according to their projects. The token changes as it moves from hand to hand, and the faithful transmission of a statement becomes a single and unusual case among many, more likely, others." (Latour, 1991)

Hence, translation encompasses more than a simple transfer or displacement. It is conceptualized as a process of transformation, wherein the ontologies and relationships of involved parties change, influenced by a 'pluriphony' of varied translation endeavors that occasionally culminate in temporary consensus regarding the perceived reality (Bachmann-Medick, 2012).

Three Phases of Translation Process

The intriguing similarities between Latour's model and the postcolonial model of translation could be found in the context of Benjamin's "task of the translator." These two models offer valuable insights into the cultural aspect of transcending boundaries. They resonate with Benjamin's perspective on translation by emphasizing the transfer of ideas or objects and the transformative processes that occur when these elements traverse individuals with distinct perceptions of "reality." Consequently, they uncover the notions of difference, transformation, and change (Draude, 2017). While Benjamin envisions the generation of a fresh original through translation, the postcolonial models emphasize the consequential power dynamics at play. In both models, a productive tension arises between the desire for mutual understanding and the undeniable presence of cultural disparities – a tension that generates social power relationships (Czarniawska, 2014).

Translation entails system integration. Deleuze and Guattari's French works are translated into English in linguistics. This is linked to French-to-English text transfer. Literary scholar Mary Louis Pratt calls social areas where various cultures meet, collide, and fight" usually in highly asymmetrical power relations (Pratt, 1991). These spaces are for conceptual uses. Mutual understanding or productive misunderstanding and epistemological impulses underpin them. Architectural theory is a traditional field between architectural and philosophical disciplines, seen in the demarcation of architectural theory from architectural philosophy.

According to the literary scholar Mieke Bal, the transformations require a certain amount of elasticity because the ideas that must be translated are polysemantic, making them elastic but infallible. Consequently, the significance of appropriate usage outweighs its accuracy, as it has the potential to generate constructive ambiguity (Bal, 2002). This is the point at which a state of reduced productivity due to misinterpretation is established, particularly evident in the study of the interpretation of the New Testament, as exemplified by Friedrich Schleiermacher, and is intensified. Antoine Picon, a scholar in architectural history, explores the idea of translating scientific concepts into the field of architecture in his work titled Architecture and Science: Scientific Accuracy or Productive Misunderstanding? (2008). The occurrence of a semantic change does not necessarily warrant reproach, as it can potentially give rise to something productive, particularly within the realm of creative disciplines (Czarniawska, 2014).

Power imbalances are associated with translation processes. The term "translation" is utilized for linguistic translation, specifically from French to English. Additionally, it pertains to cultural practices such as appropriation, transformation, resistance, and staging. Furthermore, it is linked to the context of social, economic, and disciplinary power and prestige relations. It is important to note that the term is not used metaphorically. Within the realm of architectural discourse, there exists a contention regarding the purported misinterpretation of Deleuze and Guattari and the negotiation of architecture's autonomy. In this context, translation is suggested to emphasize the generation of differences, impurities, and the corresponding mediation processes.

The main research question is subdivided into smaller questions following the theoretical framework. (Fig. 2) Examining the historical background of Anyone Corporation can provide valuable insights into the specific circumstances in which the ideas of Deleuze and Guattari were introduced to the field of architectural theory.

A History of Anyone Corporation

Anyone Corporation was established in December 1990 in New York by Cynthia C. Davidson, the editor; Peter Eisenman, an American architect; Arata Isozaki, a Japanese architect; and Ignasi de Solà-Morales Rubió, a Catalan architect. The location of organization is situated inside the Eisenman Architects office. In some ways, it replaces the Institute for Architecture and Urban Studies (IAUS), which Eisenman founded in 1967 alongside Arthur Drexler from the Museum of Modern Art and Colin Rowe from Cornell University. IAUS was shut down in 1985.

Similar to the IAUS, the Anyone Corporation, as a non-profit organization, is committed to architectural discourse and the communication of architectural theory without wanting to establish the fixed structure of an institute. Davidson describes the goal of Anyone Corporation as follows: "To

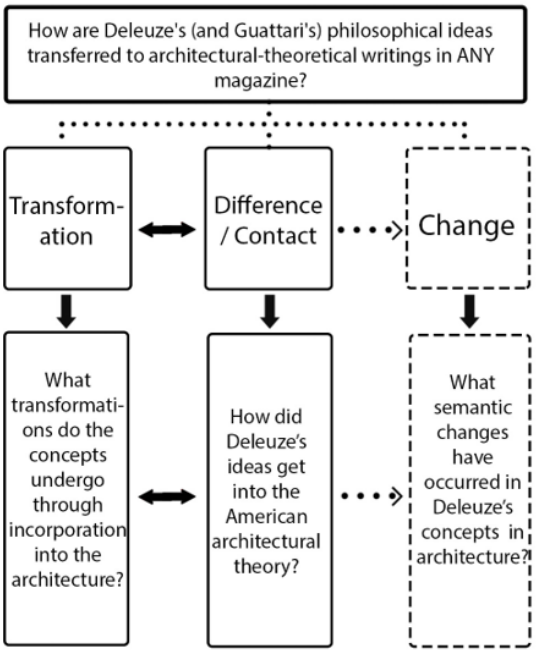


Fig. 2: The theoretical framework and the extensive research questions

advance the knowledge and understanding of architecture and its relationships to the general culture through international conferences, public seminars, and publications that erode boundaries between disciplines and cultures." (Ockman, 1988)

Three entities make up the Anyone Corporation: The Any conferences (1991–2000), the ANY magazine (1993–2000), the journal Log (which started in 2003 and is still being published today), and the book series "Writing Architecture Series," which started in 1995 and is still being published by MIT Press (with a break from 2001–2007).

The term "Any" is derived from the acronym "Architecture New York." Alternatively, its semantic function as "any" or "either" denotes a lack of specificity or uncertainty. The lack of specificity is intended to facilitate a broad, multidisciplinary, and cross-cultural dialogue. As per the analysis of Ole W. Fischer, the title 'Oppositions' was intended to critique the 'structuralist' methodology of dialectics, whereas the term 'any' was utilized to denote an approach that is non-dialectical and non-hierarchical (Fischer, 2015). "ANY corporation" has garnered significant attention in architectural discourse as it includes a particular school of thought in American architecture devoted to exploring new ideas in architectural theory. The movement has emerged due to a growing trend toward experimentation in design, which has led to a shift away from traditional architectural paradigms. This shift has imbued the discourse with a sense of dynamism, as architects are increasingly inclined to break free from conventional conceptions of space, materials, and form and instead seek to push the limits of what is possible in architecture.

ANY magazine (1993–2000)

In May 1993, the first issue of the journal ANY was published. It opens with the phrase "Writing in Architecture" and the zeroth issue to signify an empty start. In the editorial, Davidson stresses that writing always involves ambivalence and indecision, such as when using puns, double meanings, or ambiguities like the magazine's name (Davidson, 1993). ANY seeks to bridge the distance between widely read publications with many images, scholarly writings, and less theoretical architectural journals. It is purposefully distinguished from similar architecture-theoretical journals by the following statement: "In the US, we had oppositions, which dealt with historical interpretations directly, and then Assemblage, which combined theory and history. An academic tone gives way to playful, affirmative handling of intellectual fads, and the overlap of text and illustrations lead to a visual spectacle. ANY regarded history more as a resource or a backdrop against which to try new ideas and graphically clear." (Davidson, 1993) (Fig. 3)

Initially, publication every two months was intended, but ANY was issued more erratically, resulting in 26 issues between

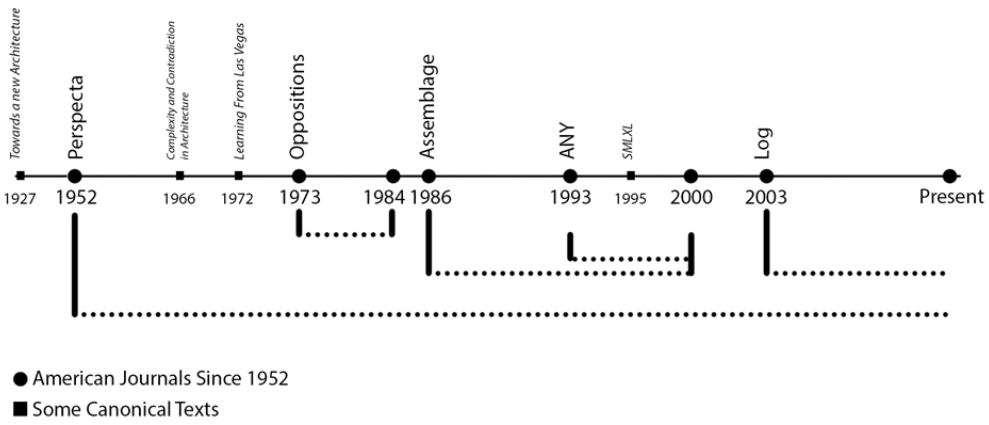


Fig. 3: A list of American Journals and some canonical theoretical texts

1993 and 2000. There are "Any Events" that come before some issues, some of which are held at the Solomon R. Guggenheim Museum or the Dia Center for the Arts in New York.

There are monographic editions on James Stirling (No. 2), Tadao Ando (No. 6), Colin Rowe (No. 7/8), Rem Koolhaas (No. 9), Charles Gwathmey (No. 11), Philip Johnson, Buckminster Fuller, and Mies van der Rohe, half of which are advertisements for members of Anyone Corporation. In addition, architecture-critical and theoretical topics are dealt with, such as “Architecture and the Feminine. Mop-up Work” (No. 4), “Tectonics Unbound. Core Form and Art Form Revisited” (No. 14) or “Being Manfredo Tafuri. Wickedness, Anxiety, Disenchantment” (No. 25/26). In the course of digitization, the issues deal with media technology issues such as “Electrotecture: Architecture and the Electronic Future” (No. 3), “Mech in Tecture. Reconsidering the Mechanical in the Electronic Era” (No. 10), “The Virtual House” (No. 19/20) or “Diagram Work, Data Mechanics for a Topological Age” (No. 23).

Architecture in Deleuze's Philosophy

The capacity of architecture to establish a connection with the philosophical tenets of Deleuze (and Guattari) is predicated upon the profusion of instances expounded in their literary works. Within the work entitled "French Theory in America," Sylvère Lotringer, a cultural theorist and editor, along with historians Sande Cohen, provides a depiction of Deleuze and Guattari's L'Anti-OEdipe as a unique amalgamation of theory, philosophy, social science, and provocative polemics. Lotringer posits that this can be attributed to the markedly speculative approach adopted by the two intellectuals, who prefer formulating "unrefined hypotheses" and scrutinizing concepts from various angles (Lotringer, 2001).

There exists a multitude of publications that provide evidence for the assertion that philosophy is grounded in architectural metaphors, including those of foundation and structure. Deleuze's skepticism towards essentialist notions such as reason or identity renders metaphors unsuitable for his philosophical framework (Karatani, 1995). He does not subscribe to a foundation upon which the universe can be rationally explained, nor does he adhere to a logically constructed philosophy like a house. However, in collaboration with Guattari, the author formulates various spatially-oriented concepts (Frichot, 2020)

Lynn emphasizes the formation of the similarity between architecture and spatial thinking in his statement, wherein he notes that Deleuze and other philosophers have adopted a philosophical style that relies on spatial thinking. This development has understandably sparked interest among architects and urbanists (Lynn, 1995a). The space category is central in Deleuze and Guattari's philosophical and political discourse.

Deleuze and Guattari discuss the concept of "geophilosophy" in their work Mille Plateaux, wherein the focal point is the territory rather than the subject or object. The user distinguishes between two distinct spatial categories: the notched or segmented space and the smooth or changing space. The convergence of imperial ruling and law-making state apparatuses with nomadic war machines occurs through de- and re-territorialization. The former operates within the notched space of territorialization, while the latter is situated in the smooth space, where it resists the state's regulatory powers and creates micropolitical alternatives. (deterritorialization) (Jobst, 2020).

The spatial explication of political processes departs from the notion of space as a universal and neutral pre-existing container for objects. Deleuze and Guattari posit that space is a dynamic

factor in creating social reality and plays a fundamental role in forming society (Deleuze, 1992).

Deleuze's engagement with architecture is infrequent, albeit with some notable exceptions. Deleuze's Le Pli, aka The Fold: Leibniz and the Baroque, contains numerous explicit references to architecture. Deleuze specifically references Baroque architecture by drawing from Heinrich Wolfflin's literature on the Baroque. In this context, space is utilized as a continuous surface exhibiting curvature in three dimensions. This notion is associated with a dynamic universe, where all elements are interrelated. The concept of fixed entities or identities is deemed inadequate in this context. Deleuze presents Leibniz's philosophy of perception and cognition through the metaphor of a two-tiered dwelling, wherein the lower level represents the domain of materiality or corporeality, while the upper level represents the domain of spirituality or consciousness. The utilization of architecture as a visual depiction of theoretical concepts is incorporated into Le Pli through a drawing that evokes the likeness of an illustration of a Baroque church (Deleuze, 1992).

Deleuze thinks of architecture primarily politically, and he writes the following:

"Architecture has always been a policy, and every new architecture depends on revolutionary forces; it can say: 'We are looking for a people,' even if the architect himself is not revolutionary. The people are always a new wave, a new fold in the social fabric; and the work is always a fold" (Deleuze, 1992)

RESULTS AND DISCUSSION

Deleuze and Guattari offer various spatial concepts and metaphors, architectural depictions, allusions to Baroque architectural structures, and thorough analyses of spaces and their influence on societal presence. They constitute the mutual zone between architecture and philosophy. Conversely, the discipline of architecture is also characterized by incorporating philosophical concepts that constitute the difference.

Phase 1: Difference

Architectural theory can be regarded as a traditional point of intersection between architecture and philosophy. The phenomenon above involves the occurrence of exchange and translation processes. Like philosophy, this discipline functions within the realm of language and written communication, eliminating potential issues related to medium translation (Livesey, 2015). Conversely, the field increasingly demonstrates characteristics of a hybrid discipline that operates interdisciplinary, drawing upon architectural and artistic history, media and semiotics theory, psychology, sociology, politics, ecology, and philosophy. The aforementioned unified characteristic is also observable in the distinction between architectural theory and architectural philosophy (Evers, 2019).

How did Deleuze and, with him, Guattari get into the American discourse? It starts in the 1970s in the educational context of the East Coast, particularly at Columbia University, and in various largely countercultural publications like Boundary 2, Diacritics, Glyph, SubStance, and Semiotext(e). The initial translations of Deleuze's works into English were An Interpretation of Coldness and Cruelty (1971) and Proust and Signs (1972), published by the esteemed New York-based publisher George Braziller. The translations are based on the authors included rather than a genuine interest in Deleuze's philosophy (Kwinter, 2011). Due to Semiotext's (e) publications, he first gained popularity in the USA.

Semiotext(e) was established as a collaborative group by Lotringer in 1973 while he was affiliated with Columbia University in New York. As an associate lecturer at the French Department, he has taught semiotics since 1972. The academic journal Semiotext(e) originated from a pre-existing semiotics reading group, which Lotringer and Rajchman subsequently edited.

Lotringer's students, namely Jonathan Crary, Michel Feher, and Kwinter, are interested in art and architecture and Deleuze's oeuvre's spatial and technoscientific aspects. They established the Zone series with Hal Foster, the art critic. A novel phenomenon is on the rise wherein scholarly publications are being transformed into objects of design. The New York publishing scene has exhibited a growing trend towards aestheticizing texts about Deleuze, as evidenced by the presence of such a phenomenon in semiotext(e).

Apart from ZONE, the linkage between Deleuze and architecture is established through alternative paths. Initially, it can be observed that the works of Foucault are authored by Marxist architects who are also recognized as architecture critics in Venice. Deleuze's publication concerning Foucault served to bring the latter into sharper focus. Manfredo Tafuri serves as an intermediary, specifically. Second, lead 1976, the two art critics, Rosalind E. Krauss and Annette Michelson introduced French post-'68 thinkers to the art world.

Thirdly, Assemblage, a journal of architecture, aids in disseminating works by and about Deleuze. Established in 1986 by K. Michael Hays, an architectural historian, and Alicia Kennedy, a design historian, this journal incorporates interdisciplinary and critical perspectives on architecture and design in a flexible format. The journal's name adopts the English rendition of the framework from Mille plateaux, and its structure is likewise explicated in the context of the structure posited by Deleuze and Guattari (Editors, 1986).

Subsequently, Deleuze and Guattari assumed prominent roles in the discourse surrounding architectural theory. The discourse regarding Deleuze's ideas was disseminated in ANY publications after Assemblage Journal, and as a result, it emerged as a significant subject matter within the field of architectural theory (Kwinter, 2011). The intersection of Deleuze's philosophical ideas and their application in architecture occurred via architectural theory, thus creating a different mutual zone.

Phase 2: Transformation

Transformations occur in the translation of philosophical concepts into architecture. Combining Deleuze's (and Guattari's) theories with specific architectural questions and discourses causes and allows reinterpretations and shifts in content. In addition, the media dispositifs of architecture require a translation of philosophy into design processes and architectural texts and images. Therefore, the central questions are: Which terms and concepts of Deleuze (and Guattari) are translated into the architectural discourse of Anyone Corporation? What architectural themes and issues are they associated with? And what transformations do the concepts undergo through incorporation into the architecture?

The following subchapter centers on the intricate subjects of smooth geometry, fold, and diagram. These topics have been conventionally discussed in architectural theory and are interrelated with ideas derived from the works of Deleuze and Guattari, as per the Anyone Corporation. (Table 1)

Table 1: The Mutual Concepts in the Transformation Phase

The Mutual Concept	Deleuze's Idea	The Related Architectural Theory	Elaboration
Smoothness	In *A Thousand Plateaus*, Deleuze and Guattari deny mimesis. It opposes becoming "devenir." Mimesis is the imitation or representation of a source or ideal. Thus, setting a fixed starting and a fixed end perpetuates power. According to Deleuze and Guattari, impersonating or being something is a false contrast to reality (Thiele, 2016).	Smooth Geometry/ Gregg Lynn	Lynn contends that the methodologies of Bataille, Deleuze, and Guattari present a prospect for conceptualizing an architectural framework that opposes structured systems of depiction and, consequently, their idealization through smooth geometrical shapes or curved outlines (Lynn, 1993b). The neglect of the political ramifications of Bataille, Deleuze, and Guattari's concepts is a notable aspect of Lynn's analysis. The words "informal" and "smooth" are only related by Lynn to the form, its geometry, and its representation, even though, according to Deleuze and Guattari, formalization and geometrization are also acts of oppression and the establishment of order in an institution (Vidler, 2002).
Fold	The notion of the fold is present in *A Thousand Plateaus* and is further elaborated by Deleuze in *Foucault* and *The Fold: Leibniz and the Baroque*. The folding concept pertains to the interrelation between an entity's internal and external aspects. The exterior is not a fixed boundary but rather a dynamic substance animated by peristaltic motions, creases, and folds that give rise to interior space (Deleuze, 1992).	Fold as a key concept/ Peter .Eisenman	Eisenman mainly connects formal categories to the fold. He published the book *Unfolding Frankfurt* (Eisenman, 1991), which contains the article "Unfolding Events," and published his design for the Rebstockpark area between 1990 and 1994. Eisenman incorporates his interest in the fold into a media-technological transition from mechanical to electronic reproduction, which destroys the original's aura and essence. Eisenman contends that the new media's reinterpretation of reality has implications for building. Eisenman argues that the design serves as a means of expressing suppressed yet immanent figurations in the building, which is accomplished through the use of the totalitarian figure-ground dichotomy. The fold is not merely a formal tool but a mechanism through which novel social organizations are introduced dynamically into the pre-existing urban landscape, resulting in aesthetically pleasing forms that arise from the fold (Eisenman, 1993).
Diagram	Deleuze discusses the focus on power dynamics within Western societies during the 18th century in Foucault's *Surveiller et Punir* (1975). For Foucault, power resides "less in a person than in an arrangement of bodies, surfaces, lights, and gazes; in an apparatus whose internal mechanisms establish the relationship in which the individuals are imprisoned." (Foucault, 1976). The Panopticon represents the quintessential example of such a mechanism.	Diagram Architecture/ Peter Eisenman and Gregg Lynn	According to Lynn (1995b), architectural theory aims to produce diagrams that surpass technological constraints and give rise to new aesthetic expressions in the physical realm. Lynn argues that un-studio signifies a shift in architectural discourse, moving from representation to generative and conceptual diagrams. These diagrams, which are non-architectural representations of functionalities, facts, or information utilized in the design process, are invigorated by specific urban and infrastructural factors. Lynn emphasizes the importance of understanding the maneuverability of the diagram and integrating contextual factors for innovative articulation in designated projects (Lynn, 1995b). Conversely, Eisenman's contribution to the "diagram. an original scene of writing" in any 23 deviates significantly from others. Eisenman focuses on the "interiority" of architecture, considering it as the accumulated architectural knowledge that sets it apart from other art forms. Additionally, Eisenman highlights the relationship between reflection and architecture's capacity for criticism, enabling culturally embedded meanings to emerge and allowing repetition with variation. Eisenman states that criticality arises from the possibility of both repetition and differences, acknowledging what has come before and embracing the ability to change that history (Eisenman, 1999).

The Eisenman's Duality

Eisenman claims that the built environment's perception can be problematized through a particular type of event produced by architecture. He compares this to two methods of urban planning that begin with immutable totalities like the figure and ground rather than with events. The figure-ground connection in Gestalt theory explains how the shape or figure differs from related evidence. Eisenman first criticizes modernism's tabula rasa method, in which buildings are put on what is supposed to be neutral ground without any association. He criticizes contextualistic design methodologies in which figures are derived from structures concealed at the bottom as if there were a reversible connection between the street space and the building structure. Figure and ground are considered totalities that determine urban development in both scenarios. For the architectural discourse to keep up with other discourses, Eisenman wishes to cast doubt on this: "But as in most disciplines such all-encompassing totalities have come into question, they are no longer thought to explain the true complexity of phenomena." (Eisenman, 1991) He uses Deleuze's fold as a metaphor for building, focusing on the fold's material composition.

Eisenman's handling of philosophical works is problematic. This is particularly evident in the "Folding in Architecture" output. The confrontation of Eisenman's project descriptions with the corresponding excerpt from Deleuze's The Fold reveals his art of appropriation:

Eisenman: "[The Alteka project] suggests the notion that an object is no longer defined by an essential form where the idea of the standard was one of maintaining an appearance of the essence and of imposing a law of constancy, but of our actual situation where the fluctuation of the norm replaces the permanence of law when the object takes place in a continuum by variation. Thus, with this other status, the object no longer corresponds to a spatial mold but to a temporal modulation that implies a continual variation of the matter as much as a perpetual development of the form. This conception is not only a temporal but quantitative [sic!] of the object. The object becomes an event." (Eisenman, 1993)

Deleuze: "As Bernard Cache has demonstrated, this is a very modern conception of the technological object: it refers neither to the beginnings of the industrial era nor to the idea of the standard that still upheld a semblance of the essence and imposed a law of constancy, but to our current state of things, where fluctuation of the norm replaces the permanence of law; where the object assumes a place in a continuum by variation; where industrial automation or serial machines replace stamped forms. The new status of the object no longer refers to its condition as a spatial mold. In other words, to a relation of form-matter – but to a temporal modulation that implies as much the beginnings of a continuous variation of matter as a continuous development of form His [Leibniz'] is not only temporal but also a qualitative conception of the object, to the extent that sounds and colors are flexible and taken in modulation. The object here is manneristic, not essentializing: it becomes an event." (Deleuze, 1992)

The excessive adoption, which, incidentally, occurs without reference to Deleuze's work's source, is plainly shown by the word groups that have been mentioned. This results in inaccurate copying, where the object's qualitative idea is transformed into a quantitative one. Deleuze's ideas, cited in his terms and relation to architectural elements, are not understood in this fashion. Eisenman instead copies entire paragraphs without making any significant connections to the draft.

A second wave of Deleuze's impact on architecture had already begun, as Lynn noted in "The WELL Conference," with the introduction of the abstract machine and the diagram (Lynn, 1995a). This presented a fresh viewpoint: Lynn suggests looking at the operationality of architecture with Deleuze rather than the notion that it dissolves into a "virtual" space and develops an aesthetics of immateriality: "Rather than debate an appropriate aesthetic for machines, we could start with a discussion of the instrumentality of machinic processes and introduce these spatial models into architecture at the level of diagrammatic machines." (Lynn, 1995b) Concerning Deleuze's work on Foucault, Lynn describes the diagram. According to Lynn, this is the most significant fusion of architectural and philosophical debate, and architecture must now incorporate its conclusions, particularly the diagram (Lynn, 1995b).

The diagram connects historically ingrained architectural concepts and ideas that are virtually present but not yet operative with the actual conditions. The diagram settles between inwardness and a concrete object. It is about the potential for architecture to express itself, to make its interiority known in a realized building. The diagram represents a method that aims to open architecture to its own discourse (Eisenman, 1999).

Eisenman's issue with the idea behind the diagram proposed in ANY 23 is the disregard for three factors: first, the conformity of the architecture with the metaphysics of presence (truth, unity.); second, the internal motivation of the architectural sign by its function (the pillar, which carries and represents carrying); and third, the subject's desire for the architecture to have a deeper meaning. (the column represents a tree) (Eisenman, 1999).

The debates over the digitalization of design, which erupted in the 1990s, are connected to Deleuze's (and Guattari's) ideas like virtuality, the abstract machine, and the diagram within the context of the Anyone Corporation. The reinterpretation of virtuality as a repository for erratic forms that must be created during the design process reflects the transformation. The diagram ultimately proves to be a method for the virtual to engage in an actualization process. Here, the diagram, unique to Foucault and Deleuze, is transformed into a tool for creativity. The subject chooses any diagram or illustration to create concrete forms from there, which depoliticizes and instrumentalizes the power relations that manifest in the

concrete and does so.

Phase 3: Change

It is worthwhile to follow the different arguments inside and outside of Anyone Corporation to comprehend the translation process and its effects on succeeding generations. The idea of "Change" incorporates the claim that translations are frequently accompanied by arguments in which the translators are charged with "contaminating" the translated text. Strategies are created as a result, or in part anticipation of the criticism, with which changes in the translation performance are to be justified. The accusations and tactics shed light on the negotiations surrounding the relationship and the limits between translated and untranslated. As a result, this chapter's main concerns are the following: What particular "impurities" of Deleuze's (and Guattari's) philosophy are the translators allegedly guilty of? How do the designers respond to this?

Instrumentalization and Depoliticization

The first argument centers on the claim that the concepts were applied, specifically that they were applied externally to the spatial form of architectural objects. In ANY 10, Lynn addresses this criticism by stating, "One must be careful not to equate looking outside of architecture with applying concepts to forms and spaces." (Lynn, 1995b) Lynn foresees this criticism. Similar to this, Juel-Christiansen cautions that architecture is not a "constructed theory" in the article "Folding in Architecture." (Juel-Christiansen, 1993) This criticism is legitimate insofar as the application philosophy, as expressed in architectural objects, disregards theoretical concepts' intent. Its goal is knowledge acquisition, not the production of things.

Tafuri contends that it is the responsibility of historians or theorists—those who do not themselves practice architecture—to reflect on architecture using philosophical concepts. Like no one else, Tafuri opposed the "operative criticism" of architects who "instrumentalize theory or history." (Tafuri, 1980). The sole purpose of theoretical or historical arguments in "operative criticism" is to produce and legitimize architectural forms. Therefore, it is not a stand-alone but focuses on how theory and history are applied to architectural practice. Tafuri claims that when a group of architects is formed whose designs and theories are to be supported by historical and theoretical endeavors, "operative criticism" experiences a surge (De Michelis, 2018).

Tafuri asserts that the issue is that architects lacking critical distance and scientific training compose 90% of the publications on architecture. The blurring of disciplinary lines and blending of criticism, history, and planning are only ostensibly progressive. Instead, there is a lack of objectivity and the capacity for criticism in the historical and theoretical study of architecture. History and theory can only uncover ideologies and reclaim their political clout when strictly separated from practice (Tafuri, 1980).

In French Theory in America, During traces how Deleuze (and Guattari) instrumentalized theoretical ideas to Massumi's introduction to the English translation of Mille plateaux. He states the following in it:

"Most of all, the reader is invited to lift a dynamism out of the book entirely and incarnate it in a foreign medium, whether painting or politics. The authors steal from other disciplines with glee but are more than happy to return the favor. Deleuze's image of a concept is not a brick but a 'toolbox.'" (Massumi, 1987)

Massumi encourages readers to give shape to the ideas in other media, arguing that Deleuze and Guattari also borrow ideas from other fields of study. Furthermore, their ideas should be applied in other contexts rather than as the cornerstone of a solid foundation.

The accusation of formalism and depoliticization go hand in hand with depicting philosophy as architectural objects. The purely formal translation is criticized because it reduces the political impact of the philosophical idea by reinterpreting it as a formal gesture. At the 1997 "Anyhow conference," Rajchman himself, despite being one of the most ardent proponents of incorporating Deleuze's philosophy into architecture, voiced criticism: "[Deleuze] introduces the diagram in a political context or a context of power. This dimension is not strongly represented when architects describe how they use diagrams in their work. (Rajchman, 1998).

The architecture is ultimately reduced to a purely aesthetic object that can be sold and consumed when the form is the main focus. As a result, instead of opposing neoliberalism like Deleuze and Guattari did with capitalism and Deleuze did with the controlled society, it runs the risk of being co-opted by its market logic. As a result, Parr wrote the following about Eisenman and Lynn in 2013:

"If concepts such as the fold, force, and becoming are not connected to the larger political impulse driving Deleuze and his collaborations with Guattari, the concepts are no longer tools in the way that Deleuze insisted they need to be treated, rather they become so profoundly un-Deleuzian as to be a political distraction. Indeed, it keeps architectural practice and theory focused on producing forms that work in the interests of neo-liberalism; meanwhile, larger social issues of equality and environmental degradation are played down." (Parr, 2013)

The architects' exclusive emphasis on form, while disregarding architecture's social, political, and economic dimensions, confines them to a limited aesthetic discourse. Furthermore, their designs may be commodified and subjected to the forces of the capitalist market economy, a phenomenon that Deleuze (and Guattari) have scrutinized and condemned.

Buzzwords without Expertise

The second point of critique pertains to a shallow application of the terminology coined by Deleuze and Guattari. Kwinter's article in ANY 19/20 provides a notable demonstration of

this phenomenon. The author presents an account of a vague discourse put forth by Fredric Jameson, who offered a dissenting viewpoint during a seminar held at the Graduate School of Design at Harvard University regarding the urban condition in China. Jameson proposed that the notion of perpetual flow, as articulated in Deleuze and Guattari's L'Anti-OEdipe, maybe a more fitting characterization of the transformation occurring in the Pearl River Delta. Kwinter proceeds to offer a critique of Jameson's lack of familiarity with the works of Deleuze and Guattari:

"This led Jameson to a murky reference to the flow model developed in Anti-Oedipus, a naive, desultory attempt on his part to recuperate a model long surpassed not only by developments but by the considerable refinements and elaborations of the authors themselves (e. g. in A Thousand Plateaus)." (Deleuze & Félix, 1993) (Kwinter, 1997)

Jameson's comprehension of the subsequent development of Deleuze and Guattari's concepts is lacking. Kwinter also disapproves of how academic ideas are applied superficially and inconsistently. Kwinter claims it is carelessly employed to produce ideas and discourses that deafen people.

Kwinter again points out that he contradicts the idea of indecision used programmatically within Anyone Corporation, which accompanies the use of the incoherent, collage-like language with a charge of theoretical fuzziness. The concept of indecisiveness is only meant to conceal a lack of clarity in fact and thought, Kwinter claims in response to Kipnis' explanation at the "Anywhere" conference that the indecisiveness concerning the space means that it cannot be specified because every specification would inscribe boundaries in the space (Kwinter, 1992).

One of the primary criticisms against applying Deleuze (and Guattari) in architectural discourse is the resulting blurring of discourse, which precludes the extraction of any tangible and, thus, critical insights. During the latest Any conference, Moneo noted that the practice of utilizing obscure quotes from French philosophy has come to an end:

"American architectural scholars [from the 1980s on] often based their work on a superficial reading of European thinkers, predominantly the French poststructuralists. Following Tafuri's precedent, critics and theoreticians began to fill their texts with quotes from Michel Foucault, Georges Bataille, Félix Guattari, Gilles Deleuze, Jean- François Lyotard." (Moneo, 2001)

Regarding these critiques, During (During) observes that in the scientific and cultural spheres of the 1990s, Deleuze's (and Guattari's) concepts were perceived not as abstract ideas, concepts, or frameworks but as recognizable labels or brand names. "They are emblems rather than devices, and their actual functioning is overshadowed by their discursive use value." (During, 2001)

The two major issues raised by internal and external critics of the Anyone Corporation attest to the potential for change that comes with translation procedures. The architects employ a variety of defense tactics in response to the charges of a lack of understanding, misinterpretation, and poor translation.

Inevitable and Creative Difference

Derrida stated that for him, architecture is both the translation and the non-translation of cultural concepts, such as the Japanese "Ma," into architecture at first Any conference in 1991: "I do not want a translation to be feasible. Any event would come to a stop at that point." (Derrida, 1991)

In reality, architects acknowledge that they frequently misunderstand or have difficulty comprehending philosophical arguments (Danailov, 2019). Eisenman remarks at the Anywhere conference following the lectures by the philosophers Rajchman, Grosz, and Sylviane Agacinsky as follows:

"I want to tell the three philosophers how much I enjoyed hearing their discourse on architecture and philosophy and their relationship. I suffer from jet lag as an architect trying to respond to their papers. Reading them in advance probably wouldn't have helped because it takes me years to misread philosophy, let alone respond to it." (Eisenman, 1995)

Eisenman had previously acknowledged that he had misinterpreted the writings of Derrida. During the "Anyone" conference, Isozaki expressed an effective sentiment that he had consistently misinterpreted Derrida's ideas (Isozaki, 1991). Eisenman argues that misreading should not be considered problematic, as it can ultimately be viewed as a form of creativity (Benjamin, 1989). In his introduction to Written into the Void, a compilation of chosen Eisenman writings spanning from 1990 to 2004, Kipnis provides further explanation on this matter:

"[It] is helpful to remember while reading these texts [of Eisenman] that the accuracy of the architect's reports of Derrida's thought does not matter at the end to the architect's conjunctures. Eisenman does not seek to derive authority or force from his representation of Derrida's position; like any speculation in dialogue form, the reports are rhetorical devices to help the architect clarify his position." (Kipnis, 2007)

Eisenman and Kipnis argue that architects may adopt a creative approach to theory that does not necessarily entail precise reading or comprehension of philosophical texts. Rather, these texts may be rhetorical tools that bolster the architects' confidence in themselves. In this context, philosophy is not primarily concerned with acquiring knowledge but serves as a wellspring of inspiration and a driving force for generating novel ideas and artistic endeavors.

Autonomy of Architecture

During the "Anyplace" conference, Eisenman underscored the importance of maintaining a clear distinction between philosophy and architecture. The former possesses a practical value, while the latter embodies a symbolic significance that lies beyond the realm of philosophy. Eisenman employs the notion of interiority to distinguish the inherent qualities

of architecture that set it apart from other disciplines. This concept involves separating it from the Other, as understood in philosophy, and adopting an approach emphasizing interiority. Eisenman suggests that it may be beneficial to reconsider the interiority of architecture by utilizing the conceptual tools provided by philosophers to expand its interiority. Eisenman argues that philosophy is crucial in facilitating architecture's journey of self-exploration. Simultaneously, architecture serves as a valuable aid to philosophy (Eisenman, 1995).

Eisenman insists on the distinction between philosopher and architect. he argues that philosophers can argue but can't see how their logic is spatially and visually developed, whereas an architect can develop his logic visually and spatially." (Asada, 1997)

Dal Co initially posits that philosophers are unable to see space and buildings. They lack the architectural eye: "I am fed up with philosophers speaking about architecture because they don't see, are unable to see. They don't perceive building and space." (Dal Co, 1991) On one side of the discussion that follows are Dal Co and Moneo. Both support the preservation of specific architectural knowledge, which, according to Moneo, ensures that only the architectural discipline can offer the proper solutions to architectural problems. Dal Co asserts that architects have a distinctive vision, particularly in how they perceive the substance of objects (Dal Co, 1991).

Eisenman's most recent conference presentation reveals a failure in bridging architects and philosophers. Eisenman contends in the "Making the Cut" section that Any project's intended content-related exchange between the actors from various disciplines did not occur. In a statement from a year prior, he said: "In listening to the presentations today, I think we have real problems communicating and understanding what each of us means by effect, the body, reality, space, and time (Eisenman, 2001). Eisenman concludes that architects should debate alone among themselves. He finishes thus the dialogue between the different disciplines:

"[We] are not communicating. We talk across each other. If we were to honestly say how many presentations we found relevant to what we are talking about as architects, I think there would be very few. In this profession, we do not talk to one another anymore. The most important architectural debate I ever remember taking place in this country was the meeting in Charlottesville, where we only had architects, and it was just dynamite; an open, viable thing because everybody understood the ground rules." (Eisenman, 2001)

The "Change phase" is visible both inside and outside Anyone Corporation. Deleuze-quoting architects are charged with depoliticizing architectural forms and the processes that generate them by applying philosophical ideas purely instrumentally instead of gaining knowledge from an independent historical or theoretical discourse on architecture. Second, it is argued that they use Deleuze's (and Guattari's) terminology solely as buzzwords, without understanding their context or meaning, to gain authority by using the names of philosophers, even though those very same philosophers reject models of authority.

In their defense, those architects point out that every translation involves differences and that artistic creativity does not require correct understanding. Additionally, the external distinction between philosophy and architecture is also internal because the difference between architectural practice and architectural theory reflects both philosophy's contact with and dissociation from it.

CONCLUSION

ANY Corporation, established in New York City in 1990 by Cynthia C. Davidson, Peter Eisenman, Arata Isozaki, and Ignasi de Solà-Morales, emerged as a platform for interdisciplinary and cross-cultural dialogue in architecture. ANY Corporation sought to bridge the gap between academia and theoretical architectural journals through conferences, publications, and journals. In particular, the publication called ANY Magazine stood out for its optimistic approach toward intellectual trends and its integration of Gilles Deleuze's philosophy.

This investigation reveals that architects often incorporate key themes from Deleuze's philosophy, most notably the concept of the fold and diagrams. Issues of disciplinary boundaries and architectural specificity are consistently explored in ANY Corporation's publications. However, architects face criticisms for depoliticizing architectural forms and employing Deleuze's concepts superficially without understanding their context or meaning.

These conflicts give rise to lively discussions within the pages of ANY Magazine and in the wider architectural community. Architects defending their use of Deleuze argue that translations inherently involve some degree of difference, and artistic creativity does not necessarily require fully comprehending theoretical concepts. They further assert that Deleuze's ideas are a theoretical equivalency to genuine architectural advancements, maintaining the field's autonomy.

The constant interplay between difference and change within the discourse of architecture and philosophy leads to the emergence of distinct disciplines. The relationship between architectural practice and theory reflects their connection and detachment from philosophy. While the proximity to philosophy nurtures architectural development, an issue within architecture itself dampens this proximity. Translations between architecture and philosophy are inherently complex and cannot be reduced to a simple equation or confined within fixed boundaries. Instead, transdisciplinarity and disciplinary constitution are mutually dependent, continuously shaping the dynamic interplay of architecture and philosophy.

AUTHOR CONTRIBUTIONS

E. Kakhani performed the literature review, analyzed and interpreted the data, and prepared the manuscript text and edition. Z. Tafazzoli helped in the literature review and manuscript edition.

ACKNOWLEDGMENT

This article is extracted from the Ph.D. thesis of the first author entitled “Rethinking the two Central concepts in architectural theory and the Relationship between them: Autonomy and Criticality,” which is in progress under the supervision of Dr. Zohreh Tafazzoli and Prof. Hadi Nadimi at Shahid Beheshti University.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or falsification, double publication or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Asada, A. (1997). Jury Discussion. ANY, 19/20, 34.

Bachmann-Medick, D. (2012). Travelling Concepts for the Study of Culture. Berlin: De Gruyter.

Bachmann-Medick, D. (2016). Cultural Turns. New Orientations in the Study of Culture. Berlin: De Gruyter.

Bal, M. (2002). Traveling Concepts in the Humanities. A Rough Guide, Toronto

Benjamin, A. (1989). Eisenman and the Housing of Tradition. Oxford Art Journal, 1, 47.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77-101.

Czarniawska, B. (2014). Bruno Latour: An Accidental Organization Theorist. In P. Adler, P. D. Gay, G. Morgan, & M. Reed (Eds.), The Oxford Handbook of Sociology, Social Theory, and Organization Studies. Oxford: Oxford University Press.

Dal Co, F. (1991). In C. Davidson (Ed.), Anyone (pp. 133). New York: ANY.

Danailov, A. (2019). The Emancipation of the Intermediary. The Other Reality of the Architectural Form in the Work of Peter Eisenman. Visual Studies. Davidson, C. C. (1993). Dear Reader. ANY, 0, 4-5.

De Michelis, M. (2018). Manfredo Tafuri and the death of architecture. In G. P. a. G. T. Teresa Stoppani (Ed.), This Thing Called Theory. New York: Routledge.

de Sola-Morales, I. (1995). Differences. Massachusetts: MIT Publication.

Deleuze, G. (1992). The Fold: Leibniz and the Baroque. Minnesota Univ Of Minnesota Press.

Deleuze, G. G., Félix. (1993). A Thousand Plateaus. Minneapolis: University of Minnesota Press.

Derrida, J. (1991). Jacques Derrida. In C. Davidson (Ed.), Anyone (pp. 90). New York: ANY.

Draude, A. (2017). Translation in motion: a concept’s journey towards norm diffusion studies. Third World Thematics: A TWQ Journal, 2(5), 588-605.

During, É. (2001). Blackboxing in Theory: Deleuze versus Deleuze. In L. Cohen (Ed.), (pp. 163–189).

Editors. (1986). About Assemblage. Assemblage, 1, 4-5.

Eisenman, P. (1991). Unfolding Frankfurt. Berlin: Ernst & Sohn.

Eisenman, P. (1993). Alteka Office Building. Architectural Design, 3/4(102), 28.

Eisenman, P. (1995). Discussion 1. In C. Davidson (Ed.), Anyplace (pp. 43). New York: Any Corporation.

Eisenman, P. (1999). Diagram Diaries. New York: Thames Hudson.

Eisenman, P. (2001). Making the Cut. In C. Davidson (Ed.), Anything (pp. 260 -263). New York: ANY.

Evers, B. F. A. (2019). Architectural Theory: From the Renaissance to the Present: Taschen.

Fischer, O. W. (2015). Anyone Corporation: Architecture Anyone? A Non-profit and the Traveling Circus of Theory. In G. Borasi (Ed.), The Other Architect. Another Way of Building Architecture (pp. 408). Montréal

Foucault, M. (1976). Discipline and Punish. The birth of the prison: Frankfurt.

Frichot, H. (2020). Infrastructural affects Challenging the autonomy of architecture. In M. F. Jobst, Hélène (Ed.), Architectural Affects after Deleuze and Guattari: Routledge.

Frichot, H. S., Loo. (2013). Deleuze and Architecture: Edinburgh University Press.

Heynen, H. (2020). Meaning and Effect: Revisiting Semiotics in Architecture. In H. A. Heynen, Loeckx (Ed.), The Figure of Knowledge Conditioning Architectural Theory, 1960s – 1990s: Leuven University Press.

Isozaki, A. (1991). In C. Davidson (Ed.), Anyone (pp. 89). New York: Anyone Corporation.

Jobst, M. F., Hélène. (2020). Introduction. In M. F. Jobst, Hélène (Ed.), Architectural Affects after Deleuze and Guattari: Routledge.

Jormakka, K. (2008). Lecture script "Architectural Theory." Weimar Bauhaus University Weimar WS

Juel-Christiansen, C. (1993). The Anhalter Folding. Architectural Design, 3/4(102), 39.

Karatani, K. (1995). Architecture as Metaphor Language, Number, Money (S. Kohso, Trans.). New York: The MIT Press.

Kipnis, J. (2007). Introduction: Act Two. In P. Eisenman (Ed.), Written into the Void. Selected Writings 1990-2004 (pp. xxvii). New Haven.

Köhler, E. C. (2020). Of Culture Wars and the Clash of Civilizations in Prehistoric Egypt – an Epistemological Analysis. Ägypten und Levante / Egypt and the Levant, 17-58.

Kwinter, S. (1992). Emergence: or the Artificial Life of Space. In C. Davidson (Ed.), Anywhere (pp. 162-171). New York.

Kwinter, S. (1997). FFE. Infrared, the Treason of Language, and the Failure of the Geometric Imagination. ANY, 19/20, 6–7.

Kwinter, S. (2011). Foreword. In S. Brott (Ed.), Architecture for a Free Subjectivity Deleuze and Guattari at the Horizon of the Real (pp. 19). New York: Routledge.

Latour, B. (1991). The Powers of Association. In J. Law (Ed.), A Sociology of Monsters: Essays on Power, Technology, and Domination (pp. 264–280). London: Routledge.

Latour, B. (1993). We Have Never Been Modern. Cambridge MA: Harvard University Press.

Livesey, G. (2015). Deleuze and Guattari on Architecture. New York: Routledge.

Lotringer, S. (2001). Doing Theory. In S. C. Sylvere Lotringer (Ed.), French Theory in America (pp. 132). New York: Routledge.

Lynn, G. (1993b). INeffective DESCRIPTions: SUPPLEmental LINES. In P. Eisenman (Ed.), Re:working Eisenman (pp. 100). London Peter Eisenman.

Lynn, G. (1995a). Forms of Expression. The Proto-functional Potential of Diagrams in Architectural Design. El Croquis, 72.1, 24.

Lynn, G. (1995b). The Well Conference. ANY, 10, 27.

Massumi, B. (1987). Translator's Foreword: Pleasures of Philosophy. In D. Guattari (Ed.), A Thousand Plateaus. Capitalism and Schizophrenia (pp. xv). Minneapolis.

Moneo, R. (2001). In C. Davidson (Ed.), Anything (pp. 122). New York: ANY.

Ockman, J. (1988). Resurrecting the Avant-Garde. The History and Program of Oppositions. In B. Colomina (Ed.), Architecture production. Revisions 2, (pp. 192). New York/NY.

Parr, A. (2013). Politics + Deleuze + Guattari + Architecture. In S. L. Helene Frichot (Ed.), Deleuze and Architecture (pp. 197- 214). edinburgh edinburgh university press.

Pratt, M. L. (1991). Arts of the Contact Zone. Profession, 34.

Rajchman, J. (1998). In C. Davidson (Ed.), Anyhow (pp. 254). New York: ANY.

Spencer, D. (2011). Architectural Deleuzism. Neoliberal Space, Control and the »Univer-city. Radical Philosophy(168), 9-21.

Tafuri, M. (1980). Theories and History of Architecture. New York.

Tarasova, I. V. (2020). On The Importance of Developing A History of Theoretical Architectural Thought. Architecton: Proceedings of Higher Education.

Thiele, K. (2016). Of Immanence and Becoming: Deleuze and Guattari's Philosophy and/as Relational Ontology. Deleuze Studies, 10(1), 117-134.

Vidler, A. (2002). Warped Space Art, Architecture, and Anxiety in Modern Culture. Cambridge: The MIT Press.

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 19-32 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI: 10.30495/IJAUD.2023.71379.1666

Comparative Comparison of Common Animal Motifs in the Sheikh Safi Al-Din Complex (Safavid Period) and the Shrine of Imam Reza (AS) (Qajar Period): An intertextual Approach

***Roya Esmi*[1], *Habib Shahbazi Shiran*[2*]**

[1] *Ph.D. Candidate in Archeology, Faculty of Social Sciences, University of Mohaghegh Ardabili, Ardabil, Iran.*

[2*] *Associate Professor, Faculty of Social Sciences, University of Mohaghegh Ardabili, Ardabil, Iran.*

Recieved 2023.01.09; Accepted 2023.06.17

ABSTRACT: Decorative motifs have evolved significantly in the architecture of the Islamic era in terms of form, structure, aesthetic, and doctrinal principles and represent the beliefs of the people in that era. In this study, an attempt has been made to provide a new possibility for a deeper analysis of common animal motifs in the Islamic periods of Safavid and Qajar with an intertextuality approach (with the help of logical reasoning and the Delphi method) to perceive decorative motifs. Therefore, the intertextuality relations between the motifs of the two historical tombs of the Sheikh Safi al-Din Ardabili complex (Safavid period) and the holy shrine Imam Reza (AS) (Qajar period) were analyzed. According to the findings, the animal motifs identified with intertextual relations included peacock (11 cases), cow (2 cases), pheasant (16 cases), duck (1 case), and dragon (16 cases). In all the motifs of the buildings, the pretext type was of the exclusive type, and the hypertext type was of the transformation type. In addition, in peacock, pheasant, and dragon motifs, the largest number of additional substitution, substitution, and substitutional -ellipsis types were observed, respectively. It seems that in selected buildings of the Safavid and Qajar periods, the change in the colors of animal motifs is more evident than in other dimensions of intertextuality. This change has had an impact on the spiritual and mystical content of the motifs, and somehow, in addition to the mystical and spiritual content, attention to material aspects (increase in wealth and abundance of blessings) has been considered in the use of various colors.

Keywords: *Intertextuality, Sheikh Safi al-Din Ardabili complex, Shrine of Imam Reza (AS), Qajar period, Safavid period.*

INTRODUCTION

Throughout the history of Iran, decorative symbolic motifs have a value beyond mere physical aesthetics in Iranian-Islamic culture and art (Esmi & Shahbazi Shiran, 2021). Animal motifs are generally divided into four main groups (Jafarzadeh, 2017; Ryan & Crabtree, 2018). The first group is animal motifs actively present in people's lives. These pets are good for people, and their existence is essential for survival. Hens, roosters, chickens, sheep or dogs, etc. can be mentioned among these animals. The second group, a symbol of purity, beauty and dignity, refers to birds such as pigeons, pheasants, and peacocks (Hill, 2013; Nikandish et al., 2019). The third group is a symbol of power and predation. These animals sometimes threaten the lives of people, villagers, and nomadic tribes. Among these, we can mention the lion and the fox. The fourth group is animal motifs that do not have a real aspect and are mostly considered combined or symbolic (Wessman, 2021).

Intertextuality is one of the researchers' findings in the twentieth century that offers a new perspective on the relation between elements in texts and motifs and deals with the intertextual relation between them (Sardaraz et al., 2020; Namvar Motlagh, 2007). Intertextuality is based on the basic principle that no text or form is without a hypertext. In addition, no text or idea is formed randomly or without a past (Shafiq, 2014). Therefore, all knowledge and thoughts have a past or a history. Every text and motif seems to have been taken from

*Corresponding Author Email: habibshahbazi35@gmail.com

previous texts and motifs, and all trends of intertextuality and trans textuality emphasize this principle (Long & Yu, 2020). As its name suggests, transformation seeks to transform pretext into hypertext through transformation and change in its style.

It should be noted that a hypertextual relation is not exclusive to one type of transformation, and it is possible to have several types of transformation in a hypertextual relation simultaneously (Namvar Motlagh, 2007). Every hypertext is always derived from one or more pretexts. If it is taken from only one pretext, the pretext is exclusive, and if it is taken from several pretexts, it is non-exclusive and mixed (Norouzi & Namvar Motlagh, 2018).

Rajabi Asl (2016), in his research entitled "Structural adaptation and analysis of architectural motifs and decorations of Sheikh Amin al-Din and Sheikh Safi al-Din tombs in Ardabil," studied all the animal and plant motifs in these two tombs and architectural decorations. The results showed that the motifs used in the architectural decorations of the tomb of Sheikh Amin Al-Din Jabrail and the tomb of Sheikh Safi al-Din Ardabili included animal motifs of peacocks, pheasants, dragons, cows, and pigeons. These researchers believed most motifs, especially bird motifs, were related to the Safavid Shia religion and mysticism. The motifs were interpreted as a symbol of the principles of the traditional Iranian Islamic worldview. The meanings and value of symbols were discovered based on the direct teachings of revelation, Islamic holy texts, philosophical and mystical teachings, and the worldview of the Safavid era. Jafarzadeh (2017) also interpreted the battle between the dragon and the cow as the battle between good and evil in interpreting decorative motifs. Often, dragon motifs mean a demonic and evil creature in ancient Iranian myths.

Numerous studies have proven intertextuality relations between different historical periods (Azar, 2016). For example, Akhavani and Mahmoudi (2015), who examined the effect of intertextuality on the decorative motifs of pottery in Neishabour in Iran in their research, concluded that the type of intertextuality and hyper textuality patterns used included ellipsis, substitutional and additional patterns. In another study, Chitsaz et al. (2019), following a study of how to read the pretext of pomegranate motif in Iranian ornaments, concluded that contemporary artists have represented the pomegranate form in the statue of contemporary jewelry (in various dimensions of ellipsis, substitution, and addition) by maintaining the nature of pomegranate, changing the form, disturbing the symmetry, using negative and positive spaces and combining different media with jewelry. The results also indicate that the pomegranate motif inspired contemporary jewelry designers in ancient times, which was of transformation type in classifying intertextuality relations. Zamaniaghaiee and Soltanzadeh (2017) investigated the architecture of public buildings in Uzbekistan and the architectural buildings of the Timurid era in this country using an intertextuality approach in their research. According to the results, intertextuality relations of imitative, ellipsis, substitutional, and additional types were obtained between the architectural motifs of the selected buildings in two periods. Jamali and Marasy (2013), in a comparative study of tiling decorations in the architecture of Safavid and Qajar-era mosques, concluded that religion played an important role in compiling decorative motifs. The motifs used in some religious buildings in the Qajar period were inspired and modeled on the religious buildings in the Safavid period. In addition, the most visible changes in architectural motifs in both the Safavid and Qajar periods were related to color and variety of colors. In this context, the research findings of Mansori et al. (2019) showed that despite the abundance of commonalities among decorative motifs, the main difference in the decorative motifs of selected buildings in the Safavid and Qajar periods was related to the outline and color of the motifs. In the Safavid period, azure and turquoise colors were often used in decorative motifs; but in the Qajar period, yellow, orange, pink, and brown colors were more popular. In addition, geometric and Arabic motifs in the Safavid period tiling decorations are often simple and separate, but in the Qajar period, complex forms of geometry and motifs with intricate details can be seen.

What is certain is that the Safavid period was the peak of architectural art in the Islamic era, especially in decorative works and motifs, and the Qajar period was the cause of the further development of Islamic art (Jamali & Marasy, 2013). In the Safavid period (1501-1722 AD) and then the Qajar period (1789-1925 AD), the foundation of the Shia religion was established and honored (Mansori et al., 2019; Babazadeh Asbagh, 2022). During the Safavid period, the most important religious building and the center of the formation of Shiism was the Sheikh Safi al-Din complex in Ardabil. The shrine of Imam Reza (AS) in the city of Mashhad is also known as the most prominent and important Shiite complex in Iran, which was very important from the point of view of religion in the Qajar period (Babazadeh Asbagh, 2022). Therefore, the prominent religious buildings in these two periods have inspired and continued using various architectural decorative motifs (Mansori et al., 2019; Babazadeh Asbagh, 2022). According to the cases mentioned, this research seeks to compare the decorative animal motifs used in the most important Shiite buildings in two periods (Safavid and Qajar) in the form of intertextual relations.

MATERIALS AND METHODS

The nature of the study was qualitative, and an attempt has been made to provide a new possibility for a deeper analysis of common animal motifs in the Islamic periods of Safavid and Qajar with an intertextuality approach (with the help of logical reasoning and the Delphi method) to perceive decorative motifs. The selected buildings of two different historical periods, the Safavid period and the Qajar period, including the Sheikh Safi al-Din Ardabili complex and the section related to the Qajar period in the shrine of Imam

Reza (AS) were selected. Since this research has been done with the approach of intertextuality theory, decorative motifs in selected buildings were considered, and the intertextuality relations between these motifs in different historical periods and buildings were observed. By carefully examining all motifs in the selected buildings of two historical periods, the motifs used with an intertextual approach in the architectural arrays of the Sheikh Safi al-Din complex in the Safavid period and the shrine of Imam Reza (AS) in the Qajar period include animal motifs of peacocks, pheasants, and dragons, cows, and duck. The Delphi method was used to increase the accuracy of intertextual analysis and verify arguments. Eighteen experts in the field of decorative motifs and familiar with the topics of intertextuality in historical works were appointed. In this way, in the first stage, the first respondent was selected with the help of theoretical sampling. In the second stage, the snowball sampling method was used to select other experts. Therefore, the sample size was determined to include 18 faculty members, specialists, and experts of cultural heritage, tourism, and handicraft organizations of Ardabil and Khorasan Razavi provinces (Education: 66.66% have doctoral level, 22.22% have master's level and 11.11% have bachelor's level; Average age: 47.44 years and average work experience: 16.06 years).

The study's investment was a questionnaire presented to experts in three stages. The questionnaire was in the form of open questions, and the first stage, the questions were about identifying and introducing common motifs in two historical periods and selected buildings. The types of motifs were determined in the second stage, and in the last stage, the type of intertextual relations was discussed. Finally, based on the consensus percentage of the respondents, the final summary of the answers related to intertextual relations was presented. In the following, according to Fig. 1, the location of the selected buildings is presented.

RESULTS AND DISCUSSION

Peacock

Peacock is one of the motifs used extensively in decorating mosques and religious places during the Safavid and Qajar periods. The reasons for the presence of this motif on the

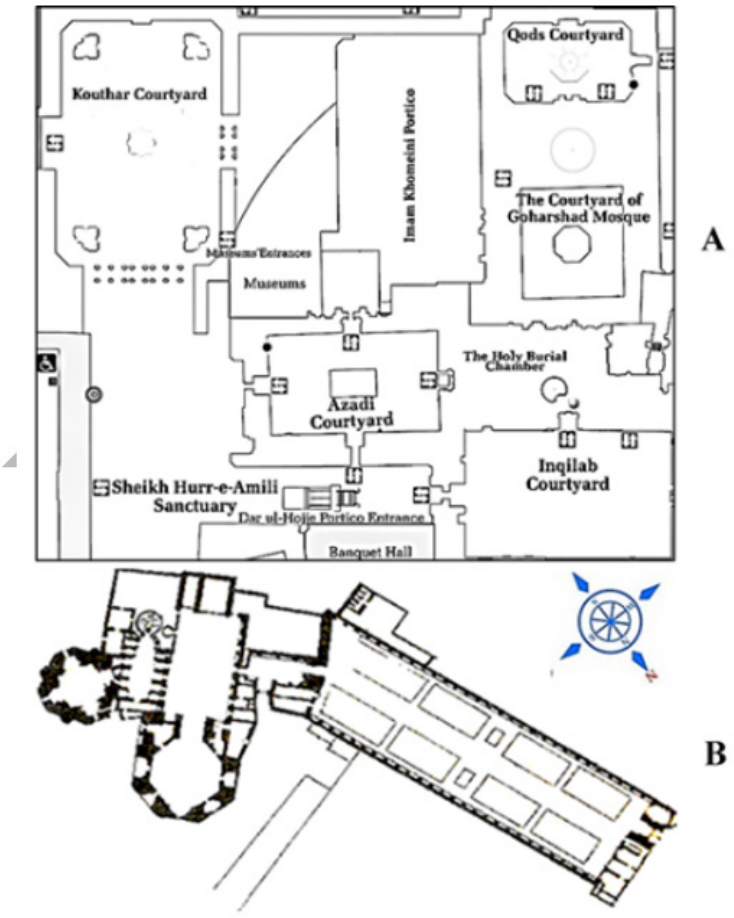


Fig. 1: Pictures of the buildings of the Holy Shrine of Imam Reza (A) and Sheikh Safi al-Din Ardabili complex (B)

entrance porch of mosques, religious schools, and Imamzadehs in the Safavid and Qajar eras is the fact that the peacock is considered a bird of paradise, and it served as a gatekeeper and guide for people in the mosque and at the same time expels the devil and invites the believers to enter (Khazaei, 2017; Rahmani & Hesami, 2017). In general, the motif of the peacock bird is often defined as a symbol of purity, beauty, and dignity in the historical works of Iran (Nikandish et al., 2019). The expansion of the divine lights (Jafarzadeh, 2017) is a symbol of eternity and completeness (Rajabi Asl, 2016), and it shows the same nature of all creatures and their softness because creatures appear and disappear as fast as a peacock opens and closes its tail (Nikandish et al., 2019).

Analysis of Intertextuality Relations of the Peacock Motif

According to Table 1 (In 11 cases), the peacock motif is an exclusive pretext type because a motif inspired this motif in the shrine of Imam Reza (AS) in Sheikh Safi al-Din Ardabili complex and was not inspired by a combination of motifs. It should be noted that according to the study's findings, in all motifs, the pretext type was exclusive, and the hypertext type was obtained from the transformation type, which has been omitted in Table 1 for brevity. Transformation type has been an additional- substitution due to internal changes in picture 2 compared to picture 1. It was added because the length and volume of the wings of motif two have increased. The nature of substitution is also since new colors have been substituted in Picture 1. The analysis of pictures 3, 4, 7, 10, 11, and 12 compared to their hyper textuality (picture 1) is the same as that of picture 2. In pictures 5, 8, and 9, the transformation type was only a substitution type due to the internal changes in these motifs. Because the only change in these pictures compared to picture 1 was the substitution of new colors. Only in picture 6 transformation was substitutional-ellipsis type due to internal changes. The nature of the substitution is due to the change of colors, and the ellipsis is because in picture 6, compared to picture 1, the peacock crown has been removed. The details of the findings are presented in Table 1 in the form of a comparative method.

Cow

The cow has been interpreted as the guardian angel of the quadrupeds. In Avesta, the word "cow" referred to all quadrupedal animals and was a prefix to the names of some animals (Pourdavood, 2015, 80). the cow embodies the great mother of all moon goddesses who have the role of sustenance, the productive force of the earth, abundance, reproduction, and maternal instinct. The horns are a symbol of the crescent moon. It also symbolizes fertility, the protective power of Masculine, royalty, and the king. It also symbolizes the earth and the wet force of nature. Cow herding or chariot pulling is the embodiment of the solar warrior. It drives away and expels evil (Chevalier & Gheerbrant, 2006, 680).

Analysis of Intertextual Relations of the Motif of Cow

The results of Table 2 indicated that the motif of the cow in both cases is of an exclusive pretext type; because a motif inspired this motif in the shrine of Imam Reza (AS) in Sheikh Safi al-Din Ardabili complex and was not inspired by a combination of motifs. Among all cow motifs, the hypertext type is the transformation type. The transformation type has been a substitution due to internal changes in picture 15 compared to picture 13. The nature of the substitution is that new colors have replaced picture 15. Also, in Picture 15, compared to Picture 13, the transformation type is of the substitution type. More details of the findings are presented in Table 2.

Pheasant

The pheasant is one of the birds that is considered a symbol of beauty in decorative motifs. It is an allegory of colorful lights, brightness, and the manifestation of the power of the sun (Chevalier & Gheerbrant, 2006, 206). It symbolizes virtue, modesty, good fortune, happiness, and blessed life (Cooper, 1987, 252). In historical motifs, it symbolizes the seeker of spirituality and harmony. It symbolizes a human seeking spirituality, mysticism, and happiness associated with theology and knowledge. Male and female pheasants play an essential role in the concepts of decorative motifs in the historical building of the Far East; Its male type is a symbol of cosmic harmony and life order due to its song and rhythmic movements, and when the female bird calls the male, her voice is like a thunderbolt, and the female bird is a symbol of a blessed and happy life (Khan Hosseinabadi & Eshraghi, 2018).

Analysis of Intertextual Relations of the Motif of Pheasant

According to Table 3, the pheasant motif is of an exclusive pretext type; because a motif type inspired this motif in the shrine of Imam Reza (AS) in Sheikh Safi al-Din Ardabili complex and was not inspired by a combination of different motifs. Also, the hypertext type is the transformation type among all cow motifs. The transformation type has been a substitution due to internal changes in pictures 18, 19, 20, 21, 22, and 24 compared to picture 16. The nature of the substitution is that new colors have replaced picture 16. However, in pictures 22 and 23, the pretext type was additional and substitution; in picture 22, the wings and tail of the pheasant have become more and longer, and in picture 23, the volume of the bird has increased.

The nature of substitution in both motifs is due to the substitution of new colors. In picture 6, the transformation was of substitution and ellipsis type due to internal changes. The reason for the nature of substitution is due to the change of colors, and the reason for the nature of the ellipsis is also since in picture 6, compared to picture 1, the pheasant crown has been removed. The analysis of the intertextuality of the pheasant motif in picture 17 is that the transformation type has been a substitution type due to internal changes in pictures 18 and 22 compared to picture 17. The reason is because of the

Table 1: The intertextuality of peacock motifs in Sheikh Safi al-Din Ardabili complex (Safavid period) and the shrine of Imam Reza (AS) (Qajar)

Case	Transformation type due to internal changes	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
1	Additional- Substitution	 Picture (1)	 Section (1)	 Picture (2)	 Section (2)	78.58
2	Additional- Substitution	Picture (1)	Section (1)	 Picture (3)	 Section (3)	80.86
3	Additional- Substitution	Picture (1)	Section (1)	 Picture (4)	 Section (4)	74.84
4	Substitution	Picture (1)	Section (1)	 Picture (5)	 Section (5)	87.45
5	Substitutional-Ellipsis	Picture (1)	Section (1)	 Picture (6)	 Section (6) (Section (7	76.61
6	Additional- Substitution	Picture (1)	Section (1)	 Picture (7)		82.73

Continiue of Table 1: The intertextuality of peacock motifs in Sheikh Safi al-Din Ardabili complex (Safavid period) and the shrine of Imam Reza (AS) (Qajar)

Case	Transformation type due to internal changes	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
7	Substitution	(Picture (1	(Section (1	(Picture (8	(Section (8	78.47
8	Additional- Substitution	(Picture (1	(Section (1	Picture (9)	(Section (9	82.76
9	Additional- Substitution	(Picture (1	(Section (1	(Picture (10	(Section (10	77.80
10	Additional- Substitution	(Picture (1	(Section (1	(Picture (11	(Section (11	75.82
11	Additional- Substitution	(Picture (1	(Section (1	(Picture (12	(Section (12	79.87
The average percentage of respondents' consensus: 79.62						

substitution of colors. However, in pictures 19, 20, 21, 23, 24, and 25, compared to picture 17, the transformation type was of additional and substitution type because the wing crown and tail have been added in these pictures compared to picture 17.

Duck

In the Sheikh Safi al-Din Ardabili complex, a duck is placed in a golden rectangular frame flying in its context, and this art has been done by layering (Khan Hosseinabadi & Eshraghi, 2018). Some turn their heads in the opposite direction of their

Table 2: The intertextuality of cow motifs in Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) (Qajar period)

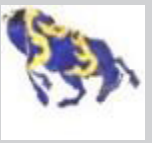
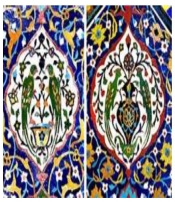
Case	Transformation type due to internal changes	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
1	Substitution	 Picture (13)	 Section (13)	 Picture (15)	 Section (15)	72.48
2	Substitution	 Picture (14)	 Section (14)	Picture (15)	Section (15)	80.36
The average percentage of respondents' consensus: 76.42						

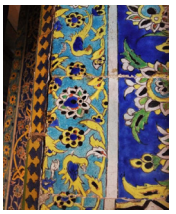
Table 3: The intertextuality of pheasant motifs in Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) (Qajar period)

Case	Transformation type due to internal changes*	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
1	Sub	 Picture (16)	 Section (16)	 Picture (18)	 Section (18)	75.53
2	Sub	Picture (16)	Section (16)	 Picture (19)	 Section (19)	80.64

Continiue of Table 3: The intertextuality of pheasant motifs in Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) (Qajar period)

Case	Transformation type due to internal changes*	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
3	Sub	Picture (16)	Section (16)	 Picture (20)	 Section (20)	74.34
4	Sub	(Picture (16	(Section (16	 Picture (21)	 Section (21)	67.42
5	Sub	Picture (16)	Section (16)	 Picture ((22	 Section (22)	80.71
6	Add-Sub	(Picture (16	Section (16)	 (Picture (23	 Section (23)	72.36
7	Add-Sub	Picture (16)	Section (16)	 (Picture (24	 Section (24)	69.76
8	Add-Sub	Picture (16)	Section (16)	 Picture (25)	 Section (25)	75.52

Continiue of Table 3: The intertextuality of pheasant motifs in Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) (Qajar period)

Case	Transformation type due to internal changes*	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
9	Add-Sub	 Picture (17)	 section (17)	Picture (18)	Section (18)	80.51
10	Sub	Picture (17)	section (17)	Picture (19)	Section (19)	76.80
11	Sub	Picture (17)	section (17)	Picture (20)	Section (20)	77.42
12	Sub	Picture (17)	section (17)	Picture (21)	Section (21)	81.74
13	Add-Sub	Picture (17)	section (17)	Picture (22)	Section (22)	69.79
14	Add-Sub	Picture (17)	section (17)	Picture (23)	Section (23)	72.50
15	Sub	Picture (17)	section (17)	Picture (24)	Section (24)	70.55
16	Sub	Picture (17)	section (17)	Picture (25)	Section (25)	81.21
The average percentage of respondents' consensus: 75.43						
. Add-Sub: Additional- Substitution; Sub: Substitution						

bodies and look at each other simultaneously as if they tend to one axis. The text of the painting is full of flowers, leaves, and ivy and looks more like a garden from a bird's eye view. The number of ducks is 40, without considering the three birds whose half of their body is painted and the other half of their body is outside the frame (Rajabi Asl, 2016). The proportion and arrangement of the birds, which were depicted flying around an axis, is somehow reminiscent of the phrase "unity in plurality and plurality in unity." Most likely, the birds are a symbol of the angels, and their direction to the center refers to the world of truth and the oneness of God (Jafarzadeh, 2017).

Analysis of Intertextual Relations of the Motif of Duck

According to Table 4, the duck motif is of an exclusive pretext type; because a motif type inspired this motif in the shrine of Imam Reza (AS) in Sheikh Safi al-Din Ardabili complex and was not inspired by a combination of different motifs in the building. Also, in these motifs, the hypertext type is the transformation type. Due to internal changes, the transformation type has been an additional- substitution type. The nature of the substitution is that new colors have replaced picture 27 compared to picture 26. The nature of the addition is since the shape of tears and circles that can be seen in the wings, body, and feathers of duck 27 have been added to the original shape. More details are provided in Table 4.

Dragon

A dragon is a winged serpent, a combination of snake and bird, meaning matter and spirit (Khan Hosseinabadi & Eshraghi, 2018). It is a creature with two traits, which in the most ancient times was a symbol of destruction and prosperity (Chevalier & Gheerbrant, 2006, 123). The dragon concept in the West and the East has opposite meanings (Jafarzadeh, 2017). In the East (like China), it symbolizes happiness and a sign of divine power. But in the West, it is a creature associated with the gods of the underworld, destructive and evil. The dragon or the devil is trying to dominate the tree of life, which causes drought and mixing water with the pestilence of saltiness and bad taste. The face of the dragon in the mythological history of Iran is extremely fierce and ugly (Khan Hosseinabadi & Eshraghi, 2018). The dragon is the guardian of hidden treasures, so to get them, you have to defeat him (Cooper, 1987, 18). According to many traditions and myths, the dragon in Iran is a symbol of evil and the devil, and it is a symbol of death, drought, and hell. It symbolizes a concupiscent soul (Khan Hosseinabadi & Eshraghi, 2018). Therefore, in Sheikh Safi al-Din Ardabili's complex, it is in the concept of the battle between good and evil. Also, on the four sides of one of the rhombus-shaped forms, the blessed names of God had been engraved, which completes the sign and superiority of right over falsehood (Jafarzadeh, 2017).

Table 4: The intertextuality of duck motifs in Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) (Qajar period)

Case	Transformation type due to internal changes	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
1	Additional- Substitution	 Picture (26)	 Section (26)	 (تصویر۳-۴۳). مرغابی در حال پرواز، غرفهٔ بالای صفهٔ شرقی، رواق الله‌وردیخان. مأخذ تصویر: نگارنده. Picture (27)	 Section (27)	79.48

Intertextuality Relations in Dragon Motifs

According to Table 5, the dragon motif is of an exclusive pretext type; because a motif type inspired this motif in the shrine of Imam Reza (AS) in the Sheikh Safi al-Din Ardabili complex and was not inspired by a combination of different motifs. Also, the hypertext type in all motifs is of the transformation type. Due to the presence of internal changes in pictures 29, 31, 30, 32, 33, 34, 36, and 37, compared to picture 28, the transformation type was substitution and ellipsis type. The nature of the substitution is that new colors have replaced picture 28. The nature of the ellipsis is also since the dragon's body has been removed in all the forms mentioned. Only in picture 35, compared to picture 28, is there a substitution type of transformation; the color of the dragon motif has only been changed and used in the same way as the pretext. In the analysis of the intertextuality of pictures 30, 31, 32, 33, 34, 36, and 37, compared to picture 29, it can be said that all forms are of substitution and ellipsis type. Here, the substitution's nature is also due to the fact that new colors have replaced picture 29. The ellipsis nature is that the dragon's body has been removed in all the mentioned forms. Only in picture 35, compared to picture 29, is there a substitution type of transformation; because the color of the dragon motif has only been changed and has repeated in the same way as the pretext. More details are mentioned in Table 5.

Transformation Types due to Internal Changes

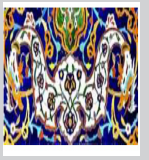
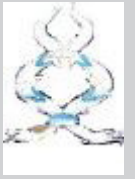
According to Fig. 2, among the animal motifs in the selected monuments, the largest number of additional-substitution transformation types was related to the peacock. Meanwhile, the largest number of substitution transformation types was related to the pheasant, and the largest number of substitutional-ellipsis transformation types was also related to the dragon. Other types of transformation were not observed in this study.

CONCLUSION

The research findings indicate the existence of intertextual relations in the majority of decorative animal motifs in the selected buildings related to the Islamic era. Also, according to the results of the Delphi method and research findings, motifs related to intertextual relations were determined in the architectural decoration of Sheikh Safi al-Din Ardabili complex (Safavid period) and the shrine of Imam Reza (AS) in the Qajar period, including animal motifs of the peacock, pheasant, dragon, cow, and chicken. According to the Delphi method, the average consensus percentage of the respondents was higher than 73%, which is a good value. The peacock is considered a bird of paradise, which acts as a gatekeeper and guide of people to the mosque and, at the same time, expels the devil and invites the believers to enter it. Considering the intertextual relations between motifs, the peacock motif is often determined as an exclusive pretext type. Also, the pretext type in all peacock motifs was the transformation type (the largest number of additional-substitution transformation types).

However, in picture 6, the transformation was of substitution and ellipsis due to internal changes. Considering the peacock's mystical and religious position in the Islamic era's historical works, strong intertextual relations can be observed between the buildings selected in this research for the peacock. According to the research of Chevalier and Gheerbrant (2006, 680), the cow was interpreted as the guardian angel of quadrupeds, the manifestation of fertility, the productive force of the earth, abundance, reproduction, and maternal instinct. According to the intertextual relations between the two selected buildings of the research, the cow motif is of an exclusive pretext type. Among all the cow motifs in the selected buildings, the pretext type is transformation type (often substitution). It seems that according to the diversity of cow motifs in historical buildings in Iran, the substitution in the colors of cow motifs indicates a

Table 5: The intertextuality of dragon motifs in Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) (Qajar period)

Case	Transformation type due to internal *changes	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
1	Sub-Ell	 Picture (28)	 Section (28)	 Picture (30)	 Section (30)	68.51
2	Sub-Ell	Picture (28)	Section (28)	 Picture (31)	 (Section (30	81.65
3	Sub-Ell	Picture (28)	Section (28)	 Picture (32)	 (Section (30	74.34
4	Sub-Ell	Picture (28)	Section (28)	 Picture (33)	 Section (33)	67.44
5	Sub-Ell	Picture (28)	Section (28)	 Picture (34)	 Section (34)	71.75
6	Substitution	Picture (28)	Section (28)	 Picture (35)	 Section (35)	69.70
7	Sub-Ell	Picture (28)	Section (28)	 Picture (36)	 Section (36)	75.52

Continiue of Table 5: The intertextuality of dragon motifs in Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) (Qajar period)

Case	Transformation type due to internal *changes	Sheikh Safi al-Din Ardabili complex (Safavid period)	Motif section	The shrine of Imam Reza (AS) (Qajar period)	Motif section	Consensus percentage of respondents
8	Sub-Ell	Picture (28)	Section (28)	 Picture (37)	 Section (37)	68.70
9	Sub-Ell	 Picture (29)	 Section (29)	Picture (30)	Section (30)	80.55
10	Sub-Ell	Picture (29)	Section (29)	Picture (31)	Section (31)	76.80
11	Sub-Ell	Picture (29)	Section (29)	Picture (32)	Section (32)	77.42
12	Sub-Ell	Picture (29)	Section (29)	Picture (33)	Section (33)	76.72
13	Sub-Ell	Picture (29)	Section (29)	Picture (34)	Section (34)	74.23
14	Substitution	Picture (29)	Section (29)	Picture (35)	Section (35)	72.55
15	Sub-Ell	Picture (29)	Section (29)	Picture (36)	Section (36)	70.11
16	Sub-Ell	Picture (29)	Section (29)	Picture (37)	Section (37)	72.26
The average percentage of respondents' consensus: 73.64						
Sub-Ell: Substitutional- Ellipsis .*						

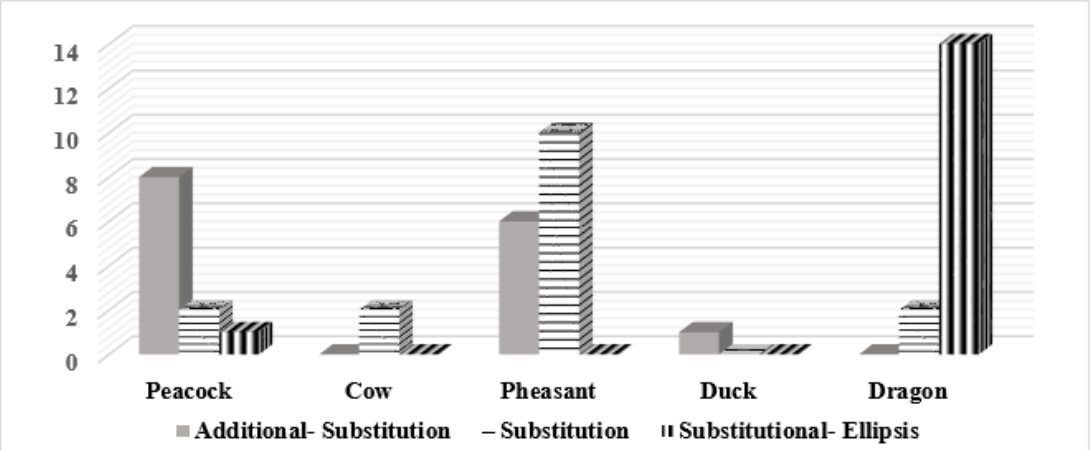


Fig. 2: Transformation types due to internal changes

conceptual change in the interpretation of the cow motif in the Islamic era. Although the interpretation of the cow motif has been emphasized in the concept of an abundance of blessings, the change to the spiritual content of the inner changes of the cow motif is hidden. The pheasant is a bird that symbolizes beauty, light, happiness, blessed life, and the sun's power. It symbolizes a human seeking spirituality, mysticism, and happiness associated with theology and knowledge.

According to the analysis of intertextual relations, the pheasant motif is also of an exclusive pretext type. Also, the pretext type in all motifs is the transformation type (the largest number of substitution transformation types). In the Sheikh Safi al-Din Ardabili complex, the proportion and arrangement of duck motifs (40 in number) which were depicted flying around an axis, is somehow reminiscent of the phrase "unity in plurality and plurality in unity." It seems that the birds are a symbol of the angels, and their direction to the center refers to the world of truth and the oneness of God. The birds were drawn like angels praising and obeying the right. According to the results, the duck motif is often of an exclusive pretext type. Also, the hypertext type in this motif is of the transformation type (additional- substitution).

In the East (like China), the dragon symbolizes happiness and a sign of divine power. But in the West, it is interpreted as a destructive and evil creature. Dragon is considered the cause of drought and mixing water with the pestilence of saltiness and bad taste. Also, the dragon is the guardian of hidden treasures, so you have to defeat him to get them. Confrontation with the dragon means overcoming difficulties to achieve the treasure of esoteric knowledge. Therefore, the collection of Sheikh Safi al-Din Ardabili complex and the shrine of Imam Reza (AS) is in the concept of the battle between good and evil and the superiority of right over false. In the analysis of intertextual relations, the dragon motif is of an exclusive pretext type here. Also, the pretext type in all motifs is the transformation type (the largest number of substitutional-ellipsis transformation types).

In sum, the intertextual relations in the obtained motifs indicate that in all the obtained motifs, the type of relations between the motifs in the selected buildings is of an exclusive pretext type. In addition, the pretext type in all motifs is of the transformation type (often substitutional-ellipsis). It seems that in line with the results of Jamali and Marasy (2013) and Mansori et al. (2019) in the buildings of the Islamic era in the Safavid and Qajar periods, the most important changes in the appearance of the motifs, the change in color and the use of more variety of colors. This has impacted the spiritual and mystical content of the motifs. In a way, in addition to the mystical and spiritual content (the content of the template in the Safavid period), in the Qajar period, attention to material aspects (increasing wealth and abundance of blessings.) in using colors have been considered more than the previous period.

AUTHOR CONTRIBUTIONS

H. Shahbazi Shiran contributed to designing and implementing the research and manuscript edition and directed the project. R. Esmi performed the literature review, analyzed, interpreted the data, and prepared the manuscript text.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or falsification, double publication and, or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Akhavani, S., & Mahmoudi, F. (2015). Investigating the effect of intertextual teachings on the analysis of applied arts (a case study of Neishabour pottery decorative patterns). *Journal of Applied Arts*, 1, 39-12.

Azar, E. (2016). An Analysis of Genetic Intertextuality Theories. *Literary Criticism and Stylistics Research,* 7 (24), 11-31.

Babazadeh Asbagh, N. (2022). Comparative Analysis of Qajar Historic Houses in Tabriz, Isfahan, Yazd, and Kashan, Regarding their Architectural Forms and Elements. *Proceedings of the International Conference of Contemporary Affairs in Architecture and Urbanism-ICCAUA,* 5(1), 586–605.

Chevalier, J. & Gheerbrant, A. (2006). *A Dictionary of Symbols,* Volume 4, Tehran: Jeihoon.

Chitsaz, S., Nedaei Fard, A., & Namvar Motlagh, B. (2019). An Inter-Textual Reading and Interpretation of Pomegranate Motif in Contemporary Jewelry of Iran Based on Archeological Pretexts. *The Monthly Scientific Journal of Bagh-e Nazar,* 16(77), 43-58.

Cooper, J. C. (1987). An Illustrated Encyclopaedia of Traditional Symbols. Thames & Hudson; Reprint edition.

Esmi, R., & Shahbazi Shiran, H. (2021). Comparative Study of Symbolic Motifs of Peacock and Simurgh in Selected Historical Monuments of the Safavid Period in Ardabil and Isfahan Cities (Iran). *Gazi University Journal of Science,* 1, 1-16.

Falaki, M., & Mehrafarin, R. (2020). The Study of Animal Motifs on the Compartmented Seals in Southeastern Iran. *Parseh J Archaeol Stud*. 3 (10), 39-50.

Hill, E. (2013). Archaeology and Animal Persons, Toward a Prehistory of Human-Animal Relations. Environment and Society: *Advances in Research.* 4, 117–136.

Jafarzadeh, B. (2017). *Investigating the relationship between the murals of Sheikh Safi collection and Quranic themes*. Master Thesis in Painting. Faculty of Arts. Shahed University.

Jamali, S., & Marasy, M. (2013). A comparative study of tiling decorations in the architecture of Safavid and Qajar period mosques based on four visual examples. *Journal of Visual and Applied Arts,* 5(10), 81-94.

Khan Hosseinabadi, A., & Eshraghi, M (2018). Symbolic meanings of

animal motifs of Golabad Allah Verdikhan tile from Safavid period in the holy shrine of Razavi. *Islamic Art Studies*, 14 (31), 1-36.

Khazaei, M. (2017). Interpretation of symbolic motifs of peacock and Simurgh in Safavid era buildings. *Journal of Visual Arts,* 26, 24-27.

Long, Y., & Yu, G. (2020). Intertextuality Theory and Translation. *Theory and Practice in Language Studies*, 10, 1106-1110.

Mansori, R., Nasr, T., & Hadiyanpour, M. (2019). Islamic Principles and Quranic Verses in Safavid Dynasty and Qajar Dynasty Masterpieces (Case Studies: Chahar-Bagh School-Mosque and Shah-Abdol-Azim Tomb). *Naqshe Jahan,* 9 (3), 191-202.

Namvar Motlagh, B. (2007). Transcripts Study the relationships of one text with other texts. *Journal of Literature and Humanities*. 56 (16), 83-98.

Nikandish, B., Askari, S., & Chitsazian, A. (2019). Symbology of Bird Motifs in Persian and Indian Carpets**. Peykareh,** 7(14), 33-51.

Norouzi, N., & Namvar Motlagh, B. (2018). Over-reading of four selected illustrations by Claudia Palmarousi with prefixes from Iranian painting. *Journal of Fine Arts - Visual Arts,* 23 (1), 5-16.

Pourdavood, A. (2015). Yashtha. Two volumes. Tehran: Asatir.

Rahmani, F., & Hesami, V. (2017). Study of Simurgh's Role in Iranian Art. *The Third National Conference on Iranian Archeology,* Tehran, 1169-1181.

Rajabi Asl, M. (2016). *Structural adaptation and analysis of the architectural designs and arrays of the tombs of Sheikh Amin al-Din and Sheikh Safi al-Din in Ardabil.* Master Thesis in Handicrafts, Traditional Arts Research Trend. Faculty of Arts, Soura Honar University.

Ryan, K., & Crabtree, P. J. (2018). *The Symbolic Role of Animals in Archaeology*. First edition, University of Pennsylvania Press.

Sardaraz, K., Roslan, A., & Nusrat, A. (2020). A Three-Tier Model for Intertextuality in the Holy Qurān. *Tahdhīb al Afkār*, 1, 15-36.

Shafiq, J. (2014). Architectural Elements in Islamic Ornamentation: New Vision in Contemporary Islamic Art. *Arts and Design Studies,* 21, 11-21.

Wessman, A. (2021). *Animals on display: animal motifs, human-animal relations, and social semiotics in the Bronze Age rock carvings from Enköping and Norrköping, Sweden.* Tabriz Akhtar, first edition.

Zamaniaghaiee, L., & Soltanzadeh, H. (2017). Interpretation of Quality and Dimensions of Intertextual Relations in Contemporary Public Constructions in Uzbekistan with Architectural Works in this Country at Timurid Era (Since 1960-1990). *Space Ontology International Journal,* 6(4), 1-16.

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 33-48 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI:10.30495/IJAUD.2023.71971.1671

Comparison of Women's Satisfaction and Empowerment through an Asset-Based Approach in Formal and Informal Settlements (Case Study: Zafaraniyeh and Rezvanshahr Neighborhoods in Tabriz)

***Raheleh Abdollahi*[1*], *Solmaz Babazadeh Oskouei*[2]**

[1*]*Assistant Professor, Department of Architecture, Mamaghan Branch, Islamic Azad University, Mamaghan, Iran.*

[2] *Assistant Professor, Department of Architecture, Oskou Branch, Islamic Azad University, Oskou, Iran*

Recieved 2023.02.21; Accepted 2023.10.24

ABSTRACT: The uneven capital distribution among settlements seems to have contributed to disparities in social classes, empowerment, and satisfaction. Empowerment refers to the expansion of assets and abilities; despite the key role of women in Iranian families, their empowerment has been neglected in studies. This study uses an asset-based approach based on the settlement types to measure and compare the level of women's satisfaction. This descriptive-correlational study used a questionnaire and observation to collect data from 376 women living in Tabriz's Zafaraniyeh and Rezvanshahr neighborhoods with formal and informal settlement patterns, respectively. The collected data were compared using a t-test between settlements regarding research variables, and the effect size was investigated using correlation and regression tests. The findings indicate that women in formal settlements have more capital, empowerment, and satisfaction than those in informal settlements. There is a significant difference between the women of both settlements regarding the research variables. The capital dimensions play a crucial role in predicting women's satisfaction directly and indirectly through empowerment. In formal settlement, physical capital (ß=1.370) and social capital (ß=0.120) have the highest and lowest effects, respectively. In contrast, in informal settlements, social capital (ß=0.560) and economic capital (ß=0.136) show the highest and lowest effects, respectively. In conclusion, this study highlights that women with greater access to capital experience more empowerment, which leads to greater satisfaction. Therefore, benefiting more from the capital dimension result in higher levels of empowerment and satisfaction for women.

Keywords: *Women, Capital, Satisfaction, Empowerment, Formal/Informal Settlement, Tabriz.*

INTRODUCTION

From sociologists' point of view, the formation of social classes is influenced by the distribution of capital in a society (Grabb,1984; quoted by Mohammad Hosseini et al., 2019). Bourdieu believes that people's position in the social structure indicates how much cultural, social, and economic capital they have. On the other hand, possessing different types of capital leads to citizens' assets and ability expansion and empowerment (Narayan Parker, 2002). Empowerment has been investigated with different approaches that focus on the men group. Therefore, empowerment in postmodern planning thinking (Eberlei, 2007) for achieving development (Sell & Minot, 2018) and satisfaction (Hossain et al., 2019) is a necessity.

In other words, improving life quality is possible only with the participation of all sex groups, especially women. At the same time, empowering women is essential to create a more just and equitable world (Reshi & Sudha, 2022). Satisfaction studies, on the other hand, have demonstrated that regardless of gender, the level of satisfaction is a crucial factor in improving the quality of urban life (Türkoğlu et al., 2019; Hataminezhad et al., 2017; Karami et al., 2022). Few studies that have dealt with women's empowerment and life satisfaction have addressed the issue from an economic and social point of view, focusing on family well-being and not women's well-being. Iranian women often ignore their impact on society despite their important roles in families.

*Corresponding Author Email: *Abdollahi2013@iaumamaghan.ac.ir*

Thus, the traditional Iranian society must recognize women's abilities and capabilities that affect their satisfaction and empowerment, emphasizing local resources and capital. Accordingly, this study aims to address this issue using an asset-based approach to examine the dimensions that influence women's empowerment. This approach mobilizes a group's total assets and capital to create capacity and determines development based on capabilities. As far as we know, no previous study has seriously investigated the relationship between women's empowerment and satisfaction with a comparative approach between residential environments. However, Hossein et al. (2019) study focused on gender in Bangladesh and proved a positive relationship between empowerment and life satisfaction without considering the type of residential environment. The study confirmed the existence of a gender gap in life satisfaction and the difference between men and women since they draw satisfaction from different areas of empowerment. Also, Lu & Wu's (2022) research findings indicate that social capital was a mediator in the relationship between neighborhood environment and life satisfaction.

Furthermore, the study revealed that the relationship between neighborhood environment and cognitive, social capital was significant only for older women. In Iran, the only case is related to the Behzadfar et al. (2018) study, which found a correlation between satisfaction and empowerment with the asset-based approach, but only among residents of the informal settlement of the Islam Shahr neighborhood in Tehran. Therefore, examining the relationship between empowerment and satisfaction, focusing on women in both developed and developing countries, is essential. This study specifically compares the number of women's resources and capital in Tabriz's formal and informal settlements and its relationship with empowerment through a comparative approach. Additionally, the study aims to explore the relationship between empowerment and satisfaction among women from different social classes, which is an innovative aspect of this research. Differences in residence patterns indicate varying resource utilization and asset ownership levels, leading to differences in empowerment and life satisfaction. Thus, this study seeks to identify the factors contributing to residential satisfaction in different residential environments.

Based on the preceding, reviewing the related literature and recognizing the knowledge gap, this study extracted the relevant components regarding the subject of study and developed a conceptual model of the research. Then, comparable conditions were provided for the research by designing a questionnaire and choosing two residential environments of two formal and informal types. In the final stage, the research hypotheses and relationships between variables were tested (Figure 1).

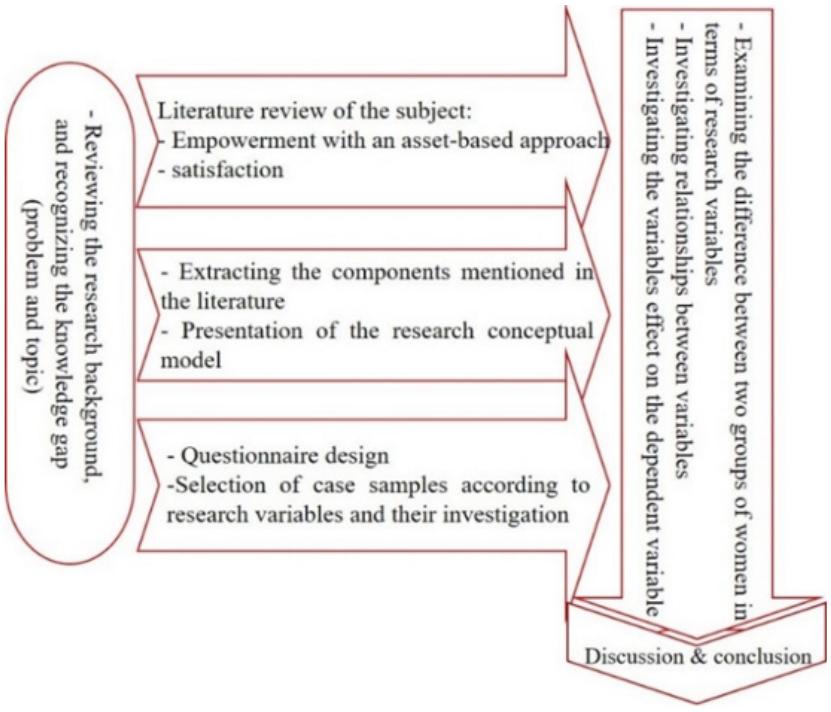


Fig. 1: Research outline

Literature Review

Empowerment with an asset-based approach

Empowerment strengthens one's sense of self-efficacy, defined in the Oxford Dictionary as "giving authority and power to someone to do something." It involves expanding people's assets and abilities to participate, negotiate, influence, control, and protect accountable institutions, which can affect their lives (Narayan-Parker, 2002). With the emergence of the asset-based approach in the late 1980s, in contrast to the need-based perspective (Grant, 1991; Kubisch et al., 1995; Porter & Habiby, 1999), the empowerment policy based the development of the local community on its assets. By mobilizing the total available resources of a local community, not necessarily what it needs, this approach has helped build capacity and mobilize social and financial (Glickman & Servon, 1998) or physical assets of the local community, leading to the integration of people and place well-being (Arafi, 2008). Recognizing the significance of local assets in enhancing community health, experts have categorized them into three main types of capital: physical, natural, and human. In the meantime, cultural capital has also been identified as the fourth type of capital, distinct and separate from the other three (Throsby, 1999). According to Kabeer (1999), resources or capital that enhance the ability to choose can be categorized as material, social, or human. Li et al. (2021) examine the effects of psychological, social, and human capital. On the other hand, Bourdieu believes that four types of capital are exchanged between social groups, which include economic capital (the wealth and money that each social actor has), Cultural capital (special skills, taste, language proficiency, educational qualifications, and ability to recognize and utilize cultural goods); Social capital (social obligations and responsibilities, connections, group relations, social networks, or organizations) and Symbolic capital (a part of cultural capital) (Turner & Turner, 1978).

Based on the preceding, as shown in Table 1, it can be stated that empowerment studies have referred to the importance of capital as the social, cultural, economic, and physical ability of individuals or local communities that are interconnected to meet the needs of residents in settlement areas. This study is focused on these four dimensions of capital as the fundamental criteria of empowerment, as mentioned below. So by considering and harnessing these types of capital, individuals and communities can enhance their ability to achieve their sustainable goals and improve their quality of life.

1. Physical capital refers to material resources such as housing, roads, parks, and public spaces (Ostrom, 1997). These resources are subject to wear and tear over time due to consumption and use, which can result in their erosion and decline.

2. Social capital plays a significant role in people's daily life. It is an intangible form of capital that encompasses demands, commitments, and expectations within relationships, networks, and communications in various fields of life (Kabeer, 1999, 11). This capital also includes the characteristics of social organizations, such as norms, social networks, and trust, which facilitate cooperation to achieve mutual benefit (Putnam, 1992). In other words, according to Putnam (1992), social capital plays an accelerating role in mobilizing financial, physical, and human resources toward achieving larger social goals (Wallis et al., 1998). Vafaei et al. (2022) identify communications and interactions, participation, collective norms and values, social network, and trust as the most influential criteria of social capital. So, strengthening community organizations would help improve the residents' quality of life necessary for achieving sustainable societies (Kshetrimayum et al., 2020).

Table 1: Capital dimensions from the researchers' perspective

Researchers	Year	Physical capital	Social capital	Cultural(human) capital	Economic capital	Natural capital
Bourdieu	1986		*	*	*	
Putnam	1992	*	*		*	
Glickman & Servon	1998	*	*	*	*	
Kabeer	1999		*	*	*	
Throsby	1999	*		*		*
Arafi	2008	*	*		*	
Mohammad Hosseini et al.	2019		*	*	*	
Li et al.	2021		*	*		

3. Cultural capital is embodied in a person. It includes various forms of knowledge, skills, creativity, and imagination (Kabeer, 1999, 11), as well as specialized skills, taste, language proficiency, educational qualifications, cognitive ability, and the usability of cultural goods, which individuals use to differentiate themselves from others (Ganji & Heydarian, 2014).

4. Economic capital is the most obvious and tangible type of capital, which includes a variety of assets such as bank assets, savings, cash, and the income earned by individuals, groups, and companies on a monthly or yearly basis (Piri & Rezaeiyan, 2014). Other assets, such as land, equipment, and working capital, are also considered part of an individual's financial capital (Kabeer, 1999). These assets are institutionalized as property rights and financial and material assets (Ganji & Heydarian, 2014).

Components of Women's Empowerment

Women's empowerment is a process during which women become aware of their needs and desires, strengthen the courage to achieve their goals through self-belief and self-confidence, and have the necessary ability to implement those (Mousavi & Ravankhah, 2016). On the other hand, women's empowerment has been announced at the center of the development discourse as one of the Eight-Millennium Development Goals (O'Hara & Clement, 2018). To achieve women's empowerment and sustainable development, there is a need to enhance women's skills, economic opportunities, education, and self-confidence (Reza & Yasmin, 2019).

In this regard, the United Nations has identified five key components of empowerment for women: a sense of self-worth, the right to access resources and opportunities, the right to make choices, the right to have the power to control their own lives, and the ability to influence the direction of social change to create more just social and economic order, nationally and internationally (Al Khayyal et al.2021; UN.Habitat, 2013). Bushra and Wajiha (2015) also have shown that women's empowerment in Pakistan is positively influenced by educational content, economic participation, and available economic opportunities. UNICEF (1994), On the other hand, considers the framework of women's empowerment to encompass welfare, access to resources, awareness-raising, participation, and control. As a dynamic process, it includes women's ability to change the structures and ideologies that have kept them in a subordinate position (Ugbomeh, 2001). Regarding women's empowerment, Kabeer (1999) refers to three dimensions and factors that expand their ability to make macro and strategic life decisions in fields where they were previously denied this ability. The ability to choose can be viewed through three interrelated dimensions that enable decision-making. These dimensions include resources that create favorable conditions for selection, the agency at the center of the decision-making process, and achievements that result from the choices made. Overall, the research on women empowerment suggests that when women are given equal opportunities and access to resources, they can achieve their full potential and positively contribute to their families and communities (Reshi & Sudha, 2022).

Table 2 collected the components of women's empowerment from previous research. These studies have pointed to the significance of the power of choice-making, control, creating economic opportunities, self-belief, trust, awareness, and participation, which are also deemed as the most crucial aspects of women's empowerment in this study. These components are necessary for achieving gender equality and empowering women to improve their quality of life. Therefore, it can be said that women's empowerment involves creating conditions that enable women to make choices, build their agency, and achieve positive outcomes that result from their choices.

Satisfaction

Life satisfaction is evaluating one's quality of life based on

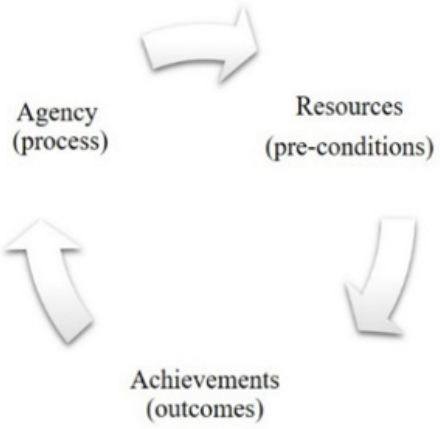


Fig. 2: Dimensions of empowering women (Source: Kabeer, 1999)

Table 2: The components of women's empowerment from the researchers' perspective

Researchers	Year	Components
Reshi & Sudha	2022	equal opportunities, access to resources
,Al Khayyal et al.; UN.Habitat	2013;2021	a sense of self-worth, the right to access resources and opportunities, the right to make choices, the right to have the power to control their own lives, the ability to influence the direction of social change
Reza & Yasmin	2019	improving women's skills, economic opportunities, education, self-confidence
Mousavi & Ravankhah	2016	self-belief, self-confidence
Bushra & Wajiha	2015	educational content, economic participation, available economic opportunities
Kabeer	1999	the right to choose and decide
UNICEF	1994	welfare, access to resources, awareness-raising, participation, control

criteria (Pavot & Diener, 1993). McConnell (1997) defines residential satisfaction as an individual's attitude towards their life, which can reflect their feelings about their past, present, or future, and is closely linked to well-being and comfort. Jiboye (2012) imagine it as a measure of people's attitudes toward certain aspects of their residential environment (Cited by Kshetrimayum et al., 2020). Numerous studies have demonstrated the impact of satisfaction on mental health (Siu & Philips, 2002; Fernandez-Portero, 2017). Satisfaction is related to people's mental health, such as reducing depression (Lee et al., 2020). In other words, life satisfaction predicts mental health, which can lead to a better quality of life and improved physical and mental health (Karimi et al., 2013).

According to Lansing & Marans (1969), a high-quality environment conveys a sense of well-being and satisfaction to its inhabitants through physical, social, or symbolic characteristics. On the other hand, residential satisfaction, a crucial part of life satisfaction (Campbell et al., 1976), is achieved when the individuals feel compatible with their surroundings (Fernández-Portero et al., 2017) and their needs are met (Coulombe et al., 2016; Hadavi, 2017). It is often defined by comparing residents' actual and aspired needs. Therefore, subjective evaluation of the residential environment is crucial since it primarily depends on residents' observation, perception, and impression of the environment (Mridha, 2020, Quoted from Jansen, 2014). It can be said that satisfaction is thus formed based on the ideals, needs, and abilities of families, and any inequality between these three factors and the existing situation can lead to dissatisfaction and displacement (Mohit et al., 2010). This means that the level of residential satisfaction can affect the residents' decision to leave or stay in a place (Bonaiuto et al., 1999; Kamlipour et al., 2012), as it affects concepts such as place belonging, participation, and permanence of residents (Arvin et al., 2020). Therefore, residential satisfaction can be defined as the experience of pleasure, satisfaction, and happiness resulting from living in a specific place (Bonaiuto et al., 2003). Moreover, factors such as material standards of living, housing quality, access to basic services, social connections, physical and mental health, sense of belonging, access to public facilities, social problems, and effective governance have been identified as crucial factors affecting life satisfaction in informal settlements in South Africa (Richards et al., 2007).

This study evaluated the most important components related to life quality, including comfort and mental health, pleasure and enjoyment, adaptability, permanence, place belonging, and participation, to measure residents' satisfaction levels in both formal and informal settlements.

MATERIALS AND METHOD

In terms of nature, the present study is descriptive-analytical research in the field of correlational research. In the first step, information and components needed to formulate the research conceptual model (Figure 3) were extracted using the library method based on previous research and researchers' opinions on empowerment, asset-based approach, and satisfaction. Then, based on the indicators obtained from the study of the theoretical foundations, the operational model of the research was obtained according to Figure 4. In the second step, the study was conducted by field survey method and using the tools of direct observation, questionnaire, and supplementary interview to collect data in the study area. The questionnaire is the main research tool, and other data were collected to ensure accurate measurement of variables and increase the validity of the measurement tools. The observation was directly collected and recorded the variables conditions, indicators, environmental events, and the behavior of the users. For comparative assessment, the researcher-made questionnaire was used to evaluate the variables of women living in both types of settlements. An interview was conducted with the respondents to understand why they chose the options and to clear their doubts.

The questionnaire comprised 62 questions using a five-point Likert scale (very much to very little). The questions' accuracy was confirmed by determining Cronbach's alpha coefficient (0.810). The current study focused on women residing in

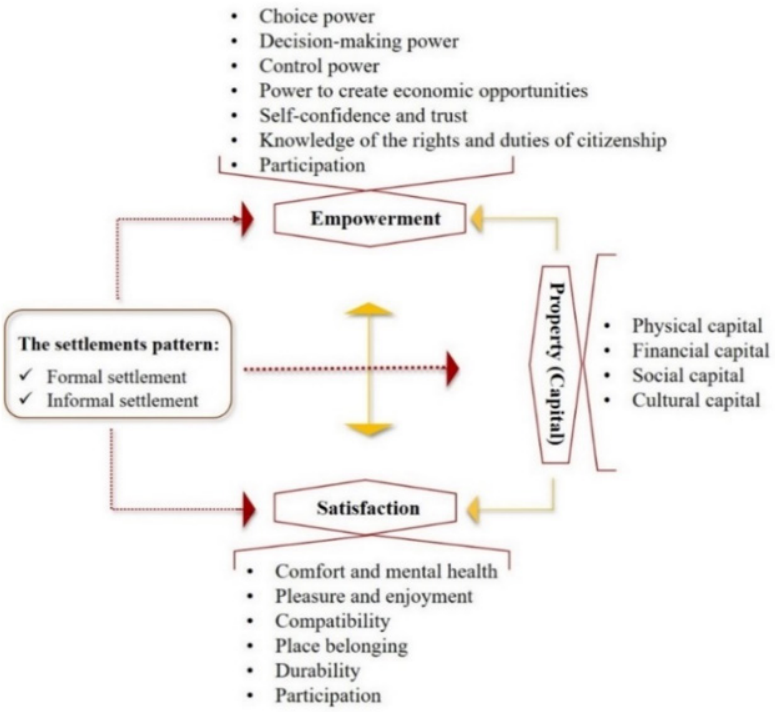


Fig. 3: The research conceptual model

the Zafaraniyeh and Rezvanshahr (Figure 5) neighborhoods, representing formal and informal settlement types. Zafaraniyeh (A) is located in the southeast region of Tabriz and is considered part of the 2-city region, while Rezvanshahr (B) is situated in the northwest of Tabriz and is part of the 4-city region. The study's statistical population included women over 18 residing in these neighborhoods. The sample consisted of 190 residents from Zafaraniyeh and 186 from Rezvanshahr, selected using Cochran's formula and a simple random sampling method. The sample was restricted to women who had resided in their respective neighborhoods for at least five years. In the final step, the questionnaire data was first analyzed using SPSS software and statistical tests such as t-tests, correlation, and regression to test the research hypotheses. The findings were then compared between the two settlements if confirmed with other tools' information. Based on this analysis, the final results of the study were determined. It is important to note that the accuracy of these results depends on the adaptation of data and the appropriateness of the statistical methods used.

RESULTS AND DISCUSSION

Investigating the Difference between Two Groups of Women

Tables 3 and 4 present the independent t-test results, indicating a significant difference between women in formal and informal settlements of Zafaraniyeh and Rezvanshahr. The amount of capital, empowerment, and satisfaction of women in formal settlement scored higher in terms of capital and empowerment, with scores of 3.4, 3.7, and 4, respectively, compared to women in informal settlement, with scores of 2.7, 2.9, and 3. This indicates that women in formal settlements benefit more from the research variables. In formal settlement, physical capital has the highest score of 3.9, followed by cultural capital with a score of 3.5, economic capital with a score of 3.3, and social capital with a score of 2.8. In contrast, informal settlements scored highest in social capital with a score of 3.6 and lowest in cultural, physical, and economic capital with scores of 2.8, 2.7, and 1.8, respectively.

The mean of the variables indicates that women in formal settlements have higher capital, empowerment, and satisfaction levels than women in informal settlements. However, the study also finds that women in formal settlements have lower social capital than women in informal settlements. Overall, the study shows a significant difference between women in the two types of settlements regarding their capital, empowerment, and satisfaction levels.

Regarding the findings, a field survey of the settlements' existing situation and additional statements from the respondents are presented in Tables 5 & 6. According to the

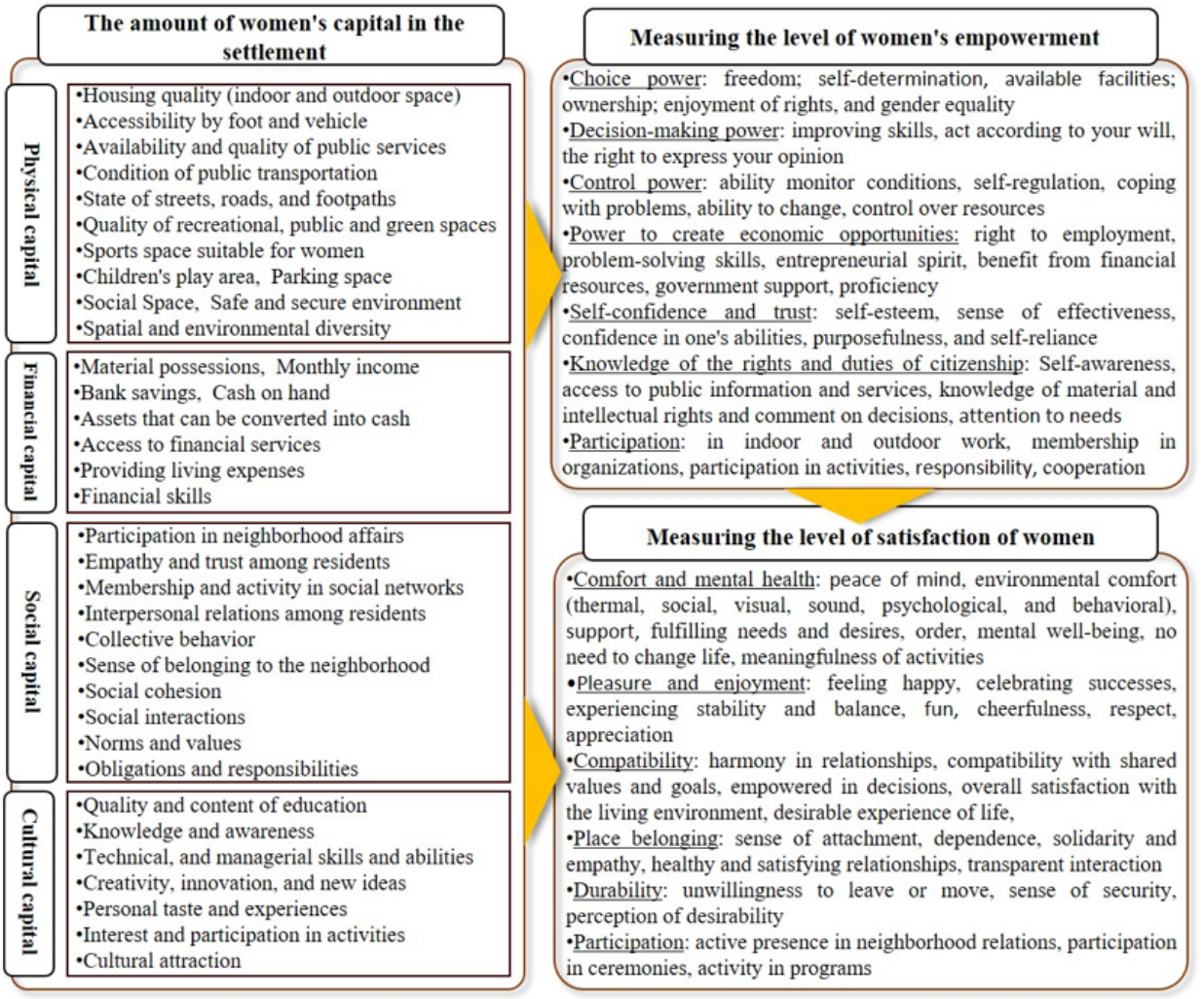


Fig. 4: The operational research model for measuring women's satisfaction level

confirmation of the results of the questionnaire, it can be said that social capital is desirable in informal communities due to a sense of dependence and belonging to neighbors, familiarity and social interactions, coherence and meaningful activity of social networks, empathy, and trust between residents. Physical capital is desirable in formal communities due to the favorable access by car and pedestrian, suitable quality of housing, proximity to important centers, coherent activity structure, the existence of suitable service and recreational spaces and children's play spaces, an attractiveness and legible environment, security, and accessibility to local shopping centers.

Variables Relationship

The study's theoretical model was examined using Pearson's correlation test to assess the relationship between variables. The findings reveal that in the formal settlement under investigation (Fig 6), the relationship between capital and satisfaction (r=0.662) is significant at a probability level of less than 1%. In comparison, the correlation between empowerment and satisfaction (r=0.406) is significant at a probability level of less than 5%. Additionally, this settlement strongly correlates capital and empowerment (r=0.859) at a probability level of less than 1%. These results suggest that the distribution of capital in local communities and women's access to various forms of capital are crucial for their empowerment and satisfaction. In other words, enhancing women's abilities and capabilities by providing access to all capital dimensions is vital for determining their satisfaction and plays a critical role.

The results of the correlation test in the informal settlement (Fig 7) reveal a significant relationship between capital and satisfaction, with a coefficient of (r=0.435), and between

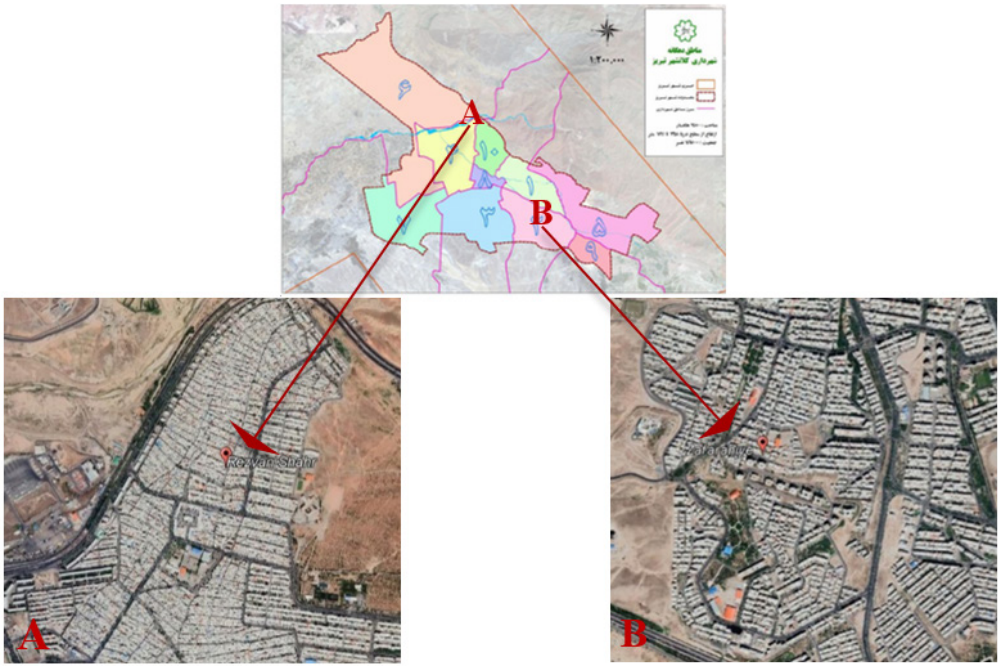


Fig. 5: A. Zafaraniyeh neighborhood, B. Rezvanshahr neighborhood (Source: Google Earth, 2022)

Table 3: Mean and standard deviation between the two groups of women

		Group	Mean	Std. Deviation	Std. Error Mean
Capital	Physical capital	Formal	3.9435	.37478	.06731
		Informal	2.7218	.28770	.05167
	Social capital	Formal	2.8806	.37896	.06806
		Informal	3.6065	.24757	.04446
	Economic capital	Formal	3.3333	.59784	.10737
		Informal	1.8280	.46445	.08342
	Cultural capital	Formal	3.5444	.36019	.06469
		Informal	2.8790	.45470	.08167
Total capital Informal		Formal	3.4255	.27227	.04890
		Informal	2.7588	.24860	.04465
Empowerment Informal		Formal	3.7043	.45635	.08196
		Informal	2.9554	.65685	.11797
Satisfaction Informal		Formal	4.0387	.460	.08278
		Informal	3.0548	.415	.0746

empowerment and satisfaction, with a coefficient of (r=0.387), at a 5% probability level. Also, there is a significant correlation between capital and empowerment, with a correlation coefficient of 0.617 at a probability level of less than 1%. Therefore, in both types of settlements, the amount of capital plays an important role in predicting women's satisfaction directly and indirectly through women's empowerment. In addition, based on the correlation coefficient values, it can be concluded that women in the formal settlement experience higher levels of satisfaction than those in the informal settlement, mainly due

Table 4: The independent t-test results

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Confidence Interval of the Difference- 95%	
						Lower	Upper
Physical capital	14.398	375	.000	1.22177	.08486	1.05203	1.39152
Social capital	-8.927	375	.000	-.72581	.08130	-.88843	-.56318
Economic capital	11.071	369	.000	1.50538	.13597	1.23305	1.77770
Cultural capital	6.386	375	.000	.66532	.10419	.45692	.87372
Total capital	10.068	375	.000	.66667	.06622	.53421	.79913
Empowerment	3.125	364	.003	.44892	.14365	.16086	.73699
Satisfaction	8.828	375	.000	.98387	.11144	.76095	1.20679

Table 5: Analysis of the environmental variables in the formal settlement of Zafaranieh using data matching

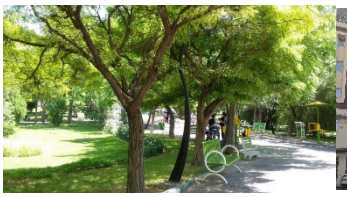
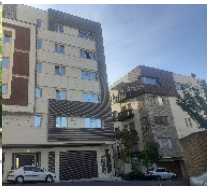
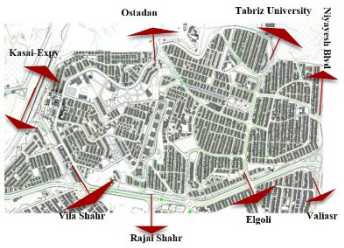
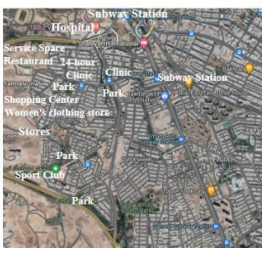
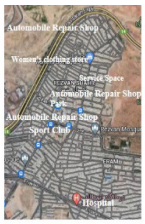
capital	Images and concepts			
Physical capital				
	Social control and supervision of neighborhood space Women's sense of security and comfortable presence in the neighborhood and feeling of peace	The existence of public service and recreational spaces, parks, and children's play space Easy and safe access for women	Providing family comfort with suitable and high-quality housing	Satisfaction with the condition of streets and sidewalks Proper flooring and inducing a sense of movement
				
	Adjacent to important centers and other neighborhoods and quick and easy access to them	The presence of local shopping centers and consistent business performance	The visual richness and beauty of the environment and the effect of space clarity and readability	Compatibility of activities with the needs of women and coherent activity structure Focusing complementary activities together
Social capital	Non-participation in neighborhood activities and ceremonies	Poor relations between families and residents of the neighborhood	Lack of feeling of responsibility in facing the issues and problems of neighbors' lives	Lack of recognition and awareness of neighbors

Table 6: Analysis of the environmental variables in the informal settlement of Razvanshahr using data matching

capital	Images and concepts			
Physical capital				
	-Lack of recreational and public services spaces, parks, and children's playgrounds Absence of shopping and commercial centers suitable for the needs of women in the neighborhood		Inadequate quality of housing and lack of family comfort	The heterogeneous growth of the neighborhood and the lack of separation of pedestrian and car paths and their unfavorable quality
	  			
	Disturbance and visual inconsistency in the streets and alleys--Unattractive environment Adjacent residential environment with incompatible uses and creating a sense of insecurity for the presence of women (lack of control and supervision in the neighborhood		-Dissatisfaction with the unfavorable situation of public transportation and lack of attention from the officials	Physical separation from the important centers and neighborhoods due to the peripheral location of the neighborhood
Social capital	Empathy and trust between residents and help in solving problems to achieve common goals	Coherence between residents and cooperation and participation in collective work and creating meaningful activities	-recognition and awareness of each other and understanding the necessity of cooperation and transparent social interaction	-Family relations between residents A feeling of connection with the neighborhood, dependence between the residents, and belonging to the neighbors

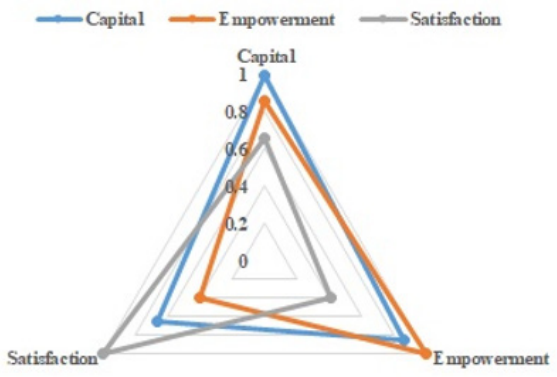


Fig 6: The correlation between research components in the formal settlement

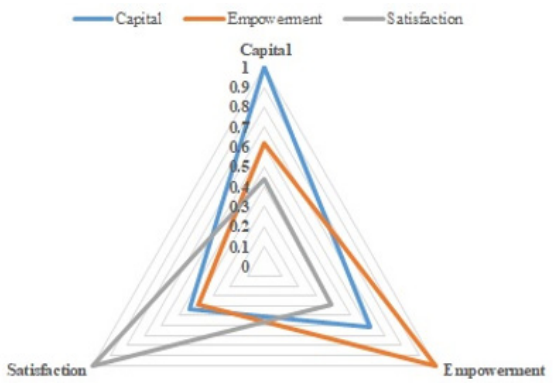


Fig 7: The correlation between research components in the informal settlement

to the greater and more favorable benefits of capital and the resulting improvement in their capabilities.

Table 7 indicates a significant relationship between the four capital dimensions and empowerment in both types of settlements. In Zafaraniyeh, the formal settlement, the cultural dimension correlates with empowerment (r=0.843), while the social dimension has the lowest correlation (r=0.397). In contrast, in the informal settlement of Rezvanshahr, the social dimension has the highest correlation with empowerment (r=0.850), and the economic dimension has the lowest correlation (r=0.281). Thus, social capital plays a more critical role in promoting empowerment in informal settlements than in formal settlements, where it has a weaker relationship with empowerment.

Table 8 results demonstrate a significant relationship between the four dimensions of capital and women's satisfaction in both types of settlements. In the formal settlement of Zafaraniyeh, the physical dimension has the highest correlation with satisfaction (r=0.767), while the social dimension has the lowest correlation (r=0.104). In contrast, in the informal settlement of Rezvanshahr, the social dimension has the highest correlation with satisfaction (r=0.560), and the cultural dimension has the lowest correlation (r=0.106). Therefore, social capital strongly correlates with satisfaction in the informal settlement. In contrast, physical capital plays a crucial role in predicting women's satisfaction in formal settlement, and social capital has a weak relationship with improving the quality of life.

Overall, based on the results of the independent t-test and correlation test, as well as the direct and indirect relationship between the capital dimensions and satisfaction, it can be concluded that women with greater access to capital and experience more empowerment have higher satisfaction levels. Therefore, promoting women's empowerment through access to various capital dimensions can improve women's satisfaction and quality of life in formal and informal settlements.

Investigating the Components' Effect on Women's Satisfaction

A multivariable linear regression test was used for both types of settlements to assess the impact of relevant components and indicators on women's satisfaction. The results (Tables 9 & 10) show that women exhibit a high level of satisfaction with the components under investigation, and women's capital is more important than empowerment, with the greatest effect in both settlements. Therefore, all the study's independent variables have strong explanatory power and can show the changes and variance of the dependent variable well. According to the findings, the following regression equations exist between the components:

Formal settlement: Satisfaction = - 0.570 + 2.024 (capital)

Table 7: The correlation test between capital and empowerment

	Empowerment	
	Formal	Informal
Physical capital	.789**	.448*
Social capital	.397*	.850**
Economic capital	.626**	.281*
Cultural capital	.843**	.607**

* And ** is significant at the 0.05 and 0.01 probability level (2-tailed), respectively.

Table 8: The correlation test between capital and satisfaction

	Satisfaction	
	Formal	Informal
Physical capital	.767**	.397*
Social capital	_.104*	.560**
Economic capital	.631**	.227*
Cultural capital	.265*	.106*

* And ** is significant at the 0.05 and 0.01 probability level (2-tailed), respectively.

- 0.627 (empowerment)

Informal settlement: Satisfaction = 1.047 + 0.728 (capital) + 0.402 (empowerment)

The test results regarding the dimensions of capital affecting women's satisfaction show that in the formal settlement (Table 11), physical capital has the greatest impact on women's satisfaction with a coefficient of 1.370. In contrast, social capital has the lowest impact, with a coefficient of 0.120. In contrast, in the informal settlement (Table 12), social capital has the greatest impact on women's satisfaction, with a coefficient of 0.560, while economic capital has the lowest impact, with a coefficient of 0.136. Therefore, in formal settlements, suitable housing, access, and suitable recreational and public spaces are considered the most important factors in women's satisfaction. Conversely, in informal settlements, women gain higher satisfaction levels from interpersonal relationships, membership in social networks, trust, and empathy between residents. The social dimension of capital is of greater importance than other capital dimensions in these settings. In summary, social capital is crucial for building and maintaining relationships, fostering cooperation, and mobilizing resources toward achieving shared goals.

Discussion

The study's findings indicate that women in formal settlements have higher capital, empowerment, and satisfaction levels than women in informal settlements. Women in formal settlements benefit more from physical and economic capital but have less social capital, while women in informal settlements benefit more from social capital and a sense of belonging. This finding is consistent with previous research by Türkoğlu et al. (2019), who reported higher satisfaction levels among residents of planned neighborhoods in Istanbul than those in unplanned neighborhoods. In this regard, Ahmadi et al.'s (2022) study showed that informal settlements suffer from a shortage of municipal services in the absence of standardized design.

Table 9: The regression test results in the formal settlement

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.570	.809		-.705	.487
Capital	2.024	.425	1.195	4.764	.000
Empowerment	-.627	.253	-.621	-2.475	.020

Table 10: The regression test results in the informal settlement

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.047	.774		1.354	.186
Capital	.728	.279	.435	2.605	.014
Empowerment	.402	.054	.223	-1.087	.040

Table 11: The regression test results between capital and satisfaction in the formal settlement

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.257	.558		-.462	.648
Physical capital	1.685	.155	1.370	10.857	.000
Cultural capital	.332	.106	.273	3.137	.004
Economic capital	-.932	.155	-.728	-6.003	.000
Social capital	.143	.008	.120	1.239	.012

Table 12: The regression test results between capital and satisfaction in the informal settlement

Model	Unstandardized Coefficients		Standardized Coefficients	t	.Sig
	B	Std. Error	Beta		
(Constant)	2.139	.259		8.251	.000
Social capital	.501	.138	.560	7.636	.000
Physical capital	.320	.099	.371	3.642	.001
Economic capital	.098	.117	.136	2.439	.015

The study also proved a positive and significant relationship between capital and empowerment variables with satisfaction in both formal and informal settlements, which is consistent with previous research by Hossein et al. (2019), Türkoğlu et al. (2019), and Behzadfar et al. (2018). Hussain et al. (2019) confirmed that empowerment is strongly linked to life satisfaction in rural Bangladesh. They also found that women who are empowered similarly to their male counterparts (as measured by empowerment levels) report higher levels of life satisfaction. Empowerment in the form of participation in family decision-making is an important capability and factor for satisfaction (Sen, 2008; Veenhoven, 2010) because it both reduces women's limitations in resource allocation and decision-making and increases women's responsibilities both inside and outside the home (Ibrahim & Alkire, 2007). Behzadfar et al. (2018) confirmed a correlation between empowerment indicators and residents' satisfaction in informal settlements in Tehran, as measured by the asset-based approach (physical, social, and financial capital). Türkoğlu et al. (2019) found that only a neighborhood's perceived physical and social capital quality significantly impacted satisfaction. This was observed in both formal and informal neighborhoods in the Istanbul metropolitan area. Therefore, the current research contradicts previous studies by demonstrating a relationship between cultural capital and satisfaction, and to some extent, between financial capital, empowerment, and satisfaction. On the other hand, this study found a significant relationship between capital and empowerment was proved in both types of settlements, which was confirmed and reported in previous research (Piri & Rezaeiyan., 2014, Behzadfar et al., 2018, Arefi, 2008) only on informal settlements. So, the current study generalizes this relationship to formal settlements as well.

In the last stage, the analysis of the findings (Fig 8) revealed that the capital dimensions are of higher importance than empowerment in improving women's life quality and satisfaction in both formal and informal settlements. In the formal settlement, physical capital showed the greatest effect on women's satisfaction, while social capital had the least effect. Conversely, in informal settlements, social capital had the highest effect on satisfaction, while economic capital had the lowest effect. This finding follows a study by Türkoğlu et al. (2019), which found that residents of planned neighborhoods were more satisfied with the physical capital (attractiveness and accessibility), while those in unplanned neighborhoods were more satisfied with the existing social capital (place attachment). Additionally, Ahmadi et al. (2022)

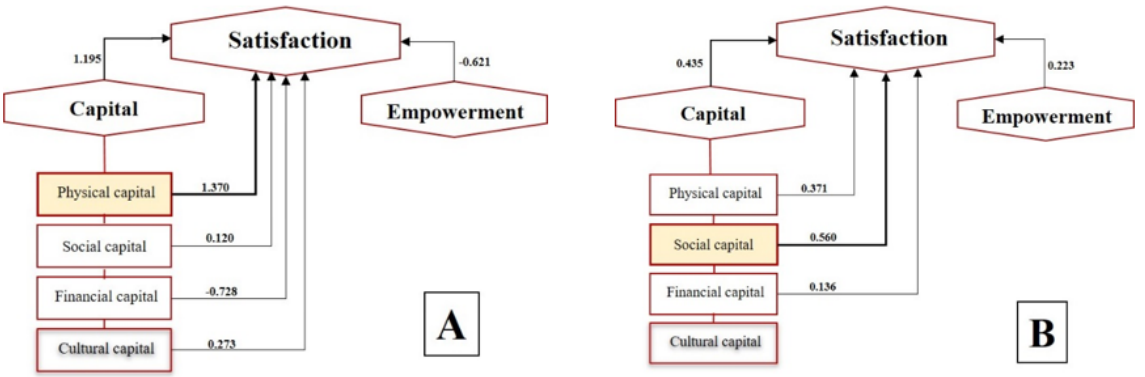


Fig 8: Path analysis results (A: Formal settlement, B: Informal settlement)

revealed that a sense of belonging, security, conformity with neighbors, and social interactions all have distinct impacts on residential satisfaction in unplanned settlements in Tehran. This finding is in contrast to a study by Rafiyan et al. (2015), which concluded that social dimensions had a greater impact on residential satisfaction in the planned area of Mehr Shahr Karaj and Behzadfar et al. (2018), who confirmed that in informal settlements, physical capital had the highest impact on satisfaction.

CONCLUSION

This study aimed to measure and compare the level of women's satisfaction in Tabriz based on the type of residential environment using the asset-based approach. The findings revealed that women in formal settlements have more capital dimensions, empowerment, and satisfaction than women in informal settlements. Therefore, a significant difference between women living in both types of settlements was proved in terms of these components. The results also indicated a significant relationship between benefiting from the capital dimensions and empowerment with women's satisfaction in both types of settlements. And empowerment in the form of benefiting from capital dimensions is considered an important capability for life satisfaction. This is, having greater access to various forms of capital, such as physical, cultural, social, and economic resources, increases women's empowerment and satisfaction levels. In other words, the more women benefit from these capital dimensions, the more likely they feel empowered and satisfied with their lives. Thus, the amount of benefit from capital dimensions plays a crucial role in predicting women's life satisfaction directly and indirectly through women's empowerment.

On the other hand, among the factors affecting women's satisfaction, the capital dimensions have the greatest impact compared to empowerment in terms of importance. Physical capital has the greatest effect on women's satisfaction in formal settlements, while social capital has the least effect. Conversely, social capital has the greatest impact in informal settlements, while economic capital has the least impact on women's satisfaction. According to the findings, it can be concluded that women residing in formal settlements experience higher satisfaction levels than those living in informal settlements due to the greater benefit of capital dimensions, which subsequently promote empowerment. The investigated capital dimensions are considered sources of power and strength for women, interconnected to improve the quality of life and satisfaction in both settlements. Also, this study highlights the need for policies and interventions that promote capital distribution and enhance women's empowerment, particularly in informal settlements.

AUTHOR CONTRIBUTIONS

R. Abdollahi Prepared the theoretical research model, analyzed and interpreted the data, and performed the manuscript text and edition. S. Babazade Performed the literature review and collected the data.

ACKNOWLEDGEMENT

This study was entirely self-funded. The authors would like to express their gratitude to those who assisted in the data collection process and the anonymous reviewers whose feedback helped enhance and elevate the scientific quality of this research.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or falsification, double publication and, or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Ahmadi, R., Ghahremani, S., Kivi, S. B., Bayat, F., Zareh, N., Rohani, A., ... & Janianpour, P. (2022). Investigating Social Factors of Residential Satisfaction and the Impact on Housing Price in Spontaneous Settlements in Tehran Fringe. *Open Access Library Journal,* 9(10), 1-21.

Al Khayyal, A. O., Alshurideh, M., Al Kurdi, B., & Salloum, S. A. (2021). Women empowerment in UAE: A systematic review. In *Proceedings of the International Conference on Advanced Intelligent Systems and Informatics 2020* (pp. 742-755). Springer International Publishing.

Arefi, M. (2008). *Asset-based approaches to community development. Un-habitat.* retrieved from: https://www.nurturedevelopment.org/wp-content/uploads/2016/01/

Arvin, M., faraji, A., & Azand, M. (2020). Investigation effect of residential satisfaction on population survival in Mehr housing projects (case study: Mehr housing Behbahan City). 11(41), 83-98.

Behzadfar, M., Noghrekar, A., & Salehi, K. (2018). Evaluation of empowerment indicators in informal settlements with asset-based approach in Tehran metropolis (Case example: Mianabad neighborhood of Islamshahr). Geography, 16(57), 96-114.

Bonaiuto, M., Aiello, A., Perugini, M., Bonnes, M., & Ercolani, A. P. (1999). Multidimensional perception of residential environment quality and neighbourhood attachment in the urban environment. Journal of environmental psychology, 19(4), 331-352.

Bonaiuto, M., Fornara, F., & Bonnes, M. (2003). Indexes of perceived residential environment quality and neighbourhood attachment in urban environments: a confirmation study on the city of Rome. Landscape and urban planning, 65(1-2), 41-52.

Bourdieu, P. (1986). The Forms of Capital. In J. Richardson (Ed.), Handbook of Theory and Research for the Sociology of Education.

Bushra, A., & Wajiha, N. (2015). Assessing the socio-economic determinants of women empowerment in Pakistan. Procedia-Social and Behavioral Sciences, 177, 3-8. https://doi.org/10.1016/j.sbspro.2015.02.321

Campbell, A., Converse, P. E., & Rodgers, W. L. (1976). The quality

of American life: Perceptions, evaluations, and satisfactions. Russell Sage Foundation.

Coulombe, S., Jutras, S., Labbé, D., & Jutras, D. (2016). Residential experience of people with disabilities: A positive psychology perspective. Journal of Environmental Psychology, 46, 42-54.

Eberlei, W. (2007). Accountability in Poverty Reduction Strategies: the role of empowerment and participation. *Social development papers,* 104, 244362-1164107274725.

Eberlei, W. (2007). Accountability in Poverty Reduction Strategies: The role of empowerment and participation. *Social Development Papers,* 104, 244362-1164107274725.

Fernández-Portero, C., Alarcón, D., & Padura, Á. B. (2017). Dwelling conditions and life satisfaction of older people through residential satisfaction. *Journal of Environmental Psychology,* 49, 1-7.

Ganji, M., & Heydarian, A. (2014). Cultural Capital and Economy of Culture. *Strategy*, 23(3), 77-97.

Glickman, N. J., & Servon, L. J. (1998). More than bricks and sticks: Five components of community development corporation capacity. *Housing Policy Debate,* 9(3), 497-539.

Grabb, E. G. (1984). *Social inequality: Classical and contemporary theorists.* Holt Rinehart & Winston.

Grant, R. M. (1991). The resource-based theory of competitive advantage: implications for strategy formulation. *California management review*, 33(3), 114-135.

Hadavi, S. (2017). Direct and indirect effects of the physical aspects of the environment on mental well-being. *Environment and Behavior,* 49(10), 1071-1104.

Hataminezhad, H., Heydari, A., Najafi, S., & Abbasifallah, V. (2017). Dimensions of the Quality of Life of Residents in Urban Vehicle Settlements (Case Study: Neighborhood of Islamabad of Tehran). *Journal of Urban Social Geography,* 4(2), 23-45.

Hossain, M., Asadullah, M. N., & Kambhampati, U. (2019). Empowerment and life satisfaction: Evidence from Bangladesh. *World Development*, 122, 170-183.

Ibrahim, S., & Alkire, S. (2007). Agency and empowerment: A proposal for internationally comparable indicators. *Oxford development studies*, 35(4), 379-403.

Jansen, S.J.T. (2014). The impact of the have-want discrepancy on residential satisfaction. *Journal of Environmental Psychology,* 40(1), 26-38.

Jiboye, A. D. (2012). Post-occupancy evaluation of residential satisfaction in Lagos, Nigeria: Feedback for residential improvement. *Frontiers of Architectural Research,* 1(3), 236-243.

Kabeer, N. (1999). *The conditions and consequences of choice: reflections on the measurement of women's empowerment* (Vol. 108, pp. 1-58). Geneva: UNRISD.

Kamalipour, H., Yeganeh, A. J., & Alalhesabi, M. (2012). Predictors of place attachment in urban residential environments: A residential complex case study. *Procedia-Social and Behavioral Sciences,* 35, 459-467.

Karami, I., Najafi, M., Javan Forouzande, A., Abdollahi, R. (2022). Explain the architectural design strategies of nursing homes from the perspective of satisfaction Case Study: Nursing Homes ("Ata," "Marhamat," and "Aftab") in Ardabil. *Journal of Architectural Thought*, 6(11), 55-72.

Karimi, T., Nouhi, E., & Iranmanesh, S. (2014). Comparing Life satisfaction of elderly between nursing home residents and seniors living in their own homes in Isfahan. *Elderly Nur J,* 1, 43-54.

Kshetrimayum, B., Bardhan, R., & Kubota, T. (2020). Factors Affecting Residential Satisfaction in Slum Rehabilitation Housing in Mumbai. *Sustainability*, 6, 2344.

Kubisch, A C, Connell, J P, Schorr, L and Weiss, C. (1995). *New Approaches to Evaluating Community Initiatives: Concepts, Methods, and Contexts.* The Aspen Institute, Washington, DC.

Lansing, J. B., & Marans, R. W. (1969). Evaluation of neighborhood quality. *Journal of the American Institute of Planners,* 35(3), 195-199.

Lee, S. W., Choi, J. S., & Lee, M. (2020). Life satisfaction and depression in the oldest old: A longitudinal study. *The International Journal of Aging and Human Development,* 91(1), 37-59.

Li, Z., Yu, Z., Huang, S. S., Zhou, J., Yu, M., & Gu, R. (2021). The effects of psychological capital, social capital, and human capital on hotel employees' occupational stress and turnover intention. *International Journal of Hospitality Management,* 98, 103046.

Lu, N., & Wu, B. (2022). Perceived neighborhood environment, social capital and life satisfaction among older adults in Shanghai, China. *Scientific Reports,* 12(1), 6686.

McConnell, E. S. (1997). *Conceptual Bases for Gerontological Nursing Practice: Models, Trends, and Issues. Teoksessa:* MA Matteson, ES McConnell & AD Linton: Gerontological Nursing, Concepts and Practice. Edition 2. Philadelphia, London, Toronto, Montreal.

Forouzande, A., Jahani Dolataabad, I., & Heidari, A. A. (2019). An Analysis of the Role of Social Class's Lifestyle in the Pattern of Housing; Case Study: The Late Qajar and Early Pahlavi Houses in Ardabil. *The Monthly Scientific Journal of Bagh-e Nazar*, 16(76), 31-44.

Mohit, M. A., Ibrahim, M., & Rashid, Y. R. (2010). Assessment of residential satisfaction in newly designed public low-cost housing in Kuala Lumpur, Malaysia. *Habitat International,* 34(1), 18-27.

Mousavi, M., & Ravankhah, F. (2016). Analyzing the relation of welfare systems with Women's Economic Empowerment. *Women's Studies Sociological and Psychological,* 14(1), 73-101.

Mridha, M. (2020). The effect of age, gender, and marital status on residential satisfaction. *Local Environment,* 25(8), 540-558.

Narayan-Parker, D. (Ed.). (2002). *Empowerment and poverty reduction: A sourcebook.* World Bank Publications.

O'Hara, C., & Clement, F. (2018). Power as agency: A critical reflection on the measurement of women's empowerment in the development sector. *World Development,* 106, 111-123.

Ostrom, E. (1997). Investing in capital, institutions, and incentives. *Institutions and economic development: Growth and governance in less-developed and post-socialist countries,* 153-181.

Pavot, W., & Diener, E. (1993). Review of the Satisfaction with Life Scale. *Psychological Assessment,* 5(2), 164–172.

Piri, I., & Rezaeiyan, M. (2014). Empowerment of informal settlements based on asset-based policies of community's development. *Motaleate*

Shahri, 3(10), 63-72.

Porter, M., & Habiby, A. (1999). A window on the new economy: Understanding the economic potential of the inner cities. Inc. Magazine. May, 49-50. Putnam, R. D., Leonardi, R., & Nanetti, R. Y. (1992). *Making democracy work: Civic traditions in modern Italy.* Princeton university press.

Reshi, I. A., & Sudha, T. (2022). Women Empowerment: A Literature Review. International Journal of Economic, Business, Accounting, *Agriculture Management and Sharia Administration (IJEBAS)*, 2(6), 1353-1359.

Reza, M. H., & Yasmin, N. (2019). Empowering Women: Empowering Bangladesh. *Open Journal of Women's Studies,* 1(1), 15-23.

Richards, R., O'Leary, B., & Mutsonziwa, K. (2007). Measuring quality of life in informal settlements in South Africa. *Social indicators research, 81(2), 375-388.*

Sell, M., & Minot, N. (2018, November). What factors explain women's empowerment? Decision-making among small-scale farmers in Uganda. *In Women's Studies International Forum*, Vol. 71, 46-55. Pergamon.

Sen, A. K. (2008). The economics of happiness and capability: In: L. Bruni, F. Comim & M. Pugno (Eds.), *Capabilities and Happiness:* 16-27.

Siu, O. L., & Phillips, D. R. (2002). A study of family support, friendship, and psychological well-being among older women in Hong Kong. *The International Journal of Aging and Human Development,* 55(4), 299-319.

Throsby, D. (1999). Cultural capital. *Journal of cultural economics,* 23(1), 3-12.

Türkoğlu, H., Terzi, F., Salihoğlu, T., Bölen, F., & Okumuş, G. (2019). Residential satisfaction in formal and informal neighborhoods: the case of Istanbul, Turkey. *Archnet-IJAR: International Journal of Architectural Research.*

Turner, J. H., & Turner, P. R. (1978). *The structure of sociological theory.* Homewood, IL: Dorsey Press.

Ugbomeh, G. M. (2001). Empowering women in agricultural education for sustainable rural development. *Community Development Journal,* 36(4), 289-302.

UN-Habitat (2013). *State of the World's Cities 2012/2013,* prosperity of cities, United Nations Human Settlements Program.

United Nations Children's Fund (UNICEF). (1994). *The Women's Equality and Empowerment Framework.*retrieved from: www.unicef.org/programme/gpp/policy/empower.html

Vafaei, S. S., Rafieian, M., & Lashkari, E. (2022). Identification Catalytic Projects of Development Based on Social Capital in Surrounding Areas of Imam Reza Holy Shrine (Case Study: Noghan Neighborhood in Mashhad). *Space Ontology International Journa*l, 11(2), 1-17.

Veenhoven, R. (2010). Capability and happiness: Conceptual difference and reality links. *The Journal of Socio-Economics,* 39(3), 344-350.

Wallis, A., Crocker, J. P., & Schechter, B. (1998). Social capital and community building: Part one. *National Civic Review*, 87(3), 253-272.

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 49-60 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI:10.30495/IJAUD.2023.72490.1673

Analyzing and Examining the Role of Computers in Improving the Quality of Undergraduate Architecture Projects

Babak Fadavi Akhavan[1], Shabnam Akbari Namdar[2*], Mirsaeed Mousavi[3]

[1] Ph.D. Candidate, Department of Architecture, Faculty of Art, Islamic Azad University of Tabriz, Tabriz, Iran.

[2] Assistant Professor, Department of Architecture, Faculty of Art, Islamic Azad University of Tabriz, Tabriz, Iran.*

[3] Assistant Professor, Department of Architecture, Faculty of Art, Islamic Azad University of Tabriz, Tabriz, Iran.

Recieved 2023.03.18; Accepted 2023.08.20

ABTRACT: The complexity of the field of architecture, its ever-increasing application, and the rapid growth of technologies and software used in this field necessitate the need to investigate the effects of computer software on the quality of students' learning and a solution to improve the role of software in learning. Therefore, research has been carried out to investigate the role of computers in improving the quality of undergraduate architecture projects. This research is applied research, and its nature is descriptive-analytical and inferential research. The data for this research was obtained through questionnaires distributed among 86 undergraduate students in the 3rd course. The final reliability of the questionnaire was 0.889 using Cronbach's alpha test. The research findings were analyzed using T-test, ANOVA, and Tukey's. The t-test showed that the role of computers in architecture students' learning rates differs from each other. Also, the ANOVA test results showed that students' learning amount based on the type of software has a significant difference equal to Sig=0.000. According to the results obtained from the findings of the research, it can be said that despite the effectiveness of computer systems in improving the learning of architecture students, the priority is on the individual and collective characteristics of students, and the use of computers should be appropriate to the nature of the course, students' ability and interest.

Keywords: *Architectural Design, Computer Systems, Gender, Software, Project Topic.*

INTRODUCTION

The research literature on the present topic, in terms of time, about how the architectural work is formed, goes back to the second half of the last century, which at the same time led to the emergence of a special field of knowledge in architecture, which is called the design process. (Asefi & Imani, 2016). In recent decades, this field has expanded and appeared more comprehensively, which is referred to as research design and includes various parts such as the design process, creativity, and artificial intelligence. (Priya et al., 2020) the research design is a word that includes all the studies carried out on how to perform design (Newton, 2019). A person's familiarity with the design process made what was considered a secret among architects in the past to be changed into a problem, and design is considered a way to solve the problem. The process of creative design in architecture includes stages of problem-solving and creativity. (Torabi, 2013, 54)

In recent years, application software in architecture has brought about considerable transformations in architectural design if people using these technologies can easily create different formal structures in other areas of aesthetics. Various new things arrive which could not even be traced in the designer's or employer's mind. Technologies can transform the human experience (Rosenberger & Verbeek, 2015, 10). It should be noted that technology gains meaning based on the type of use it is made (Aagaard, 2015). The relationship between humans and technology is different and ambiguous in different situations (Langsdorf, 2016).

In the current research, the qualitative improvement of architectural design is identified as a dependent variable, which includes the interface between the designer and the design, an element called creativity. In the following, creativity is considered the main variable to improve the quality of the design. Creativity is a mental process composed of the power of initiative and flexibility (Sternberg, 1988). The design process

*Corresponding Author Email: *namdar@iaut.ac.ir*

is based on a person's creative development, formed using architectural design tools. The conditions that affect the main variables of using architectural software and its relationship to cultivating creativity in a person are the subject of this research. The authors are looking for effective factors in improving the design quality, i.e., increasing the individual's creativity in the face of architectural software and related digital technologies in designing an architectural work, whether this architectural work is a professional project. It is considered an academic design exercise. Of course, here and in the current research, the meaning of architectural design is a design that can be got in Iran's university system and architecture studios by people (students) at a certain time.

In 1970, John Chris Jones divided the evolution of design methods into four eras of development of art and craft, design with the help of drawing, systematic and systematic design, and design in the present era. Artisans used limited tools to create their pieces during art and craft development and had a direct relationship between their thoughts and their hands. In the design period, with the help of drawing (Renaissance to 1950), the designer's method was not obvious to anyone, and sometimes the designer did not know how the problem was solved. Systematic design began in the 20th century and was according to the military needs of World War II. At this stage, design is a tool to solve a micro-problem and part of a more extensive system. The present age is the age of rapid technological changes or tech-oriented social innovations. One of the modern methods of evaluating the problem and discovering the plan in the contemporary period is the principle of changing the strategy and allowing the penetration of involuntary thinking into planned thinking and vice versa (Rezaei, 2014, 26).

According to the proposed problem, it can be said that the current research sought to find scientific answers to these questions.

What is the role of computer software in the learning rate of architecture students? What are the advantages and disadvantages of students learning two ways of designing with software and freehand design?

Horst Rittel divides the models presented for the design process into two generations. While the first generation (the 1960s) is defined based on scientific, rational, and systematic methods, the second generation (from the early 1970s) is for increasing the collaborative process of design and making the environment designer a partner of the problem owners, the employer, customers, users and introduces social groups (De Vries et al., 1993, 17).

After referring to Rittel's theory about two generations of rational and argumentative models, John Lang pointed to the emergence of a new generation of design under the title of hypothesis building and testing, which is influenced by Popper's ideas and relies on the mental structure of the designer himself. Ashraf Salame introduced three models for the design process: the intuitive model (black box approach), the rationalist model or problem-solving, whose approach is by the glass box, and two systematic design approaches and pattern language. The third model, the collaborative model, follows the research approach or design and refers to society (Salman et al., 2014). Voort and Van Vegan stated that the design was emphasized as a problem-solving activity in the first generation at the beginning of the 1960s. In the second generation (the second half of the 1960s to the mid-1970s), with growing criticism of the resulting failures, attention shifted to social solutions. The design methods movement ended in the third generation (the mid-1970s to 1980s). Thus, Alexander strongly opposed labeling any idea with the title of the method. In the fourth period (1990s to today), attention to information processing systems and decision support systems in design has increased significantly. The design process can include hypothesis and hypothesis testing, but it cannot be expressed as a cause-and-effect relationship; A bit; this process works relatively with a connection between change and disturbance.

Besides the design process, various researchers have provided several patterns for it. Alexander's model (Alexander, 1964, 94). Dubberly has classified these patterns as academy, advisory, cyclical, and hierarchical (Dubberly, 2004), while Cross has introduced design processes as two descriptive and prescriptive patterns (Cross, 2000, 30-34).

Along with the research of thinkers in the framework of expressing creativity, which has often been based on exploitation in the production of industrial products, experts of design techniques and psychology, idea generation, and idea generation have proposed a general form and typically in architecture in a certain way. That is often based on the behavioral and psychological sciences data and can be considered the result of generalizing research results and commenting on these basic sciences (Abel, 2013). Researchers in this field aim to understand the structure of the design process, design issues, solutions, and design thinking to help architecture design education and the development of computer-aided design techniques and software. Several architects, interior designers, industrial designers, engineers, urban designers, and urban planners can be considered among these researchers (Wyatt et al., 2012).

Before any other architectural phenomenon, architectural design will benefit from understanding the place of media in the world of architecture; because, in the contemporary period, the last medium between man and reality, the computer, recreates a critical role in the most tangible manifestation of design activity, namely the design process (Eilouti, 2018). The architectural design process without a computer disadvantages architectural design activity (Benzenberg, 2011). Today, architectural design, production processes, tools, ideas, theories, methods, and forms have widely influenced computers and communication technology (Cudzik & Radziszewski, 2018). The increasing use of computers in architectural and engineering design is

one of humanity's most important recent achievements in the design process and increases productivity in various stages of construction (Navarro et al., 2016; Vuletic et al., 2018).

Studies and research around the design process occupy a huge amount of research. Such texts remain from Archer and Christopher Alexander in the 1960s to the recent research of Cross, Ullman, Rosenberg, and Lawson and studies about design patterns, including Christian works (Gislason, 2010). Design methodological studies about design theories and paradigms have dealt with design's essence, the leaders of which are Simon and Shun (Menges & Ahlquist, 2011). Wiggin, Seva, and Torski have conducted extensive studies to investigate the information that architects think about and what they infer from their freehand sketches (Caetano et al., 2020), and Rioca based on existing models of design, Axman has proposed new models of digital designs that explain the difference between the developing paperless design style and the traditional paper-based process (Furniss, 2020).

Among the most significant research conducted in the role field of computers in improving the quality of architectural designs, Öztoprak & Çağlar (2020), in an article on examining the different dimensions of design methods in architectural design studios, investigated the innovative aspects of the subject and concluded that the use of simultaneous methods of idea generation by free hand and digital methods could lead to brilliant results in this field, providing comprehensive guidance of students in terms of creativity and visualization. Newton (2018), in an article about the optimization of design methods, pointed out that interactive solutions can improve students' creativity in this field because of the rapid growth of technology in architecture and urban development projects.

Mahdavinejad (2013), in the paper entitled "Creativity and the Process of Creative Education in Architectural Design," concluded that using computers can create a suitable platform and environment for the emergence of creativity. The research results showed that computer systems can simultaneously and interactively promote the role of the computer in the design of architectural projects by cultivating spatial intelligence and creativity. Jamiri et al. (2013), in a study entitled "Investigation of Adaptation of the Architectural Engineering Curriculum to the Needs of the Labor Market in Iran," concluded that the topics of the bachelor's degree in architectural engineering did not match the needs of the labor market, and computer expertise and specialized software lesson added to their class. Naserkhaki (2008), in a research paper entitled "The Role of Computer in Architectural Design Process: The Comparative Comparison of Two Generations of Contemporary Architects in Iran," concluded that two models, "the situational interaction model of the designer and the computer" and "the model of acquiring the skills of designers," are the needs of contemporary architects that should be considered in designing using computers. Asefi & Imani (2016) analyzed the effect of using digital software on promoting creativity in architectural design education. The research showed that developing computer systems could improve imagination in teaching applicable architectural design by creating dynamics and purpose.

MATERIALS AND METHODS

This research is based on the purpose of applied research, and in terms of nature and method, it is descriptive-analytical. According to the research hypotheses, the statistical population of this research includes undergraduate students studying in the architectural engineering field at Islamic Azad University and Tabriz University. According to the statistics from the education office, 86 students took design lesson 3 in three semesters. Because of the low number of students (the statistical population of the research), sampling was not done in this research, and the selection of the statistical population was based on the total number. The validity of the questionnaire was confirmed with the opinions of university professors, and the reliability of the questionnaire was confirmed using Cronbach's alpha, separately for each dimension. The results are in Table 1.

A review and study of all kinds of internal and external written sources, including books, articles, treatises, reports, and other written research, has been conducted. The general results from the studies show the existence of variables with various dimensions, including the type of software, age, gender, educational level, previous design experience, and freehand skills. In the quality improvement of the design. The variables Identified for the first hypothesis includes 25 variables in the

Table 1: Validity and Reliability Results of the Research Questionnaire

Dimension	Validity	Reliability
Anthropological	The item was approved in good condition	0.875
Environment design	The item was approved in good condition	0.902
Final	The item was approved in good condition	0.889

two dimensions of anthropological characteristics and design environment (Table 2).

Pearson correlation, t-tests, and ANOVA tests are used to analyze data. The t-test is used to check the average of independent groups. This test is used when the researcher's goal is to investigate the significance of the average difference of a trait in two.

Random samples from two independent societies. The assumptions of the t-test with two independent samples must meet the following conditions:

a) The variable whose average is compared in two independent groups must be quantitative (i.e., its scale must be interval or ratio).

b) The scale of the variables should be qualitative and at the nominal level (bi-dimensional).

c) The variables must be independent and distinct from the two populations.

d) Variable data distribution should be normal (Equation 1).

$$H_0 : \mu_1 = \mu_2$$

$$H_1 : \mu_1 \neq \mu_2$$

Equation 1: T-Test calculation method

Where μ_1 is the average of the first sample and μ_2 is the average of the second sample.

Analysis of Variance (ANOVA) test

Variance analysis tests are a set of statistical models that examine the average of groups and functions related to them

Table 2: The dimensions and indicators of each of the variables based on the studies conducted

Dimension	Index	References
Anthropological	Age	(Vowles et al., 2012; Asefi & Imani, 2016)
	Gender	(Glatt et al., 2007; Vowles et al., 2012)
	Interested in architecture	(Gorji Mahlbani & Sadeghi, 2018)
	Approach and motivation to use the software	(Bahmanesh nia & Sheikhiyeh Gol-Zardi, 2015)
	Previous design experience	(Mousavi & Pejohanfar, 2018)
	Practice and repetition times	(Mousavi & Pejohanfar, 2018; Asefi & Imani, 2016)
	The power of student visualization with project design	(Kalisperis et al., 2002; Navarro et al., 2016;
	Practice and individual software work during the design	(Navarro et al., 2016)
	Using self-learning resources in design (educational software, internet, mobile.)	(Benzenberg, 2011)
	Practice and software teamwork during the design	(Navarro et al., 2016)
	Software type	(Newton, 2019; Kruchten et al., 2009)
	The teacher's power of expression	(Al-Matarneh & Fethi, 2017)
	Time design	(Dalziel, 2003)
	Ambient light compatibility	(Gislason, 2010)
	Compatibility of tables and chairs with architectural work	(Gorji Mahlbani & Sadeghi, 2018)
	Atile's temperature compatibility	(Gislason, 2010)
environment Design	The elasticity of the labor market and the possibility of employment in the field of software	(Kruchten et al., 2009)
	Interacting with others while designing	(Sanchez & Mahoney, 1996)
	Type of computer system	(Mitchell, 2017; Salman et al., 2014)
	The number of corrections	(Henri, 2003)
	The degree of difficulty of the project	(Eilouti, 2018)
	The duration of experience working with the software	(Kruchten et al., 2009)
	The time limit for submitting the plan	(Green & Bonollo, 2004; Benzenberg, 2011)
	The degree of freedom of action of the student in the ideation of the plan	(Priya et al., 2020)
	Educational electronic peripherals (video projector)	(Mitchell, 2017; Salman et al., 2014)

(such as variance within a group or between multiple groups). In the analysis of variance, research hypotheses can take two forms: 1) the existence of a significant difference between variable groups: Do the means of the dependent variable differ in the groups created by the factor variable differ, or are they equal?

2) The existence of a cause-and-effect relationship between the variables: If the averages of the dependent variable in the groups created by the factor variable are not equal, it means that the independent variable affects the values of the dependent variable in the groups of the factor variable. If so, these two variables (independent and dependent) can have a cause-and-effect relationship. It can be said that variance analysis and variance analysis methods are a category of statistical models that can investigate the difference between groups or categories. Conditions to consider when using analysis of variance include:

• The values of each group or community must have a normal distribution.

• Variance must be constant in each group. This shows that the data should not contain "outliers."

• The variance of the groups should be equal to each other.

• The average must be different among the groups. This is the same expression we seek as a counterhypothesis in variance analysis. As mentioned in the method, to survey the quality of the projects presented by the students, similar criteria were needed to evaluate and prioritize the student's projects. Using these criteria, the data in the ultimate results of evaluating the goat quality of students' designs were presented in Table 3. The results of the findings in this field show that the measure of implementation ability and the progress from research to design had the lowest values, with values of 2.14 and 2.11, respectively. Regarding the criterion of executive ability, it can be said that this is caused by the major weakness of education in Iranian universities, which ignores the needs and demands of the labor market. Also, regarding the criterion of the transition from research to design, it can be said that one of the biggest challenges of education in architecture is the lack of attention to theoretical foundations and theoretical studies that lead to the presentation of surface designs because of the lack of study before the design process begins. The results connected with the criteria of creativity, attention to the texture of the designed site, aesthetics, proposed materials, change of climatic conditions, and the ability to express the design taken from the software verbally were also higher than the average (5-2.5-1). Using software in the design of architectural projects leads to improved beauty of the architecture design, enhanced ability of the student to explain their project, greater freedom of action in choosing materials, improved visual aesthetic dimension of the architecture design, and better analysis of the project site because of the ease of use of the site maps (Table 3).

Besides deepening the criteria of project evaluation by separate gender criteria, project subject, and the type of software used for design, the difference between the average of design evaluation scores has been separated by separating the above three criteria. The most important findings of this section of the study show that, in terms of executive criteria, male students with an average of 2.74 were over 2.60 female students. Also, in both groups of male and female students, the project's implementation criteria on residential issues have been more than other issues. Regarding the measure of creativity, the average got for male students is 2.91, and for female students, it is 9.71. Also, most of the calculated averages were for recreational projects in both groups of male and female students. The results of the research findings regarding the criterion of progress from research to design also showed that female students with an average of 2.64 were more compared to male students with a value of 2.42. The got results for the criterion of paying attention to the texture of the site in the design showed that there was almost an equal number of male and female students. In terms of aesthetic criteria and the overall fit of the project, female students had an average score of 2.67, which was higher than the average male 2.49 for students. According to this criterion, the highest scores were related to residential, recreational, and commercial projects. (Table 4)

Table 3: The Obtained Average from Students' Projects According to Eight Criteria

Criteria Evaluation	Quality Average
To The Existing Execute	2.14
create	2.62
From research to design	2.11
Attention to the existing texture of the site in the design	2.65
General aesthetics	2.51
Suggested materials	2.64
setting environmental conditions (climate)	2.66
The ability to verbally express the plan taken from the software	3.01

RESULTS AND DISCUSSION

The research results using the t-test show that the role of computer use in improving the quality of architecture projects of undergraduate students has a significant difference between the two groups of male and female students. The role of the computer among these two groups of students in terms of the variables of executive ability, creativity, progress from research to design, attention to the existing texture of the site in the design, general aesthetics, the suitability of the proposed

Table 4. Character and score of each criterion

Score	Character		criteria evaluation	Score	Character		criteria evaluation
49 .2	Male	Gender	General aesthetics	2.74	Male	Gender	Executable capability
2.67	female			2.60	female		
2.54	Residential	Project Subject		2.74	Residential	Project Subject	
2.50	Commercial			2.56	Commercial		
2.46	Educational			2.55	Educational		
2.51	Recreational			2.63	Recreational		
2.36	Treatment			2.61	Treatment		
2.88	3-D	Software		2.84	3-D	Software	
2.71	V-Ray			2.75	V-Ray		
2.70	SketchUp			2.64	SketchUp		
2.64	Autocad			3.05	Autocad		
2.70	Revit			2.62	Revit		
2.41	Male	Gender	The proportion of the proposed materials with the subject of the project	2.91	Male	Gender	Creativity
2.44	female			2.71	female		
2.56	Residential	Project Subject		2.78	Residential	Project Subject	
2.54	Commercial			2.54	Commercial		
2.50	Educational			3.05	Educational		
2.52	Recreational			3.14	Recreational		
2.52	Treatment			2.64	Treatment		
2.45	3-D	Software		3	3-D	Software	
2.54	V-Ray			2.89	V-Ray		
2.53	SketchUp			2.71	SketchUp		
2.78	Autocad			2.68	Autocad		
2.61	Revit			2.72	Revit		
2.88	Male	Gender	(setting environmental conditions (climate	2.42	Male	Gender	From research to design
2.83	female			2.64	female		
2.71	Residential	Project Subject		2.53	Residential	Project Subject	
2.54	Commercial			2.54	Commercial		
3.01	Educational			2.60	Educational		
2.64	Recreational			2.55	Recreational		
2.66	Treatment			2.50	Treatment		
2.41	3-D	Software		2.31	3-D	Softwere	
2.47	V-Ray			2.30	V-Ray		
2.45	SketchUp			2.35	SketchUp		
2.65	Autocad			2.40	Autocad		
2.50	Revit			2.41	Revit		

Continiue of Table 4. Character and score of each criterion

Score	Character		criteria evaluation	Score	Character		criteria evaluation
2.42	Male	Gender	The ability to verbally express the plan taken from the software	2.74	Male	Gender	Attention to the existing texture of the site in the design
3.24	female			2.75	female		
2.87	Residential	Project Subject		2.81	Residential	Project Subject	
2.85	Commercial			2.84	Commercial		
2.76	Educational			2.64	Educational		
2.80	Recreational			3.12	Recreational		
2.77	Treatment			2.79	Treatment		
2.80	3-D	Software		2.64	3-D	Software	
2.89	V-Ray			2.78	V-Ray		
2.83	SketchUp			2.96	SketchUp		
2.90	Autocad			2.97	Autocad		
2.89	Revit			2.88	Revit		

materials with the project topic, setting the environmental conditions (climate) and the ability to express verbally, and the plan taken from the software has an average difference. In the meantime, all the variables, except the two variables of the suitability of the proposed materials with the subject of the project, regulation of environmental conditions (climate), correlate by 0.000 (Table 5).

Also, the one-way variance analysis results showed that the difference between the five groups of variables related to the software in the presentation of architectural designs was significant at the level of 0.001, and the error coefficient was 0.05%. Meanwhile, the average difference between AutoCAD and 3-D software with the value of F=15.368 has the maximum average difference with the rest of the group in the quality of the designs presented, and then, the 3-D variables, respectively, V-Ray, SketchUp, and REVIT. The exact results of the ANOVA

Table 5: t-test results regarding the role of computer systems in improving the quality of student projects in terms of gender

Variables	Use of computer in design		Not using computers in design		t	Sig
	Average	SD	Average	SD		
Executable capability	4.625	1.365	3.365	2.352	2.511	0.000
Creativity	4.447	2.254	2.254	1.365	2.421	0.000
From research to design	4.651	3.351	3.541	2.255	2.885	0.000
Attention to the existing texture of the site in the design	4.365	3.545	3.545	1.625	12.121	0.000
General aesthetics	4.300	3.855	3.855	2.325	2.585	0.000
The proportion of the proposed materials with the subject of the project	4.630	3.365	3.365	1.368	2.006	0.004
setting environmental conditions (climate)	4.984	3.541	3.541	1.985	2.052	0.003
The ability to verbally express the plan taken from the software	4.320	3.880	3.880	1.902	2.157	0.000

test regarding computers' role in improving the architecture scheme's quality using different software. (Table 6).

Finally, Tukey's test has been used to analyze the gap between the qualities of architectural designs using five types of software statistically. The results of Tukey's test showed that both the internal difference between the five groups of used software is significant, and the external difference between the groups is significant in terms of the impact of the software on the quality of architectural designs. (Table 7).

The results of the one-way variance analysis regarding the role of computer systems in improving the quality of architectural designs in terms of the project topic showed that the difference of five groups of variables related to the project topic in the presentation of architectural designs was significant at the level of 0.000 and the error coefficient of 0.05%. The recreational subject had the most significant average difference with the F=15.368 value, compared to the remaining subjects regarding the quality of the plans presented, followed by educational, residential, commercial, and other treatments. The more detailed results of the ANOVA test regarding the computer's role in improving the architectural design quality using different software are in Table 8.

Table 6: The results of the ANOVA test regarding the difference between student designs in terms of the software used

P	F	average of squares	df	sum of squares	Index
0.000*	13.474	81.325	86	187.254	3-D
0.000*	11.331	69.471	86	145.632	V-Ray
0.000*	9.789	65.520	86	88.024	SketchUp
0.000*	15.368	83.221	86	189.460	Autocad
0.000	8.635	59.069	86	71.765	Revit

Table 7: The results of Tukey's test about the gap between the quality dimensions of architectural designs using architectural software

Confidence Interval		Sig	Est. error	mean difference (1,2,3,4,5)	Five variables	Architectural Software	
upper bounds	Lower bounds						
0.9865	-6.6574	0.000	1.74589	-2.6000	X1		
-1.6574	-8.9865	0.000	1.74589	*-5.2000	X2		
6.5095	-0.9865	0.000	1.74589	2.6000	X1		
1.3095	-6.1065	0.000	1.47589	-2.4000	X3	Five architectural software	
8.9865	1.4950	0.000	1.74589	5.2000*	X1		
6.6574	-1.3095	0.000	1.74589	2.4000	X4		
6.452	2.365	0.000	1.74589	-2.4000	X1		
7.365	3.698	0.000	1.74589	-5.2000	X5	X1 3- =D	
10.9865	-7.5065	0.000	1.74589	-2.6000	X2	X2 =V-Ray	
8.3028	-9.9865	0.000	1.74589	5.2000	X3	X3 =SketchUp	
12.9095	-1.9095	0.000	1.74589	-2.6000	X2	X4 =Autocad	
9.1095	-7.3625	0.000	1.74589	2.4000-*	X4	X5 =Revit	Tukey- HSD
9.258	2.674	0.000	1.74589	-2.6000	X2		
9.742	-3.852	0.000	1.74589	-2.4000	X5		
14.3028	2.9865	0.000	1.74589	5.2000	X3		
11.1095	-2.3028	0.000	1.74589	2.4000	X4		
13.587	-3.657	0.000	1.74589	2.4000	X4		
15.854	-5.451	0.000	1.74589	5.6000	X5		

Finally, Tukey's test was used to analyze the gap between the qualities of architectural designs in terms of five groups of different subjects. The results of Tukey's POSt-HOC test showed that both the internal difference of the five groups of the considered subjects was significant and the external difference of the groups in the effect field of computer systems on the quality of architectural designs in terms of different subjects was also significant (Table 9).

According to the investigations conducted on the primary scope of the subject, there is still much qualitative research to be done on improving architectural designs. According to the identified problem, research was conducted to investigate the role of computers in the qualitative improvement of architectural designs. To better understand the role of various types of architectural software in the quality improvement of designs, as well as the role of computers in the quality improvement of designs, males and students were asked to female examine and analyze the presented designs according to different topics so that the sides hidden from the role of computer systems in improving the quality of architectural designs could be better understood.

Table 8: The results of the ANOVA test on the role of the computer in improving the quality of architectural designs in terms of the project topic

Index	sum of squares	df	average of squares	F	P
Residential	159.362	86	82.652	15.474	0.000
Commercial	155.874	86	78.028	12.331	0.000*
Educational	165.369	86	89.754	19.789	0.000*
Recreational	190.785	86	97.368	21.368	0.000*
Treatment	87.324	86	68.810	9.635	0.000

Table 9: The results of Tukey's test about the gap between the quality dimensions of architectural designs in terms of the project topic

Confidence Interval		Sig	Est. error	mean difference (1,2,3,4,5)	Five variables	Subjects of architectural projects	
Lower bounds	Lower bounds						
1.6574	-6.6760	0.000	1.74589	-2.6000	X_1		
-1.3240	-9.3625		1.74589	*-5.2000	X_2		
6.6760	-1.0760	0.000	1.74589	2.6000	X_1		
1.4760	-6.2760		1.74589	-2.4000	X_3		
9.3625	1.3028	0.000	1.74589	*5.2000	X_1		
6.3028	-1.4760		1.74589	2.4000	X_4		
11.9865	-8.9865	0.000	1.74589	-2.6000	X_1	Residential = X_1	
8.1095	-10.9095		1.74589	5.2000	X_5	Commercial =X_2	
13.3028	-2.9095	0.000	1.74589	-2.6000	X_2	Educational =X_3	
10.3028	-8.3028	0.000	1.74589	*-2.4000	X_3	Recreational =X_4	**Tukey- HSD**
15.9095	3.9865	0.000	1.74589	5.2000	X_2	Treatment =X_5	
13.1095	-3.3095		1.74589	2.4000	X_4		
6.2258	2.6704	0.000	1.74589	-2.6000	X_2		
9.7942	-3.3510	0.000	1.74589	-2.6000	X_5		
10.9865	-7.5874	0.000	1.74589	-2.6000	X_3		
8.3028	-9.3098		1.74589	5.2000	X_4		
13.587	-7.7452	0.000	1.74589	2.4000	X_4		
15.845	-5.3658	0.000	1.74589	5.6000	X_5		

CONCLUSION

The general results of the research showed that the role and function of computer systems had a significant difference according to the gender of the students, the subject of the project, and the type of software used.

In response to the first question of the research, it can be said that using the t-test, it is determined that the role of computer use in improving the quality of architectural designs of undergraduate students has a significant difference between the two groups of male and female students.

The most significant difference between the two groups of male and female students was the variables of interest in the field of architecture, interest in the subject of the project, and previous experience using the software.

In response to the second question that what is the advantage of freehand skill, it is based on the research output that it is clear that the most important negative aspect of using computer systems is the lack of attention to human emotions in the designs, which ultimately leads to the architectures without considering the space for human use. Also, according to the research findings regarding the advantages and disadvantages of software and freehand design, it can be said that using computers in design has advantages such as increasing the speed of design, providing complex designs, and providing real models. Before construction, it is to adapt to the market's needs and increase students' creativity. On the other hand, it has disadvantages, such as not paying attention to individual and collective students' feelings and psychological characteristics. In contrast, in freehand design, students can easily bring their emotions and feelings into the design, which leads to more lively and dynamic designs. According to the mentioned problem, nowadays, many types of research have been presented to humanize the architectural designs presented in the computer software environment.

According to the research results, the greatest impact of computer systems was in the environment of AutoCAD software and related to recreational subjects. The main reason is that the use of AutoCAD software in architecture, especially for architecture students, is more prevalent than other software. Also, entertainment subjects are designed mostly to be enjoyable; therefore, students feel more freedom of action in their subconscious minds when working on this subject, which is the effect of computer systems in entertainment subjects. Because of the high repetition of residential subjects among different subjects, students have gained more and better knowledge of this matter, and because of gaining more knowledge, they seek to present more creative designs using computer systems. The results are like the results of the study by Gharibpour (2013) regarding the role of computers in improving the quality of architectural designs and Mozaffar & Ekhlasi (2017) regarding the act of computers and software. Architecture is in harmony with the new design horizons and the findings of Asefi & Imani (2016) regarding the act of architectural software in creating creativity in architectural designs. According to the research findings, it can be suggested that paying attention to the human-centered dimensions in architectural education at the undergraduate level, which is considered a basic level, should be given serious attention. Choosing the right software can lead to the improvement of students' architectural designs. Finally, it can be said that one of the most important aspects of the impact of computer systems in the quantitative and qualitative improvement of architectural maps is related to the subject of projects. Therefore, improving the quality of architectural designs is effective by providing specialized training on computer systems for each subject. Finally, it can be said that improving the quality of architectural maps is a complex process that is influenced by various types of human conditions, software, and hardware. Therefore, to accurately understand this issue, it is suggested to conduct studies on the role of educational systems, the act of native culture, and the mental characteristics of students.

AUTHOR CONTRIBUTIONS

B.Fadavi Akhavan performed the literature review and experimental design, analyzed and interpreted the data, and prepared the manuscript text and edition. Sh. Akbari Namdar performed the experiments and literature review, compiled the data, and manuscript preparation. M. Mousavi helped in the translation and manuscript preparation.

ACKNOWLEDGEMENT

This study was supported by the Islamic Azad University of Tabriz Branch, Faculty of Architecture and Urbanism.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or falsification, double publication or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Aagaard, J. (2015). Drawn to distraction: a qualitative study of off-task use of educational technology. Computers & Education, 87, 90-97.

Abel, T. (2013). Design education: out of the studio and into the research lab. *Online Journal of Art and Design,* 1(1), 10-16.

Alexander, C. (1964). *Notes on the Synthesis of Form Cambridge:* Harvard University Pres.

Al-Matarneh, R., & Fethi, I. (2017). Assessing the Impact of CAAD Design Tool on Architectural Design Education. *Malaysian Online Journal of Educational Technology,* 5(1), 1-20.

Asefi, M. & Imani, E. (2016). An analytical study of the effect of using digital software on the promotion of creativity in architectural design education*, journal of Hoviat Shahr,* 11(4), 79-92.

Bahmanesh Nia, F. & Sheikhiye Gol Zardi, H. R. (2015). Investigating the role of software in the level of creativity of architecture students, *the first competition of the comprehensive international conference of*

engineering sciences in Iran, Tehran.

Benzenberg, E. M. A. (2011). *Exploring Design Process Evolution in Architecture and Interior Design Firms,* the Ohio State University.

Caetano, I., Santos, L., & Leitão, A. (2020). *Computational design in architecture: Defining parametric, generative, and algorithmic design.* Frontiers of Architectural Research.

Cross, N. (2000). *Engineering Design Methods* (3rd Ed.) Chi Chester: John Wiley & Sons Ltd.

Cudzik, J., & Radziszewski, K. (2018). *Artificial intelligence aided architectural design*. Retrieved from: https://www.researchgate.net/publication/328018944_Artificial_Intelligence_Aided_Architectural_Design

Dalziel, J. (2013). Implementing learning design: A decade of lessons learned. *In ASCILITE-Australian Society for Computers in Learning in Tertiary Education Annual Conference* (pp. 210-220). Australasian Society for Computers in Learning in Tertiary Education.

Darke, J. (1984). *The primary generator and the design process.* In N. Cross (Ed.) Developments in Design Methodology. Chi Chester: Wiley.

De Vries, M. J., Cross, N., & Grant, D. P. (Eds.). (1993). *Design methodology and relationships with science.* Dordrecht: Kluwer Academic Publishers.

Dubberly, H. (2004). How do you design? A compendium of models.

Eilouti, B. (2018). "Concept evolution in architectural design: an octonary framework." *Frontiers of architectural research*. 7, Issue 2, June 2018, 180-196.

Furniss, L. (2020). *Beyond Discipline: Evolving Design Practice and Design Education in the Twenty-First Century.* Architecture_MPS.

Gislason, N. (2010). "Architectural design and the learning environment: A framework for school design research." *Learning Environments Research,* 13(2), 127-145.

Glatt, V., Canalis, E., Stadmeyer, L., & Bouxsein, M. L. (2007). Age-related changes in trabecular architecture differ in female and male C57BL/6J mice. *Journal of bone and mineral research,* 22(8), 1197-1207.

Green, L. N., & Bonollo, E. (2004). The importance of design methods to student industrial designers. *Global J. of Engng. Educ,* 8(2), 175-18

Gorji Mahlbani, Y.; Sadeghi, N. (2018). Examining the level of satisfaction of graduate students of architecture majors in comparison with students of 5 top universities of architecture in Iran, *Andisheh Memari Magazine,* 3(6), 110-125.

Henri H, A. (2003). New design methods for computer-aided architectural design methodology teaching. *International Journal of Architectural Computing,* 1(1), 72-91.

Jamiri, V.; Hatami, J.; Fathi Azar, I.; Pakdel Fard, M.R., (2018), Examining the Compliance Degree of Architectural Engineering Bachelor's Curriculum with the Labor Market Needs in Iran, First Year Higher Education Curriculum Studies, No. 2.

Kalisperis, L. N., Otto, G., Muramoto, K., Gundrum, J. S., Masters, R., & Orland, B. (2002). Virtual reality/space visualization in design education: the VR-desktop initiative. *Proceedings of eCAADe2002, design e-ducation: Connecting the Real and the Virtual*, 64-71.

Kruchten, P., Capilla, R., & Duenas, J. C. (2009). The decision view's role in software architecture practice. *IEEE Software,* 26(2), 36-42.

Langsdorf, L. (2016). From Interrelational Ontology to Instrumental Ethics: Expanding Pragmatic Postphenomenology. *Techné: Research in Philosophy and Technology,* 20 (2), 112- 128.

Lawson, Brian (2014), *How Designers Think: Demystifying the Design Process,* translated by Hamid Nadimi, Shahid Beheshti University Press, Tehran.

Mahdavinejad, M.J., (2013), creativity and the process of creative education in architectural design, *Scientific Research Journal of Fine Arts, University of Tehran*, (21), 55-63.

Menges, A., & Ahlquist, S. (2011). *Computational design thinking: computation design thinking*. John Wiley & Sons.

Mitchell, W. J. (2017). "*Computer-aided architectural design.*" Cambridge, Mass. The MIT Press.

Mousavi, S.E; Pejohanfar, M. (2018). Review and comparison of learning approaches used by professors in architecture courses in order to improve the teaching process in architecture, *4th National Conference on Architecture and Sustainable City,* Tehran.

Naserkhaki, H. (2008) *The role of computer in architectural design process; Comparative comparison of two generations of contemporary Iranian architects.* Ph.D. Thesis, University of Tehran.

Navarro, I., O. de Reina, A. Rodiera & D. Fonseca (2016). Indoor positioning systems: 3D virtual model visualization and design process of their assessment using mixed methods: Case study: World heritage buildings and spatial skills for architecture students. *11th Iberian Conference on Information Systems and Technologies (CISt*I*)*, IEEE.

Newton, D. (2018). Multi-objective qualitative optimization (MOQO) in architectural design.

Newton, D. (2019). "Generative deep learning in architectural design." Technology| Architecture, *Design*, 3(2), 176-189.

Öztoprak, Z., & Çağlar, N. (2020). Designerly Ways of Understanding Research Capabilities of Architectural Design and Studio. *Thresholds in Architectural Educatio*n, 7, 129–144.

Pena, William P & Parshall, Steven A (2001), *problem seeking an architectural programming primer,* John Wiley and Sons, New York.

Priya, R. S., P. Shabitha and S. Radhakrishnan (2020). "Collaborative and participatory design approach in architectural design studios." *Social Sciences & Humanities Open,* 2(1).

Rezaei, Mahmoud, (2014), Design Analytics. Tehran: Publications of Islamic Azad University, Central Tehran branch.

Rosenberger, R., & Verbeek, P. P. (2015). *A field guide to post phenomenology.* In R. Rosenberger & P. Verbeek (Eds.), Post phenomenological Investigations: Essays on Human-Technology Relations: Post phenomenology and the Philosophy of Technology (pp. 9-41). Lexington Books.

Salman, H. S., R. Laing and A. Conniff (2014). "The impact of computer-aided architectural design programs on conceptual design in an educational context." *Design Studies,* 35(4), 412-439.

Sanchez, R., & Mahoney, J. T. (1996). *Modularity and economic organization: Concepts, theory, observations, and predictions.* In Handbook of Economic Organization (pp. 383-399). Edward Elgar Publishing.

Sternberg, R. J. (1988). *A three facet model of creativity in R.J. Sternberg (Ed.). The nature of creativity.* Cambridge: Cambridge

University Press.

Torabi, Z. (2013) *Explaining the design process in creative education (case study: architectural design workshops of Tehran University).* Ph.D. Thesis, University of Research Sciences.

Vowles, H., Low, J., & Doron, H. R. (2012). Investigating architecture studio culture in the UK: A progress report. *Journal for education in the built environment,* 7(2), 26-49

Vuletic, T., Duffy, A., Hay, L., McTeague, C., Pidgeon, L., & Grealy, M. (2018). The challenges in computer-supported conceptual engineering design. *Computers in Industry,* 95, 22–37.

Wyatt, D. F., Wynn, D. C., Jarrett, J. P., & Clarkson, P. J. (2012). Supporting product architecture design using computational design synthesis with network structure constraints. *Research in Engineering Design,* 23(1), 17–52.

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 61-76 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI:10.30495/IJAUD.2023.72889.1680

Analytical Comparative of Early Mosques of Iran and China: Investigation of Architectural, Cultural and Spatial Structure Characteristics

Kamyab Kiani[1*], Ali Fath Taheri[2], Reza Rahimnia[3]

[1]Ph.D. Candidate in Architecture, Faculty of Architecture and Urbanism, Imam Khomeini International University(IKIU), Qazvin, Iran.*
[2] Professor, Department of Philosophy, Faculty of Literature and Humanities, Imam Khomeini International University(IKIU), Qazvin, Iran.
[3] Assistant Professor, Department of Architectural Heritage Conservation, Faculty of Architecture and Urbanism, Imam Khomeini International University(IKIU), Qazvin, Iran.

Recieved 2023.04.26; Accepted 2023.08.31

ABSTRACT: Mosques represent Islamic art and identity and have displayed themselves in each geographical region in a way compatible with the culture and identity of that society. The significance of this research lies in its meticulous examination of early mosques within two distinct cultural and societal contexts, Iran and China. By investigating these mosques' architectural, cultural, and spatial attributes, this study sheds light on the divergent approaches of two communities facing the same religious, social, environmental, and cultural challenges during a comparable historical period. Despite sharing the same religious foundation and featuring similar spatial arrangements within the mosques, the contrasting cultural affinities reveal the crucial need to comprehend and appreciate the distinctive qualities inherent to early mosques in these two distinct cultural spheres. This research endeavor is a pioneering exploration toward unraveling the complexities surrounding early mosques, thereby deepening our understanding of their historical and cultural significance in disparate cultural contexts. The research methodology involves a comprehensive review of library sources, articles, and software analysis using Depthmap X. As a result, and mosques have been compared based on the four main dimensions of architecture: spatial, conceptual, and philosophical structural features. Iranian mosques demonstrate a fusion of Saudi Arabian Islamic architecture and Iranian design, emphasizing entrance connectivity. Chinese mosques, on the other hand, blend Islamic elements with ancient Chinese architectural art, prioritizing courtyard connectivity and integrating environmental elements, resulting in a distinctly Asian flavor.

Keywords: *Mosque, Iran, China, Architectural, Spatial Structure.*

INTRODUCTION

Since the beginning of Islam, the institution of the mosque has played an influential role in the creation, development, and prosperity of Islamic societies. Muslims worldwide have long agreed that the mosque has a tremendous impact on life (Utaberta et al., 2015; Rahmawati et al., 2018; Adriani, 2019). In the past, mosques were places for Muslims to conduct religious activities and were often the centers of Muslims' politics, economy, and culture. Usually, Muslims go to the mosque to worship and hold religious ceremonies. At the same time, the mosque undertakes the mission of organizing religious education and spreading spiritual knowledge and knowledge. During the time of the Prophet, the mosque was the Prophet's pulpit for preaching Islam, preaching and holding prayers. A mosque is not only a place for "congregation for worship" but also a place for Muslims to resolve disputes and judge injustice. Historically, in the Muslim struggle against reactionary rule, it was once a strong fortress of Muslim unity and fighting (Gladney, 2003; Armijo, 2008; Erie & Carlson, 2014; Utaberta et al., 2015; Harris et al., 2021; Feng, 2017b, Su, 2017, Jeong, 2022).

Mosques are closely related to the life of Muslims throughout their lives. Their functions are reflected in the following aspects (Utaberta et al., 2015; Rahmawati et al., 2018; Adriani, 2019; Omar et al., 2019; Riwajanti, 2019; Al and Al-Juhani, 2022; Fairuz et al., 2022, Murod et al., 2022): Religious Activity Center, The Center for Education, Religious Education Center, Cultural Center, The center of Muslim contact and communication. Furthermore, There are many types of mosques built in history, including (Utaberta et al. 2015; Rahmawati et al., 2018; Adriani, 2019; Omar et al., 2019; Riwajanti, 2019; Al & Al-Juhani, 2022, Fairuz et al., 2022,

*Corresponding Author Email: *kamyabkiyani1390@gmail.com*

Murod et al., 2022): (1) Holy Mosques, that is, mosques related to the time of the Prophet Muhammad, such as the "Three Holy Mosques." (2) Royal mosques: mainly built in the name of caliphs, sultans, and emirs of successive dynasties, such as the Umayyad Mosque. (3) Jameh Mosque: It is the central temple in the region, also known as the Great Temple; there are many in Iran. (4) Mausoleum Temple, a mosque attached to the main building of the mausoleum, such as the Hussein Mosque. (5) General mosques. Mosques hold immense historical, cultural, and religious significance, serving as sacred spaces for worship, community gatherings, and architectural masterpieces.

In this respect, studying early mosques in Iran and China is of great importance and necessity in understanding the diverse architectural, cultural, and spatial dimensions of these significant religious structures. Specifically, the different distances of the two countries from the cradle of Islam (Arabia), their cultural differences, and the limited studies of Chinese mosques and the investigation of their architectural features are some of the notable things in this choice. By exploring and comparing mosques from these two distinct geographical regions, we gain valuable insights into the cultural and historical contexts that influenced their design and construction. Understanding the architectural features, cultural influences, and spatial arrangements of these mosques helps us appreciate the rich diversity within Islamic architecture and how it assimilated with local cultures. Additionally, this research contributes to the conservation and documentation of the architectural heritage of these mosques, ensuring that their unique characteristics and historical significance are recognized and celebrated. By delving into this topic, we not only enhance our knowledge of mosque architecture but also foster cross-cultural understanding and appreciation of the diverse artistic and cultural expressions within the Islamic world (Pirnia & Memarian, 2005a; Biglari et al., 2022; Jeong, 2022). With this explanation, the commonalities and differences in spatial arrangement for mosques in two different cultures and paying attention to traditional architecture in the region can be key issues.

This research aims to undertake a comparative analysis of the early mosques in Iran and China. We will focus on their architectural characteristics, spatial structure, and cultural dimensions. By examining specific examples from Iran, such as the Jameh Mosque of Fahraj, Tarikhaneh Mosque, Jameh Mosque of Nain, and Jameh Mosque of Kabir Neyriz, and from China, such as the Huaisheng Mosque, Great Mosque of Xi'an, Niujie Mosque, and Qingjing Mosque, we aim to gain a deeper understanding of the diverse dimensions and influences that shaped these mosques. We also hope to explore the mutual effects of culture, religion, and architecture in the two countries of China and Iran during a specific period. The current research seeks to understand the early mosques built in Iran and China and to compare the spatial structure of mosques of the same period in these two countries. The goal is to learn about the early mosques built in different geographical areas with different design thinking and cultural backgrounds. This will help to raise awareness of the early mosques constructed in these areas for those interested in the field of mosques. The study's central question is whether the mosques of the same period in Iran and China have any differences, even though the Arabs built the mosques in Iran after conquering them, while the mosques in China were constructed without war and welcomed by the Chinese people.

The research explores the architectural dimension by analyzing the distinctive architectural styles, design elements, and decorative motifs employed in constructing these mosques. The spatial structure dimension will delve into these mosques' spatial organization, layout, and functionality, examining the arrangement of courtyards, prayer halls, and ancillary spaces. The cultural dimension will investigate the historical and cultural contexts in which these mosques were built, considering their roles as cultural symbols, centers of community activities, and religious and cultural heritage repositories.

By conducting a comparative analysis, we seek to identify similarities and differences between the early mosques in Iran and China, shedding light on the architectural, spatial, and cultural influences that shaped these sacred structures. This study will contribute to a wider understanding of Islamic architecture and its interaction with cultural traditions and local architecture in different regions. Through this comparative exploration, we hope to deepen our knowledge of the early traditional mosques in Iran and China, enhance our understanding of the cultural exchange and syncretism that occurred between Islamic and local architectural styles, and gain insights into the symbolic, cultural, and spiritual dimensions embodied within these significant religious structures. Ultimately, this research aims to provide a valuable resource for architectural historians, cultural scholars, and anyone interested in these regions' rich architectural and cultural heritage.

Research Background

Much research has been conducted to recognize mosques in Iran, China, and even the world, some of which have been analyzed in Table 1. This research has examined mosques based on their architectural characteristics or single buildings. Also, some researchers aim to know the spiritual attributes of mosques. However, unlike other research, this research has dealt with the comparative study of the structure of the spatial relations of the early mosques built in Iran and China with a detailed look at the knowledge of the mosques of these two countries.

MATERIALS AND METHODS

The present study is developmental, seeking to develop cognition in early Islamic mosques in Iran and China. The methodology is based on specialized analyses and descriptions. The data required has been collected by the library method,

Table 1. Research background

1	Quran verses are influential in the design of religious places, especially mosques. This research, by examining the verse of light in the altars of Iranian mosques, has investigated the characters related to the Quran in the design of altars and the direct connection of Islamic thinking in the design of mosques and its manifestation in the creation of mosques(Arezoofar & Marasy, 2023).
2	Xi'an Mosque is one of the mosques built in 1523 in China. This mosque has been a show of Islamic architecture. By examining the Xian mosque with illustrated sources, this research has helped recognize and contribute to the mosque's position in China (HAGRAS, 2019b).
3	The historical investigation of Chinese mosques, especially the Xian mosque, is one of the main goals of this research. This research seeks to show the cultural and historical characteristics of the Xi'an Mosque and expand these values to Muslim mosques in China(Hagras, 2019a).
4	This research aims to investigate the architecture of mosques and understand the impact of mosques in non-Islamic contexts. This research has studied the role of mosques for people and has finally studied the effect of these buildings on the surrounding buildings and local people(Farrag, 2017).
5	The architecture of mosques was formed based on specific instructions. This research introduced the characteristics of mosques by documenting eighty mosques and scrutinizing them(Khan, 1990).

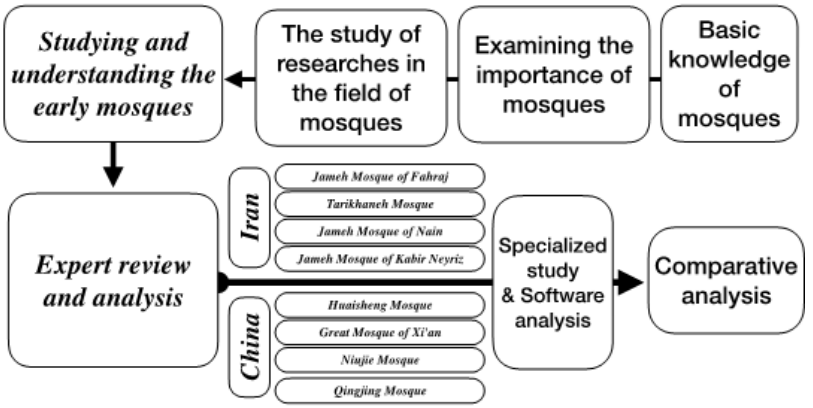


Fig. 1: Research process

reviewing various documents, and using DepthmapX software. The mosques of the same period in Iran and China were investigated using logical reasoning and natural analysis and then analyzed with Jamvi statistical software. Finally, they were compared based on the different structural dimensions of the mosques. The analysis unit in the present study is the mosque and its components, elements, and values. The process of the research is summarized in Figure 1. In the research process, the research is first presented to express the topic and its need and importance in formatting and examining it in a general study structure. To explore the theoretical and empirical background of the subject, the literature on Iranian and Jain mosques and the course of the emergence of mosques in these two countries have been examined. Based on this characteristic, the characteristics of mosques and the formation process of each mosque in Iran and China have been obtained. Finally, it has been compared with the composition of the space relations structure of the mosques of the same period with the software to obtain it from the analytical system. Finally, the explanatory values of the mosques of Iran and China, which can be used in other related studies, are presented.

The Emergence of Islam in Iran

Mosques in Iran began to be constructed after the Arab conquest in the 7th century, reflecting the evolution of Iranian architecture. Initially following Khorasani and Razi styles, Iranian mosques underwent a transformative phase during the Al-Buyeh period. With the attention of elders, sages,

kings, artists, and architects, these mosques incorporated beautiful design motifs like Shabestani and the forty columns, showcasing impressive artistic views. The construction of a mosque in Iran adheres to three principles: a well-designed structure, the implementation of divine instruments and facades, and the use of tasteful materials for overall beautification (Ramzy, 2022; Pirnia & Memarian, 1995; Pirnia & Memarian, 2004, Pirnia & Memarian, 2005b, Biglari et al., 2022). Iranian art and architecture find a unique manifestation in mosques, representing the pinnacle of Iranian craftsmanship and culture within Islam. The symbolic, decorative, and repetitive motifs in mosques exemplify the deep connection between Iranian architecture and its religious significance. Mosques have been historically significant in Iran, serving as centers for education and community life. Quranic inscriptions adorn the interior and exterior, establishing a strong link between the holy book and the place of prayer. Decorations in Iranian mosques avoid human and animal forms and instead feature geometric designs, flowers, plants, and calligraphy, symbolizing the promise of heaven (Biglari et al., 2022; Ramzy, 2022; Pirnia & Memarian, 1995; Pirnia & Memarian, 2004, Pirnia & Memarian, 2005a, Pirnia & Memarian, 2005b, Pirnia & Memarian, 2007, Pirnia & Memarian, 2008).

Iranian artists and architects in the Islamic era incorporated abstract elements of Islam while drawing inspiration from the art and culture of ancient Iran. They created unique geometric and abstract forms, combining symbolic and structural elements in a highly artistic manner. Iranian mosques stand as wonders and attractions, built in various styles throughout history and revered as masterpieces of Iranian Islamic architecture. The emergence of mosques in Iran can be traced back to the early centuries of Islam, following the Islamic conquest of the country (Pirnia & Memarian, 2005a; Sarhaddi-Dadian et al., 2022). These mosques featured rectangular or square plans with central courtyards, surrounded by arcades or porticos. Architectural elements included minarets, domes, intricate geometric patterns, tilework, and calligraphy. Vibrant colors and floral motifs further enhanced the aesthetic appeal. Over time, mosque architecture in Iran evolved and incorporated influences from the Seljuk, Timurid, Safavid, and Qajar eras, resulting in a diverse and rich architectural heritage. Iranian mosques served as places of worship and as centers of community life, education, and social activities, shaping the country's religious, cultural, and architectural identity. They remain significant landmarks in Iran's history and heritage (Biglari et al., 2022; Ramzy, 2022; Pirnia & Memarian, 1995; Pirnia & Memarian, 2004; Pirnia & Memarian,2005a; Pirnia & Memarian, 2005b; Pirnia and Memarian, 2007, Pirnia and Memarian, 2008).

Evolution of Mosque Architecture in Iran

The early mosques built in Iran followed the Khorasani style. This style was the first style of building mosques in Iran, and Table 2 shows the changes in mosques in this style according to time (Pirnia & Memarian, 1995; Pirnia & Memarian, 2004; Pirnia & Memarian, 2005a; Pirnia & Memarian, 2005b, Pirnia & Memarian, 2007, Pirnia & Memarian, 2008).

Khorasan-style architecture in religious buildings is a mixture of four-arched Zoroastrian architectural designs. Khorasani architecture is the first style of designing mosques, and the main components of this style cannot be reduced to simplicity, low decorations, rectangular plan, use of raw materials such as natural clay and brick, use of Arabic plans in the design of mosques and buildings with Iranian design (Zibaeenejad & Jowkar, 2008, Hashemi et al., 2015). Over time, the characteristics of Khorasan period mosques have gradually increased, but they have always maintained their original features, as shown in Table 2.

Investigation of Prototypes of Mosques in Iran

The examples were selected based on the book of Pirnia; these examples were among the most prominent early mosques in Iran, which researchers in many studies set. In the following, each of these examples will be examined. Also, the time process of the formation of these mosques is shown in Figure 2 and Table 3.

Table 2: Evolution of early mosques in Iran

Courses of Khorasani style	Early mosques	middle mosques	late mosques
Architectural components of the mosque	Simple design without decorations The use of Iranian architecture, along with the Arabic plan Using brick and clay materials Use of square medians Rectangular plans The use of canvas materials The portico leading to the dome of the house Single porch design	Shabestan design The use of a plastered altar	Limited use of decorations

Table 3: Introduction of selected mosques (Image source: Newslaw, 2022)

Name	Jameh Mosque of Fahraj	Tarikhaneh Mosque	Jameh Mosque of Nain	Jameh Mosque of Kabir Neyriz
District	Fahraj	Damghan	Naein	Neyriz
Province	Yazd	Semnan	Isfahan	Fars
Dynasty	Dynasty Sassanid		Buyid Dynasty	Seljuq Dynasty
Style	Khorasani style			
Picture				

Fig. 2: Chronological diagram of early mosques in Iran

Jameh Mosque of Fahraj

The Fahraj Jame Mosque, built in 670-680 AD, is considered one of the earliest mosques in Iran and holds great historical significance. Located in Fahraj, Yazd province, this mosque exhibits a unique architectural blend influenced. Constructed primarily with adobe, the mosque underwent subsequent additions, including incorporating a minaret. Unlike other mosques in cities that were converted to Islam, the Fahraj Jame Mosque was specifically established as a mosque from its inception, retaining its original appearance over time. It stands alongside other notable mosques in Iran, such as the Yazd Jame Mosque, Borujerd Jame Mosque, Niriz Mosque, and Mohammad Nayin Mosque. The architectural design of Iranian mosques finds inspiration in the first mosque of Islam, the Medina mosque, incorporating certain principles in their construction. The Jameh Mosque of Fahraj serves as both a spiritual sanctuary and a communal gathering place, upholding the cultural and religious heritage of the region. Its architectural elements, including minarets and rocking arches with geometric patterns and calligraphy, exemplify the rich artistic traditions of Islamic and Persian cultures. (Holakooei & Karimy, 2015, Dizany, 2017).

Tarikhaneh Mosque

The Tarikhaneh Mosque is one of the early mosques of historical significance and one of the oldest mosques in the country. It was built in 767 AD in Semnan, Damghan region, making it one of the early mosques constructed in Iran. This mosque, also known as the Damghan Historical Mosque, is a testament to Iran's rich cultural and architectural heritage. The mosque's rectangular plan and central courtyard showcase intricate architectural elements such as arcades, porticos, and

minarets. The use of geometric patterns and calligraphy further highlights the artistic traditions of Islamic and Persian cultures. The spacious central courtyard provides a gathering space for worshippers, while the surrounding covered porticoes feature curved arches and circular columns. Notably, the southwestern part of the mosque houses a pillared hall, reminiscent of the palaces from the Sassanid era. The materials used in the construction include endemics, and the mosque is characterized by its historical value and cultural significance, acting as a place of worship for the local Muslim community and preserving Iran's ancient architectural heritage (Azad, 2013; Azad, 2022).

Jameh Mosque of Nain

The Jameh Mosque of Nain, located in Iran's Isfahan province, is an early mosque with rich architectural and historical significance. Built in 960 AD, it exhibits a unique blend of Islamic and Persian influences in its design and decorations. The mosque's rectangular layout features a central courtyard with arcades adorned with plastering, intricate geometric patterns, and calligraphy. Notable architectural elements include the tall minaret and a beautifully crafted mihrab (prayer niche). The mosque's spatial structure emphasizes the vast central courtyard, providing a gathering space for worshippers and reflecting the grandeur of its construction. The Jameh Mosque of Nain, boasting a rich historical heritage across ages, is a dynamic center for religious and cultural endeavors. It proudly exhibits Iran's multifaceted architectural legacy and the harmonious amalgamation of artistic customs prevalent in the area (Salimi & Sharifzadeh, Soltani Mohamadi & Azad, 2018).

Jameh Mosque of Kabir Neyriz

The Jameh Mosque of Kabir Neyriz is an early mosque known for its historical and architectural significance. It is considered one of the oldest mosques in Iran and represents the peak of Khorasani architectural art. Built-in Fars province, Niriz area, between 913 and 1010 AD, the mosque showcases distinct architectural features and design elements influenced by Sassanid architecture. The building's construction followed a rectangular plan with a central courtyard surrounded by arcades and porticos. Iranian-Islamic influences are evident in tiling with geometric patterns along with complex plastering. The Jameh Mosque of Kabir Neyriz stands out with its brick minaret and five arches. These elements, including a single porch and plastered altar, contribute to its visual appeal and architectural uniqueness. Over the years, parts of the mosque have been added, repaired, and maintained, solidifying its status as a selected work of Iranian art and architectural design. The Jameh Mosque of Kabir Neyriz maintains its cultural and religious importance, functioning as both a sacred sanctuary and a communal hub. It splendidly showcases Iran's opulent architectural legacy and seamlessly integrates Islamic and Persian artistic customs, symbolizing the harmonious fusion of these traditions (Monazzah & Khazaei, 2013; Akbari et al., 2014; Taghavi Nejad and Moazzeni, 2016).

The Emergence of Islam in China

Architecture is the solidification of culture, and silent buildings embody a lively culture. The architecture of Chinese mosques embodies Chinese Islamic culture and is a beautiful commentary on the cultural exchange between China and Iran. According to their architectural styles, Chinese mosques can be divided into three main architectural types: Chinese style, Arabic style, and Sino-Arab combined style. From these three architectural types of mosques, we can see the degree, history, reasons, and results of combining Chinese and Iranian cultures. We can also look forward to the future Chinese Islamic architectural culture trend. In a certain sense, Chinese mosques are a part of the history of Islam in China (Erie and Carlson, 2014; Utaberta et al., 2015; Ma, 2006). Mosques can explain different historical stages. Using mosque architecture to illustrate the history of Islam in China can better reflect the process and characteristics of the cultural exchange and integration between China and Iran. The current Chinese Islam in the context of globalization is also reflected in the recent mosque architecture (Gladney, 2003; Armijo, 2008; Erie & Carlson, 2014; Utaberta et al., 2015; Harris et al., 2021; Norris, 2001, Ma, 2006, Lane, 2016, Hagras, 2019b, Liu et al., 2021, Jeong, 2022).

A mosque (Masjid) is one of the Islamic architectural groups. It is central for Muslims to hold worship, religious homework, religious education, and missionary activities. Also called a temple of worship. It is a free translation of the Arabic "Masjid" (the place of prayer). The Qur'an says: "All mosques belong to Allah, so you should pray to Allah and not to anything." During the Tang and Song Dynasties in China, it was called "Tang," "Auditorium," "Sacrificial Hall," and "Worship Hall." After the Yuan Dynasty, it was called "Temple," "Huihui Hall," and "Worship Temple." In the Ming Dynasty, Islam was called "Halalism." Then, the "auditorium" was renamed "mosque," which is still used today. Muslims of Hui, Dongxiang, Baoan, Salar, and other ethnic groups in the northwest region still follow the original name of "Masjid" or "Jama'at" (the temple). In China, mosques are called Qīng Zhēn Sì (Temples of the Pure Truth). Other names include Huí Huí Táng (Hui people's hall), Huí Huí Sì (Hui people's temple), Lǐ Bài Sì (Temple of worship), Zhēn Jiào Sì (Temple of the True Teaching) or Qīng Jìng Sì (Pure and clean temple) (Gladney, 2003, Armijo, 2008, Erie and Carlson, 2014, Utaberta et al., 2015, Harris et al., 2021, Lane, 2009, Feng, 2017a, Hagras, 2019b, Bhatt & Wang, 2022, Miranti et al., 2022).

The mosque is in the land of China. Since the day foreign Muslims entered China, they have been running around, fighting, farming, doing business, and traveling all over China. They migrated there, and the mosque appeared there. Today, mosques of various forms can be seen in many places in different regions of China. Legend has it that the earliest mosque was built in the Tang Dynasty. With the development and spread of Islam, the number of mosques gradually increased. In the Yuan

Dynasty, mosques appeared one after another, but there was no fixed name at the time (Armijo, 2008, Liu et al., 2021, Bugnon, 2019, Wang et al., 2002). At the end of the Yuan Dynasty and the beginning of the Ming Dynasty, because Islam was sometimes called "Halalism," the monastery was called a "mosque." From the Ming Dynasty to the Qing Dynasty, mosques were called "chapels," "mosques of worship," and "mosques," and Islam was called Islam. The teaching staff of the mosque has practiced a hereditary "three ways" system for a long time. The so-called three-path system is a religious organization composed of the Imam in charge, Hai Tuibu, who is to persuade and practice religion, and Mu'anjin, responsible for summoning prayers. In some places, there are religious judges, "Gazui," and spiritual judges, "Mufti." With the formation and development of the Hui nationality, the hereditary Gazui and Mufti's three-way system were eliminated. The school imam and the old school of Xuedong Township replaced it (Gladney, 2003, Armijo, 2008, Erie & Carlson, 2014, Utaberta et al., 2015, Harris et al., 2021, Wang et al., 2002, Ma, 2006, Dilmi, 2014, Bugnon, 2019, Liu et al., 2021, Jeong, 2022, Liu & Yang, 2022).

Evolution of Mosque Architecture in Chinese Dynasties

There are at least two reasons why mosques in central and eastern China have embraced Sinicization. Firstly, throughout history, Muslims in China have developed a close affinity with traditional Chinese culture, merging it with Islamic practices. Chinese Muslims have adopted Chinese as their mother tongue and embraced Han customs, demonstrating the integration of Chinese and Islamic cultures. During the Ming Dynasty, Islam had fully transformed into Chinese Islam, making it a part of the Chinese religious and cultural fabric. Consequently, adapting mosque architecture to Chinese styles became a natural progression. Secondly, the isolationist policies of the Ming and Qing dynasties hindered interactions between Chinese Muslims and the Arab world, leading to a lack of expertise in Arab architectural art among domestic artisans. This limitation further propelled the Sinicization of mosque architecture (Wang et al., 2002, Jinchen, 2007, Lane, 2011, Chen et al., 2019, Hang, 2019, Hanaoka, 2021, Liu et al., 2021, Steinhardt, 2021, Jeong, 2022, Miranti et al., 2022).

However, Xinjiang presents a different scenario. Its proximity to Central Asia, South Asia, and the Middle East facilitated communication and exchange with Muslims from those regions. Moreover, Han culture in Xinjiang was less dominant than in other parts of China, allowing Uyghur culture to influence the local mosques. Consequently, Xinjiang mosques have preserved the Arabic architectural style to a significant extent, alongside the Uyghur cultural influence. The historical transformation of Chinese mosques, shifting from Arabic to Chinese architectural styles, signifies the cultural exchanges between China and Iran in architecture. The fusion of Chinese and Western architectural cultures has resulted in the creation of numerous exquisite Chinese mosques that showcase the harmonious integration of diverse influences (Wang et al., 2002, Jinchen, 2007, Lane, 2011, Chen et al., 2019, Hang, 2019, Hanaoka, 2021, Liu et al., 2021, Steinhardt, 2021, Jeong, 2022, Miranti et al., 2022). The developments of early Chinese mosques are shown in Table 4 in summary.

Investigation of Prototypes of Mosques in China

The selected Chinese mosques were the first ones built in China until the end of the 11th century and were selected based on China's research and tourism websites. Also, their chronological chart is shown in Figure 3, and samples are introduced in Table 5.

Huaisheng Mosque

During the reign of Emperor Gaozu Wude of the Tang Dynasty (618-626), Muhammad, the "sealed prophet" of Islam, sent four disciples to China to preach. Among them, Said ibn Abi Waqas (ancient translation of Abu Wan Gesu) arrived in Guangzhou via the Maritime Silk Road during the early years of Tang Zhenguan and began spreading the teachings of Islam in China. In the first year of Zhenguan (627), Abu Wan Gesu and the Arab Muslim community in Guangzhou raised funds to construct a mosque in memory of the "Holy Prophet," which was named "Huaisheng." The Huaisheng Mosque in China is an early mosque of historical and cultural significance. It represents the presence of Islam in China and reflects the cultural integration between Chinese and Islamic architectural styles. Covering an area of 2,966 square meters, the mosque follows a traditional Chinese symmetrical layout. Its central

Table 4: The evolution of Chinese mosques

Dynasty	Tang Dynasty	Liao Dynasty	Song Dynasty
Architectural components of the mosque	The emergence of mosque architecture in China The brick and stone structure represents the connection between Chinese and Iranian architecture. The architectural style of mosques is based on the traditions of Arab mosques.	Design based on Chinese traditional architecture	Construction of Arabic mosques in the style of Central Asia Using gates, minaret, and main hall in Arabic style

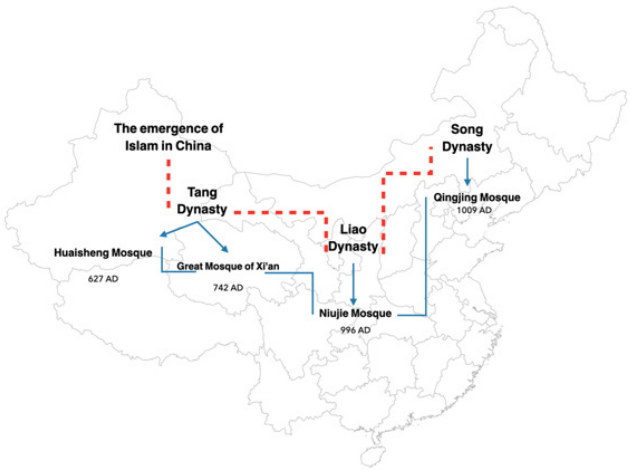


Fig. 3: Chronological diagram of early mosques in China

Table 5: Introduction of selected mosques (Image source: So, 2022)

Name	Huaisheng Mosque	Great Mosque of Xi'an	Niujie Mosque	Qingjing Mosque
District	Guangzhou	Xi'an	Xicheng	Quanzhou
Province	Guangdong	Shaanxi	Beijing	Fujian
Dynasty	Tang Dynasty		Liao Dynasty	Song Dynasty
Style	Taoism		Buddhism	
Picture				

axis consists of three gates, a moon-watching tower, and the worship hall, which faces east and serves as the holy land of Mecca during prayers. Over the years, the mosque underwent multiple repairs, preserving its original architectural style (Jinchen, 2007; Buseri, 2015; Su, 2017; Hang, 2019; Hagras, 2020; Liu et al., 2021; Jeong, 2022).

The mosque complex also features the "Huaisheng Pagoda" situated in the southwest corner of the temple gate. With a height of 36 meters, this Arabic-style pagoda is also known as the "Bangka Tower" due to believers chanting scriptures from its top. Originally built during the Zhenguan period of the Tang Dynasty, the pagoda served as a landmark and was historically used to guide ships on the Pearl River by illuminating its top at night. Huaisheng Mosque exemplifies the fusion of Chinese and Islamic architectural elements. Its design incorporates traditional Chinese spatial organization, colorful porcelain tiles, intricate carvings, and Arabic calligraphy, showcasing the blending of decorative motifs. Beyond its architectural significance, the mosque holds cultural and symbolic value, representing religious tolerance and the coexistence of different faiths within Chinese society. It remains an important spiritual and community center for Chinese Muslims, upholding China's multicultural heritage (Jinchen, 2007; Buseri, 2015; Su, 2017; Hang, 2019; Hagras, 2020; Liu et al., 2021; Jeong, 2022).

Great Mosque of Xi'an

The Great Mosque of Xi'an, located northwest of the Drum Tower, is an early mosque of significant historical and cultural importance. It is a large-scale Chinese temple-style ancient building complex that showcases a unique blend of Islamic and traditional Chinese architectural styles. The mosque's origins can be traced back to the Tang Dynasty, although it was confirmed to have been built during the Ming Dynasty. It underwent maintenance and protection throughout history, evolving into its current pattern. Designated as a fundamental cultural relics protection unit in Shaanxi Province, the Great Mosque combines the architectural form and keynote of Chinese national style with the strict layout principles of the Islamic system (Ain & Jianyou, 2014, Dilmi, 2014, Hagras, 2019a, Hagras, 2019b, Bhatt & Wang, 2022, Cai, 2022, Miranti et al., 2022).

Within the temple, one can appreciate the ingenious combination of styles, where Chinese and Islamic traditions merge seamlessly. The exquisite carvings and arabesque

decorations throughout the mosque are composed of Arabic script, while the overall layout adheres to the principles of traditional Chinese architecture. This unique synthesis earned the Great Mosque a place among UNESCO's world Islamic cultural relics. Furthermore, the mosque has garnered recognition and acclaim beyond its cultural significance. It was promoted to one of China's critical cultural relics protection units in 1988 and was later listed as one of the top ten tourist attractions in Xi'an in May 1997. Therefore, the Great Mosque of Xi'an is a testament to religious tolerance and cultural integration, representing Islam's rich and diverse history in China. Beyond its architectural and cultural appeal, it serves as a tranquil space for prayer and reflection, attracting both worshippers and visitors alike (Ain & Jianyou, 2014, Dilmi, 2014, Hagras, 2019a, HAGRAS, 2019b, Bhatt & Wang, 2022, Cai, 2022, Miranti et al., 2022).

Niujie Mosque

The Niujie Mosque, located in China, is an early mosque with historical and cultural significance. It is considered one of Beijing's oldest and largest mosques, first built in 996 during the Liao Dynasty. The local Muslim community constructed the mosque using traditional Chinese architecture, except that it displays Arabic calligraphy in the interior, with the original design by Nazaruddin, the descendant of an imam. However, the mosque was destroyed by the armies of Genghis Khan in 1215 and later rebuilt in 1443 during the Ming Dynasty. The mosque exemplifies a blend of Islamic and Chinese architectural styles. It consists of buildings that follow traditional Chinese architectural norms and features two courtyards according to the Siheyuan layout. The mosque includes various facilities, such as a worship hall, the Wangyue Building, the Building for Publicising Etiquette, a lecture hall, the Tablet Pavilion, the Twin Pavilions, and bathrooms.

Additionally, it houses a library with ancient manuscripts. The design of the Niujie Mosque incorporates traditional Chinese elements like the distinctive Chinese roof and courtyard layout, along with Islamic architectural elements such as domes and minarets. Adorned with intricate decorations, including Arabic calligraphy, geometric patterns, and colorful glazed tiles, the mosque serves as a religious and cultural center for the local Muslim community. It provides a space for prayer, worship, and community activities. The Niujie Mosque represents the long-standing presence of Islam in China and stands as a testament to the integration and coexistence of Islamic and Chinese cultural traditions (Norris, 2001, Wang et al., 2002, Hasmath, 2014, Ridgeon, 2020, Liu & Yang, 2022).

Qingjing Mosque

Qingjing Temple, also known as the Holy Friends Temple, was originally constructed in the second year of Dazhong Xiangfu during the Northern Song Dynasty (1009), coinciding with the 400th year of the Muslim calendar. Spanning an area of 2,184 square meters, the Qingjing Mosque combines elements of Islamic and Chinese architectural styles, exemplifying the cultural fusion between these two traditions. While the mosque's overall orientation follows the east-west axis, resembling the majority of mosques in China, its internal layout exhibits a flexible distribution with a distinction between primary and secondary spaces. The main worship hall, Fengtian Temple, retains its prominent position at the forefront of the complex, while auxiliary structures like personnel housing and water rooms are discreetly located in the rear area. The mosque's functional spaces demonstrate the Islamic architectural characteristic of dispersion and decentralization. Yet, some buildings, such as the Mingshan Hall and the newly constructed worship hall, form a cohesive system, encompassing facilities essential for Islamic religious activities such as worship and bathing. Situated in China, Qingjing Mosque holds historical and cultural significance as an early mosque that embodies the harmonious coexistence of Islam and Chinese culture. Its architectural design seamlessly blends traditional Chinese elements, including sloping roofs with upturned eaves, with Islamic features like domes and minarets. The mosque's exterior is adorned with intricate carvings and colorful glazed tiles, integrating Islamic and Chinese decorative motifs. A central courtyard is surrounded by prayer halls and pavilions, creating a spatial layout conducive to prayer, religious rituals, and community gatherings. Serving as a spiritual and community center for the local Muslim population, Qingjing Mosque stands as a testament to the multicultural heritage of China, symbolizing the cultural integration between Islam and Chinese traditions (Clark, 1995; Ma, 2006; Feng, 2017a; Feng, 2017b, Bugnon, 2019, Hagras, 2019b).

Analysis

This section compares selected examples of mosques in Iran and China based on their spatial structure and architectural features.

Mosques of the First Series

The first mosque built in Iran was Fahraj Mosque, and in China, Huaisheng Mosque. Huaisheng Mosque has a stone minaret, and its spatial structure is broader and more integrated than Fahraj Mosque. Fahraj Mosque generally has better connectivity based on the area-to-connectivity ratio. However, based on the spaces, Huaisheng Mosque has better connectivity in wisdom spaces such as the entrance, courtyard, and paths. The connectivity level in the place of prayer is the same in both. Fahraj Mosque was built in the Qibla direction, but Huaisheng Mosque was built in the south-north order based on the beliefs of Feng Shui and the flow of qi energy. Also, in Table 6, the spatial relationships of these mosques are shown based on software analysis.

Mosques of the Second Series

The Tarikhaneh and Xi'an mosque were both built in the 8th century AD. The Xi'an Mosque has wooden and stone materials, but Tarikhaneh Damghan has used brick and adobe materials. The spatial structure is also very different in these two mosques. Tarikhaneh had a square-shaped plan facing forward Qibla; however, the Xi'an Mosque is rectangular based on the flow of Qi energy and in the south-north direction, contrary to the imagination. Also, due to its large area, the Xi'an Mosque has less connectivity than connectivity. But in the micro-spaces, this mosque has a better spatial relationship than Tarikhaneh in all parts. This is because the mosque of Xi'an has a greater extent, and this extent makes the structures of the space sit better next to the monolith. Also, in Table 7, the spatial relationships of these mosques are shown based on software analysis.

Mosques of the Third Series

The time of construction of these mosques goes back to around 960 AD; in the third period of comparison of early mosques in Iran and China, Jameh Mosque of Nain is compared with Niujie Mosque, which can be seen in Table 8 of the survey of the spatial structures of these mosques is Niujie Mosque has a more robust system of spatial relations and also a greater extent than Jameh Mosque of Nain. Jameh Mosque of Nain also has better connectivity in the entrance part and approximate unity in the connectivity structure in all regions. However, the more we move from the southern part of the building to its northern territories, the more spatial connectivity is added until finally, In the prayer room section, we reach the peak of spatial

Table 6: Comparison of the spatial structure of mosques in the first period

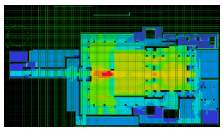
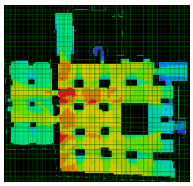
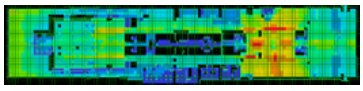
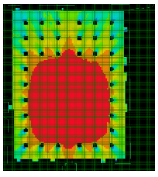
Mosques	Entrance	Courtyard	Routes	Place of prayer	The extent of the connectivity			Connectivity Plan
					Min	Mid	Max	
Huaisheng Mosque					3	490.865	1442	
Jameh Mosque of Fahraj					15	1198.22	2091	
Guide								
					Min			Max

Table 7: Comparison of the spatial structure of mosques in the second period

Mosques	Entrance	Courtyard	Routes	Place of prayer	The extent of the connectivity			Connectivity Plan
					Min	Mid	Max	
Great Mosque of Xi'a					1	490.865	1442	
Tarikhaneh Mosque					269	4941.92	6489	
								
					Min			Max

communication, which is due to the design of the mosque based on Qi energy flows.

Mosques of the Fourth Series

These mosques are the last series of mosques to be compared. In this section, two mosques from around 900 to 1100 AD have been reached, and their spatial structure has been examined in Table 9. Qingjing Mosque, unlike other Chinese mosques that have been reviewed in the past, has Arabic designs and is a different representation of the mosque in China. Also, the area of this mosque is smaller than in the previous examples. Jameh Mosque of Kabir Neyriz followed the designs of its last mosques and only increased the number of decorations. Connectivity is more in Qingjing Mosque, mainly in the entrance and hall, but in Jameh Mosque of Kabir Neyriz, the connectivity in the central courtyard and entrance is low and has peaked in the secondary spaces.

RESULTS AND DISCUSSIONS

Investigating early traditional mosques in Iran and China is paramount due to their immense cultural significance and recognition in both societies. These religious structures serve as vital embodiments of historical, artistic, and architectural heritage, necessitating comprehensive exploration. By Delhe architectural and historical aspects of each country's mosques, this research presents a Detpresents Additionally, the comparative analysis of these mosques, encompassing their cultural identities, traditions, and physical manifestations, will enable a deeper comprehension of these two civilizations' cultural exchanges and influences. To enhance the accuracy and rigor of this comparative analysis, the advanced Depthmap X software will be employed, enabling precise spatial and architectural examinations.

This research thoroughly investigates and thoroughly investigates By unraveling their historical development and individual identities, this study sheds light on the importance of comprehending the intricate details of these remarkable religious edifices. The comparative analysis, aided by sophisticated software, further enhances the accuracy and depth of the research, enabling a comprehensive understanding of the unique cultural and architectural elements associated with these mosques.

This research explores the significance of early mosques and their distinctiveness within the cultural contexts of Iran and China. By meticulously investigating these mosques' architectural, cultural, and spatial elements, the study highlights the necessity of understanding their historical development and structural compositions. Through a comprehensive examination of each country's unique mosque designs, this research provides an insightful analysis of their identities. Furthermore, employing advanced software such as Depthmap X, a comparative study is conducted to elucidate the disparities and similarities regarding cultural significance, socio-spatial dynamics, and physical attributes of these architectural marvels.

Chinese mosques embody the fusion of ancient Chinese architectural art with the religious components of Islam, resulting in a distinctive Asian flavor. One notable aspect of Chinese mosque design is the attention given to the spatial arrangement of environmental elements. Different spaces are created to induce varied environmental feelings in visitors. Additionally, nature plays an integral role in the design, as mosque architects seek to imitate natural scenery rather than dominate it. Traditional Chinese identity is also evident in the orientation of courtyards and the overall structure of the

Table 8: Comparison of the spatial structure of mosques in the Third Period

Mosques	Entrance	Courtyard	Routes	Place of prayer	The extent of the connectivity			Connectivity Plan
					Min	Mid	Max	
Niujie Mosque					19	4436.02	8195	
Jameh Mosque of Nain					9	1386.42	2483	
Guid					Min		Max	

mosque, which sometimes faces north based on the belief in energy flows.

In contrast, traditional mosques in Iran maintain a closer adherence to the early mosques of Islam in Saudi Arabia while incorporating elements of Iranian architecture. These mosques were typically built in hot and dry areas, featuring square-rectangular enclosed structures. The design focused on simplicity, devoid of excessive decoration, and drew inspiration from the four arches and porticoes of the Zoroastrian era. Iranian mosques project an Islamic identity within an Iranian architectural context, with their Qiblah-facing orientation emphasizing their Islamic nature.

The research aimed to conduct an analytical comparative analysis of early traditional mosques in Iran and China, focusing on their architectural, cultural, and spatial structures. By examining these dimensions, the investigation sought to understand the distinct characteristics and influences that shaped these mosques in their respective regions. Starting with the architectural dimension, the analysis explored the unique architectural styles, design elements, and decorative motifs employed in constructing the selected mosques. Iranian mosques exhibited a fusion of Islamic and Persian architectural influences, with prominent features of intricate tilework, geometric patterns, and calligraphy. These elements showcased the rich artistic heritage of Persia and its incorporation into Islamic architecture.

On the other hand, Chinese mosques blended Islamic and traditional Chinese architectural styles, incorporating elements such as sloping roofs, upturned eaves, and decorative carvings. Combining these features resulted in a distinctive architectural character that reflected the integration of Islamic design principles with the local Chinese aesthetic. This analysis highlighted the cultural and artistic diversity represented in the mosque designs of both regions. The investigation then delved into the cultural dimension by considering the historical and cultural contexts surrounding the construction of these mosques.

In Iran, the mosques were influenced by Arab conquests and served as symbols of Islamic presence and religious identity. They represented the spread of Islam and the establishment of Islamic communities in the region. The architectural and cultural fusion observed in Iranian mosques reflected the integration of local traditions with the religious and artistic influences brought by the Arabs. In contrast, the mosques in China were built without military conflict and were embraced by the Chinese people, representing a harmonious coexistence of Islam within the local cultural fabric. These mosques were often constructed by Chinese craftsmen who incorporated traditional Chinese architectural elements into the design, blending them with Islamic features. These mosques' presence in China reflected Islam's acceptance and assimilation into Chinese society. This research provided valuable insights into the distinct characteristics and influences that shaped early traditional mosques in Iran and China by examining the architectural, cultural, and spatial dimensions. It sheds light on each region's unique historical narratives, societal dynamics, and artistic expressions, emphasizing the cultural and artistic diversity within the broader Islamic architectural tradition.

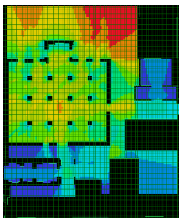
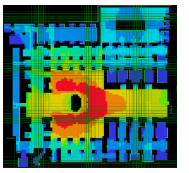
Based on the amount of connectivity structure, according to the Diamond abundance chart in Table 10, Chinese traditional mosques have the lowest and average connectivity. However, traditional Iranian mosques exhibit a higher level of connectivity in the highest connectivity component. Additionally, when examining the different spaces of Iranian and Chinese mosques according to the Connectivity network of mosque spaces in Table 10, the entrance of Iranian mosques is found to have a direct spatial relationship with the place of prayer while having an inverse relationship with the courtyard. Moreover, the place of prayer in Iranian mosques demonstrates an inverse relationship with the courtyard and routes. Conversely, Chinese mosques exhibit different characteristics, as they showcase a direct relationship between the courtyard and the place of prayer, with inverse relationships among other elements such as routes and entrances. This study reveals that early Chinese mosques prioritized the courtyard and its relationship with the place of prayer, whereas Iranian mosques focused more on the entrance and its connection with the place of prayer.

The spatial structure dimension was explored to understand the layout and functionality of the mosques. The analysis revealed that Iranian and Chinese mosques emphasized the central courtyard as a gathering space for worshippers but with variations in architectural arrangements. Iranian mosques featured rectangular plans with surrounding arcades, while Chinese mosques showcased traditional Chinese courtyard layouts with prayer halls and pavilions. This spatial organization served the functional needs of the Muslim communities and reflected the architectural traditions prevalent in each region. Based on the analytical investigation, it can be concluded that the early traditional mosques in Iran and China exhibit remarkable architectural, cultural, and spatial structure dimensions. While influenced by Islamic architectural principles, the mosques in each region also reflect Iran and China's unique cultural and artistic traditions. The mosques in Iran display a fusion of Islamic and Persian influences, while the mosques in China showcase a harmonious blend of Islamic and Chinese architectural styles. The mosques' spatial organization caters to worshippers' specific needs and is influenced by local architectural traditions.

CONCLUSION

This research contributes to a deeper understanding of the early traditional mosques in Iran and China, shedding light on their architectural, cultural, and spatial characteristics. The findings emphasize the significance of historical and cultural contexts in shaping mosque architecture and highlight the cultural diversity and syncretism prevalent in these regions. The analysis

Table 9: Comparison of the spatial structure of mosques in the fourth period

Mosques	Entrance	Courtyard	Routes	Place of prayer	The extent of the connectivity			Connectivity Plan
					Min	Mid	Max	
Qingjing Mosqu					104	1899.75	3766	
Jameh Mosque of Kabir Neyriz					5	777.053	1922	
Guide					Min		Max	

underscores the importance of preserving and appreciating the architectural heritage of these mosques, providing valuable insights for scholars, architects, and enthusiasts interested in the field. In the context of Chinese mosques, they serve as representations of ancient Chinese architectural art, blending the religious components of Islam with a distinct Asian flavor.

Notably, these mosques focus on the spatial arrangement of environmental elements. The design of Chinese mosques aims to evoke various environmental sensations, creating diverse spaces for worshippers. Nature plays an integral role in this design philosophy, with mosque designers seeking to imitate natural scenery rather than dominate it. One interesting aspect

Table 10: Connectivity analysis with Jamovi software

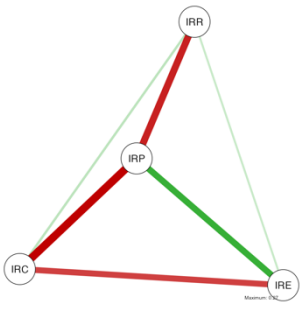
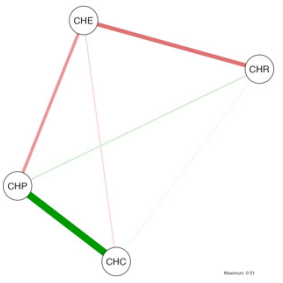
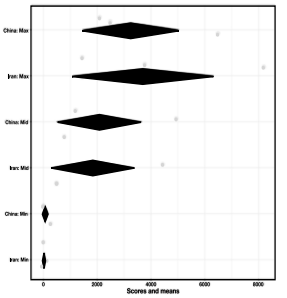
Connectivity network of mosque spaces		Diamond abundance chart
Early mosques in Iran	Early Chinese mosques	
		
Guide		
IR: Iran, CH: China, E: Entrance, C: Courtyard, R: Routes, P: Place of prayer The green lines mean a direct relationship, and the red lines mean an inverse relationship, meaning that in the green lines, one increases with the increase of the other, and in the red lines, it decreases with the increase of the other. Greater thickness and boldness of the lines mean stronger connectivity.		A larger diamond means better connectivity. The elongation of the diamonds is due to the extent of the ranges of each component in the examined samples; based on these data, a diamond diagram was formed.

Table 11: Comparison of traditional mosques in Iran and China

Dimensions		Iran	China
Architectural	Features	Iranian mosques often feature rectangular plans, central courtyards, arcades, and minarets.	Chinese mosques exhibit a fusion of Islamic and traditional Chinese architectural elements. They include sloping roofs, upturned eaves, pagoda-style minarets, and courtyards.
	Ornamentation	Mosques display geometric patterns, mud and plaster decorations, inscriptions, plastering, calligraphy, and decorative patterns.	Chinese mosques incorporate Chinese motifs, carvings, and colorful porcelain tiles. Arabic calligraphy is often integrated into the design.
	Styles	The architectural styles range from early Islamic and pre-Islamic influence to the Khorasani style. The use of local materials and craftsmanship is prevalent.	The mosques blend Islamic architectural traditions and traditional Chinese architectural styles.
Spatial Structure Characteristics	Central Courtyard	Iranian mosques typically have spacious central courtyards surrounded by arcades, providing a gathering space for worshippers.	Chinese mosques also have central courtyards, although .they may be comparatively smaller
	Prayer Hall Placement	The prayer halls are often located on one side of the courtyard, facing the Qibla (direction of Mecca).	The prayer halls are commonly situated at the front or sides of the courtyard, accommodating Chinese architectural conventions.
	Spatial Organization	The layout emphasizes the congregation's collective experience and fosters a sense of unity during prayer.	Chinese mosques integrate Islamic and Chinese spatial traditions, adapting to the cultural context of the region.
Conceptual	Symbolism	Iranian mosques convey spiritual symbolism, representing the Islamic faith, transcendence, and the importance of Islamic art and culture.	Chinese mosques symbolize the harmonious coexistence of Islamic and Chinese cultural values.
	Beauty and Aesthetics	The intricate geometric patterns and decorative elements evoke a sense of beauty and visual splendor.	The fusion of architectural styles and decorative elements reflects the cultural exchange between Chinese and Muslim communities.
	Sacred Space	The mosques create a sacred space for worshippers, facilitating a connection with the divine and fostering a sense of spirituality.	Chinese mosques represent religious tolerance and the blending of diverse traditions within the broader Chinese cultural context.
Philosophical	Spiritual Transcendence	Iranian mosques emphasize the philosophical dimension of spiritual transcendence. The intricate geometric patterns, calligraphy, and symbolic motifs evoke awe, beauty, and spiritual elevation, inviting worshippers to transcend the material world and connect with the divine.	Chinese mosques embody the philosophical idea of interconnectedness. They serve as a physical manifestation of the interconnectedness between different religious and cultural communities. Chinese mosques represent a shared space where Muslims and non-Muslims can interact, fostering dialogue, understanding, and mutual respect.
	Unity and Harmony	Iranian mosques often embody the philosophical concept of unity and harmony. The spatial organization, architectural design, and decorative elements aim to create a sense of cohesion and balance, reflecting the Muslim community's unity and connection with the divine.	Chinese mosques reflect a philosophical dimension of cultural synthesis. They symbolize blending Islamic and Chinese cultural traditions, highlighting the philosophical concept of integration and cultural harmony. Chinese mosques can harmoniously combine cultural and religious practices within a single architectural and spiritual space.

is the orientation of courtyards and the entire mosque structure facing north, which is influenced by the belief in energy flows and reflects the incorporation of traditional Chinese identities.

Finally, the early historical mosques of Iran and China have been analyzed based on studies and investigations according to Table 11 based on four dimensions of architecture: spatial, conceptual, and philosophical structural features. And these four dimensions are the most important. It compares the early mosques of Iran and China, which compares them from different perspectives.

Furthermore, this comparative analysis of the early traditional mosques of Iran and China opens avenues for future research and exploration. Several potential areas could be investigated to expand our understanding of these architectural and cultural phenomena. One potential area for future research could be a deeper examination of the symbolic and conceptual dimensions of the mosques. Exploring the philosophical and symbolic meanings of these mosques' architectural elements, decorative motifs, and spatial arrangements would provide valuable insights into their religious and cultural significance. This could involve studying symbols, representing sacred geometry, and incorporating religious narratives and themes in mosque designs.

AUTHOR CONTRIBUTIONS

All the authors, "K. Kiani, A. FathTaheri & R. Rahimnia," worked

equally in writing all research sections, each written by all three authors.

ACKNOWLEDGEMENT

The University of Imam Khomeini International University(IKIU) supported this study.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the authors have witnessed ethical issues, including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy.

REFERENCES

Adriani, Z. (2019). Improving performance through transformational leadership and utilization of information technology: A survey in mosque-based Islamic cooperatives in Indonesia. Academy of Strategic Management Journal, 18(2), 1-13.

Ain, A. Q. U., & Jianyou, L. (2014). Historical Narratives Embedded in Stone: Analyzing the Inscription on Xi'an Ancient Mosque Steles. Mankind Quarterly, 55(1).

Akbari, A., Torshabi, K. B., & Gahani, T. (2014). Relationship Between Persian Mosques and Sassanid Architecture Based on Theories of "Cultural Continuity" and "Temperament of Time. Indian J. Sci. Res, 7(1), 1011-1017.

Al, S. B. M. B. M., & Al-Juhani, R. (2022). The Position of Scholars Regarding the Hadiths Mentioned in The Funeral Prayer in The Mosque-A Hadith and Jurisprudence Study. Journal of Al-Farahidi's Arts, 14(48-1).

Arezoofar, S., & Marasy, M. (2023). Analysis of the symbolic aspects of the verse of light in the altars of Iranian mosques from the 5th to the 10th centuries AH. Negareh Journal.

Armijo, J. (2008). Islam in China. Asian Islam in the 21st century, 197-228.

Azad, M. (2013). Continuation of Sassanid Religious Architecture in Trikhaneh Mosque, Damghan. Soffeh, 23(2), 85-104.

Azad, M. (2022). A Survey on the Three Important Seljuk Minarets, Chehel Dokhtaran, Tarikhaneh, and Saveh Jami Mosque. Journal of Iranian Architecture Studies, 3(5), 39-56.

Bhatt, I., & Wang, H. (2023). Everyday heritaging: Sino-Muslim literacy adaptation and alienation. International Journal of the Sociology of Language, 2023(281), 77-101.

Biglari, M., Formisano, A., & Davino, A. (2022). Seismic vulnerability assessment and fragility analysis of Iranian historical mosques in Kermanshah city. Journal of Building Engineering, 45, 103673.

Bugnon, P. Religious blending along the Maritime Silk Roads: the case of Muslim's descendants in Baiqi village (Quanzhou City, China). Eighteenth-Century Studies, 47(2), 195-231.

Buseri, F. B. (2015, September). The Role of Chinese Ethnic in the Spread of Islam in Indonesia. In Proceeding Of The International Seminar and Conference on Global Issues (Vol. 1, No. 1).

Cai, R. (2022). A Preliminary Study on the Main Ridge Decoration of Buildings in Yuan, Ming, and Qing Dynasties in Guanzhong Area. Journal of Architectural Research and Development, 6(3), 1-8.

Chen, Q., Morton, A., & Hodous, F. (2019). The Phoenix mosque and the Persians of medieval Hangzhou. Gingko Library.

Clark, H. R. (1995). Muslims and Hindus in the Culture and Morphology of Quanzhou from the Tenth to the Thirteenth Century. Journal of World History, 49-74.

Dilmi, D. (2014). Sino-Arabic Script and Architectural Inscriptions in Xi'an Great Mosque, China. Journal of Islamic Architecture, 3(1), 39-48.

Dizany, E. (2017). Finding the Patterns of Indian Mosque Architecture. Iran. Sci. J. NAZAR Res. Cent. Art, Archit. Urban, 14(48), 73-82.

Erie, M. S., & Carlson, A. (2014). Introduction to Islam in China/ China in Islam'. Cross-Currents: East Asian History and Culture Review, 12, 1-13.

Fairuz, K., Nugraha, A. A., Yudantyo, F. M., Sambodo, N. P., Choiriyah, E. A. N. m., Pertiwi, U. W., & Sekaringsih, R. B. (2022). Do mosques use Islamic bank services? Evidence from Indonesia. International Journal of Monetary Economics and Finance, 15(3), 232-252.

Farrag, E. (2017). Architecture of mosques and Islamic centers in Non-Muslim context. Alexandria Engineering Journal, 56(4), 613-620.

Feng, J. (2017). Architectural Styles of Mosques in China: Analysis and Comments. In Islam (pp. 17-34). Brill.

Feng, Z. (2017). A Brief Narrative of Chinese Style Islamic Relics. In Islam (pp. 53-63). Brill.

Gladney, D. C. (2003). Islam in China: Accommodation or separatism? The China Quarterly, 174, 451-467.

hagras, h. (2019). xi'an daxuexi alley mosque: historical and architectural study. egyptian journal of archaeological and restoration studies" ejars, 1, 97-113.

Hagras, H. M. (2019). The Ming Court as patron of the Chinese Islamic Architecture: The case study of the Daxuexi mosque in Xi'an. Shedet, 6(6), 134-158.

Hagras, H. M. (2020). the functions and symbolism of chinese minarets: a case study of the huaisheng guangta. Journal of Islamic Architecture, 6(2), 68-76.

Hang, X. (2019). Soaring dragon amid dynastic transition: Dates and legitimacy among the post-Ming Chinese diaspora. In The Ming World (pp. 279-303). Routledge.

Harris, R., Ha, G., & Jaschok, M. (2021). Ethnographies of Islam in China. University of Hawaii Press.

Hashemi, S. H., Mahmoudi, K., & Azimi, S. A. (2015). Baharieh, Description of Spring in Khorasani Style Poetry. International Journal of Literary Studies, 5(3), 96.

Hasmath, R. (2014). The interactions of ethnic minorities in Beijing. University of Oxford Centre on Migration, Policy and Society Working Paper, 14-111.

Holakooei, P., & Karimy, A.-H. (2015). Early Islamic pigments used at the Masjid-i Jame of Fahraj, Iran: a possible use of black plattnerite. Journal of Archaeological Science, 54, 217-227.

Jeong, J. H. (2022). Little Mecca in Canton: representations and resurgences of the graveyard of Sa'd ibn Abī Waqqās. History and

Anthropology, 1-24.

Jinchen, C. (2007). Guangzhou–Tanah Suci Islam Timur Jauh. Humaniora, 19(1), 11973.

Khan, H.-U. (1990). The architecture of the mosque, an overview, and design directions. Expressions of Islam in buildings, 109-127. https://www.masjed.ir/Content/media/article/DPC0262_0.pdf

Lane, G. (2009). Nasir al-Din Tusi,"; "Sayyed' Ajall,"; "Phoenix Mosque, Hangzhou," and "Uzan Hasan.

Lane, G. (2011). The Phoenix Mosque of Hangzhou. Qinghua Yuanshi (1).

Lane, G. (2016). The Phoenix Mosque feng huang si, feng huang qing zhen si. The Mongols' Middle East, 237-276. https://ixtheo.de/Record/1743525613

Liu, C., Yang, R., Xue, D., & Tan, Y. (2021). Globalization and the Governance of Muslim Spaces in Contemporary Guangzhou. The Professional Geographer, 73(4), 754-764.

Liu, X., & Yang, Y. (2022). The Hard Road to Reform: Curriculum Renewal for Muslim Education in Early Twentieth-Century China. Religions, 14(1), 46.

Ma, H. (2006). The Mythology of Prophet's Ambassadors in China: Histories of Sa'd Waqqas and Gess in Chinese Sources. Journal of Muslim Minority Affairs, 26(3), 445-452.

Miranti, Y. N., Wulan, D., & Korimatores, F. (2022). Studying the Al Mahdi Mosque. KnE Social Sciences, 53–69-53–69.

Monazzah, A., & Khazaei, M. (2013). Studying the Graphical Structure Altar Inscriptions and around Neyriz Great Mosque. Archi-cultural Translations through the Silk Road: 2nd International Conference.

Murod, M. m., Sulastri, E., Gunanto, D., Sahrasad, H., & Mulky, M. A. (2022). Islam and the state: Indonesian mosque administrators' perceptions of Pancasila, Islamic sharia and transnational ideology. HTS Theological Studies, 78(4), 1-10.

Newslaw. (2022). Khorasani architectural style Its background and characteristics.

Norris, H. (2001). The Mushaf in Beijing's (Bikīn's) Oldest Mosque. Journal of Qur'anic Studies, 3(1), 123-134.

Omar, N., Muda, Z., Yaakob, R., & Maoti, M. (2019). Mosques as an Agent for Community Development in the History of Islam. International Journal of Academic Research in Business and Social Sciences, 9(9).

Pirnia, M. K., & Memarian, G. (1995). Introduction to Iranian Islamic architecture. Iran University of Science and Technology Publications.

Pirnia, M. K., & Memarian, G. (2005). Islamic architecture of Iran. Tehran, Iran. Soroosh Danesh Publications.

Pirnia, M. K., & Memarian, G. (2008). Iranian architecture. Tehran: Soroush Danesh Publishing House.

Pirnia, M. K., & Memarian, G.-H. (2004). Styles of Iranian architecture. Tehran: Sorush Danesh Publications.

Pirnia, M. K., & Memarian, G. H. (2005). Introduction to Islamic architecture of Iran. Tehran: Soroosh Danesh Publications.

Pirnia, M. K., & Memarian, G. H. (2007). Stylistics of Iranian architecture. Editor: Gholam Hossein Memarian, Tehran: Soroush Danesh Publication.

Rahmawati, R., Yahiji, K., Mahfud, C., Alfin, J., & Koiri, M. (2018). Chinese ways of being good Muslim: from the Cheng Hoo Mosque to Islamic education and media literacy. Indonesian Journal of Islam and Muslim Societies, 8(2), 225-252.

Ramzy, N. S. (2022). Beyond Beauty, Life and Nature in Nasir El-Molk Mosque, Iran. Nexus Network Journal, 24(1), 217-245.

Ridgeon, L. (2020). The Problems of Sinicizing Beijing's Mosques. Journal of Muslim Minority Affairs, 40(4), 576-596.

Riwajanti, N. I. (2019). Mosque-based Islamic cooperative for community economic development. Review of Integrative Business and Economics Research, 8, 196. http://sibresearch.org/uploads/3/4/0/9/34097180/riber_8-s2_15_h18-163_196-208.pdf

Salimi, M., & Sharifzadeh, M. Phenomenology of Islamic-Iranian architecture of Naein's Jama Masjid (Jameh Mosque). Islamic Art Studies, 20(51).

Sarhaddi-dadian, H., Malekzadeh, S., & Ramli, Z. (2022). The Architecture of Dezzak Grand Mosque, Iranian Baluchestan, With Reference To Prophet Mohammad Mosque in Medina. Journal of Islamic Architecture, 7(2), 279-288. So, H.-H. (2022). Islamic architecture in China. Retrieved 2022 from https://www.hisour.com/islamic-architecture-in-china-31830.

Soltani Mohamadi, M., & Azad, M. (2018). Comparative Analysis of a Special Style in Religious Troglodytic Architecture of Central Zone in Iran (Nain County) and Three Relics in North West of Iran. pazhoheshha-ye Bastan shenasi Iran, 8(16), 203-222.

Steinhardt, N. S. (2021). Mosque architecture and decoration in China. In Routledge Handbook on Islam in Asia (pp. 253-266). Routledge.

Su, P. (2017). The floating community of Muslims in the island city of Guangzhou. Island Studies Journal, 12(2), 83-96.

Taghavi Nejad, B., & Moazzeni, M. (2016). A Study of Plant and Geometric Designs in the Stucco Mihrab of Neyriz Great Mosque. Negarineh Islamic Art, 3(11), 76-86.

Utaberta, N., Asif, N., Rasdi, M. T. M., Yunos, M. Y. M., Ismail, N. A., & Ismail, S. (2015). The Concept of Mosque Based on Islamic Philosophy: A Review Based on Early Islamic Texts and Practices of the Early Generation of the Muslims. Advances in Environmental Biology, 9(5), 371-375.

Wang, W., Zhou, S., & Fan, C. C. (2002). Growth and decline of Muslim Hui enclaves in Beijing. Post-Soviet Geography and Economics, 43(2), 104-122.

Zibaeenejad, M., & Jowkar, N. (2008). A Look at Transformation of Literary Terms and Metaphors of the Khorasani Style in the Eraqi Style. researches on mystical literature (gowhar-i-guya), 2(3), 39-74.

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 77-86 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI: 10.30495/IJAUD.2023.72943.1681

Role of the Third Place in Recognition of Environmental Perception Theories

Mohammadreza Mohammadi Vosough[1], Toktam Hanaee[2*]

[1] M.A. Student of Urban Planning, Department of Urbanism, Mashhad Branch, Islamic Azad University, Mashhad, Iran.
[2] Assistant Professor, Department of Urbanism, Mashhad Branch, Islamic Azad University, Mashhad, Iran.*

Recieved 2023.04.25; Accepted 2023.07.30

ABSTRACT: Since the third places are very effective in relieving the anxiety and tension of the citizens and the studies conducted in the past, consider this component as a multifaceted component that different results are mentioned in the articles depending on the time and different places, in this article using A comprehensive questionnaire of artificial intelligence has been used. We are looking to find key variables in these main components of this research, which are the perception of persons, third place, and environmental perception. In this case, we can achieve maximum use of third places to improve urban spaces according to key variables. This research, which aims to improve the quality of urban hangouts to increase the quality of urban space on urban perception, originated from a basic question which is to identify and prioritize the factors effective in improving the quality of the third place in urban perception, in this research artificial intelligence information by setting up a questionnaire The detailed influencing variables of the third rank of environmental perception have been collected. The purpose of this research is to investigate and identify the role of the third place in environmental perception, and since the research method is qualitative, it has been analyzed using research onion and MAXQDA software. In the end, by showing a map of the relationships between the influential variables of this research, it is stated which includes: the sense of belonging, individual perception, experience and habit, and environmental perception.

Keywords: *Environmental Perception- Man & Environment Interaction- Third Place - environmental psychology- Behavior of people.*

INTRODUCTION

In environmental psychology, the research examines people's responses to what is perceived by considering the mechanisms involved in cognition and, ultimately, the creation of personal perception. In particular, Stephen Kaplan (1979) has inspected the assessment of 2D versus 3D scenes through 4 instructive components counting coherence, complexity, lucidness, and riddle. The Ambiances organize particularly investigating experiential and tangible subjects in space and put. (Thibaud, 2012; Thibaud & Siret, 2015). Individual and social behaviors happen and create in physical spaces and space, and individuals have a common impact that's appeared through culture. From this point of see, the part of the physical space plan is exceptionally critical, even though it may be a component that decides the quality of the space and people's prosperity. As an illustration, able to allude to when we plan and look at the spaces in such a way that our objective is to meet human needs, and we are conditioned by social and individual wants and indeed the understanding of the concept of well-being. (Hall, 1996). In other words, it can be said that the comes about of an urban plan should not be judged as an objective reality per se but should be inspected concerning clients. (Altman & Rapoport, 1980). The urban design contains a coordinated and indirect effect on the physical environment of people's way of life (encounter) and eventually on social and individual behavior. In other words, it can be said that the development of fabric space empowers and indeed bad habit versa it cannot avoid its creation, foresee human elements, and eventually make social life. All the concepts that Jan Gehl called life between buildings. (Gehl, 2011). Last, inside this social space, people's individual life takes place. (Piga & Morello, 2015). The relationship between reality and recognition isn't momentary. The perceptual involvement of a question isn't a genuine duplicate of reality but a representation. This

*Corresponding Author Email: *t.hanaee@mshdiau.ac.ir*

representation is continuously a halfway entertainment of reality. Now and then, we cannot get things that exist or bad habits and versa, and sometimes we get things that don't exist. Sometimes, These perceived illusions appear that what the individual feels within the tactile organs does not compare to what is seen within the mental representation. Concurring to (Bronfenbrenner, 1996), discernment is the set of forms by which we recognize, organize, and make sense of the feelings we get from natural boosts. We emphasize that boosts can come from an inner or outside environment. This way, recognition, and feelings are organized and then framed a discernment, a mental representation of a seen boost. The contrast between animal perception in common and human recognition is within the shape and way of this representation. People have an uncommon way of utilizing the more complex tactile data "in a way that oversees it in such a way as to make a mental representation of objects, highlights, and spatial connections from the environment" (Bronfenbrenner, 1996). Their capacity compensates for the tangible confinement in people for mental representation, which enhances the quality of interaction with the environment. Each creature, in its advancement, has created a perfect way", a perfect way, to adjust to its environment. We capture ourselves by being human. In expansion to steady activity, response, and interaction, people can cut real-time joins with reality and make other times and spaces, in other words. People can oversee reality uniquely, bargain with symbolism, and alter their behavior after this perusing. Since human capacity is the most distinct, looking at his natural discernment becomes more vital. Man's interaction with the environment numerous times causes environmental lopsidedness and the return of weight on the man himself and negative impacts on nature. In expansion, if the man is dependable for numerous natural issues, the arrangement to these issues lies in him. The way people interpret reality and themselves, that's, understanding reality and themselves meddling with the quality of human interaction with the environment. (Saunders, 2003). With the progress of urbanization and the rapid growth of cities, paying attention to the needs of people's communities and planning and planning has found a special place in the perception of individuals, each person, by being in the environment, according to a series of variables, including the level of awareness, experience. has a distinct understanding. Considering that the study of environmental perception is a multifaceted component and provides different research results depending on the time and place, identifying and investigating the influential variables of this component using artificial intelligence information and inference and the high percentage of collected information compared to setting up a device is necessary. The questionnaire is different from the people in this research from the environment, this research, which aims to improve the quality of urban hangouts to increase the quality of urban space on urban perception, originates from a basic question which is to identify and prioritize the effective factors in improving the quality of the third place in urban perception. In the following figure, research keywords have been compiled for better familiarity with the research. (Fig. 1)

Literature Review

Over five decades of his recognized career, Gibson brought modern clarity to the ancient issues of the convention. He proposed an elective hypothesis of discernment, which he depicted as an adaptation of coordinate recognition to recognize it from the circuitous approach of Rene Descartes. For White, and Rene Descartes, our recognition of reality comes from the representations we have shaped inside ourselves, whereas Gibson's hypothesis of coordinate discernment states that the environment contains all the data required to decide its characteristics. Hence, recognizing these highlights depends on acknowledging the specified data within the environment (Braund, 2008).

David Morris says that we don't get the crude and uncovered highlights of the environment, but we get what the environment

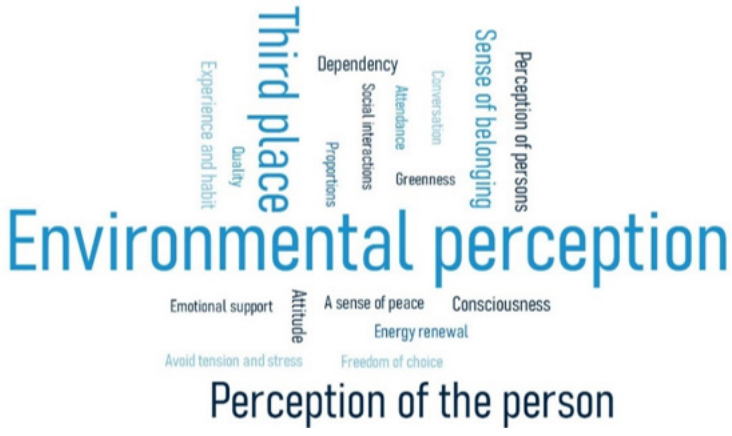


Fig. 1: Research cloud code

can do for our body, how we will utilize it, or within the encompassing environment. (Braund, 2008).

Environmental perception is a concept of discernment for connections between people and social orders with the encompassing environment. In other words, interaction with the quality of natural discernment is a basic component of life. In connection and communicating with the environment, people have been continually disturbing the biological adjust, which has eventually driven them to make a push for themselves and natural harm. However, it ought to be famous that natural recognition is straightforwardly related to natural mindfulness in such a way that individuals Are more mindful, and the quality of interaction between people and the environment is more profound. Intelligent behaviors all result from discernment and cognitive forms. (Marques et al., 2020).

Interaction with the environment is basic for the survival of species. Interaction with high-quality natural recognition is a basic component of creature life. In an intriguing approach, we can see how this developmental consideration is progressively coordinated into today's brain research (Gangestad & Tybur, 2016, 5-8).

Gibson's hypothesis of coordinate discernment, known as the environmental show, conceptualizes affordance and accepts that being human does not require higher cognitive forms to the degree of tactile and perceptual encounters. While, within the top-down concept, constructivist creators consider that the perceiver makes an introductory inside representation of the boost and employments other sources of data separated from sensory information. In this way, learning encompasses an important part of this handle. Recognition may be an energetic handle amid which different theories are proposed concerning recognition based on three components:

1. Tangible information, sense data. 2. Put away information, known and recovered data from memory. 3. Built data, inferred data when cognitive forms are enacted at a tall level. (Marques et al., 2020).

Recognition is the primary step in human communication. The act of perception is so common and visited that it is taken for allowed in most cases and isn't.

Indeed assessed or taken under consideration. We hypothesize that if people extend their environmental mindfulness, they are likely to associate more mindfully with the environment. The level of biological mindfulness is specifically related to the self-awareness of the quality of one's natural discernment (Marques et al., 2020). Each day we watch the aimless utilization of the thing "recognition," with two common implications:

As a cognitive act and a moral act, which suggests how an individual sees, interprets, or judges reality. In casual discussion, you'll ordinarily see, "Did you take note of something distinctive around me?" when there's a alter in someone's appearance, such as hair color. Or "How do you see the effect of this news on the economic advertise?" when you present an unused component into a discourse, such as a political choice. These implications of the word discernment are not off-base; be that as it may, its meaning is broader, and the semantic issue, as it were, emerges when we diminish or mutilate its meaning, which can jeopardize the discussion.

Recognition can be inspected from distinctive viewpoints:

1-Through handling is made by physical, chemical, natural, social, and mental jolts (full of feeling, social, and cognitive).

2-With perceptual levels and bearings, from subliminal discernment to wide cognizant discernment, or from self-perception (inner world) to natural discernment (external world).

3-The variables that influence that recognition:

Outside (such as concentrated, differentiate, movement, and discord).

Inner (inspiration, encounter, culture [information, convictions, values]).

4-Through perceptual shortfalls, obsessive (visualizations, daydreams) or not (visualizations, camouflage, impersonation). Perceptual handle.

As we have seen so distant, discernment isn't fair the natural product of a brain at work, yet the organically acquired viewpoints of the species, but the mind in conjunction with the full body, systemically and comprehensively that brings together the individual as well. Mental reality has outside physical and social impacts. It can be said that recognition has a natural substrate and another agent. We have something specifically related to the human physical, tactile framework concerning the natural substratum. It may be a framework that covers three major capacities:

Sense of depth, sense of self,

Interception, sense of function

Major systems of organs in the body and internal conditions

External sense is the direct interaction of the external world on the body; for example, responsible for the feeling of heat and cold (Marques et al., 2020).

Beneath the layer of representation, it alludes to the method of making self and reality. This handle of organizing and extraordinarily deciphering tangible information is socio-historically affected.

It recognizes two deciding components in recognition:

Self-directed and behavioral. The primary one alludes to the organic qualities related to the apprehensive framework and associated with the brain. The moment alludes to behavioral characteristics related to inspiration, identity, learning, demeanor, social needs, and social foundation related to the intellect. The Bruner impact development got to be known as the "Modern See at Recognition," which highlighted the mental components that meddled with discernment:

1. Selectivity (each perceiver sees reality depending on his characteristics and interface. 2. Arrange and meaning for the caught-on (the set of thoughts related to the caught-on, concepts, and essential concepts within the case and setting). 3. Shaping a thought (nourishment from encounters, information,

biased convictions). 4. Classification (organization of decisions into classes, not as it were levelheaded but ideological and enthusiastic).

It ought to be arranged towards a homogeneous system, regarding the fundamental divisions agreeing to the embraced hypothetical approach, which may get a differing topical center, from which illustrations based on the involvement of conspicuous thinks about within the fields of human topography, ponders on the topophilia establishments of discernment; Instruction, cognitive and social authentic angles, imperative life encounters and memory; Human science, questions approximately the delineation and development of human ecology, social interaction; and logic, the phenomenological establishments of discernment and their moral and tasteful measurements (Maia, 2020) The consider of natural discernment joins together the components that contribute to it:

A. The shared impact of understanding human behavior and his environment. B. Giving information for the favorable human natural participation of the settlement organization between. C. Arranging natural instructive measures (Alves, 2016, 131-148).

Natural recognition assembles cognitive, passionate, and social components as common discernment. It can be characterized as an outlet for tricky scrupulous joins with the environment, be that as it may, the act of seeing the environment is implanted in it and learning to ensure it. And beware of the same. Too, concurring with the ideological impact of each society, it can be characterized by how individuals see, get it, and communicate with the environment. The coming about reactions or appearances are the result of collective and personal judgments and desires, from cognitive recognition, the forms of each person (Ursi & Towata, 2018) rejoining the diverse psychosocial measurements of natural recognition:

1-cognitive (arrangement of mental pictures)

2-passionate;

3-Inclinations related to the environment (allure level).

According to urban sociologist Ray Oldenburg, the third place, a major public institution, is a shelter in front of the home or workplace, where one can regularly interact with friends, neighbors, colleagues, and strangers. Relatedly, according to Oldenburg, third places are informal public gathering places. Next, Oldenburg also described third places as public places in a neutral context where people can gather and interact with each other. In contrast to the first places, i.e., home and the second places, defined as workplaces, in the third places, the conditions are such that people put aside their usual worries and enjoy socializing and social relations with the people around them. (Oldenburg, 1997). In the following form, the variables studied and investigated in this research are categorized according to the main components, compiled for better understanding and easier familiarization with the variables that will be investigated further. (Fig. 2)

MATERIALS AND METHODS

Since many articles related to environmental perception are all information collected by people, we are trying to fill the information gap in this field and examine new results using artificial intelligence. In this research, by combining the two variables of environmental perception and the third place, we investigate the role of the third place in the recognition and perception of the environment from the point of view of artificial intelligence because many of our searches in the virtual space, which are often affected by the personality of each person, exist in the internet space. Also, in other articles where the questionnaires were conducted through individuals due to the limitation in the number of questionnaires and often a small group of people was selected as a statistical volume, like a greenhouse, it provides different results depending on the place

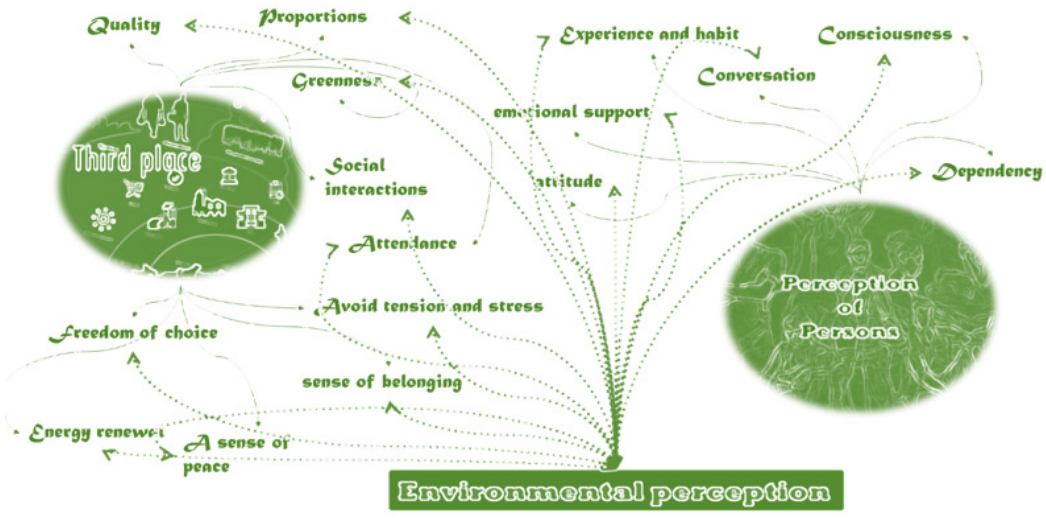


Fig. 2: The theoretical framework of research

and time, but in this research, using intelligence Artificial that by creating an algorithm from the results of people's searches that leads to the recognition of each person's personality, it is possible to obtain the most dominant and accurate answers to the questionnaire and the results obtained from it can be adopted as the main results in this field of studies. This research has been carried out using qualitative approaches, which have special complexity and variety, and further, the primary analysis has been done using thematic analysis. (Denzin et al., 2023).Because by using this type of analysis, it will base the main skills for other analyses. (Holloway & Todres, 2003). For example, we can refer to the research done by Ryan and Bernard in 2000, which uses thematic analysis as an analytical process based on the opinion of the data and considers a specific approach in research. (Ryan & Bernard, 2000).

Flexibility is one of the most important benefits of thematic analysis. Qualitative analysis methods are divided into two parts:

1- The first category includes those that exist because of integration with a specific theoretical or epistemological position or are a root of them. Such as conversation analysis (Hutchby & Wooffitt, 2008, 265) and interpretive phenomenological analysis (Smith & Osborn, 2015, 312). There are limitations in the framework of this method, and it can be stated as a principle to guide the analysis. However, for other methods, Such as contextual analysis (Corbin & Strauss, 2014, 131) and discourse analysis (Willig, 2015, 312), and quotation or narrative analysis (Murray, 2015, 312), there are discrepancies, the most important of which can be pointed to is extensive extraction from within their theoretical framework.

2- The second category, which is independent of epistemology and theory and is used in a wide range of theoretical and epistemological approaches, although they are often implicitly expressed as

a practical/experimental method, but the thematic analysis is originally in the second category. (Roulston, 2001). The thematic analysis method that we mentioned earlier leads to the foundation of a flexible and useful research tool by creating theoretical freedom, and it can potentially be used for an accurate and rich report combined with the complexities of the data. This research uses the potential of thematic analysis, such as flexibility, as mentioned earlier, for data analysis.

Thematic analysis is used to classify the analyzed data and express patterns related to the extracted data. As mentioned, this method can express and interpret more detailed data with various topics. (Boyatzis, 1998, 70). In research that seeks to discover the use of interpretations, thematic analysis can be used as one of the best analyses available in this field because, in this research method, we see an increase in complexity and accuracy, ultimately improving the overall concept of the research. Thematic analyzes allow understanding and analyzing any problem, and finally, the researcher can analyze the potential of each problem more extensively by using this method. (Marks & Yardley, 2003, 30). Using comparative and establishment methods due to their flexible nature can be considered another benefit of using thematic analysis. (Frith & Gleeson, 2004). Taking advantage of the dominant approaches of the collected information leads to the beginning of the research with precise content. It will lead to a wider allocation and, finally, to the statement of theories, which will increase the accuracy and ensure the effective connection of the patterns with the information. The processed data are categorized and displayed considering their differences and similarities. (Miles, Huberman, & Saldana, 2019). It is important to display the content in the research when using thematic analysis; the model should describe a major part of the data. (Marks & Yardley, 2003, 67).

In this method, a logical process should be carried out that at the beginning of each pattern and the connection between them, the classification of information is connected to discover the mutual connection between variables and factors, to create conceptual coherence, and at the end to identify the validity of the final results in a way that fits the theoretical framework of the research is done All the steps of displaying and drawing information must be done sequentially. (Mile et al., 2019). Considering that the collected information is of qualitative type, the research method adopted is qualitative, and the collected information was done using research onion and MAXQDA software. First, the required information was collected, and then by examining the literary background and examining the variables proposed by the experts and paying attention to the library documents to categorize the variables of the Third place components as well as the important components of environmental perception and personal perception and evaluating these components using the results obtained from the questionnaire using MAXQDA software and finally we reach the most important influencing variables. The following text has compiled a graph to understand the research process better. (Fig. 3)

Data Analysis

In this section, we analyze the collected data using MAXQDA software. First, in the collected documents, we code the words from the texts of the collected documents. At this stage, according to the variables mentioned earlier in the theoretical literature and the theoretical framework of the stated research, we choose the codes displayed in the following list, compiled in the figure of all the checked codes. (Fig.4)

In this section, the number of coding done in the documents collected in the software is displayed, and as you can see, the highest number of coding is related to environmental perception & third place variables, and the lowest number of coding is related to emotional support & avoid tension and stress variables. The following figure displays the evaluated codes' ratio for better understanding. (Fig. 5)

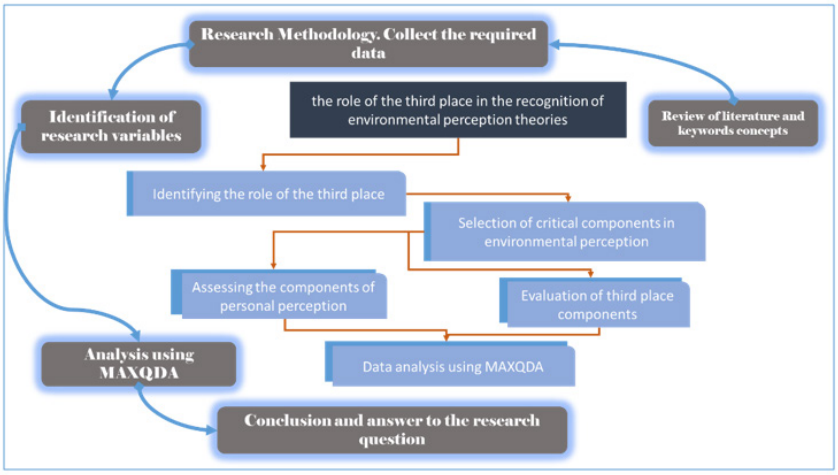


Fig. 3: The model and process of research methodology

Code System	1209
Environmental perception	420
Perception of the person	208
Dependency	27
Conversation	8
Social interactions	9
Attendance	8
Attitude	24
Emotional support	5
Experience and habit	37
Consciousness	24
Perception of persons	47
Third place	248
Avoid tension and stress	6
Sense of belonging	77
Freedom of choice	8
Energy renewal	14
Greenness	12
A sense of peace	13
Proportions	6
Quality	8

Fig. 4: The list of coding done in the MAXQDA software

In the output of the matrix from the MAXQDA software, from the analysis and coding of the documents collected in this research, we see the highest correlation between the variables environment perception & third place and then environment perception and perception of the person, among which among the variables third place, perception of the person, we see the most coding relationship between sense of belonging & experience and habit & dependency & attitude variables. In the following figure, the output matrix from the software shows the relationships between all the coding done from the documents collected in this research. (Fig. 6)

Finally, for a better conclusion and a complete view of all the relationships between the codings done in the MAXQDA software, we prepare a map of the relationships between the codings done from the collected documents, which you can see in the following figure, and it is important that based on the frequency, the thickness of the connecting line between the codes increases. (Fig. 7)

RESULTS AND DISCUSSION

The results of this research are in line with the results of research such as Ryuzo Ohno's research, which is 2018, in an article entitled Studies on Environmental Perception indicates the importance of environmental perception and the effect of

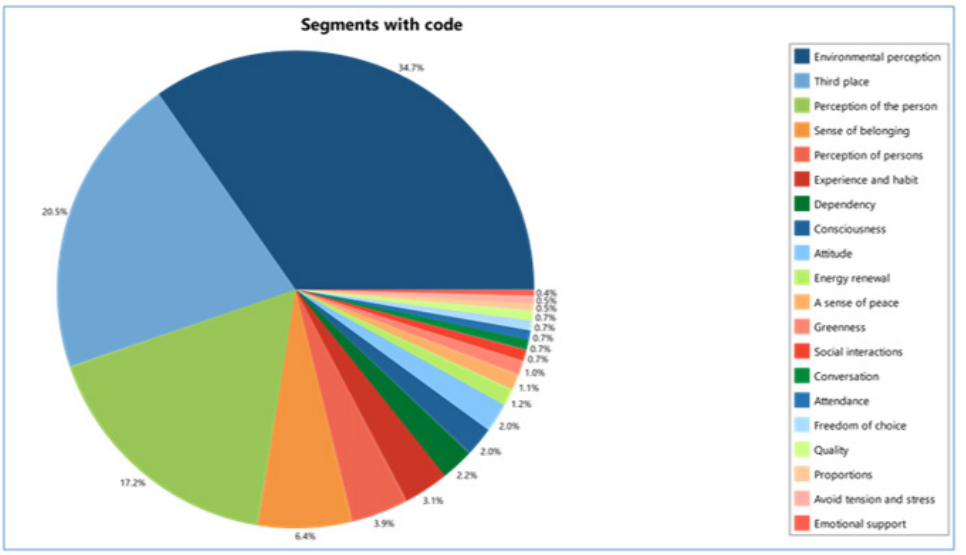


Fig. 5: Segments with code

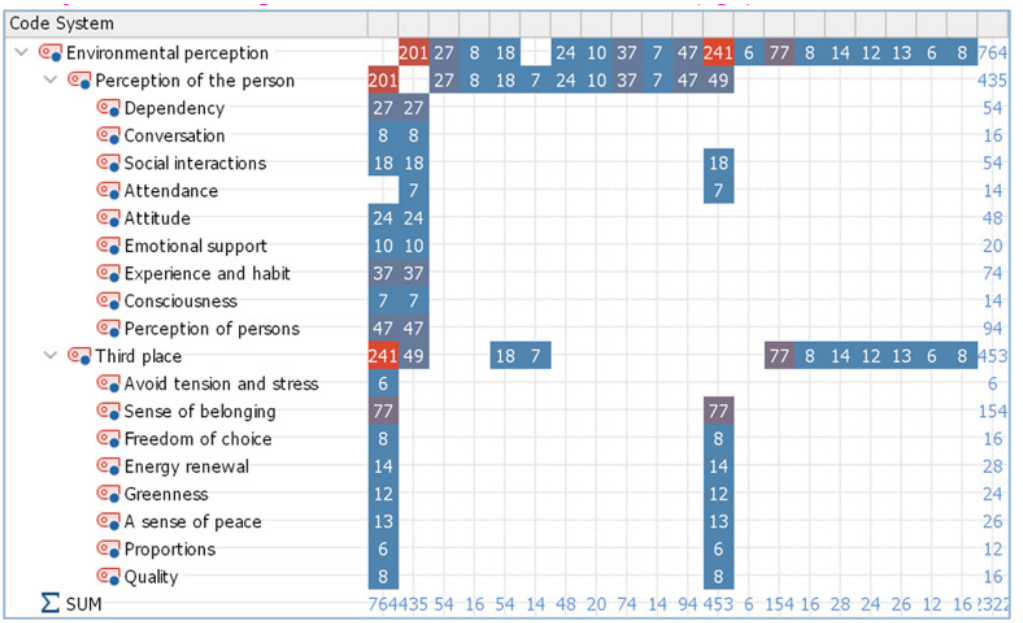


Fig. 6: The relations between codes in the MAXQDA software

spatial proportions and characteristics on people's perception. Some characteristics in people must cause perception. Different from the environment, the most important of which have been discussed in this research, include the type of attitude, experience, habit, and also In this paper, direct and continuous perception is emphasized instead of cognitive aspects of perception, which depend on conditions such as cognitive schema and the current psychological state among individual perceivers. Also, in this article, the study of vision and perception of the environment during movement may compensate for the shortcomings of the traditional object-oriented approach and contribute to a more comprehensive understanding of environmental perception. New research tools have been developed and tested to investigate the dynamic nature of environmental perception. During movement, empirical studies generally support their validity. While other

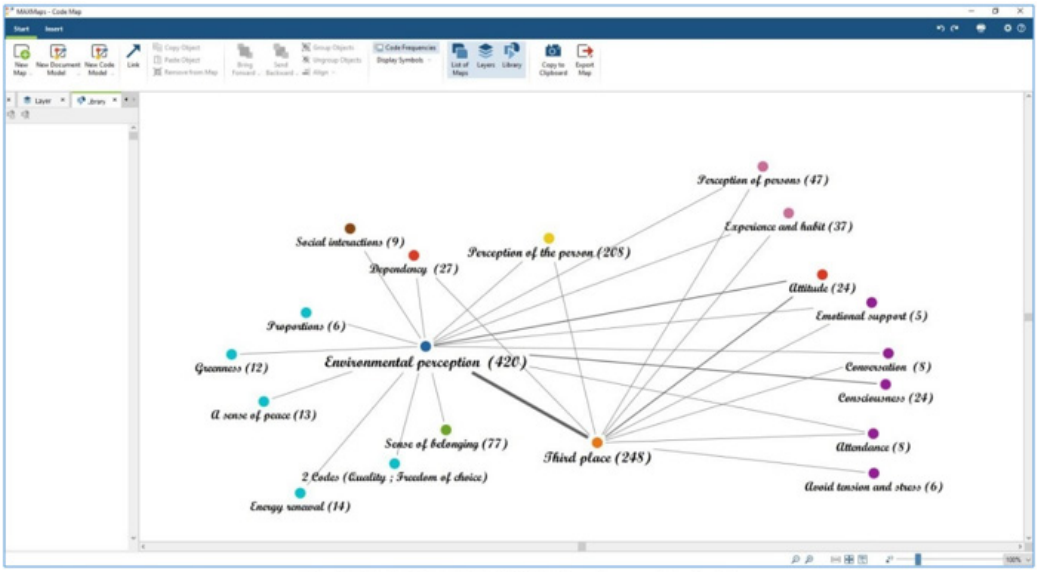


Fig. 7: CODE MAP, MAXQDA software

researchers tend to limit their research subjects according to existing conventional methods, in this article, an attempt has been made to examine perception in its natural state, which requires new tools. Regarding future environmental behavior studies, the impact of a new data environment should be considered. Today, it is easy to obtain information about the physical properties of the built environment at a fine scale through Google Street View photos and 3D laser-scanned models of buildings, as well as information about human behavior through the digital footprints left by tracked individuals. By sensors such as mobile phones and social media records. Meanwhile, it has many new sophisticated techniques to measure and analyze human responses, such as wearable physiological sensors, virtual reality simulation, and big data mining. Although the new data environment and analytical techniques provide strong support for investigating basic and immediate perceptions of the environment, these tools alone do not lead to understanding the relationship between the environment and behavior. Because to gain a comprehensive understanding of that relationship, the results must be interpreted with careful reference to existing theories or models of environmental and behavioral studies. Finally, although this paper has mainly focused on visual aspects, this paper attempts to draw attention to the multifaceted nature of environmental perception. The influence of non-visual environmental information received unconsciously was suggested by the experimental research of this research on a Japanese garden. Due to the changes in built environments that cause an increasing dependence on new artificial elements, the importance of environmental features of natural and traditional environments that enrich our sensory experience should be rediscovered. (Ohno, 2018, 194-206). Also, the results of the research conducted in 2020 by Valéria Marques and her colleagues in research entitled "Environmental Perception" indicate that environmental perception is expressed as an important concept of perception that is very effective in the relationships of individuals and societies with the environment. which has been the cause of discovering the interactive relationship between humans and the environment and has been the cause of finding important influencing characteristics in this relationship, and finally for the most important influencing variables in that research, including moral, emotional, ecological and knowledge and awareness characteristics, and its results show that people in interaction With environmental perception, it leads to environmental awareness. The more this awareness, the better its quality, and also, In this article, the interaction between the environment and living beings is emphasized. That each creature has acquired the capacity to reply to boosts. The appraisal made in this investigation between the level of mindfulness and activity control appears to contrast these two components. In people, the interaction with the environment isn't as it was based on physiological needs; in expansion, needs and wants are moreover-shaped. In its social quality, environmental education is vital in improving natural recognition. The cognitive, enthusiastic, and inactive highlights of the gathering of people are emphasized in this investigation. Standard recognition alludes to the capacity influencing the organism's perceptual preparation to procure natural highlights and components critical for survival (life). Any standard recognition will be influenced by how perceptual forms are fortified, whether the information is considered or overlooked. The standard recognition is impacted by mental

plans (acquired and developed), metallic structure, concepts (developed), and temporal-spatial settings. Natural instruction ventures give a wealthy involvement that fortifies the subject. The (re)construction and transaction of faculties are fueled by overhauling involvement and the trade of discernments between members. Natural mindfulness is closely related to the presentation of natural mindfulness, and it induces that the more mindfulness; there's, the higher the quality of interaction between humans and the environment. Person and bunch attitude meddling a part with discernment and picking information. Intelligent behavior is caused by recognition and cognitive forms and is highlighted in judging and anticipating the course of environmental occasions. There's no non-partisanship; indeed, there's an ideological-political course within the impassion or avoidance of explicit metalizing. Freedom is found not as it were in cognitive advancement but in self-awareness, expecting duty, and social maturity. It can be concluded that the relationship between recognition and natural mindfulness isn't as if it were a cognitive address but moreover incorporates other socio-historical questions such as financial matters and legislative issues. Media can strongly influence perceptual preparation. In any case, to counter ordinariness, ideological generation, lived encounters are proposed that enter profoundly into the subject and his bunch and continually apply the issue of the interaction between man and reality, with successful measures to construct a common world and more facilitated offer assistance. (Marques et al., 2020).

CONCLUSION

In this research, first by examining the theoretical literature in the field of third place and environmental perception, the study of the literature defined in these fields from the point of view of experts and the knowledge of the variables examined in research and global experiences has been done, and then by creating a theoretical framework that the relationship between these two components and The considered variables in this research has been done and the variables that are to be investigated in this research have been introduced, these final variables include:

1-Experience & habit, 2- Dependency, 3-Attitude, 4-Sense of Belonging 5-Society interaction

In the following, using the MAXQDA software, the relationship between the variables of these components was investigated from the information collected from the results of the questionnaire, and the results of this research show that conversations in a third place are an effective way to raise awareness and awareness of environmental issues and perceptions. Third places are social spaces where people can engage in meaningful conversations that stimulate their thinking about environmental issues. In such places, people can learn from each other, share their experiences, and offer new perspectives and solutions to environmental problems. Considering the effect of the feeling of dependence on the third place on a person's ability to know and understand the surrounding environment, it can be said that dependence can have positive and negative effects. On the one hand, frequent visits to the third place can increase familiarity with the environment and better understand its unique features. On the other hand, dependence can lead to a narrower view of the environment and limit one's ability to recognize and

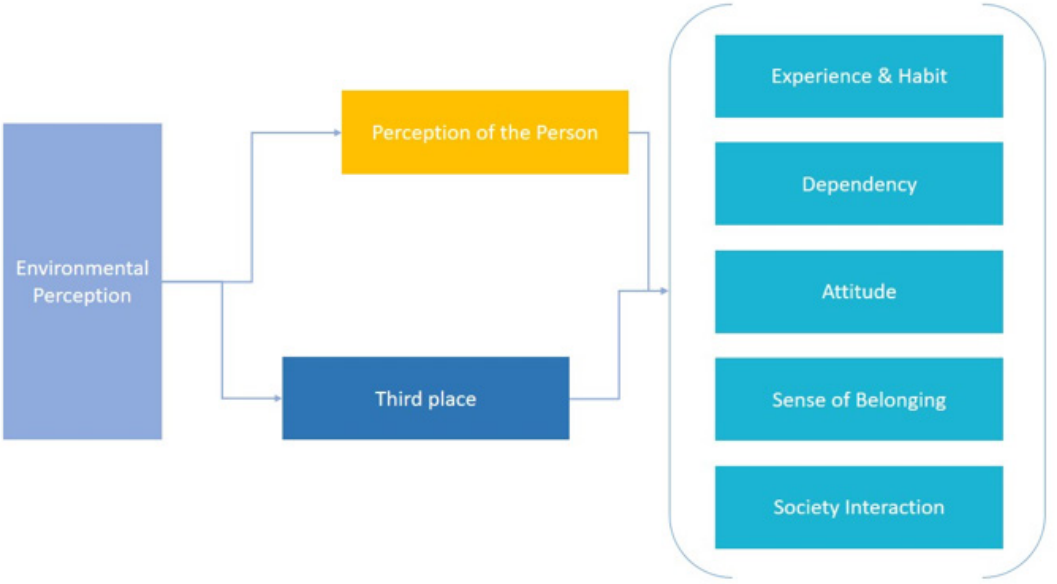


Fig. 8: Relationships between influencing variables of the third place in environmental perception

understand its broader environmental and social consequences. In the following figure, the relationships between the influential variables between the components examined in this research are placed for better understanding. (Fig. 8)

AUTHOR CONTRIBUTIONS

Performing literature Review, collection of raw data, design, and distribution of questionnaires work with related software for data processing, and preparation of manuscript text and manuscript edition have been done by M. Mohammadi Vosough. (including substantive translation), and The research methodology was designed with the participation of M. Mohammadi Vosough and T. Hanaee.

T. Hanaee has also participated in reviewing the research and making some corrections.

ACKNOWLEDGEMENT

This manuscript is extracted from the thesis of M. Mohammadi Vosough.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or falsification, double publication and, or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Altman, I., & Wohlwill, J. F. (2012). *Human Behavior and Environment: Advances in Theory and Research* (Vol. 2). Springer Science & Business Media.

Alves, S. C. V. (2016). *Estado da arte dos estudos sobre percepção ambiental no Brasil no período entre 2008 e 2015.*

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development.* Sage. 1-183

Braund, M. J. (2008). *The structures of perception: an ecological perspective.* Kritike, 2(1), 123-144.

Bronfenbrenner, U., & MORRIS, P. (1996). *A ecologia do desenvolvimento humano* (Vol. 80). Porto Alegre: Artes Médicas.51-88

Corbin, J., & Strauss, A. (2014). Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory (Fourth edition ed.). Thousand Oaks, California: SAGE Publications, Inc, 131

Denzin, N. K., Lincoln, Y. S., Giardina, M. D., & Cannella, G. S. (Eds.). (2023). *The SAGE Handbook of Qualitative Research* (Sixth Edition ed.). Thousand Oaks, California: SAGE Publications, Inc.

Frith, H., & Gleeson, K. (2004). Clothing and Embodiment: Men Managing Body Image and Appearance. *Psychology of Men & Masculinity*, 5(1), 40–48.

Gangestad, S. W., & Tybur, J. M. (2016). *Editorial overview: Evolutionary psychology* (Vol. 7, pp. v-viii): Elsevier.

Gehl, J. (2011). *Life between buildings: Using Public Space.* Washington: Island Press.

Gibson, J. J. (1986). *The ecological approach to visual perception.* Hillsdale. NJ: Lawrence.

Hall, E. T. (1966). *The Hidden Dimension.* New York: Doubleday &Company.

Holloway, I. and Todres, L. 2003: The status of method: flexibility, consistency, and coherence. *Qualitative Research,* 3, 345/57.

Hutchby, I., & Wooffitt, R. (2008). *Conversation Analysis* (2nd edition ed.). Cambridge, UK: Polity.

Kaplan, S. (1979). P*erception and Landscape: Conceptions and Misconceptions.* In: Elsner,

Maia, E. d. C. (2020). *Percepção ambiental de adolescentes sobre o manejo do pirarucu (Arapaima gigas)* no interior do Amazonas.

Marks, D. F., & Yardley, L. (Eds.). (2003). *Research Methods for Clinical and Health Psychology.* Thousand Oaks, California: SAGE Publications Ltd, 30

Marques, V., Ursi, S., Silva, E. L., & Katon, G. (2020). Environmental Perception: Notes on Transdisciplinary Approach. *Scientific Journal of Biology & Life Sciences,* 1(3), 1-9.

Miles, M. B., Huberman, A. M., & Saldana, J. (2019). *Qualitative Data Analysis: A Methods Sourcebook* (4th Edition ed.). Thousand Oaks, California: SAGE Publications, Inc.

Murray, M. (2015). Narrative psychology. In J. A. Smith (Ed.), *Qualitative Psychology: A Practical Guide to Research Methods* (p. 312). Thousand Oaks, California: SAGE Publications Ltd.

Oldenburg, R., (1997), Our Vanishing Third Places, *Planning Commissioners Journal*, 25(4), PP. 6–10.

Piga, B., & Morello, E. (2015). *Environmental design studies on perception and simulation: an urban design approach. Ambiances.* Environnement sensible, architecture et espace urbain (1-24).

Roulston, K. (2001). Data analysis and 'theorizing as ideology.' *Qualitative Research,* 1(3), 279–302.

Ryan, G. W., & Bernard, H. (2000). *Data Management and Analysis Methods.* In N. K. Denzin, & Y. S. Lincoln (Eds.), The SAGE Handbook of Qualitative Research (2nd Edition ed., pp. 1143: 769-802). SAGE Publications, Inc.

Saunders, C. D. (2003). The emerging field of conservation psychology. *Human ecology review,* 137-149.

Smith, J. A., & Osborn, M. (2015). *Interpretative phenomenological analysis.* In J. A. Smith (Ed.), Qualitative Psychology: A Practical Guide to Research Methods (third edition ed., p. 312). SAGE Publications Ltd.

Thibaud, J. P. (2015). The sensory fabric of urban ambiances. *The Senses and Society,* 6(2), 203-215.

Thibaud, J. P., & Siret, D. (2012). *Ambiances in action-ambiances en acte* (s).

Ursi, S., & Towata, N. (2018). environmental perception about marine and coastal ecosystems: evaluation through a research instrument based on model of ecological values. *Problems of Education in the 21st Century*, 76(3). 393-405

Smith, J. A. (2015). Qualitative psychology: A practical guide to research methods. *Qualitative psychology,* 1-312.

Ohno, R. (2018). Studies on environmental perception during locomotion—a review of empirical studies by the Ohno laboratory. *Japan Architectural Review,* 1(2), 194-206.

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 87-96 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI: 10.30495/IJAUD.2023.73295.1685

Impact of Southern Window-to-Floor Area Ratios on the Thermal Performance of the Settlement in the Hot and Dry Climate (Case Study: Kashan City)

MohamadAli Karbasfuroosha[1], Fereshteh Habib[2*], Hossein Zabihi[3]

[1] Ph.D. Candidate, Department of Architecture, Pardis Branch, Islamic Azad University, Tehran, Iran.
[2]Assistant Professor, Department of Architecture, Pardis Branch, Islamic Azad University, Pardis, Iran.*
[3]Associate Professor, Department of Urban Planning, Sciences and Research Branch, Islamic Azad University, Tehran, Iran.

Recieved 2023.05.22; Accepted 2023.08.07

ABSTRACT: A major party of generated energy is now used for heating and cooling buildings. Hence, it is beneficial to apply solutions that reduce the thermal load of buildings. However, solutions for energy consumption reduction always face barriers. Optimizing window proportions in energy consumption saving is highly influential in this case. The window is one of the main components that receives solar radiation energy but also serves as a thermal bridge transmitting energy from interior to exterior space. This study investigates the climate conditions of Kashan. It determines materials as constant variables to examine the impact of southern window-to-floor area ratios on the thermal performance of settlements in hot and dry climates to achieve higher efficiency of this element using simulation of different models through EnergyPlus software. This study then examines the cooling and heating load created in interior space considering variable elements of ratios, window elongation, and window-to-floor ratio, using single and double-glazed glass and its analysis considering meteorological data of this city using EnergyPLus software. Finally, the most optimum southern window-to-floor ratio was determined. This study aims to achieve efficiency and the highest impact of the southern side's window of a building on the thermal performance of the building by simulating various models through EnergyPlus software. This study has used the descriptive-analytical method, then analyzed the obtained results, and lastly outlined the priority of application among models as follows:1.38 ratio, 1 ratio, and 1.95 ratio. In contrast, the most optimum window ratio is a 15% window-to-floor ratio with 1.38 proportions and eastern and western elongation using double-glazed glass.

Keywords: *Southern Windows; Thermal Performance; Hot and dry climate; Kashan.*

INTRODUCTION

Housing demand has increased due to the growing population rate in metropolitans. The lack of balance between housing supply and demand, especially in megacities, has led to higher housing prices. Therefore, many urban residents have lived in small, inexpensive apartments. Apartment construction is indeed an accelerated version of housing problems, which was a novel solution in the past but now has led to a hidden wave of social and psychological issues (Poormohammadi, 2000). Nowadays, living space in city centers has faced many social, cultural, and particularly environmental problems due to population concentration causing low-quality of life in these spaces (Kokabi, 2007).

On the other hand, the quality of human life environment highly affects humans' body and mental health. According to the definition proposed by WHO, health means the state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. Inappropriate housing causes depression, behavioral disorders, and nervousness (Tyson et al., 2002). Moreover, satisfaction with the quality of an environment leads to positive impacts on relationships between occupants (Zabihi et al., 2011). Moreover, the window is one of the major parts that receives solar radiation energy but also serves as a thermal bridge transmitting energy from interior to exterior space. Hence, windows are determinant in providing thermal comfort to occupants, so around one-third of

*Corresponding Author Email: *fereshteh_habib@yahoo.com*

thermal loss in winter occurs through windows (Ebrahimpour & Mohammadkari, 2011).

On the other hand, windows can allow sun radiation energies to enter over the day, increasing interior space temperature. This specification of windows has linked the name of windows in different countries with its fundamental function, light, radiation, or wind control (Parsa, 2011). Lack of attention to the shape and proportions of the window towards geographical directions using similar windows and improper window-to-backward space area ratio led to many climate and environmental problems. These problems have diminished the efficiency of windows as the area connects inside and outside environments, so occupants have to use internal curtains to overcome a lack of privacy and undesired sunlight. Therefore, the window has become weak in transferring heat and unwanted noises from outside, preventing light and fresh air entrance (Tahbaz, 2018). One of the factors influencing energy transfer through windows is the direction the window faces. This impact differs in various areas and climates. For instance, a window towards sunlight can gain more radiation energy, or the energy transfer through a window exposed to wind differs from other windows. Overall, the best direction for placing windows in terms of energy is the direction through which maximum energy is received, minimum energy is lost in cold weather, and lowest energy is received in hot weather. This direction directly depends on the considered geographical location. For example, the best direction for solar energy gain in the cold season and not excessive energy gain in the hot season in Poland is in the southern direction to 10° towards the southeast (Chwieduk & Bogdanska, 2004). Since this topic and other subjects associated with building energy issues are relatively new, especially in Iran, the available studies do not have a long history, but some studies have been recently conducted in this field.

Dr. Lashgari et al. optimized the orientation of construction buildings based on the climate conditions of Ahwaz City, for instance. They concluded that the maximum energy is gained in the southeast sides of the building. The solar energy received on the surfaces is symmetrical in eastern and western directions over the year, while the western direction gains a minor amount of energy in cold seasons (Lashgari et al., 2011). According to a study that investigated optimum orientation for housing in a hot and dry climate, the best direction among four examined states in terms of maximum solar energy absorption was the direction in which the main axis of the building was 30° rotating around the north axis, so windows were towards the south (Faizi et al., 2011). This study aims to find the optimum south-facing window-to-floor area ratio to increase the thermal performance of settlements in hot and dry climates considering the climate conditions of Kashan with the same materials.

Literature Review

Many Persian and English papers, theses, books, and standards have been carried out on windows and their impact on light and heat. These studies are classified into several categories, including optimum window ratio in terms of solar radiation absorption and heat loss, accurate design of windows to achieve suitable daylight, and examining rate and way of impact of window's physical variables on the use of daylight. Among studies on the optimum size of windows regarding light and heat, Fayaz conducted a study to measure the optimum southern window ratio of residential buildings in Tehran and Ardabil to receive maximum solar radiation. This ratio equaled 10% of the floor area for a room with double-glazed windows and equaled 20% for single-glazed windows (Fayaz, 2012). Among available theses, Heirani Pour optimized the window dimensions considering light and heat factors in residential buildings located in cold climates (Heirani Pour, 2021), and Montaser Kouhsari examined the optimum dimensions of windows in terms of heat and light in residential buildings located in a moderate and humid climate in four main directions for sitting room. Window dimensions had a maximum 10% impact on energy consumption depending on the type of glass, heat rate and visible light transmitting through window glass, area of considered space, and window location (Montaser Kouhsari, 2014). In the second category of conducted studies on the accurate design of windows regarding illumination to achieve suitable daylight in apartments located in Tehran, 2.48% of the total interior areas of the room and 30% of skylight walls were highlighted for the southern side (Ahadi et al., 2016). Moreover, some foreign studies are available, and one of them has suggested the importance of daylight in space and ways to optimize it. The results of these studies indicated window-to-wall ratios of 50% and 25% and window-to-floor ratios of 17% and 35% (Sharifah Fairuz, 2013). Another study addressed the association between window-to-floor ratio (WFR) of space in providing suitable light, and results showed an optimum light amount for the room when WFR is less than 10% (Acosta et al., 2016). The available standards on windows considered in Topic 19 of National Building Regulations 2015 suggest the external light-transmitting wall surface for receiving daylight 1.9 of useful infrastructure and up to 25% of the external wall (Topic 19 of National Building Regulations, 2021). Topic 4 of National Building Regulations 2017 expresses that the required glass rate is at least one-eighth of floor area in residential spaces unless windows are placed only on one of the walls of the space, and the distance between that wall and the front wall is considered space is more than 4.50m; in this case, one-seventh of floor area is required (Topic 19 of National Building Regulations, 2021). Finally, in the category of studies that examined the impact rate and method of window physical variables on suitable daylight use, a study conducted in 2016 examined the geometry and location of windows in residential spaces expressing that energy consumption does not depend on the window shape by window's position is an effective factor (Acosta et al., 2016). Moreover, a Ph.D. thesis modeled the impact of window's physical variables on suitable daylight

use in classrooms of secondary schools in Tehran in 2021 to provide optimum window patterns from students' viewpoint (Pournaseri, 2012). The mentioned studies have considered the connection between window and space, so some studies have been conducted on WFR and WWR. Also, window orientation has been examined on the southern side, and four orientations in some cases. The point that has caught the eyes of many researchers is the thought of optimization in energy consumption and reduction in artificial heating and illumination need. Such studies have a long history in developed countries. Dr. Jay Lee et al. studied window performance optimization in five cities in Asia's Continent: Manila, Taipei, Shanghai, Seoul, and Sapporo, with five different latitudes. The results showed that windows placed on the northern side of buildings in Manila and Taipei provided a maximum advantage for energy saving. The northern side was followed by southern, western, and eastern sides that provided less advantages. In the case of Shanghai, Seoul, and Sapporo, however, the southern side had the highest influence, followed by the northern, western, and eastern sides in the next ranks (Lee et al., 2013). Various factors affect the suitable orientation for window placement. A good view is one of the determinants that may indicate a stronger impact rather than the mentioned variables. Nevertheless, various conditions must be considered regarding windows' energy issues. In this case, a study conducted in the climate of Algeria indicated that building orientation does not significantly affect the interior temperature of the building if the building is fully thermal insulated (Hamdani et al., 2012).

MATERIAL AND METHODS

As mentioned, this study examines the impact of southern window-to-floor area proportions on the thermal performance of settlements in hot and dry climates. The research method of this study is descriptive-analytical. For this purpose, southern window-to-floor area proportions were examined in moderate climate conditions based on library studies, modeling, and computer simulation in the hot and dry climate of Iran-Kashan City. According to the physical nature of this study, seven plans with the same areas were modeled in two modes of single- and double-glazed glass, assuming a room insulated with similar materials through EnergyPlus software. Finally, heating and cooling loads created in room space were evaluated and compared with other models.

The Applied Meteorological Data

Meteorological data of Kashan was used in EPW format to simulate the thermal performance of the prepared model under a condition similar to the climate of Kashan City. In EPW format, meteorological data are inserted hour-to-hour. This file is one of the available meteorological files in Iran confirmed by producers of EnergyPlus software and uploaded to the online database of the Repository of free climate data for building

5.6 * 5.6	1
4.75 * 6.57	2
7.8 * 4	3
10.4 * 3	4
4.75 * 6.57	5
7.8 * 4	6
10.4 * 3	7

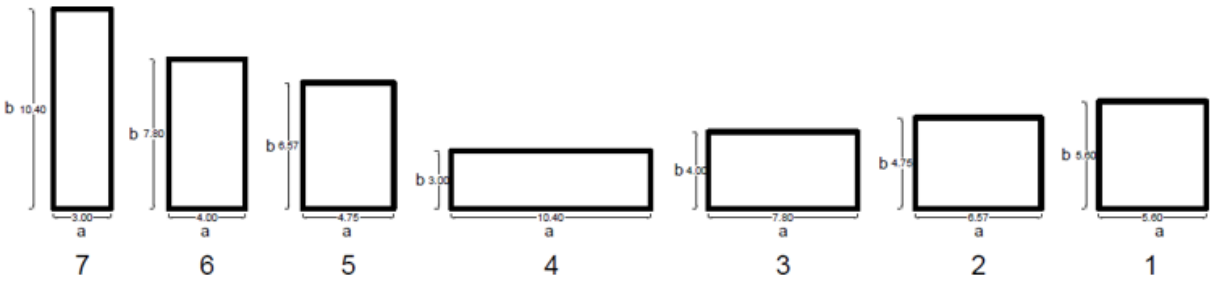


Fig. 1: Forms of studied plans

performance simulation sites.

Thermal Comfort Range of Residents Living in Kashan City

According to studies carried out on citizens living in Kashan and the temperature range of their thermal comfort, the thermal well-being range of Kashan in summer is 21.8°c-27°c, while this range equals 20.4°c-23°c in winter, and the relative humidity range equals 18%-53% (Sadeghi Ravesh & Tabatabaie, 2009).

Studied Models

The most common passive solar system is called direct gain. A direct gain system is designed by measuring window area and thermal mass required for heating interior space. Five plans with identical areas have been designed in this phase, assuming that heating and cooling loads have been assessed. Generally, the glass area in direct gain must equal 0.07 of the ceiling area, not exceeding 12%. In direct gain, double-glazed glasses are also recommended. WFR in winter spaces of Iran's hot and dry climate is around 50%. The results of ratios 30%, 20%, 15%, 12%, and 7% are presented herein. The first model is square, while other models are rectangular-shaped with east-west and north-south elongation. The ratio considered in model 2 is observed in most vernacular buildings of Kashan located in the summer part, which is chosen due to the past winter use of these spaces. The models (2&5), (3&6), and (4&7) have similar dimensions with different elongations (Figure 1).

Materials used in the model simulation

Tables 1 and 2 report the specifications of materials used in opaque and translucent walls for all models (Figure 1).

Simulating the thermal performance of proposed models

Table 1: Specifications of opaque walls for models 1 to 7

Wall type	Materials (from the outer layer to the inside)	Roughness	Thickness (m)	Heat conductivity coefficient (w / m-k)	Density (kg / m^3)	Eigen heat (J / kg-k)
Wall	Ashlar	Rough	0.03	3.5	2800	840
	Cement mortar	Rough	0.02	0.55	1200	840
	Clay block - 1	Rough	0.1	0.79	2000	630
	Thermal insulation	Rough	0.05	0.040	40	1500
	Clay block - 2	Rough	0.1	0.79	2000	630
	Plastered	Rough	0.03	0.56	1500	109
Roof	(Mosaic (stone	Rough	0.03	3.5	2800	840
	Thermal insulation	Rough	0.08	0.038	80	840
	Clay block	Rough	0.25	0.79	2000	630
	Plastered	Rough	0.03	0.56	1500	109
Floor	Parquet	Rough	0.025	0.14	530	1880
	Concrete	Rough	0.2	1.6	2300	850

Table 2: Specifications of double glazing for models 1 to 7

Wall type	Layers (from outer layer to inner layer)	Thickness (m)
Double glazed window	Clear glass with low energy emission coating	0.006
	Xenon gas	0.006
	Clear glass	0.006

Simulation results have been reported in Tables 3 and 4. The order of diagrams is as follows:

-Table 3 reports the results of plans with insulated materials (Table 1) and single-glazed glasses structure (Table 2)

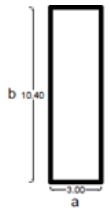
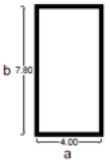
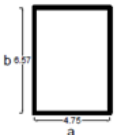
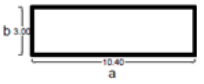
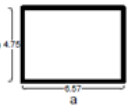
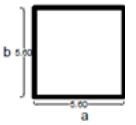
-Table 4 reports the results of plans with insulated materials (Table 1) and double-glazed glasses structure (Table 2).

RESULTS AND DISCUSSION

The following results are obtained from Tables 3, 4, and Figures 2-6:

Models 2 and 5, 3, 4, and 7 have similar dimensions with different elongations. Model 2 has east-west elongation, and model 5 includes north-south elongation. In all states of WFR,

Table 3: Room with insulated materials and single-glazed glass

7	6	5	4	3	2	1	number	
							module	
10.4 * 3	7.8 * 4	4.75 * 6.57	3 * 10.4	4 * 7.8	4.75 * 6.57	5.6 * 5.6	a × b	
0.29	0.51	0.72	3.47	1.95	1.38	1	Plan-to-door ratio	
-	-	38.92	42.66	38.56	37.94	38.6	50%	Win-dow-to-floor ratio
-	-	885.25	920.43	878.83	870.35	873.46		
69.54	59.07	54.81	64.79	56/5	54.77	55.39	30%	
740.25	669.29	643	674.62	636.23	628.75	632.09		
99.18	81.71	76.07	88.37	76.85	74.23	74.8	20%	
604.97	533.85	508.3	538.18	501.03	493.91	497.33		
121.18	100.69	94.02	108.15	94.15	90.87	91.4	15%	
537.33	467.12	441.97	469.23	432.61	425.63	429.06		
137.05	115.28	108.42	123.57	123.97	120.15	120.66	12%	
497.28	427.7	401.35	429.85	463.02	456.11	459.92		
170.25	146.73	138.94	156.25	139.62	135.52	135.93	7%	
429.97	359.36	333.97	359.81	324.24	317.47	320.88		

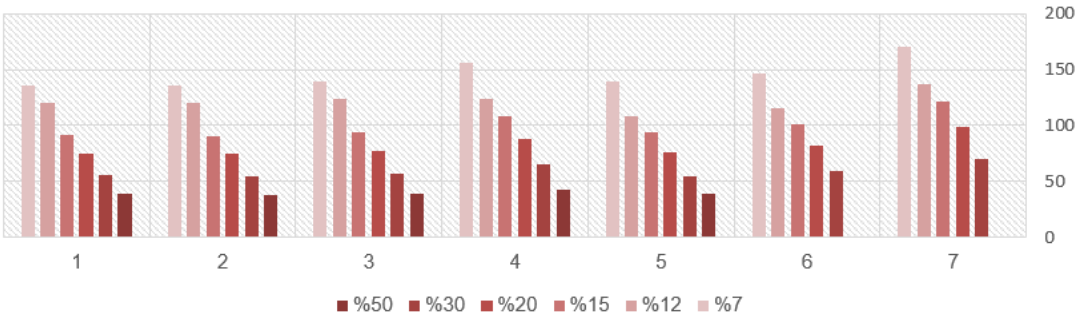


Fig. 2: Comparison between single-glazed glass in heating

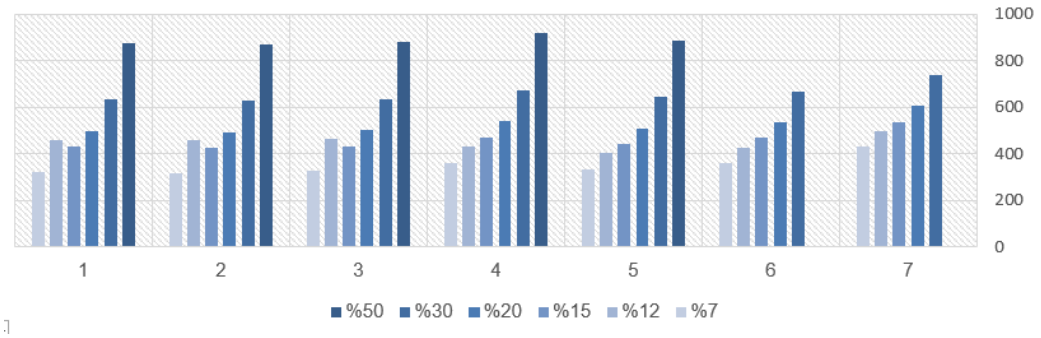
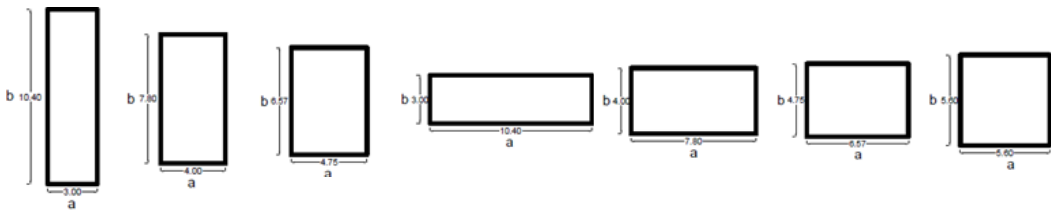


Fig. 3: Comparison between single-glazed glass in cooling

Table 4: Room with insulated materials and double-glazed glass

7	6	5	4	3	2	1	number	
							module	
10.4 * 3	7.8 * 4	6.57 * 4.75	10.4 * 3	7.8 * 4	6.57 * 4.75	5.6 * 5.6	a × b	
0.29	0.51	0.72	3.47	1.95	1.38	1	Plan-to-door ratio	
-	-	0	0	0	0	0	50%	Win-dow-to-floor ratio
-	-	662.88	690.83	653.64	646.68	650.07		
17.49	8.36	6.2	12.29	6/6	5.45	5.57	30%	
592.27	521.26	495.18	522.69	486.3	479.5	483		
59.14	42.38	37.23	49.48	37.56	34.8	35.09	20%	
502.82	432.42	407.07	434.58	398.57	391.8	395.27		
90.38	70.24	63.8	79.39	64.68	61.06	61.38	15%	
459.39	389.9	365	391.23	355.56	348.81	352.25		
112.28	90.47	84.23	100.27	100.46	96.32	96.65	12%	
434.1	365.23	339.72	366.83	401.66	394.93	398.75		
156.64	133.07	125.3	143.39	126.31	122.01	123.35	7%	
395.87	325.65	300.36	323.19	288.08	281.47	284.93		

east-west elongation is better in terms of both heating and cooling loads. The thermal performance of models 1 and 2 are highly similar, but model 2 (1.38 length-to-width ratio) is more suitable when Colling loads are considered. The minimum heating and maximum cooling requirements are observed in WFR of 50% in buildings with single- and double-glazed glass. This cooling requirement in model 2 is less than other models, so they are useful for the design of those rooms with a single winter application. The maximum heating and minimum cooling requirements are observed in a WFR of 7%. This heating requirement in model 2 is less than in other films. This ratio is useful for the design of rooms that are only used in summer. When WFR is downsized, the heating load increases (because the southern window gets smaller), and the cooling

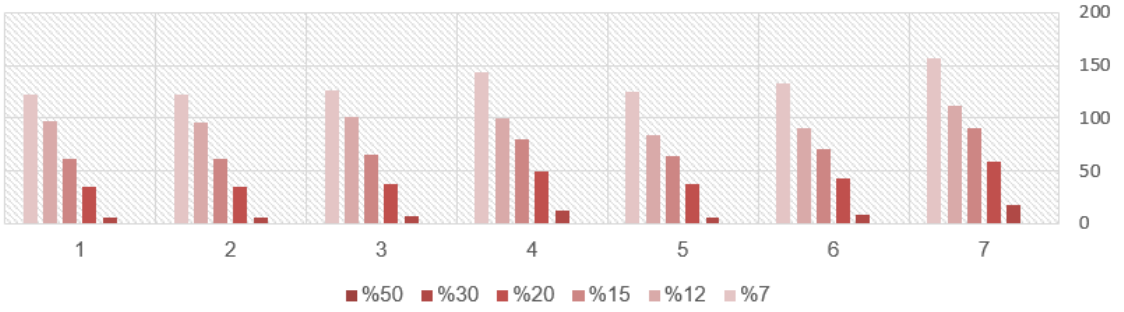


Fig. 4: Comparision between double-glazed glass in heating

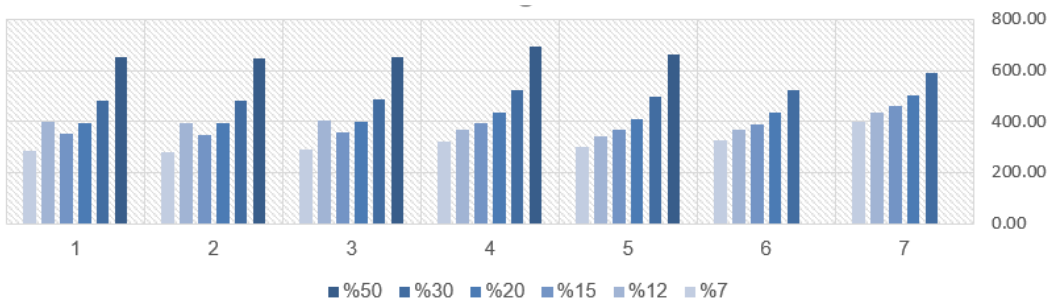


Fig. 5: Comparision between double-glazed glass in coolin'

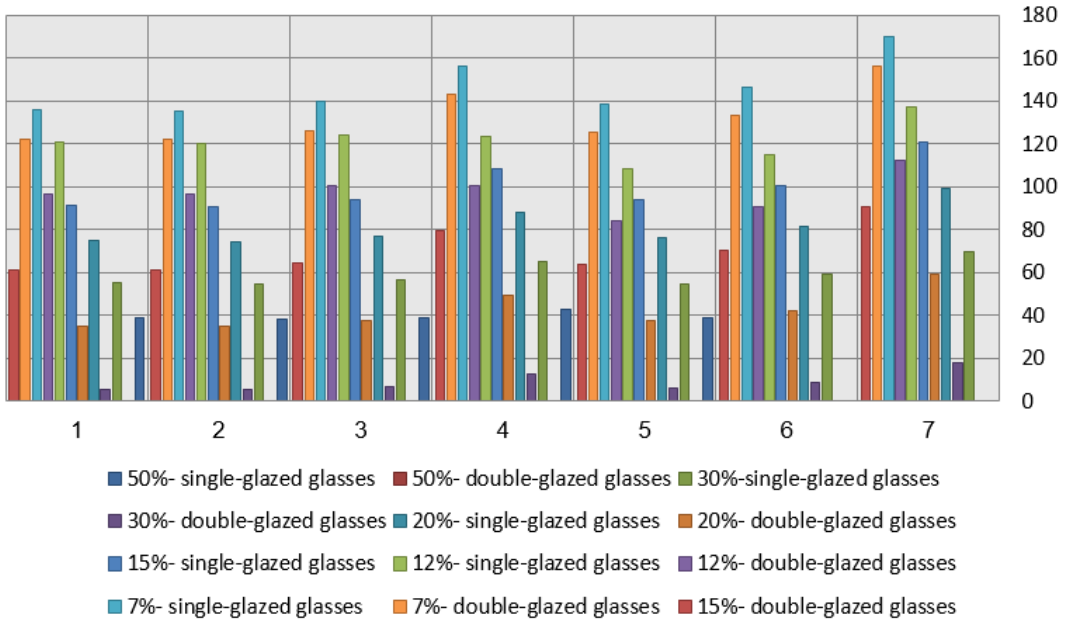


Fig. 6: Comparision between single-glazed glass and double-glazed glass in heating

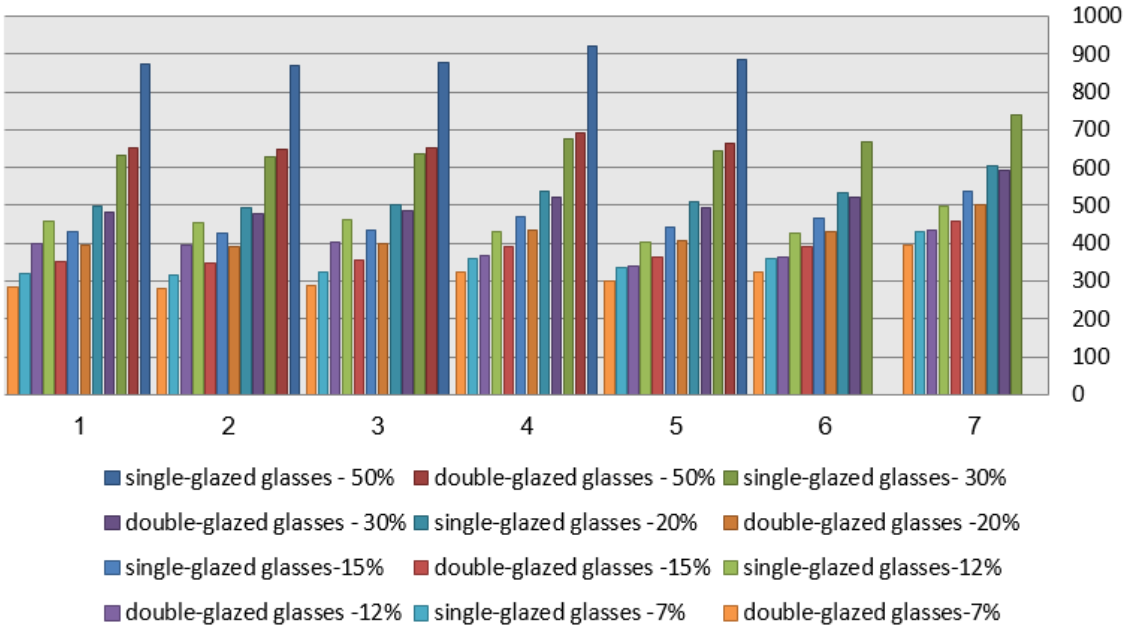


Fig. 7: Comparision between single-glazed glass and double-glazed glass in cooling

load decreases (a lower opening surface leads to less heat transfer to interior space). Although ratios 50% and 70% have the minimum need for heating and cooling loads, a WFR of 15% indicates the best performance in terms of annual climate moderation and providing occupants with thermal well-being. In comparison between Tables 4 and 5, model 2 is optimal in which the room with insulated materials and single and double-glazed glasses have been used so that the heating load in single-glazed glass with a 50% ratio has been decreased from 37.94 kWh to cooling load 29.81 kWh while cooling load with 7% ratio has increased from 36 kWh to 76.82 kWh (Table 3) (Table 4), (Figure 7).

According to the results of heating and cooling loads computations, the priority of using models is as follows: models 2, 1, and 3. According to different WFRs, 50% had the lowest need for heating load, the 7% ratio had the lowest need for cooling load, and the ratio of 15% was chosen as the optimum ratio over the year. Since the studied model is small. Heating-cooling loads do not show significant variations in different models of each table, while load difference is more seen in larger dimensions and elongations. Opaque and light-transmitting materials have a considerable impact on loads. Heating and cooling loads are reduced in the table of changing materials of walls and using double-glazed glasses. Hence, materials with low heat-transfer coefficients in opaque and light-transmitting walls have decreased the need for heating and cooling loads resulting in energy savings. Therefore, double-glazed glass decreases the need for cooling and heating load, and the most optimum window proportion is WFR of 15% with 1.38 proportion with eastern and western elongation and use of double-glazed glass (Table 5).

CONCLUSIONS

Examining the climate conditions of Kashan and determining materials as a constant variable, this study investigated the impact of southern window-to-floor area ratio on the thermal performance of settlements located in hot and dry climates to achieve high efficiency of this element simulating different models in EnergyPlus software. In the next phase, this study took proportions, window elongation, WFR, and using single-double-glazed glass as varying elements. It analyzed them considering meteorological data of this city through EnergyPlus software to assess cooling and heating loads created in interior space. Materials of walls, ceiling, and roof were considered constant variables, window glasses were considered single- and double-glazed forms, then different proportions were simulated, and finally, the most optimum southern window-to-floor ratio was determined. However, studies and simulations

Table 5: Results table

insulated materials and double-glazed glass	insulated materials and single-glazed glass	
East-west	East-west	Plan Extension
15	15	The optimal percentage of the window to the floor
2,1,3	2,1,3	Module

of this research have not been conducted on a certain basis and are limited to hot and dry climates, square and rectangular-shaped shapes with vertical and horizontal elongation, and used materials presented in tables. Therefore, a comparison between western-eastern and northern-southern elongations indicated that eastern-western elongation is better for heating and cooling loads in all WFR modes. The minimum need for heating and cooling is seen in buildings with single- and double-glazed glass with a southern window-to-floor ratio of 50%.

Moreover, model 2 needed less cooling compared to other models for designing rooms with a single winter application, while this model required maximum heating to design rooms with single summer use regarding the southern window-to-floor ratio of 7%. When WFR is decreased, the high heating load (due to downsized southern window) and low cooling load (lower opening surface) lead to lower heat transfer to interior space. Although 50% and 7% ratios of gas are the minimum need for heating and cooling loads, WFR of 15% outperformed in terms of annual climate moderation and providing thermal comfort for occupants. Finally, models 2, 1, and 3 were preferred to be used, and the most optimum window proportion was WFR of 15% with 1.38 proportion with eastern-western elongation and use of double-glazed glass. Further studies are recommended to examine new materials of translucent walls and window behavior in reducing the internal temperature in addition to other effective factors, such as ventilation and transiting light intensity.

AUTHOR CONTRIBUTIONS

M. Karbasfuroosha performed the literature review and model design, analyzed and interpreted the data, and prepared the manuscript text and edition. F. Habib and H. Zabihi prepared the manuscript text and manuscript edition. Compiled the data and manuscript preparation.

ACKNOWLEDGEMENT

This article is taken from the Ph.D. thesis of the first author with the title: " Utilization of renewable energy and technology of green buildings In Indigenous architectural designs in the semi-warm and dry climate – Kashab case study" which was guided by Dr. Fereshte Habib and advised by Dr. Hossein Zabihi is being done at Islamic Azad University, Tehran-PARDIS Branch - Campus.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication, falsification, double publication and, or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Acosta, I., Campano, M., and Molina, J. (2016). Relationship between window-to-floor area ratio and single-point daylight factor in varied residential rooms in Malaysia. *Indian Journal of Science and Technology,* 9(33), 1–8.

Ahadi, A.; Msoudi-Nejad, M. & Piryaei, A. (2016). Proper design of windows to achieve appropriate daylight at apartment buildings in the city of Tehran, *Journal of Hoviat-e-Shahr,* 10(1), 41-50.

Chwieduk, D., Bogdanska, B. (2004). Some recommendations for inclinations and orientations of building elements under solar radiation in Polish conditions, *Renewable Energy,* 29, 1569-1581.

Ebrahimpour, A, & Mohammadkari, B. (2011). New method for designing windows based on energy consumption, *Journal of Teacher Mechanical Engineering,* 11(1), 77-88

Faizi, F., Noorani, M., Ghaedi, A. & Mahdavinejad, M., (2011). Design an optimum pattern of orientation in residential complexes by analyzing the level of energy consumption; Case study: Maskan Mehr complexes*, Procidia Engineering,* 21, 1179-1187.

Fayaz, R. (2012). Optimal window level of residential buildings in Ardabil and Tehran. *Journal of Architecture and Urban Planning,* 5(10), 105–119.

Hamdani, M., Bekkouche, S.M.A., Benouaz, T., Cherier, M.K., (2012): "Study and effect of orientation two-room of buildings located in Ghardaia, Algeria," *Energy Procedia,* 18, 632-639.

Heirani pour, M.; Fayaz, R. & Mahdavinia, M. (2021). Optimization of window dimensions according to light and heat factors in cold climate residential buildings case study: Ilam city", Journal of Architecture, *Urban Design & Urban Planning.* 14(35),85-95.

IranianNationalBuildingRegulations. (2015). *Nineteenth,* Energy Saving

Kokabi, A. (2007). Evaluation of urban quality of life indicators in central areas, *Hoviat-e-Shahr journal,* 1(1), 75-86 .

Lashgari, H.; Mozermi, S.; Salaki, H. & Lotfi, K. (2011). Optimizing building direction for the city of Ahvaz using climatic conditions, *Quarterly of Natural Geography,* 4(12): 45-62

Lee, J.W., Jung, H.J., Park, J.Y., Lee, J.B., Yoon, Y. (2013). Optimization of building window system in Asian regions by analyzing solar heat gain and daylighting elements, *Renewable Energy,* 50, 522-531.

Montaser Kouhsari, A. (2014). *Optimal dimensions of windows from the perspective of heat and light in residential buildings of temperate and humid climates.* Master's thesis, Tehran University of Arts.

Parsa, MA. (2011). Origins of the architecture of windows; a search for the concept of windows in Persian language and culture, *Housing and Rural Environment,* 30(134): 75-94.

Poormohammadi, M.R. (2000). *Tehran's housing planning,* Tehran: SAMT.

Pournaseri, Sh. (2012). *Modeling the effects of structural variables of windows to achieve a disrobed window pattern from the view of junior school students of Tehran.* Doctoral dissertation, University of Science and Industry.

One building (2022). *World Meteorological Organization designation.* Retrieved from: https://climate.onebuilding.org/

Sadeghi Ravesh, M.H., & Tabatabaei, S.M. (2009). Determination of Limit of Thermal Comfort in Arid Climate (Case Study: Yazd City). *Hoviat-e-Shahr*, 3(4), 39-46.

Sharifah Fairuz, SF., Adel, A., and Wan Mariah Maulin, W. (2013). The impact of varied orientation and wall window ratio (www) to daylight distribution in residential rooms. I*n International Symposium in Developing Economies: Commonalities Among, Diversities,* 478–486.

Tahbaz, M. (2018). *Architectural Design,* Tehran: University of Shahid Beheshti.

Zabihi, H.; Habib, F. & Rahbari-Manesh, K. (2011). Investigating the relationship between satisfaction with residential complexes and the effects of residential complexes on human relations, *journal of Hoviat-e-Shahr,* 5(8), 103-118.

Tyson, G. A., Lambert, G. & Beattie, L. (2002). The Impact of Ward Design on the Behaviour Occupational Satisfaction and Well-Being of Psychiatric Nurses. *International Journal of Mental Health Nursing,* 11(2), 94-102.

International Journal of Architecture and Urban Development
Vol. 13, No. 4, P 97-106 .Autumn 2023

E-ISSN 2345-2331
Applied Research Article
DOI: 10.30495/IJAUD.2023.73494.1687

Analysis of the Quality of Light Obtained from the Stained Glass Windows of Traditional Iranian Architecture based on the Color Temperature Curve (CIE)

Faeze Barzegari Naeini[1], Hossein Soltanzadeh[2*], Shervin Mirshahzadeh[3], Seyed Zaeem Moosavi Mohammadi[4]

[1]Department of Architecture, Central Tehran Branch, Islamic Azad University, Tehran, Iran
*[*2]Department of Architecture, Central Tehran Branch, Islamic Azad University, Tehran, Iran*
[3]Department of Architecture, Central Tehran Branch, Islamic Azad University, Tehran, Iran
[4]Department of Mechanics, Yadegar-e-Emam Shahre-Rey Branch, Islamic Azad University, Tehran, Iran

Recieved 2023.05.30; Accepted 2023.08.15

ABSTRACT: The color temperature of light is one of the important indicators in lighting that should be considered. Because people experience and feel their surroundings not only with brightness and darkness, light and shadow but also through colors, the feeling that the color of the light creates in the space affects human perception and health through the warmth and coldness of the light. The color receptivity and color temperature chart is a tool that determines how the human eye feels when faced with a spectrum of light. Since the purpose of this research is to analyze the light quality of the stained glass windows of traditional Iranian architecture, calculating the color temperature will be a suitable criterion for judgment, that is, if the color temperature of the light from the stained glass windows is calculated, the experience of people in facing the light can be calculated quantitatively. Comparative methods were used to analyze the quality of light based on the color temperature curve with calculation tristimulus values XYZ from spectral data and calculation xyz chromaticity values. Investigations showed that the light color temperature of 65% of the windows is 3000 to 4600 K, and 35% is. In these windows with this combination model and area percentage of four colors, red, green, blue, and yellow, the quality of light has not decreased based on the color temperature curve.

Keywords: *Iranian architecture, Lighting, Stained glass, Color temperature curve.*

INTRODUCTION

One of the important indicators in the lighting of an environment is the color temperature of the light. Because people experience and feel their surroundings not only through light and darkness, light and shadow but also through light color, the feeling that the color of light creates in the space affects human perception and health. For this reason, choosing light with the right color temperature is important for every space. The International Commission on Illumination (CIE) introduces the color temperature curve as an important tool for determining how the human eye experiences a light spectrum. In this research, the color temperature curve calculates the color temperature of light passing through stained windows. Stained glasses reduce the intensity of sunlight. The main research question is that despite the reduction of light intensity by stained glasses, how is the quality of light passing through these glasses based on the color temperature curve? In other words, in what range is the color temperature of the light obtained from stained glass windows in Iranian architecture, and is this color temperature, according to the CIE standard, suitable for human health and the use of these spaces?

The brilliant point of this research is calculating the color temperature of the light obtained from the stained glass windows of Iranian architecture, which has not been calculated so far. In this way, the perceptual parameters of light quality can be judged by converting them into quantitative parameters.

Among all the visual cells of the human eye, nearly 123 million of them are of the cylindrical type, sensitive to the brightness of the light source, and it can almost be stated that they have no sensitivity to the color of the light. Therefore, these cells are most sensitive when the ambient light is low

*Corresponding Author Email: ***Hos.soltanzadeh@iauctb.ac.ir***

(night light). About 7 million cells sensitive to the color of light in the human eye are responsible for recognizing colors; the brightness of the environment must be higher than a certain level for them to be activated. Upon receiving light, the human eye cells are stimulated and send appropriate orders to the body's internal glands, each of which has a different effect on the human body that must be considered in lighting design. For example, the hormone that regulates the level of alertness in the human body is called melatonin, the secretion of the melatonin hormone in the human body, which follows the body's internal clock and the hours of the day, causes a decrease in the level of consciousness and conversely, a decrease in the level of melatonin in the blood increases human consciousness. Light color is one of the main factors of melatonin secretion in the human body. Ambient light affects melatonin secretion in the human body and, as a result, regulates the circadian rhythm (Kalhor, 2009).

CIE 1931 color space: CIE 1931 color spaces are the first quantitatively defined links between wavelength distribution in the visible electromagnetic spectrum and physiologically perceived colors in human color vision. The mathematical relationships that define these color spaces are fundamental tools for color management. The CIE 1931 RGB color space and the CIE 1931 XYZ color space were created by the International Commission on Illumination (CIE) in 1931. They resulted from a series of experiments conducted in the late 1920s by William David Wright using ten observers (Wright, 1928), and John Guild conducted it using seven observers (Guild, 1931). The experimental results were combined into the CIE RGB color space specification from which the CIE XYZ color space was derived.

The CIE XYZ color space includes all color sensations visible to a person with average vision. This is why CIE XYZ (with tristimulus values) is a fixed device of color representation and serves as a standard reference based on which many other color spaces are defined. Most wavelengths stimulate two or all three types of cone cells because the spectral sensitivity curves of these three types overlap. The CIE 1931 color space defines tristimulus values and represents them as X, Y, and Z.

Since the human eye has three types of color sensors that respond to different wavelengths, a complete projection of all visible colors is a three-dimensional figure. However, the concept of color can be divided into luminance and chromaticity. For example, white is a light color, while gray is considered a less light version of white. In other words, white and gray are the same color, while their brightness is different.

The CIE XYZ color space is intentionally designed so that the Y parameter measures a color's luminance. Then the color (chromaticity) is determined by two derived parameters, X and Y, which are two of the three stimulus values X, Y, and Z (Poynton, 2012, 275).

Color temperature: A black body is an element like platinum that does not reflect any light and absorbs all the light that shines on it. The color temperature is defined based on the color emitted from the black body at a certain temperature and is expressed in degrees, Kelvin. The meaning of color here is not the absolute colors but the heat spectrum of the color. The range of color temperature in practice is between 1000 and 10000 degrees Kelvin, and it starts from red and yellow at lower temperatures and reaches blue at higher temperatures (Fig.1).

Fig.1 shows that a color temperature below 2000 degrees Kelvin has a faint glow of light, similar to that perceived by candlelight. Candlelight has a color temperature of 1500 degrees Kelvin. Table 1 shows that 2000-3000 degrees Kelvin gives a soft glow to the white color, often yellow. It is best for living, dining, bedroom, and outdoor spaces. 3000-4600 degrees Kelvin emits a bright white light. The best option for kitchens, offices, workspaces, and washrooms where lighting is needed. 4600-6500 degrees Kelvin gives a bright blue-white light, similar to daylight which is best for exhibition areas and work environments where much light is needed. Six thousand five hundred degrees Kelvin and more give a bright bluish color of light often found in commercial settings (Al Bahadly & Berndt, 2010).

Fig. 2 illustrates the effect of light color temperature on the environment.

Literature Review

Haji Seyed Javadi & Pourdihemi (2008) investigated the

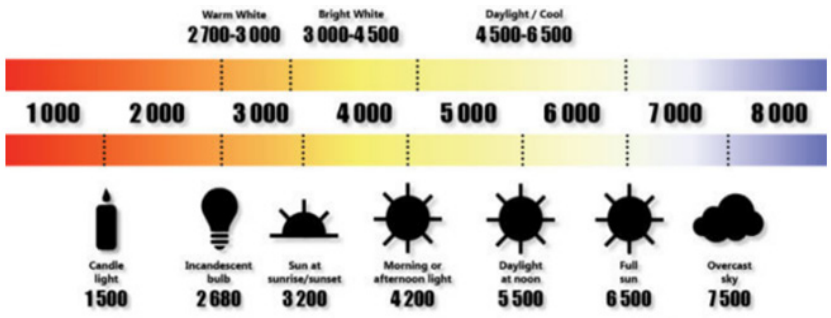


Fig. 1: Color temperature range (Standardpro, 2023)

Table 1: Light suitable for different environments according to light color temperature based on CIE standard

Color temperature (Kelvin)	D Kelvin 3000 – 2000	D Kelvin 4600 – 3000	D Kelvin 6500 – 4600
Light Appearance	Warm white It varies in appearance from orange to yellow-white.	Bright white – natural white Middle light or natural and living light. It emits a more neutral white light and may have a slight blue tint.	daylight – cool white The light is bluish-white in appearance.
Environment	Warm and intimate inducing a gentle, relaxing feeling creates an inviting and welcoming feeling.	It makes the surrounding space bright and attractive. It is brighter and more lively.	It cools the surrounding environment and makes it concentrate and invigorate. It imitates daylight.
Suitable for	Living environment or rest environment, bedroom and living room, patient room in hospital and hotel rooms.	Schools, offices, kitchens, corridors, public areas, hospitals, and dormitories.	Best for outdoor lighting, security lighting, and commercial or retail spaces. Exhibition spaces, lathe workshop, press, cutting, needlework, drawing, and similar jobs

Fig. 2: The effect of light color temperature on the environment (Westinghouselighting,2023)

effect of daylight on humans and the perceptive and biological-psychological processes of daylight. Mirgholami & Pishbin (2013) briefly studied the effect of light and color in residential interior spaces of Islamic Iranian architecture. Jazdareh & Zia Bakhsh (2014) used a questionnaire to ask the opinion of users to understand their feelings towards the surrounding environment and, based on that, provided solutions for adjusting the light in dark and bright spaces. Dashti Shafiei et al. (2014) used the correlation research method to discover the relationships between phenomena and the effect of natural light on humans' quality of life and mental health. In their research, Tahbaz et al. (2013) investigated natural lighting in traditional Kashan houses. By using field measurements and computer simulation, they tried to show the way of light distribution and its amount in different types of spaces and old skylights. In their research, Haqshanas & Qayabaklou (2008) investigated the effect of stained glass on the amount of light and energy transmitted in the visible range. In another study, Hagh Shenas et al. (2016), by examining the sashes of several traditional houses in Isfahan, concluded that the type of glass in the sashes was selected in such a way that, in addition to reducing the transmission of visible light or radiant energy, the passage of wavelengths harmful for skin and other materials in the main space of the building is reduced. Bani Hashem & Latifi (2014), by collecting information through library-field and observational methods, tried to state the identity and place of light in Iran culture by representing the role of light in traditional architecture as a cultural foundation, as well as the relationship between light and human states of mind and spirit and the effect of light on human physical health. Alipour (2011) studied the design of Qajar palace sashes and examined the main motifs and their comparison with other arts in the Qajar

period. Vahdat Talab & Nik Meram (2017) investigated the importance and abundance of red in the sashes of Qajar houses. Bellia & Fragliasso (2021) investigated the role of architecture in determining the non-visual effects of light, including influencing the process of melatonin secretion and, as a result, the sleep-wake cycle. Houser et al. (2020) have studied human-centered lighting and stated that considering visual comfort, which is important in lighting design, a new responsibility regarding how light affects non-visual human responses is also considered. Mostafavi et al. (2023) stated that investigating human responses to light can reveal important information that can potentially improve environmental design, circadian health, cognitive performance, and overall well-being. In their study, the researchers used V.R. immersion, EEG, and a machine-learning approach to understand better the relationship between brain activity and two important lighting properties - the illumination level and the correlated color temperature (CCT). Zeng et al. (2022) investigated the effect of a correlated color temperature of office light on subjective perception, mood, and task performance. Their research has shown multiple light-correlated color temperature (CCT) effects on office staff. These findings highlight that the optimal CCT level varies for different demands such as comfort, positive mood, alertness, and task performance, so the selection of office light CCT should be weighed according to the scenario demands. Tofel et al. (2004) investigated color in healthcare environments and classified experts' opinions about the effects of colors at different times. Edwards & Torocellini (2002) reviewed the relevant literature on the effects of natural light on building users. Dai et al. (2018), while introducing a new lighting design method based on health benefits, analyzed four combined lights and used the color temperature curve for this purpose. Salonen & Morawska (2013) examined the physical characteristics of the interior space that affect health and well-being in healthcare spaces. Bosch & Gresham (2012) studied the use of color in healthcare spaces. Samuels (1990) stated that due to the impact of light on the retina and its transmission to the hypothalamus, human circadian cycles are controlled, and the body's internal clock is synchronized with different 24-hour times. Terman et al. (1986) stated that individuals subjected to isolated laboratory conditions would have a circadian cycle of more than 24 hours. This fact illustrates the ability of light to correct the body's internal clock daily. In the absence of light, the synchronization of the body with the outside world is deviated. Franta & Anstead (1994) designed a fun and healing environment for people with mental health conditions in a psychiatric treatment center in Maryland. The design of this center was based on the use of daylight in different parts of the building. Benedetti et al. (2001) emphasized the advantages and effects of bright artificial light on non-seasonal depression in people with mental health conditions. In this research, it has been concluded that natural light is not very effective in treating bipolar depression because it cannot be controlled. Sharma (2016) explored different types of lighting designs in different cultures. Among these, the illumination of Iranian sashes is mentioned.

As it is observed, until now, the light quality of Iran's stained windows has not been investigated based on the color temperature curve, and this research is important from this point of view.

MATERIALS AND METHOD

Research Method

This research has been conducted as a case study and research on specific samples. A descriptive-analytical method is used to classify the extracted data. Comparative methods are used to analyze the quality of colored light based on the color

Table 2: The area percentage of each stained glass (yellow, green, blue, red)

#	Location of window	Yellow	Green	Blue	Red
1	Karim Khan Citadel 1, Shiraz	41.77%	15.39%	19.01%	23.83%
2	Karim Khan Citadel 2, Shiraz	45.77%	12.86%	22.16%	19.21%
3	Dowlat Abad Garden Monument, Yazd	31.29%	30.68%	14.74%	23.29%
4	Tekye Moavenolmolk, Kermanshah	36.02%	23.30%	14.62%	27.06%
5	Rezazadeh Historical House, Ardebil	21.67%	25.34%	26.67%	26.32%
6	Emamzadeh Zanjiri, Shiraz	25.90%	25.82%	21.78%	26.50%
7	Nasir al-Mulk Mosque Shabistan 1, Shiraz	25.35%	22.63%	24.68%	27.34%
8	Nasir al-Mulk Mosque Shabistan 2, Shiraz	27.64%	21.72%	23.93%	26.71%
9	Nasir al-Mulk Mosque Shabistan 3, Shiraz	21.88%	30.40%	23.65%	24.07%
10	Akhavan Historical House, main sash, Isfahan	12.12%	33.34%	11.11%	33.33%
11	Akhavan Historical House, eastern sash, Isfahan	37.50%	12.50%	12.50%	37.50%
12	Sheikh ol-Islam Historical House, Isfahan	14.28%	42.86%	0	42.86%
13	Sadr Historical House, Isfahan	28.57%	14.28%	14.29%	42.86%

Continiue of Table 2: The area percentage of each stained glass (yellow, green, blue, red)

#	Location of window	Yellow	Green	Blue	Red
14	Baghaee Historical House, Isfahan	33.34%	11.11%	33.33%	22.22%
15	Bozorgzad Historical House, Isfahan	12.50%	37.50%	12.50%	37.50%
16	Rangrazha Historical House 1, Isfahan	23.53%	35.29%	11.76%	29.42%
17	Rangrazha Historical House 2, Isfahan	28.57%	14.29%	14.29%	42.85%
18	Taghavi Historical House, Isfahan	33.33%	11.12%	33.33%	22.22%
19	Zavolian Historical House, Isfahan	5.88%	47.06%	11.76%	35.30%
20	Petrus Historical House, Isfahan	6.66%	40%	13.34%	40%

temperature curve.

To analyze the quality of light obtained from stained windows in Iranian architecture, 20 stained windows were first selected. Then, the area percentage of each stained glass is calculated, as given in Table 2.

Relations for Calculating Color Temperature: This section describes the method of calculating the color temperature of light passing through stained glass and their relations. Before starting this section, it is to mention the fact that the parameters XYZ (tristimulus values) and XYZ (chromaticity values) and $\bar{x}$ $\bar{y}$ $\bar{z}$ (color matching functions) discussed in the following are different from each other. More precisely, first, by using $\bar{x}$ $\bar{y}$ $\bar{z}$ (color matching functions), the values of XYZ parameters (tristimulus values) are calculated. Then, using the calculated XYZ parameters, XYZ values (chromaticity values) are obtained. Finally, the color temperature can be extracted by two chromaticity values, i.e., xy. The detailed relations and steps for performing these calculations are given below.

Calculating tristimulus values XYZ from spectral data: The concept of tristimulus values (X, Y, and Z) was explained in the previous sections. In this section, how to calculate them is discussed. These values for color are obtained from the following relations:

$$X = \frac{K}{N}\int_{\lambda_1}^{\lambda_2} S(\lambda), I(\lambda), \bar{x}(\lambda), d\lambda \qquad \text{(Equation 1)}$$

$$Y = \frac{K}{N}\int_{\lambda_1}^{\lambda_2} S(\lambda), I(\lambda), \bar{y}(\lambda), d\lambda \qquad \text{(Equation 2)}$$

$$Z = \frac{K}{N}\int_{\lambda_1}^{\lambda_2} S(\lambda), I(\lambda), \bar{z}(\lambda), d\lambda \qquad \text{(Equation 3)}$$

The value of N is obtained from the following equation:

$$N = \int_{\lambda_1}^{\lambda_2} I(\lambda), \bar{y}(\lambda), d\lambda \qquad \text{(Equation 4)}$$

In the above relations:

λ: wavelength of colored lights (from 380 nm to 780 nm);

K: scaling factor (zero to one, completely dark to completely light);

S(λ): spectral transmissivity coefficient of the engineering object;

I(λ): spectral emissive power of the black body;

$\bar{x}(\lambda)$: red color matching function in CIE standard (Fig. 3).

$\bar{y}(\lambda)$: green color matching function in CIE standard (Fig. 3).

$\bar{z}(\lambda)$: blue color matching function in CIE standard (Fig. 3).

Color matching functions in the CIE standard, i.e., parameters $\bar{x}(\lambda)$, $\bar{y}(\lambda)$ and $\bar{z}(\lambda)$ These are the numerical descriptions of the chromaticity response by an observer. These curves represent the spectral sensitivity of the three main lights, leading to the calculation of tristimulus values (X, Y, and Z) in the CIE standard.

The values $\bar{x}(\lambda)$, $\bar{y}(\lambda)$ and $\bar{z}(\lambda)$ A computer code calculates using the above chart and considers the area share of the red, green, and blue glasses in the windows in question. Since yellow is a combination of red and green colors, its area was equally distributed between red and green colors if the yellow color was used in the window in question.

In calculating the integrals of equations 1 to 4 to simulate the amount of illumination at different day hours, the value of the scaling factor (K) was placed in three different modes: 0.25, 0.5, and 1. It is notable that although the value of K is effective in the calculation of tristimulus values (X, Y, and Z), it will be observed in the next section that the value of K will lose its effect in the calculation of chromaticity values (x, y, and z). Therefore, since the subsequent analysis of this research is focused on x, y, and z values, the approximate choice of K will not affect the research results.

Based on the information available in the relevant references, the value of stained glass's transmission coefficient was considered 0.79. Due to the variability of the I(λ) function, the method of spectral bands was used to calculate the integrals accurately. It is a common method for calculating radiation at limited (spectral) wavelengths (Incropera & DE Witt, 1996). It is to explain that in this method, instead of considering λ1 and λ2 as the lower and upper limits of the integrals, the parameters λ1.T and λ2.T are used. Consequently, the value of the integrals is calculated with the help of tables in which T is the temperature of engineering surfaces approximated by the black body. Based on the information in the related references, the value of T=5800 degrees Kelvin was considered (Incropera & DE Witt, 1996). In this way, the limits of the integral are calculated as follows:

$$\lambda_1 = 380\,\eta m \Rightarrow \lambda_1, T = 2204\,\mu m, \qquad \text{(Equation 5)}$$

$$\lambda_1 = 780\,\eta m \Rightarrow \lambda_1 T = 4524\,\mu m, K \qquad \text{(Equation 6)}$$

Taking into account the above values and using the reference tables, the fractions of radiation up to the desired wavelength (F) are obtained:

$$F(0 \rightarrow \lambda_1) = 0{,}101675 \qquad \text{(Equation 7)}$$

$$F(0 \rightarrow \lambda_2) = 0{,}567696 \qquad \text{(Equation 8)}$$

And finally, to facilitate the calculation of integrals, the fraction of spectral radiation from 380 nm to 780 nm, F(λ1-λ2), is obtained as follows:

$$F(\lambda_1 - \lambda_2) = F(0 \rightarrow \lambda_2) - F(0 \rightarrow \lambda_1) = 0{,}46602 \qquad \text{(Equation 9)}$$

By placing the values and relations mentioned in equations 1 to 3, X, Y, and Z values can be easily calculated. This section explains the equations and relations for calculating the tristimulus values (X, Y and Z) of stained glass windows. This article aims to calculate the color temperature of these windows. For this purpose, chromaticity parameters (x, y, and z) must be calculated, which will be explained below.

Calculating xyz chromaticity values: after calculating the XYZ values, the normalized chromaticity values (x, y, and z) should be calculated. The concept of chromaticity values (x, y, and z) has been described in the previous sections. In this section, how to calculate them is discussed. The normalized chromaticity values are obtained from the following relations:

$$x = \frac{X}{X+Y+Z} \qquad \text{(Equation 10)}$$

$$y = \frac{Y}{X+Y+Z} \qquad \text{(Equation 11)}$$

$$z = \frac{Z}{X+Y+Z} = 1 - x - y \qquad \text{(Equation 12)}$$

As observed, the parameter z does not have an independent value mathematically and can be written in terms of x and y. Therefore, chromaticity can be extracted by the abovementioned normalized parameters x and y. It is clear from the above relations that these two normalized values are functions of all tristimulus values (X, Y, and Z).

Calculating the color temperature: The color temperature can be calculated by having x and y values. Since the human eye has three types of sensors that cover different ranges of wavelengths, the complete diagram of visible colors will be three-dimensional. However, the concept of color is divided into luminance and chromaticity. For example, white is a bright color, while gray is the non-bright version of the white color. In other words, the chromaticity of white and gray are the same, but their brightness is different. Fig 4 illustrates chromaticity and color temperature in the range of visible radiation (from 380 nm to 780 nm). It is emphasized that the chromaticity chart does not specify the apparent color of the object (the apparent color depends on the characteristics of the object. As stated in the relations, the degree of chromaticity depends on the light source in addition to the characteristics of the object). In other words, the chart of chromaticity and color temperature is a tool that determines what the human eye experiences when faced with a spectrum of light.

RESULTS AND DISCUSSION

Data Analysis

Since this research aims to analyze the performance of traditional Iranian windows, calculating the color temperature of the windows will be a suitable criterion for judgment. That is, if the color temperature of the stained windows of traditional Iranian architecture is calculated, the experience of people facing the sunlight passing through these windows can be quantitatively expressed.

In this research, according to the described relations, the exact

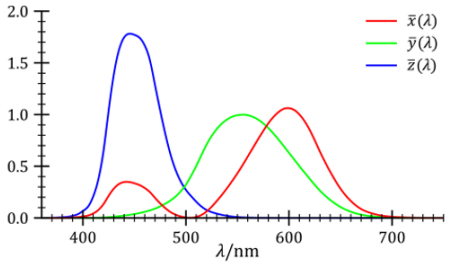


Fig. 7: Comparision between single-glazed glass and double-glazed glass in cooling

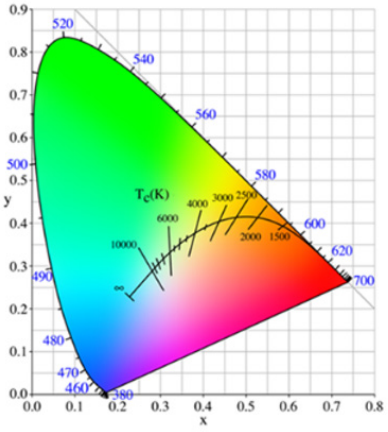


Fig. 4: Color Temperature curve (International Illumination Commission, CIE 1932).

values of x and y chromaticity values of each of the windows in question are calculated (Table 3). Then, the color temperature value of each window will be extracted by locating the x and y values on the chromaticity and color temperature diagram. Of course, some sites provide services in this field to facilitate it. That is, instead of finding approximate points on the diagram, the user can get the color temperature value by entering the calculated x and y values (Table 4).

As observed, all windows are in these two ranges, so 65% are in the range of 3000 to 4600, categorized in the natural white lights category, and 35% are in the range of 2000 to 3000, in the warm white lights category (Fig 5). Therefore, even though the color temperature of the sunlight changes during the day, the stained windows under study keep the color temperature of the ambient light constant in these two ranges. In other words, even though the stained windows reduce the intensity of the sunlight, the feeling they create in the space is in the following two categories (Table 1):

- Warm and friendly with a soft and relaxing feeling and an inviting and welcoming feeling;
- The feeling of a bright, attractive, and lively space.

It is noted that the color temperature range of 2000-3000 degrees Kelvin is called sunny, and its color is warm and yellowish. This light color will make the surrounding space warm and comfortable. The light color temperature range of 3000 to 4600 degrees Kelvin is called natural, and its color is close to the sunlight during the day and combines two colors of natural light and moonlight. This light color will make the surrounding space bright and attractive. The light color temperature range of 4600 to 6500 degrees Kelvin is called moonlight. Light cools the surrounding space by using this color, creating concentration and invigoration. Therefore, it can be concluded that in all samples of studied windows, the temperature of the transmitting color is in a range that psychologically induces a favorable feeling in humans.

CONCLUSION

Incorrect architecture and other harmful factors can cause stress, fatigue, psychological symptoms, and even physical discomfort. Generally, these effects are not obvious immediately but often appear after several months or years. This conclusion also proves that the spaces can promote healing and health processes with the reverse function. It has been proven that humans are under the influence of different spectrums of light, both psychologically and physiologically. These effects have been less measured or easily ignored in architecture.

Table 3: Calculation of the color temperature of the windows from the color temperature curve

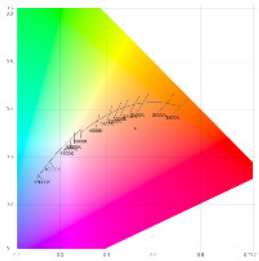
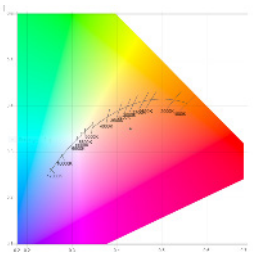
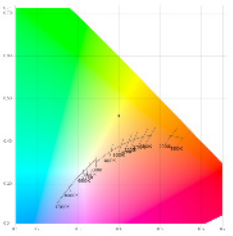
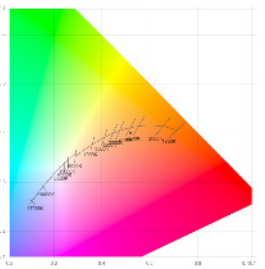
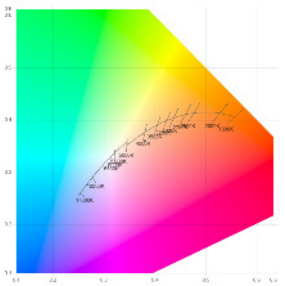
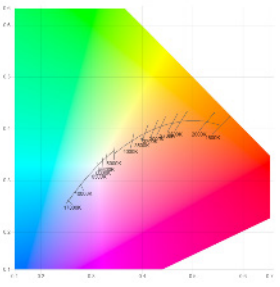
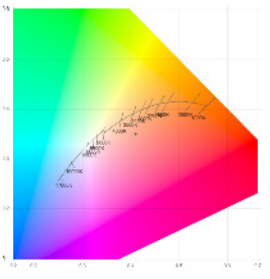
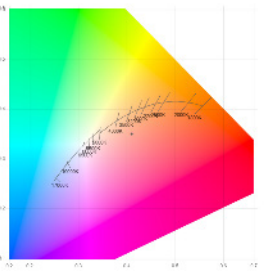
Karim Khan Citadel 1, ShiraZ	Karim Khan Citadel 2, Shiraz	Dowlat Abad Garden Monument, Yazd	Tekye Moavenolmolk, Kerman-shah
			
Rezazadeh Historical House, Ardebil	Emamzadeh Zanjiri, Shiraz	Nasir al-Mulk Mosque Shabistan 1, Shiraz	Nasir al-Mulk Mosque Shabistan 2, Shiraz
			
Nasir al-Mulk Mosque Shabistan 3, Shiraz	Akhavan Historical House, main ,sash	Akhavan Historical House, ,eastern sash	Sheikh ol-Islam Historical House, Isfahan

Fig. 7: Comparision between single-glazed glass and double-glazed glass in cooling

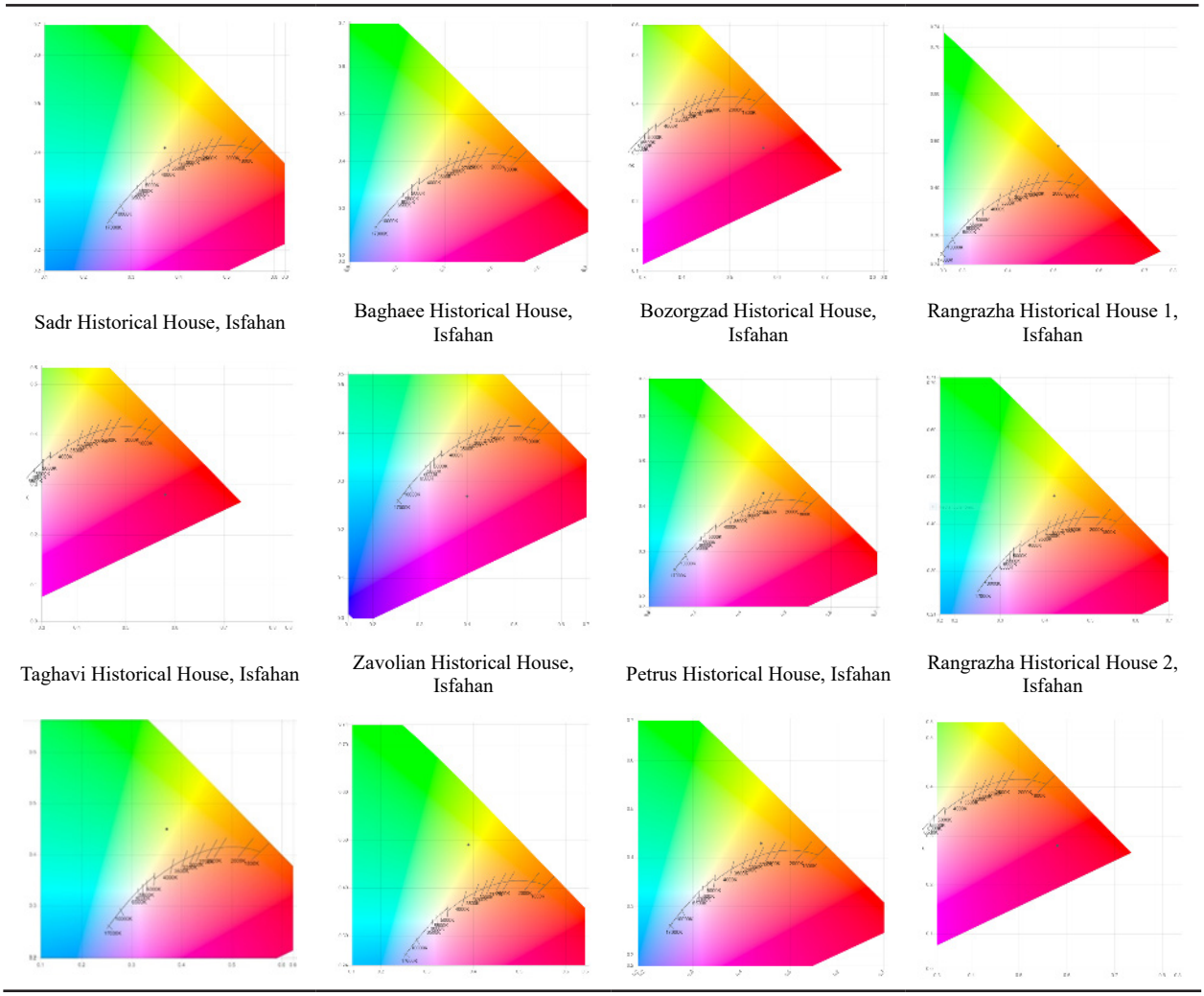


Table 4: Conversion of x and y to color temperature in degrees Kelvin

#	Location of window	x	y	Color temperature
1	Karim Khan Citadel 1, Shiraz	0.46	0.36	2246
2	Karim Khan Citadel 2, Shiraz	0.43	0.35	2612
3	Dowlat Abad Garden Monument, Yazd	0.40	0.46	4030
4	Tekye Moavenolmolk, Kermanshah	0.46	0.40	2610
5	Rezazadeh Historical House, Ardebil	0.38	0.36	3891
6	Emamzadeh Zanjiri, Shiraz	0.40	0.38	3537
7	Nasir al-Mulk Mosque Shabistan 1, Shiraz	0.41	0.35	3024
8	Nasir al-Mulk Mosque Shabistan 2, Shiraz	0.41	0.35	3024
9	Nasir al-Mulk Mosque Shabistan 3, Shiraz	0.37	0.41	4455
10	Akhavan Historical House, main sash, Isfahan	0.45	0.44	3064
11	Akhavan Historical House, eastern sash, Isfahan	0.57	0.31	2518
12	Sheikh ol-Islam Historical House, Isfahan	0.51	0.49	2648
13	Sadr Historical House, Isfahan	0.58	0.28	4439

Continiue of Table 4: Conversion of x and y to color temperature in degrees Kelvin

#	Location of window	x	y	Color temperature
14	Baghaee Historical House, Isfahan	0.40	0.27	2095
15	Bozorgzad Historical House, Isfahan	0.45	0.43	2993
16	Rangrazha Historical House 1, Isfahan	0.42	0.46	3672
17	Taghavi Historical House, Isfahan	0.37	0.45	4600
18	Zavolian Historical House, Isfahan	0.39	0.49	4337
19	Petrus Historical House, Isfahan	0.44	0.43	3149
20	Rangrazha Historical House 2, Isfahan	0.58	0.28	4439

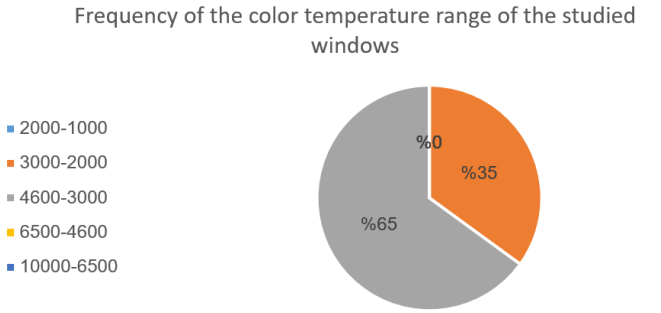


Fig.5: Frequency of the color temperature range of the studied windows

In this research, the color temperature of the light obtained from twenty stained windows of Iranian architecture was calculated based on the CIE color temperature curve to determine the quality of the light obtained from these windows based on the standards. Investigations affirmed that the light color temperature of 65% of the windows is in the range of 3000 to 4600 degrees Kelvin, categorized in the natural white light group, and 35% are in the range of 2000 to 3000, in the warm white light category; so despite that the stained glasses reduce the intensity of sunlight, but the color temperature of the light they create is either equivalent to natural light or equivalent to warm white light. Therefore, the use of stained glass with this model (a combination of four colors, red, green, blue, and yellow, and the area percentage that is used in each stained window) affirms that despite the decrease in light intensity, that seems essential in most regions of Iran, the light quality is not reduced based on the color temperature curve.

It is to mention that the concept of color is divided into two parts, brightness and chromaticity (color temperature). Despite the day's brightness change based on the sun's radiation throughout the day, the stained glasses of the studied windows always keep the color temperature of the light constant.

AUTHOR CONTRIBUTIONS

F. Barzegari Naeini performed the literature review and experimental design, analyzed and interpreted the data, and prepared the manuscript text and edition. H. Soltanzadeh performed the literature review and helped with the methodology. S. Mirshahzadeh helped with the literature review and methodology. S.Z. Moosavi Mohammadi performed some of the remaining experiments, helped with the research method and data analysis, and helped prepare the manuscript text.

ACKNOWLEDGEMENT

This manuscript is extracted from F. Barzegari Naeini's Ph.D. thesis, "The Effect of colored lights on human health in Iranian Architecture. "

The Architecture and Urban Planning Department of the Islamic Azad University, Central Tehran Branch, supported this study.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or falsification, double publication and, or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Al Bahadly, I., & Berndt, R. (2010). LED-based color sensing system, *Sensors & Transducers Journal,* 114(3), 132-150.

Alipour, N. (2011). Studying the design of sashes of Qajar palaces in Tehran. Negareh Journal, 18, 5-21.

Bani Hashem, A., & Latifi, M. (2015). Examining the role of light in interior architecture with the approach of the effect of light on the exaltation of the human spirit. *Scientific research conference of new horizons in the sciences of geography and planning, architecture and urban planning,* [Conference presentation], Tehran, Iran.

Bellia, L., & Fragliasso, F. (2021). Good Places to Live and Sleep Well: A Literature Review about the Role of Architecture in Determining Non-Visual Effects of Light. Int. J. Environ. Res. *Public Health,* 18(3), 1002.

Benedetti, F., Colombo, C., Barbini, B., Campori, E., & Smeraldi, E. (2001). Morning sunlight reduces length of hospitalization in bipolar depression. *J Affect Disord,* 62(3), 221–223.

Bosch, S., & Gresham. S. (2012). *The application of color in healthcare setting.* KI Jain Malkin INC. San Diego, CA.

CIE. (1932). *Commission Internationale de l'Éclairage Proceedings, 1931.* Cambridge: Cambridge University Press.

Dashti Shafiei, A., Kianoosh, N., Mojtahedi, M., & Hekmat, F. (2014). Investigating the effect of natural light in residential spaces on people's quality of life and mental health. *National Conference on Sustainable Development in the Sciences of Geography and Planning, Architecture and Urban Planning, Mehr Arvand Institute of Higher Education*, Tehran, Iran.

Edwards, L. & Torocellini, P. (2002). *A Literature Review of the Effects of Natural Light on Building Occupants*. NREL/TP-550-30769.

Guild, J. (1931). *The colorimetric properties of the spectru*m. Philosophical Transactions of the Royal Society of London, A230, 149-187.

Haqshanas, M., & Qayabaklou, Z. (2008). Investigating the effect of colored glass on the amount of light and energy transmitted in the visible range. *Color Science and Technology Research Journal,* 2, 213-220.

Hagh Shenas, M., Bamanian, M., & Qayabaklou, Z. (2016). Analysis, the Criteria of Solar Transmittance from Stained Glasses, Used in Some of the Orosis from Safavid Dynasty. *Color Science and Technology Research Journal,* 10, 55-64.

Haji Seyed Javadi, F., & Pourdihemi, S. (2008). The effect of daylight on humans, the administrative process, and the biology-psychology of daylight. *Soffeh magazine*,17 (46),75-67.

Houser, K.W., Boyce, P.R., Zeitzer, J.M., Herf, M. (2020). *Human-centric lighting: Myth, magic or metaphor?* Light. Res. Technol.1–22.

Incropera, F.P. & DE Witt, D.P. (1996). *Introduction to heat transfer,* second edition. Volume 2. Publications of the Isfahan University of Technology, Isfahan, Iran.

Jazdareh, S., R., & Zia Bakhsh, N. (2014). Investigating the effect of using natural light in residential buildings on the mental health of the residents. *The second national conference of applied research in civil engineering, architecture, and urban management, [*Conference presentation], Tehran, Iran.

Kalhor, H. (2009). *Lighting engineering.*Tehran: Enteshar company.

Mirgholami, M., & Pishbin, A. (2013). The effect of light and color in residential interior spaces of Islamic Iranian architecture. *The third national interior architecture and Decoration conference*, Isfahan: Institute of Higher Education of Danesh Pajouhan.

Mostafavi , A., Cruz-Garza, J., G., & Kalantari, S. (2023). Enhancing lighting design through the investigation of illuminance and correlated color Temperature's effects on brain activity: An EEG-VR approach. *Journal of Building Engineering*,(75),67-76.

Poynton, C. (2012). *Digital Video and H.D. - Algorithms and Interfaces* (2 Ed.). Elsevier.

Dai, Q., Huang, Y., Hao, L., Lin, Y., & Chen, K. (2018). Spatial and spectral illumination design for energy-efficient circadian lighting. Building and Environment, 146, 216-225. Salonen, H., & Morawska L. (2013). Physical characteristics of the indoor environment that affect health and well-being in healthcare facilities: a review. *Intelligent building international,* 5 (1), 3-25.

Samuels, R. (1990). *Solar Efficient Architecture and Quality of Life: The Role of Daylight and Sunlight in Ecological and Psychological Well-Being. Energy and the environment into the 1990s*. Vol. 4, Oxford: Pergamum Press, 2653–2659.

Sharma, D. (2016). *Incandescent Cultures: Cultural Expressions in Lighting Design.* Submitted to OCAD University in partial fulfillment of the requirements for the degree of Master of Design in Inclusive Design. Canada, Toronto.

Standardpro, (2023). Retrieved May 2023, from http://www.standardpro.com/guide-colour-temperature

Tahbaz, M., Jalilian, S., Mousavi, F., & Kazemzadeh, M. (2013). The effect of architectural design on the play of natural light in traditional Iranian houses. *Armanshahr Architecture and Urbanism Journal,* 15, 71-81.

Terman, M., Fairhurst, S., Perlman, B., Levitt, J., & McCluney, R. (1986). Daylight Deprivation and Replenishment: A Psychobiological Problem with a Naturalistic Solution. *International Daylighting Conference Proceedings II.,* Long Beach, CA, 438–443.

Tofel, R., B., Schwarz, B., yoon,S., Y., & Royale, A. (2004). *Color in healthcare environments.*

Vahdat Talab, M., & Nik Meram, A. (2017). Investigating the importance, frequency, and distribution of red color in the sashes of the historical houses of Iran. Case Study: 22 crowns of the sashes of the Qajar houses in Tabriz. *Journal of Fine Arts-Architecture and Urban Development,* 22, 87-97.

Westinghouse Lighting,2023. Retrieved May 2023, from

Wright, W. D. (1928). A re-determination of the trichromatic coefficients of the spectral colors. *Transactions of the Optical Society,* 30,141-164.

Zeng, Y., Sun, H., Yu, J., & Lin, B. (2022). Effects of the correlated color temperature of office light on subjective perception, mood, and task performance. *Building and Environment,* 224, 109508.