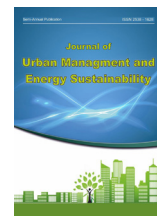


# Journal of Urban Management and Energy Sustainability (JUMES)

Homepage: <http://www.ijumes.com>



## ORIGINAL RESEARCH PAPER

### Human Scale in prominent houses of Isfahan School of Architecture in Safavi Era

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#### ARTICLE INFO

##### Article History:

Received 2023-08-27

Revised 2023-10-10

Accepted 2023-12-25

##### Keywords:

Architecture, Human Scale, Isfahan School of Architecture, Contemporary, Safavi Era

#### ABSTRACT

Human scale is one of the characteristics of architecture that has a decisive role in the formation of the relationship between man and environment. "Isfahan School of Architecture", especially in the Safavid era, is one of the most successful examples of understanding the human scale in various buildings. In this research, the analysis of human scale in the prominent houses of "Isfahan School of Architecture" during the Safavid period was carried out in the three topics of geometry, enclosure, and details by checking the factors affecting them. The method used in this research is descriptive-analytical based on library studies. This study showed that human scale in the houses of the "Isfahan School of Architecture" is reflected in the human perception of environment. In other words, "Isfahan School of Architecture" has achieved a balance between house architecture and human understanding. The extraction of house architectural interaction methods and human understanding resulted in presenting a codified, contemporary and referable diagram in the category of human scale in houses.

DOI: [10.22034/IJUMES.2024.2016584.1183](https://doi.org/10.22034/IJUMES.2024.2016584.1183)

Running Title: Human Scale in prominent houses of Isfahan School of Architecture in Safavi Era



NUMBER OF REFERENCES

14



NUMBER OF FIGURES

09



NUMBER OF TABLES

02

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## INTRODUCTION

Various scientists have commented on the human scale. “Paul Zucker” notes in the book “Town and square from the agora to the village green” that spaces become closer to the human scale by being enclosed. (Zucker, 1959)

“Hedman & Jaszewski” in the book “Fundamentals of urban design” discuss the effect of using architectural techniques and details such as bright shadows, rhythmic elements and openings in creating a human scale in architectural buildings and urban spaces. (Hedman & Jaszewski, 1984) “Ewing & Handy” in the article “Measuring the unmeasurable: urban design qualities related to walkability” point out that the human scale is related to the size and texture and the way of expressing the physical elements. (Ewing & Handy, 2009) “Francis Tibbalds” in the book “Making People-Friendly Towns” discusses the connection between the enclosure of space and the sense of human security. (Tibbalds, 2012) Mette Hvass” and colleagues” in the article “Intensity and ratios of light affecting perception of space, co-presence and surrounding context, a lab experiment” about the effect of the light of a place and the light of the surrounding environment on human perception of that space, speaks. (Hvas et al., 2021) In the book “Principles and Methods of Designing Urban and Residential Spaces in Iran”, Mahmoud Tausli talks about the optimal relationship between the dimensions of a space and the size of the human body and the effects of small spaces and large spaces on humans. (Tavasoli, 1945) “Rob Cryer” in the book “Proportions in Architecture” has investigated the golden proportions in the human body and then in examples of buildings by considering the plan, view and section, which finally led to providing guidelines for controlling the proportions of the building and Its elements are designed in (Krier, 2019) “Ali Shahabinejad et al” in the article “Human Scale in Naqsh Jahan Square, Isfahan” conclude that in Naqsh Jahan Square, due to the large dimensions of the space, the confinement of the space and attention to details and the pres-

ence of people in the space, as the main criteria needed for Creating quality in spaces is used. (Shahabinjad et al., 2013) “Nader Ardalan and Laleh Bakhtiar” in the book “The Sense of Unity” talks about geometrical proportions and the necessity of proportionality of building components for human use. (Ardalan & Bakhtiar, 1973) A review of the architecture and urban planning of the Isfahan school, which we witness in Isfahan during the Safavid period, shows the artistic balance between the human scale and the dimensions and size of the architecture, which is often huge and magnificent. In the Isfahan school, not the scale, but the human space is discussed. Scales, sizes, volumes, openings, closures, etc. are all intended to express this space (Habibi & Ahri, 2013). In this school of architecture, sometimes due to functional necessities such as what we see in Naqsh Jahan square, the proportion between the dimensions of space and the dimensions of man is less seen, and the emphasis is on the perceptual dimension of space by humans. In other words, “human perception” has been replaced by “human scale”. (Narimani et al., 2023) To facilitate this perception, methods such as creating enclosure, using the combination of rhythmic and continuous elements along with contrasting architectural elements, creating a balance between architectural volumes and their visibility hierarchy, and also creating a balance between the amount of attention to architectural details and their visibility distance have been used. (Shahabinjad et al., 2013). “The school of Isfahan, without seeking to build and erect memorials, itself becomes our memory. (Hasani et al., 2023) By avoiding the creation of dominant spaces and domineering buildings, this style succeeds in creating magnificent buildings and complexes that are very people-like, engage in conversation with the people, find identity from them and give them an identity” (Habibi & Ahri, 2013). After the decline of the Isfahani style, which began during the time of Mohammad Shah Qajar, its architecture no longer followed the previous evolutionary process (Pirnia, 2010). The methods used in

Iran's past architecture have been passed down from master to student, so at the present time there is no written collection of these methods and a documented collection of these methods is not available. And it is necessary to modernize it.

## MATERIALS AND METHODS

### Methodology

The research method employed in this study is descriptive-analytical based on library research. In this regard, the analysis of human scale in top houses in Isfahan School of Architecture during the Safavid era was conducted. This analysis covered focusing on three aspects: Geometry, Confinement, and Details, while considering influential factors.

## DISCOUSION AND FINDINGS

### Human scale in the architecture of Isfahan school houses during the Safavid era

One of the prosperous artistic periods of Iran is the Safavid period. The vast architectural activity of the Safavid period began during the time of Shah Abbas I (Kiyani, 2001). In this period, the city of Isfahan became very prosperous and huge and lasting architectural works were built in it. In this section, examples of the architecture of Isfahan school houses during the Safavid era are presented and the interaction of each of them with the subject of human scale has been investigated based on the available maps and images.

### David House

David's house dates back to the Safavid era and is located in Jolfa, Tabriziha neighborhood, on the corner of Agha Davoudi alley (Map 2). This

house has a central courtyard, and the most important spatial complex of the house is located on its northern front, which includes a cross-shaped two-story room in the middle and four three-door rooms on the two sides of it. The south front is one floor and has a semi-open space in the middle and two rooms with three doors on both sides. (Fig. 1)

### Geometry in David's House

The entrance of the house is located in the northeast corner, and the old man's platforms are on the wall of the building on both sides of the entrance. The space of the vestibule is square and a corridor from the vestibule moves across the eastern front and provides access to different parts of the house along its length. The yard of the house is a square of 25 x 25 meters and the human observer has a full field of vision when entering and has a view of the bodies, the pond and the garden. The presence of the pond on the right side of the entrance axis directs the audience's visual focus to the main part of the house, which is in the north of the courtyard. In most spaces of the house, the user has a view of the yard and benefits from natural light. The dimensions of the rooms are based on the human scale and the use of the space, and a ledge or shelf is installed in all the spaces for the use of the human user.

### Confinement and Details in David's House

The ratio of the height to the length of the courtyard is 1:4 in the east-west axis and 1:3 to 1:4 in the north-south axis. Although the observer does not see much height in the entrance axis, the height of the north and south sides has provided

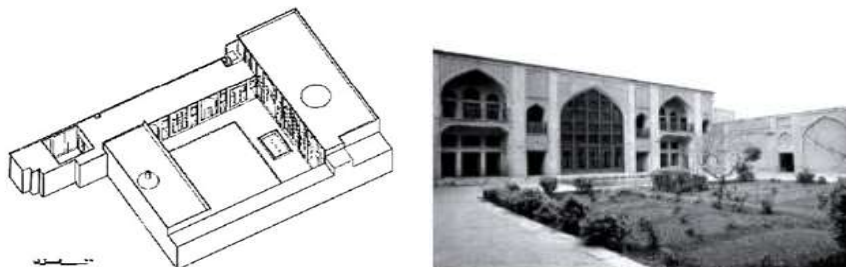


Figure 1: Plan, 3d model and photo of David house

a suitable enclosure. The body of the courtyard is continuous. In the southern and northern bodies, the three-way division inside the big arches brings them closer to human understanding. Also, in the middle arch of the northern body, the wooden lattice window has humanized the large scale. The northern cross-shaped hall, which is a large space and has a height equivalent to two floors, has details that are worked in proportion to distance and proximity, and has created a human environment. (Fig. 2)

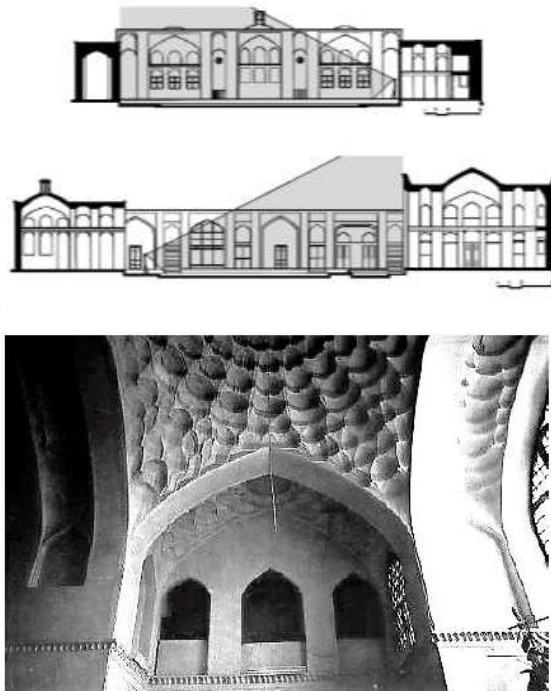


Figure 2: Elevation and photo of David house

#### Suksasian House

This house, which is a work of the Safavid era, is located in Jolfa, Tabriziha neighborhood, stone carver's alley. The building has a wide and long yard and spaces on both the north and south fronts, and there is another yard behind the spaces on the south front (Esatidhamkar, 1957). (Fig. 3)

#### Suksasian in David's House

The main yard has dimensions of 25 x 45 meters and the length of the yard is in line with the entrance axis, and the human observer has a complete understanding of the yard when entering. This extension directs the visual focus to the pond in the southern part of the yard. The sitting platforms are located in the first part of the entrance, the user can directly or indirectly see the main yard or the back yard in the house and benefit from natural light. The dimensions of the rooms are based on the human scale and space usage, and all the spaces have niches based on human needs.

#### Confinement and Details in Suksasian's House

In the entrance hall, the height-to-length ratio is 1:1 and creates a complete enclosure for the audience, but in the courtyard, the ratio of the height of the body to the length of the courtyard in the entrance axis is about 1:13. which brings a sense of large expanse and lack of confinement (Map 8). In the Hozkhaneh section, we again see high enclosure with a height-to-length ratio of 1:1 to 1.3:1. In the eastern and western parts of the courtyard, we have a uniform rhythm of repetition of arches of the same size. In the southern facade, we see three big arches. To

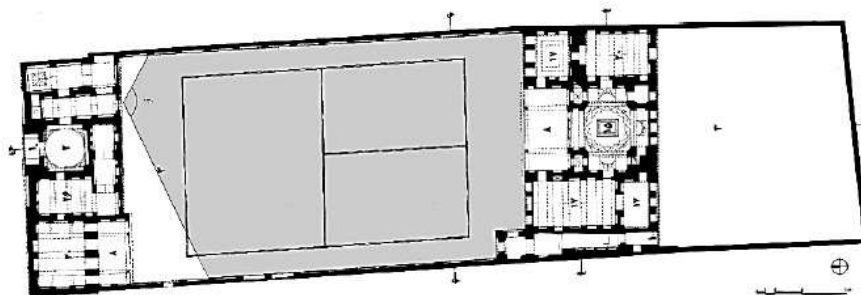


Figure 3: Plan of Suksasian house

emphasize the pond, it includes smaller arches like the frame of the big arch. The arches on both sides have divisions that bring this large body closer to the human scale (map 9). The size of the decorations on the roof of the Hozkhaneh porch, as well as the paintings on its bodies, are made according to the distance of the human observer. (Fig. 4)

#### Sheikh-ul-Islam House

This house is located in Chaharbagh Abbasi, Takhti intersection, Sheikh-ul-Islam alley. The entrance of the house is located in a large vestibule that is shared with the neighboring houses (Map 10). The most important space of the house is the big and kingly pillared porch, which is on the south side. This part is the highest part of the house and because of its architectural style, it has distinguished this house from other houses of its time. (Fig. 5)

#### Geometry in Sheikh-ul-Islam House

The main courtyard is rectangular with dimensions of 30 x 20 meters. The location of the entrance of the house in the corner of the yard has made the observer have a complete understanding of the main structure of the building upon entering. The space of the porch and the throne room, which are the most important parts of this house, direct the visual focus to themselves. The dimensions of the rooms are based on the human scale and space usage, and all the spaces have niches based on human needs.

#### Confinement and Details in Sheikh-ul-Islam House

The body of the courtyard in this building has a high continuity, and the entrance to the back yard has not created a disruption in this continuity. The ratio of the height to the length of the courtyard body in Shah-Neshin axis is about 1 to 2.5, which creates a suitable enclosure for



Figure 4: Elevation and photo of Suksasian house

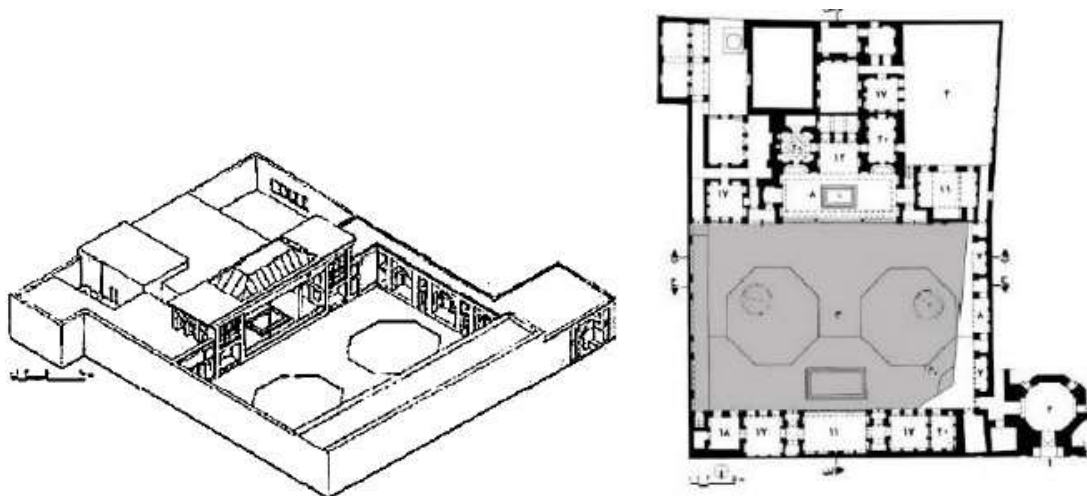


Figure 5: 3d model and plan of Sheikh-ul-Islam house



the human audience when entering. The ratio of height to length in the other direction of the yard is 1 to 4. When the audience stands in the middle of the yard and facing south, the royal porch fills his field of vision and creates a complete visual enclosure for him. (Fig. 6)

In the body of the main courtyard, we see a regular rhythm of large arches that contain smaller arches, and in the back yard this rhythm has become a simple repetition of arches and right angles. The south side, which forms the main facade of the building, has a pillared porch with three large arches at the top and rhythmic divisions of right-angles at the bottom. On both sides of the upper side of the porch, there are fine mesh windows that the observer from inside the courtyard can recognize their details, and at the bottom we have rectangular doors. On the north side of the courtyard, there is a large mesh door, and next to it we see a rhythm of arches and right angles. (Fig. 7)

#### Martha Peters House

This house is located on Hakim Nizami St., Jolfa neighborhood, at the beginning of Mehrdad St. (Map 16). It seems that the house of Martapeters

has undergone changes over time and was originally a shack in a garden. The main part of the cube-shaped masonry house belongs to the Safavid period. This space has a height equivalent to two floors and had porches on both its eastern and western sides (Esatidhamkar, 1998).

#### Geometry in Martha Peters House

Martha Peters house has two rectangular courtyards. The main courtyard, which enters the building from the northwest corner, has a length of nearly 33 meters and an average width of 5 meters. The back yard is rectangular, 21 meters long and 11 meters wide, and it leads from the southeast of the main yard. When the observer enters the building, he has a full view of the courtyard, and the arrangement of the pond and gardens places the visual focus on the north-south axis. The dimensions of the rooms are based on the human scale and space usage, and all the spaces have niches based on human needs. The spaces have light and air from one of the two courtyards. (Fig. 8)

#### Confinement and Details in Martha Peters House

After passing through an enclosed entrance, the audience enters the main courtyard. The body

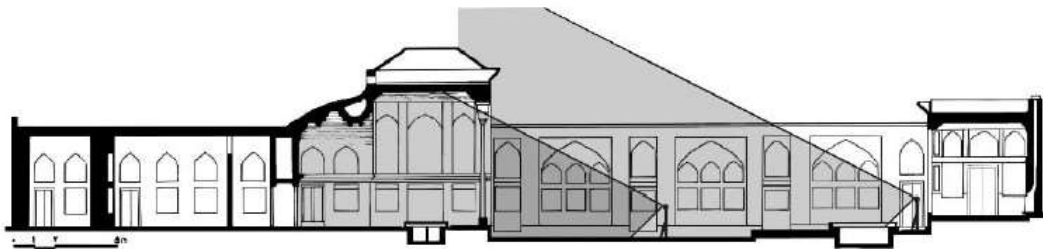


Figure 6: Elevation of Sheikh-ul-Islam house

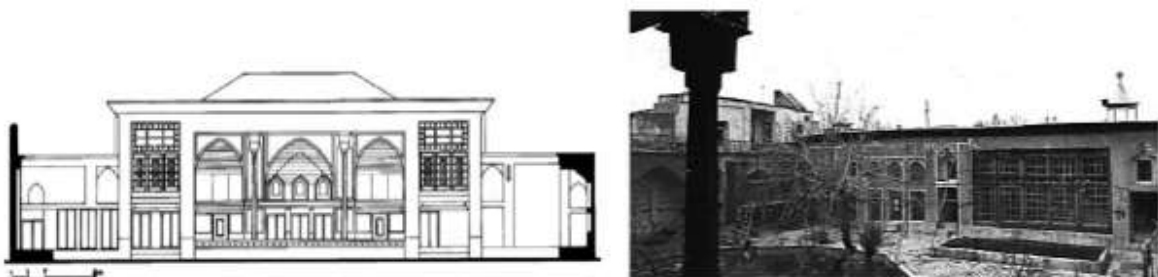


Figure 7: Elevation and photo of Sheikh-ul-Islam house

of the main courtyard and the eastern courtyard are highly connected. The height-to-length ratio of the main courtyard is close to 1 to 3.5 in the north-south axis and 1 to 2 in the transverse axis, which creates a suitable enclosure for the audience without distorting the view of the sky. In the cross-section of the back yard (eastern yard), the ratio of the height to the width of the yard is 1 to 1.5, which creates a high enclosure. In most of the spaces inside the building, the ratio of height to width is 1:1, but due to the vastness of the space, there is no sense of confinement. The bodies of this building, both in

the courtyards and inside the building, have a regular rhythm of arches and right angles. At the moment of entering the main courtyard, the audience sees three large arches that contain small arches, and as they approach the opposite body, they see more details. In the interior, the rhythm can be seen in the bodies and the division of the large space inside the arches, in addition to the functional role, brings the space closer to the scale and human understanding. The details are worked according to the distance of the human observer's vision. (Fig. 9)

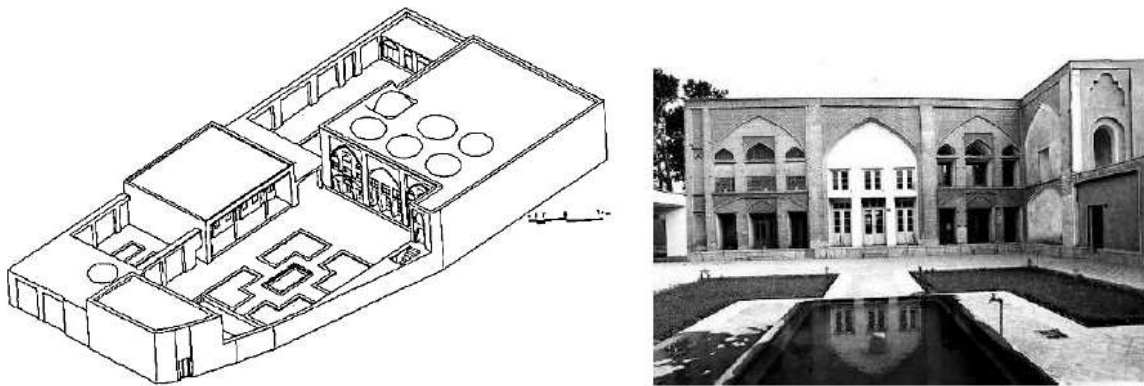


Figure 8: 3d model and photo of Martha Peters house



Figure 9: Elevation of Martha Peters house

## CONCLUSION AND RESULTS

### Factors affecting human scale in Houses

In this section, based on the studies of the buildings, a table has been prepared that shows the architectural features of prominent houses in the Isfahan school of architecture, the Safavid period. In this table, the symbol (\*) represents the lowest value and the symbol (\*\*\*\*\*) represents the highest value for each feature. (Tab. 1)

Extraction and compilation of modernized patterns of human scale in Isfahan school architecture houses

In this section, the factors that have the greatest impact on increasing the human understanding of the space of houses are presented in a tabular format. (Tab. 2)

Examining the above tables provides documented data for the humanization of spaces as follows:

The main factors in humanizing the space of houses in Isfahan school architecture are proper field of view, visual focus, continuity of the body, rhythm, proportion of details with the distance of sight and human details of the

Table 1: Factors affecting human scale in Houses

Building	Geometry			Confinement		Details			
	House Name	Size	Light and Open Space	vision and visual focus	Continuity and continuity of the body	Height to body length ratio	Details with spacing	Human details of architecture	Rhythm
David	***	*****	*****	*****	*****	1:4 1:3	*****	*****	*****
Suksasian	****	*****	*****	****	****	1:13 1:1 1:1.3	*****	*****	*****
Sheikh-ul-Islam	***	*****	*****	*****	*****	1:4 1:2.5	*****	*****	*****
Martha Peters	****	****	*****	*****	*****	1:3.5 1:2 1:1.5 1:1	*****	*****	*****

Table 2: The most influential factors in human perception of space

House Name	The most influential factors in human perception of space		
	Geometry	Confinement	Details
David			
Suksasian	Suitable field of view Visual focus	Continuity and continuity of the body Height to body length ratio $\geq 1$ to 4	Rhythm Fit details with spacing Human details of architecture
Sheikh-ul-Islam	Suitable field of view Visual focus	Continuity and continuity of the body The ratio of the height to the length of the Hooz-khaneh $\geq 1$ to 1	Rhythm Fit details with spacing Human details of architecture
Martha Peters	Suitable field of view Visual focus	Continuity and continuity of the body Height to body length ratio $\geq 1$ to 4	Rhythm Fit details with spacing Human details of architecture
House Name	Suitable field of view Visual focus	Continuity and continuity of the body Height to body length ratio $\geq 1$ to 3.5	Rhythm Fit details with spacing Human details of architecture



architecture, and the ratio of height to length of the body, inside the spaces including the yard, hall and rooms are more than 1 to 4. The factors affecting the human scale of houses are Suitable vision field, Visual focus, Body integration, 1:4 proportion, Rhythm, Detail proposition with view distance and Human detail in architecture.

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### HOW TO CITE THIS ARTICLE

Kondori, S., Shahabinejad, A., & Asgharzadeh, A. (2024). *Human Scale in prominent houses of Isfahan School of Architecture in Safavi Era*. *Journal of Urban Management and Energy Sustainability*, (), -. doi: 10.22034/jumes.2024.2016584.1183  
DOI: [10.22034/JUMES.2024.2016584.1183](https://doi.org/10.22034/JUMES.2024.2016584.1183)

