

# Comparative Investigation of Sense of Place Components in Historical Bridges of Iran; Case Study: Bridges Constructed on the Path of Zayandeh Rood River from Source to Wetland\*

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## ABSTRACT

Regarding the advent of the sense of place topics and the excessive importance of objective and functional issues in the modern era, an opposite movement began, and theorists paid more attention to human and semantic factors. Sense of place topics that seem simple have been less directly analyzed. This study aims to examine the effect of sense place components on the historical bridges constructed on the path of the Zayandeh Rood River from the source to the wetland. This study first collects the library data based on the documentary technique among the relevant documents, by using a mixed method and nested qualitative-quantitative approach with developmental-practical productivity. The interview technique is then used to scrutinize the components obtained from theoretical foundations. The extracted components are formulated in the questionnaire based on the Likert Scale, and the questionnaire is distributed among occupants. Interview analysis was done through Atlasti Software, and the results of the questionnaire were examined based on PN modeling through SPSS and JMP software. Descriptive and inferential statistics are used to analyze the results. According to regression results and average determination coefficients of historical bridges, it is concluded that hierarchies of spatial sense have used certain components in different historical periods to create a sense of place in bridges as an urban space. However, the important point is that body and adornments may play a more significant role in creating a sense of belonging to a place over time, because green space component and easy access with the value of 1.000 have the highest factor contribution to the sense of place of bridges, while the lowest rate (0.274) belongs to spatial diversity. Also, dimensions of the sense of place in historical bridges of Zayandeh Rood River, from source to wetland are divided into four categories: physical-spatial, functional-physical, perceptual-communicational, and social-communicational dimensions. Social-communicational dimension leaves the highest impact on the sense of place created in the studied bridges.

**Keywords:** Sense of Place, Historical Bridges in Zayandeh Rood Path, Mixed Method.

\* This paper is derived from the Ph.D. thesis by the first author titled "Latent Values of the Architecture of Historical Bridges of Iran" guided by the second and third authors and consulted by the fourth author in 2023.

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## 1. INTRODUCTION

Sense of place means individuals' perception of the environment and their more or less conscious feelings about their environment, which creates an inner relationship between them and the environment. In this case, an individual's perception and feelings are linked to and integrated with the semantic context of the environment (Nateghi 2019). This sense makes the space a place with specific sensory and behavioral features for special individuals. Heidegger defines a human as a creature being in the world with direct relation and interaction with it (Kashi and Bonyadi 2013). In line with the development of human communities and changes in people's lifestyles and settlement, architects, designers, and planners paid more attention to the quality of built spaces and environments so that design is used as a tool for shaping the built environments r spaces based on the human mentalities, activities, and behaviors (Qashqaei 2015). In addition to physical elements, the environment comprises some messages, meanings, and codes that individuals perceive, encode, and judge based on the activities, roles, expectations, motivations, and other factors. The sense created in a person after perceiving the space within the relationship with a particular environment is called a sense of place. However, collective life on bridges is not a new phenomenon, so fixed bridges have been used since medieval times as a place for spending leisure time and a space for enhancing social interactions and meetings (Ebrahimi et al. 2012).

Accordingly, those structures can be widely defined as a bridge in terms of urban design that not only connects two areas but also provides various commercial, religious, creational, and other roles, which contribute to both the continuity of the area and social integrity. Those bridges that provide rich community life have been considered market bridges, park bridges, historical bridges, and recreational bridges in some countries. This study aims to answer a question by assessing the sense of place components in bridges constructed on the Zayandeh Rood River from source to wetland: what is the difference between components in urban and non-urban bridges over history? It seems that spatial components have remained constant through time to explain the sense of place.

## 2. Background and Theoretical Foundations

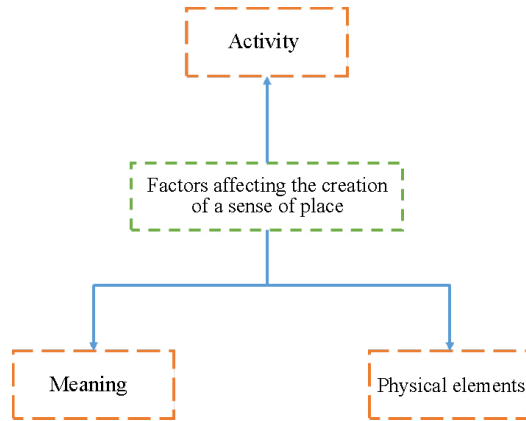
All academic studies should review the topic background to know the opinions and viewpoints of researchers and find how they dealt with the relevant subjects. Such review of points investigated by others prevents repeating their measures and activities helping to overcome shortcomings and complete the study.

### 2.1. Sense of Place

The most important term used for place includes the

concept and definition of sense of place. This concept has been developed in the past four decades and has covered a wide range of studies. After the introduction of definitions provided for a sense of place, this term has been analyzed by many experts (Raymond et al. 2016, 199). Sense of place includes a wide range of relationships between humans and place (Kamali 2013), which consists of the place and sense of belonging concepts (Stedman 2003, 672). Sense of place is usually related to the relationships between a group of people experiencing a single place and is attributed to the feelings of people toward a specific place (Ainifar 2001). The experience of place, which is an individual and subjective phenomenon in which, a person experiences the same feelings as others is called a sense of place (Gussow in Relph 1976). Sense of place not only creates comfort in an environment but also supports the considered cultural concepts of people, and social and cultural relationships of a community in a special place (Falahat 2007). Sense of place is also a combination of conscious and unconscious feelings and perceptions and a rich concept that includes perception, experience, and expression of individuals that make it meaningful so that the sense of place by a person can influence the human attitudes and behaviors in the place (Shamai 1991, 34). Space included physical, semiotic, and semantic components that are encoded, perceived, and judged by individuals based on the roles, expectations, motivations, and other factors (Pirjahangir 2017). Sense of place is indeed perceiving and expressing the space, its features, and knowing the meaning and concept of space (Steaman 2018, 566).

Lynch defines a sense of place as a communicational factor between humans and place, which creates unity (Norberg-Schultz 1997). He believes that space must have a perceptual identity, and should be detectable, memorable, and observable to be able to create a sense of place (Tuan 1980, 4-8). Sense of belonging or place attachment is rooted in activities and human-place or human-human interactions is a special place (Altman and Low 1992, 9). This sense deals with the mutual effect of feelings, knowledge, beliefs, and behaviors shaped in a specific place (Proshansky et al. 1983, 155). Moreover, a direct relationship exists between a sense of belonging and place attention, so an increased sense of belonging would raise the attention of individuals to the place making them protect that place (Mesch and Manor 1998, 509). Sense of place occurs with external changes, which can be varied in line with economic and social-political change (Devine Wright 2009). Integration of concepts in the planning and developing process of urban spaces sometimes has led to the elimination of local identity (Ralph 2010). Figure 1 depicts the factors that affected the sense of place.

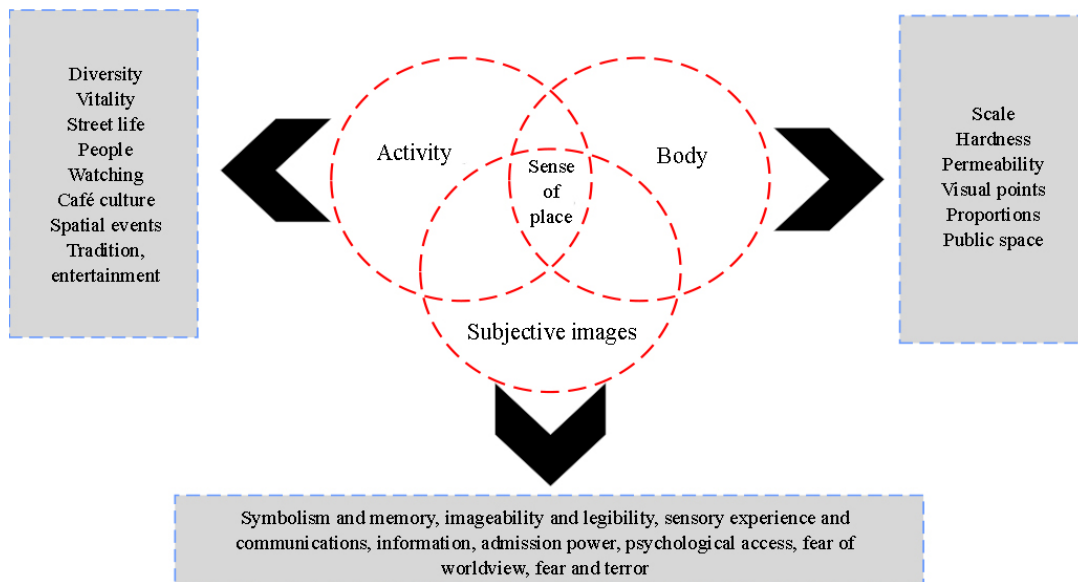


**Fig. 1. Factors Affecting Sense of Place**  
 (Carmona and Tiesdell 2007, 99)

The experiences of a person in a space and place are relative (Steel 1981). Everybody had different collective, group, and individual experiences of space and place through which, they are connected to the world (Hay 1988, 208). This concept appears in the persons and their perceptions over time (Stedman 2018, 566).

William (2014) divides the sense of place into two parts. In the first branch, sense of place is defined as a person's belonging to a place, and sense of attachment is considered in another category (Raymond et

al. 2016). The first one is related to an operational structure that is related to geographic status (Altman and Low 1987), which becomes meaningful in the structure, events, subjects, and incidents in the absence of a person (Lokoff and Johnson 1999). The persons are under the influence of external factors existing around them. These factors may include biological variables too (Heft 2013, 19). Sense of place occurs when a connection is created between person and place (Canter 1977, 189). Figure 2 depicts the indicators and components of the sense of place.



**Fig. 2. Indicators of Sense of Place**  
 (Carmona and Tiesdell 2007)

**2.2. Physical Factors of Sense of Place**

In the opinion of Norberg-Schultz, a sense of place appears in places that have distinctive roles and outstanding characters (Cross 2001). Under place and behavior theory in space psychology, the factors

affecting the environment are divided into two physical and activity categories (Qashqaei 2015). Activity class includes some factors and indicators, such as social-cultural indicators, individuals' actions, interactions, and communications between

individuals, and physical category comprises some indicators such as form, structure, arrangement, and organization of elements. Physical elements create a sense of belonging by creating differences in the environment and internal or external relationships in the place (Rappaport 1997). Physical elements can make a relationship with activity elements so that the environment provides personal and individual needs through integration with different activities in the environment. Personal needs are satisfied in the first step, and the social needs of the person are considered within various group dimensions (Karami et al. 2014). In the next step, physical elements of the environment like cultural indicators in the mind of individuals create subjective relationships. In this case, physical factors resulting from the social and cultural values of the environment would remind memories in the minds of individuals (Ramkissoon, Liam, and Weiler 2014). Therefore, physical specifications of the environment, including form and materials and deployment of elements would create a kind of spatial arrangement (Gokce and Chen 2020, 18), contributing to environment perception and knowing physical elements and factors by defining boundaries of the environment, making internal and external relationships, sense of confinement in the space, permeability, legibility, and matching with behavioral patterns of individuals (Motallebi 2002). In the opinion of Fritz Steele, physical components that have a considerable effect on the perception and creation of a sense of place include the area of

the place, human scale, similarities and contrasts, visual richness and diversity, sound, and odor in the environment, confinement in the place, spatial proportions, the distance between elements and components of space (Porter 2013). Salvesen believes that a sense of place occurs as a result of the relationship between three elements of an individual's situation in the environment, the landscape of the environment, and the relationship of a person with the environment, which each element alone is not enough for creating a sense of place (Erfani 2020, 15). In his opinion, physical features, including ownership of the place, occupants' identity and welfare facilities such as green space and nature in the environment, the connection between public and private spaces, and spatial hierarchy are the main elements that create a sense of place (Salvesen 2002, 7). Yan Zhu assumes that those structures that make the environment meaningful would create special qualities in the environment, which play role in making sense of place (Karimi 2017, 131). Yan Zhu introduces three main variables of place: legibility of environment, visual perception of the environment, and coordination of behavioral settings (Rajala et al. 2020, 721). Researchers have tried to reveal a specific part of this concept due to the extensive, complex, and multifaceted nature of the sense of belonging to the place. However, the physical dimension of the sense of place and physical factors affecting sense of place promotion have not been identified precisely (Stedman 2003, 682).

**Table 1. Physical Factors of Sense of Place and Its Definitions**

Physical Factors of Sense of Place	Contrast	Creating contrast using scale, materials, color
	Human Scale	Using human scales
	Fabric	Using some forms that create unity
	Color	Mimicking the composition of colors used in the old fabric to prevent façade confusion
	Visual Diversity	Using various forms

(Ulrich et al. 2008, 63)

### 2.3. Historical Bridges

The bridge has been an important and strategic passage in human civilizations, and its creation depended on various factors, such as political, military, social, and economic goals in communication routes, heavy cargo, and the use of modern vehicles due to the faster speed required for communications and need for an easy and safe route to cross rivers. The following are different types of historical bridges in Iran:

1. Bridges that connect two river coasts, so have a simple linear physical shape with a stone-made path protected with short protrusions at two sides.
2. In the second group, the bridge is a part of the urban space where life occurs. this linear flow is connected to the water flow (another linear shape) in its path

starting a dialogue with it. Therefore, the linear shape becomes a point within a constant repetition to make this connection (Azizi Ghoomi et al. 2015, 276).

Bridges were constructed when humans could use the basic path for crossing small streams and rivers by using tree trunks. To cross wide rivers with low depth, people constructed an anchor in the middle point when there was low water volume, and then put tall trucks on two sides of the coast and this anchor to solve the crossing problem (Qashqaei 2015).

The construction of passages and bridges to cross valleys and rivers is among the oldest human activities. They used materials available in nature to construct such bridges. Suspension bridges are suspended from cables made of plant fibers that are fastened to trees and rocks from two sides, and girder bridges are made

of wooden beams covered with stone-made materials (Motallebi 2002).

### 3. METHOD

The research method of this paper is based on two developmental and applied approaches. The applied method is used to benefit from all latent values, and the developmental approach is used for a studied area in historical bridges. The study is done based on the mixed qualitative-quantitative method. In the qualitative method, grounded theory is used to extract components, and the factor share of each variable is presented in the quantitative phase. Semi-structured interviews with experts and professors of the Art University of Isfahan are coded. The following questions were asked:

1. What is a sense of place, and why is it important?
2. Which factors are effective in creating a sense of place or physical belonging to a place?
3. Which one of the sense of place factors has a greater factor share in the formation of studied bridges?

Qualitative sampling was done among 15 experts in the faculties of Art University of Isfahan who

had full knowledge about the topic and studied case studies. The sampling method was done through the snowball method, and selected experts were asked to give scores (from 1 to 10) to the bridges in terms of the various components used in them and the sense of place conditions of the bridges. Those bridges with mean values greater than the upper and lower limits are chosen and sent to the board of experts for validation. At the point of theoretical saturation in this study, 46 experts were interviewed based on the purposeful semi-structured interview based on the inclusion criteria, so that data saturation and repetition occur from the 37th interview. Following the principles of grounded theory, labeling is done from the first interview. The score (1-10) is given to the bridges based on the sense of place factors used in them so that those bridges with average scores greater than 5 were chosen and referred to the experts to confirm or reject them. In the next step of the study, 46 experts were interviewed and received data repeated from interviews 37 forwards. Labeling is done through Atlasti<sup>1</sup> 9.1.3.0 software based on the grounded theory.

**Table 2. Profession of Interviewed Individuals**

Interviewees	Cumulative Percentage	Frequency	N
Architecture Professors	21	45.65	45.65
Landscape Architecture Professors	13	28.26	73.91
Urban Design Professors	12	26.2	100
Sum	46	100	-

The categories derived from themes are then used in the questionnaire. The questionnaire's items are designed based on the concepts extracted from a sense of place in architecture. The accuracy of the items or questions has been examined and scored based on the Delphi technique. The instrument's validity was measured using the CVI formula and equaled 0.72 for 20 experts. Moreover, Cronbach's alpha coefficient was used to examine the reliability of the instrument, which equaled 0.72 and confirmed its generalizability. Atlasti software is used for analyzing semi-structured interviews to reduce data.

In the quantitative phase, the results extracted from the questionnaire are imported to JMP<sup>2</sup> Pro 17.1.0.671353 Software and analyzed based on descriptive and inferential statistics. The results are ultimately analyzed based on the PN model. In the quantitative phase, the obtained variables are used to formulate a questionnaire based on the Likert scale, which is then distributed among spatial users of the bridge.

Sampling is done based on the upper limit of Morgan Table (384) in the quantitative phase to achieve sample adequacy. The validity of the instrument is assessed based on the CVR=0.76 formula, while Cronbach's alpha of 0.78 is used to ensure reliability. For this purpose, regression determination coefficient and graphic correlation coefficients are used.

#### 3.1. Studied Area

There are 13 historical bridges constructed on the path of the Zayandeh Rood River, from source to wetland. All of these bridges were eligible to examine their sense of place, which is a non-objective value in the constructed historical bridges. For this purpose and to extract the bridges, the Delphi expert board is asked to select some bridges through three brainstorming, limiting, and choosing phases. Among the selected bridges, 4 cases are extracted to do a comparative analysis of their components.

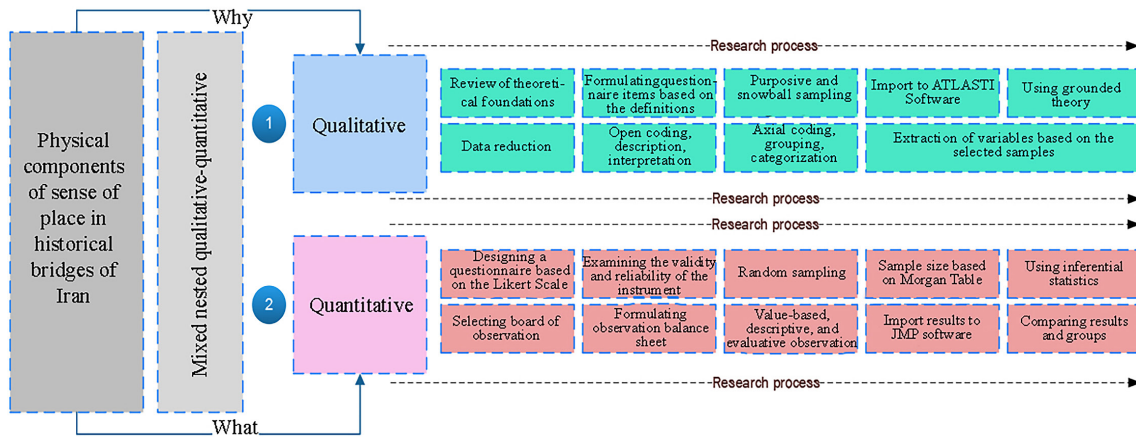






Fig. 3. Research Process

Table 3. Introduced and Selected Historical Bridges

Row	Bridge's Name	Historical Period	Image of Bridge	Kandal Coefficient
1	Vargan or Falavarjan Bridge	Safavid	 <a href="https://fa.wikipedia.org">https://fa.wikipedia.org</a>	0.941
2	Si-o-Se Pol Bridge	Safavid	 <a href="https://fa.wikipedia.org">https://fa.wikipedia.org</a>	0.845
3	Jooie Bridge	Safavid	 <a href="https://fa.wikipedia.org">https://fa.wikipedia.org</a>	0.769
4	Khajoo Bridge	Safavid	 <a href="https://fa.wikipedia.org">https://fa.wikipedia.org</a>	0.711

4. RESULTS

Research results include qualitative findings that are based on open and axial coding and quantitative findings shaped based on the casual relationships regarding descriptive and inferential statistics. Also, research results explain the details of extraction or evaluation, and the variables extracted in the case studies are discussed in the last step.

4.1. Qualitative Results

Qualitative study is based on non-probabilistic sampling, which is usually called purposive or criterion-oriented sampling which is a general and dominant form of sampling in a qualitative study. The qualitative data are collected through semi-structured interviews and are analyzed based on the grounded theory through three open, axial, and selective coding steps.

#### 4.1.1. Open Coding

bridges are presented in Figure 4.

All codes extracted from interviews about the selected

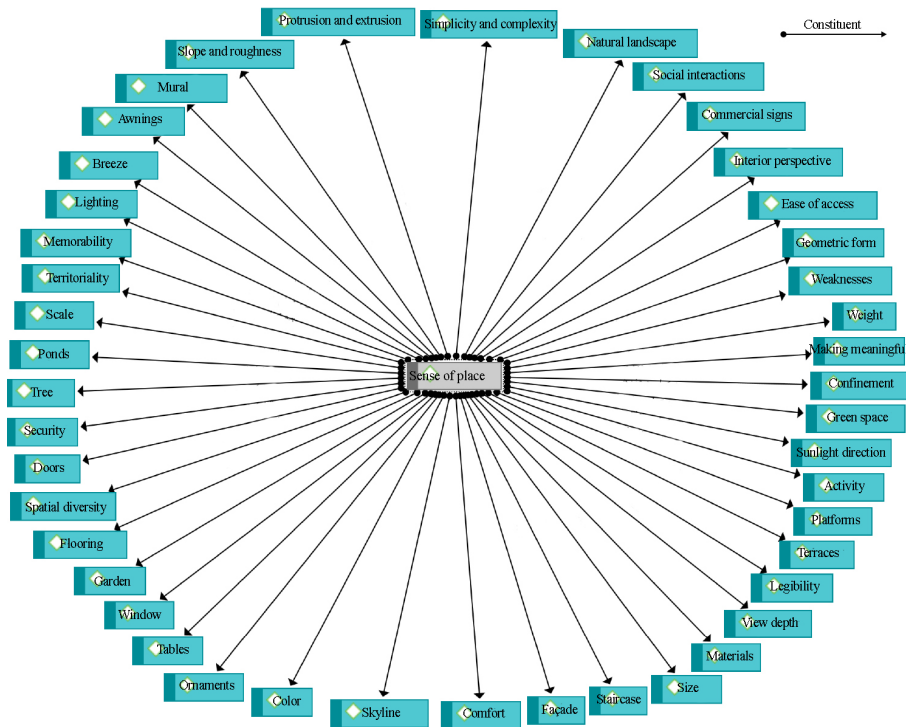


Fig. 4. Open Codes extracted from Interviews in two Groups

#### 4.1.2. Axial Coding

According to the table below, the extracted codes were classified and the higher frequency of each code was determined based on their iterations. Also, the codes were classified based on their commonalities,

and 23 codes that were not matched with theoretical foundations were deleted. Accordingly, the lowest frequency among sense of place indicators belonged to comfort (5), and breeze (6), while the highest frequency belonged to comfort and activities (33) followed by security (31).

Table 4. Coding and Classifying Open Codes and Extracting Axial Code for each Category

Code's Name	Frequency	Type of Code	Extracted Code
Various shapes-diverse geometric form	17	Physical	Geometric Form
Green landscape, vegetation, and diverse trees	21	Natural Space	Green Space
Collective movement, children's play and biking	33	Functional	Activity
Privacy boundaries, personalization, and sense of belonging	29	Social	Territoriality
The presence of geometric floors and the separation of floors using flooring	24	Communicational	Flooring
Landscape walls, fencing, and wall borders	16	Physical	Confinement
Using special symbols and vernacular materials	25	Perceptual	Making Meaningful
Human design and design for all age groups	16	Perceptual	Scale
Flow decorations, ornaments in the landscape, and decorative plants	22	Natural Space	Tree
Family tables, chess tables, and multifunctional tables	23	Urban Furniture	Tables
Painting white walls of buildings and painting the sign's back	21	View and Landscape	Mural
Damaged façade, non-legibility of path, and non-use of vernacular materials	24	Perceptual	Weaknesses
Simple façade, Persian façade, brick-made and hollow façade	29	Physical	Façade
Lighting plants and trees	23	Spatial	Lighting
Blowing a gentle breeze and stimulating climate to increase wind power	6	Perceptual	Breeze

Code's Name	Frequency	Type of Code	Extracted Code
Rigid shapes, light shapes, and visual weighing	11	Spatial	Weight
Confined view, visual confinement, and confusion in the space	13	View and Landscape	View Depth
Uneven intersection, upward slope, and downward slope	14	Communicational	Slope and Roughness
Easy access, pedestrian and riding access, close distance from main centers	31	Communicational	Ease of Access
Natural platforms, sitting platforms, and multipurpose platforms	30	Functional	Platforms
Protrusion for awnings, and vertical-horizontal awnings	26	Functional	Awnings
Simplicity of forms and complexity of ornaments	12	Physical	Simplicity and Complexity
Warm colors, colors created by plants, and color-change with light	13	Physical	Color
Wooden doors, designed doors, and metal door	14	Urban Furniture	Doors
Non-confusion in space, high legibility, and legibility principles	14	Perceptual	Legibility
Variable or fixed skyline, and building with fixed height	18	Perceptual	Skyline
Good memories, a sense of attachment, and belonging to space	29	Perceptual	Memorable
Ponds, pond spouts, and pond lighting	8	Spatial	Ponds
Spatial diversity, specific definitions for several spaces, and multifunctional spaces	21	Perceptual	Spatial Diversity
Individuals talking to each other and doing group activities	30	Social	Social Interactions
Natural views and landscapes, beautiful landscapes, and movable landscape change	11	View and Landscape	Natural Landscape
Perspective from indoor to outdoor	5	View and Landscape	Interior Perspective
The direction of the building towards sunlight and north-south facing building	14	Functional	Sunlight Direction
Special materials, materials made of stone, and various substances	13	Physical	Material
Brock ornaments, decorations of windows, and landscape ornaments	22	Physical	Ornaments
Different and large terraces	19	Spatial	Terraces
Colorful signs and advertisement boards	21	Urban Furniture	Commercial Signs
Squared-shape windows and full-length windows	25	Physical	Window
Shirt stairs, low-height stairs, and staircases of landscape	23	Communicational	Staircase
Façade protrusion or extrusion and filled or hollow design of façade	20	Physical	Protrusion and Extrusion
Decorating gardens, types of gardens, and integrating gardens and plants	21	Natural Space	Garden
Environmental comfort, thermal comfort, acoustic comfort, and inner comfort	33	Functional	Comfort
Different sizes of stones, grain size of materials, and same sizes	30	Physical	Size
Visual security, sidewalk security, use of CCTVs, and custodian	31	Perceptual	Security

After codes are extracted, they are classified based on their similarities or communalities through axial coding. The results of the extraction process include communicational, view and landscape, physical, natural space, urban furniture, social, functional, perceptual, and spatial dimensions.

#### 4.2. Quantitative Results

According to descriptive statistics, 253 members (72.1%) of the sample society were men 98 members (27.9%) were women, and 74.4% were in the age range of 18-30. Analyses are done in this step based on the components used in the factors affecting the façade design. The process is done as follows: a

question is formulated for indicators of each factor (5 indicators), and each question is scored based on the 1-5 scale. The sum score of an indicator per dimension shows the score given by each respondent to a detectable quality. Therefore, a score of each quality varied between 5 and 25. The scores between 5 and 11 indicate poor scores given by respondents, while 12-18 and 19-25 scores indicate moderate and good scores. The most important factors used in the frequency graph are reported below. The highest frequency belongs to the functional dimension in the variable of activity (1901), and the lowest rate is related to sunlight direction (1152).

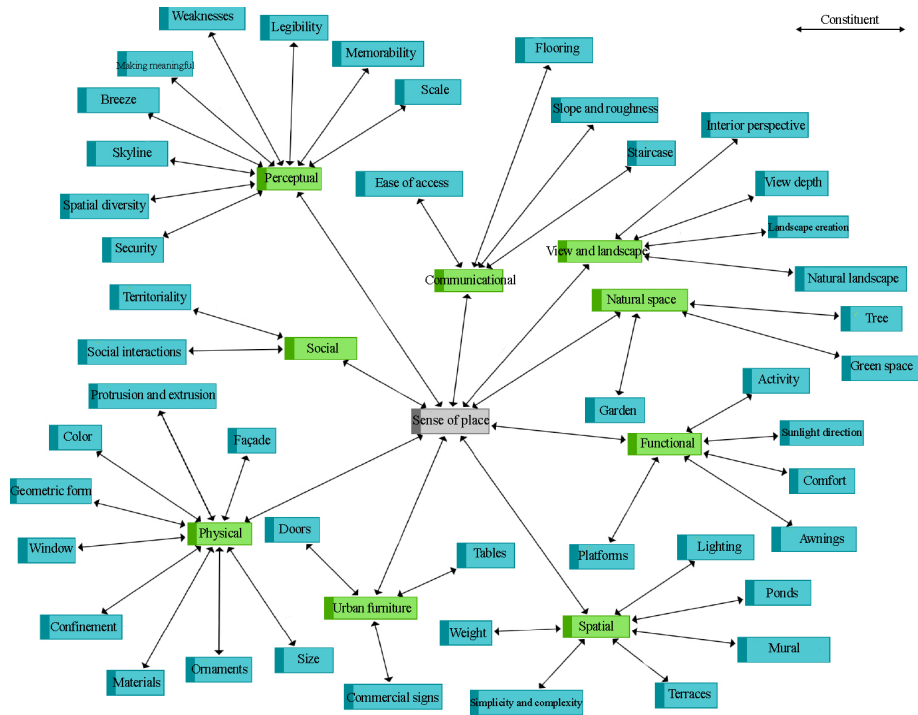


Fig. 5. Axial Coding through ATLASTI Software

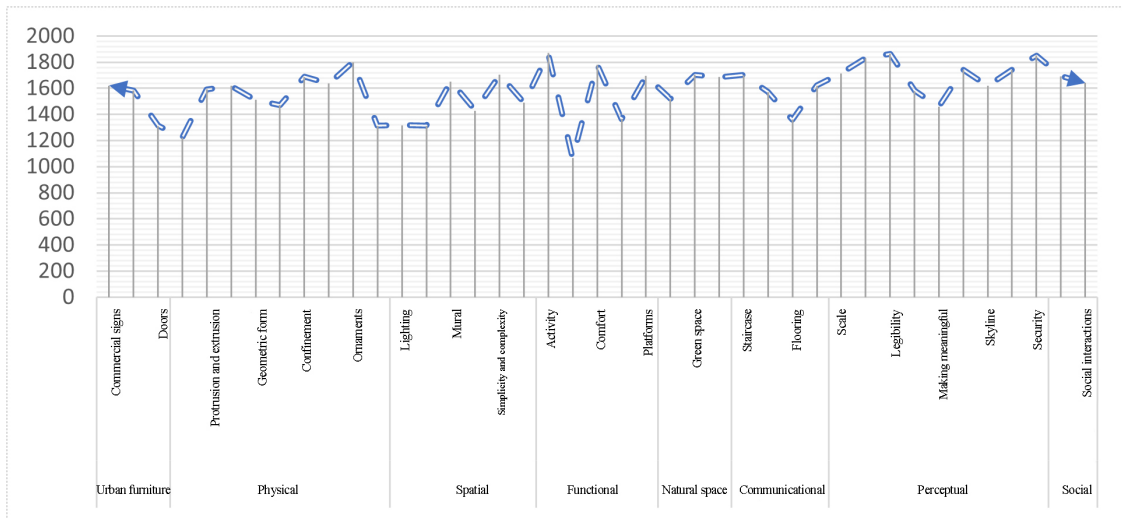


Fig. 6. Frequency of Sense of Place Variables

#### 4.2.1. Inferential Statistic

After extracting and classifying variables of the qualitative phase, items of the questionnaire are formulated in this step, and then the questionnaires are distributed among spatial users selected through

random sampling. The numerical results are then inserted into the JMPSAS16 Software. Numerical and graphical regression and correlational equations are used for the analysis phase. A two-sample Kolmogorov-Smirnov Test was used to find data normality.

Table 5. P and Z Values for Data Normality

Criterion Variable	Numerical Mean	SD	Kolmogorov-Smirnov Z	Sig.
Extracted Components of Sense of Place	77.27	23.3	793.0	314.0

According to the values reported in Table 5, these scores are significant for components affecting the sense of place ( $p=0.314$ ); therefore, internal and external indicators do not have parametric distribution, so the Pearson correlation test must be used to analyze them.

#### 4.2.2. Spearman Correlation

According to the correlation table and obtained

results, the moving average of variables is greater than 0.5 indicating the high effect of variables on each other, so they have been chosen accurately. Also, the highest correlation rate belongs to activity (0.925), and the lowest rate is obtained for the scale (0.209). Accordingly, one unit increase in these variables leads to an increase in other variables, which equals the correlation coefficient of other variables.

**Table 6. Correlation Coefficient of Components Affecting the Façade Design of Residential Buildings**

Dimensions	Component	Correlation Coefficient	.Sig
Urban Furniture	Commercial Signs	0.741	0.000
	Tables	0.429	0.000
	Door	0.623	0.000
Physical	Façade	0.685	0.000
	Protrusion and Extrusion	0.621	0.000
	Color	0.652	0.000
	Geometric Form	0.612	0.000
	Window	0.381	0.000
	Confinement	0.484	0.000
	Material	0.464	0.000
	Ornaments	0.372	0.000
	Size	0.812	0.000
Spatial	Lighting	0.685	0.000
	Ponds	0.597	0.000
	Mural	0.436	0.000
	Terraces	0.853	0.000
	Simplicity and Complexity	0.665	0.000
	Weight	0.213	0.000
Platforms	Activity	0.925	0.000
	Sunlight Direction	0.414	0.000
	Comfort	0.421	0.000
	Awning	0.421	0.000
	Platforms	0.615	0.000
Natural Space	Garden	0.424	0.000
	Green Space	0.423	0.000
	Tree	0.454	0.000
Communicational	Staircase	0.521	0.000
	Slope and Roughness	0.542	0.000
	Flooring	0.545	0.000
	Ease of Access	0.411	0.000
Perceptual	Scale	0.209	0.000
	Memorable	0.517	0.000
	Legibility	0.517	0.000
	Weaknesses	0.607	0.000
	Making Meaningful	0.619	0.000
	Breeze	0.562	0.000

Dimensions	Component	Correlation Coefficient	.Sig
Perceptual	Skyline	0.588	0.000
	Spatial Diversity	0.458	0.000
	Security	0.518	0.000
Social	Territoriality	0.552	0.000
	Social Interactions	0.544	0.000

### 4.2.3. Regression

Correlation matrix pretest is used in this step to examine the internal correlation between variables. The closer the correlation coefficient to 1, the more

the intensity of the linear relationship will appear. In contrast, the relationship tends to be nonlinear when this value is close to 0. The correlation matrix indicates the nonlinear relationship between components. Therefore, multivariate regression must be used.

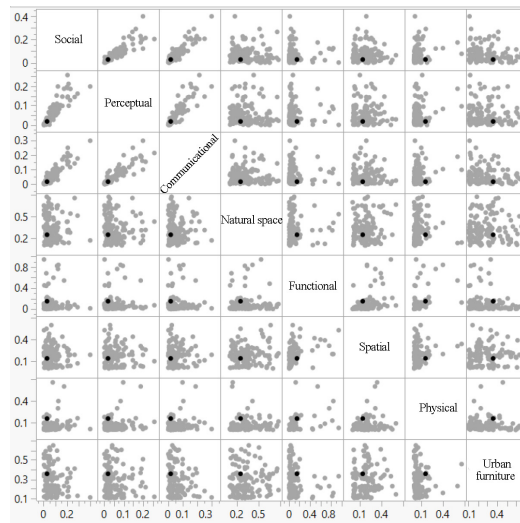


Fig. 7. Correlation Matrix of Factors

According to the results of multivariate regression, green space and ease of access (1.000) have the highest factor contribution in the sense of place

of bridges, and the lowest rate belongs to spatial diversity (0.274).

Table 7. Stepwise Regression of Sense of Place Components in Historical Bridges of Iran

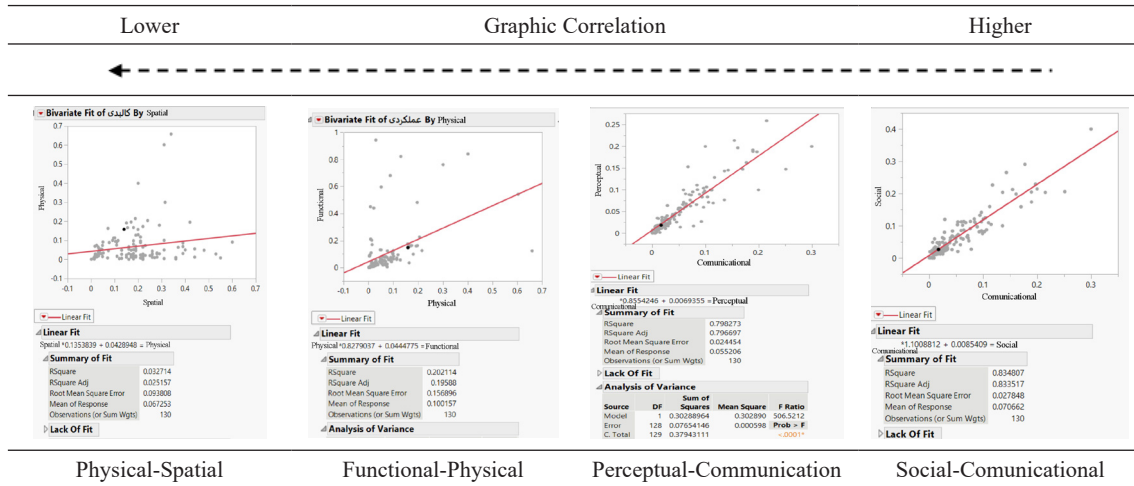
Dimensions	Component	Determination Coefficient	F	B	$\beta$	t	Sig.	df
Urban Furniture	Commercial Signs	0.867	314.217	1	0.762	39.451	0.000	383
	Tables	0.895	523.147	1	0.372	44.328	0.000	383
	Door	0.349	852.381	1	0.872	36.823	0.000	383
Physical	Façade	0.625	298.921	1	0.685	39.362	0.000	383
	Protrusion and Extrusion	0.612	247.257	1	0.597	18.958	0.000	383
	Color	0.656	644.321	1	0.436	16.644	0.000	383
	Geometric form	0.645	845.523	1	0.852	21.422	0.000	383
	Window	0.645	754.254	1	0.665	19.144	0.000	383
	Confinement	0.715	124.541	1	0.213	39.231	0.000	383
	Material	0.514	232.241	1	0.425	29.914	0.000	383
	Ornaments	0.795	201.321	1	0.414	24.221	0.000	383
	Size	0.323	443.124	1	0.421	48.248	0.000	383

Dimensions	Component	Determination Coefficient	F	B	$\beta$	t	.Sig	df
Spatial	Lighting	0.958	522.134	1	0.421	25.288	0.000	383
	Ponds	0.921	229.265	1	0.615	65.254	0.000	383
	Mural	0.421	323.412	1	0.424	49.517	0.000	383
	Terraces	0.246	441.211	1	0.423	25.326	0.000	383
	Simplicity and Complexity	0.821	321.541	1	0.454	58.351	0.000	383
	Weight	0.285	621.991	1	0.341	29.324	0.000	383
Platforms	Activity	1.000	581.920	1	0.578	21.825	0.000	383
	Sunlight Direction	0.754	218.654	1	0.514	31.586	0.000	383
	Comfort	0.756	752.382	1	0.542	48.566	0.000	383
	Awning	0.661	514.321	1	0.541	25.618	0.000	383
	Platforms	0.874	428.167	1	0.654	22.131	0.000	383
Natural Space	Garden	0.265	431.175	1	0.221	287.861	0.000	383
	Green Space	1.000	154.425	1	0.521	43.418	0.000	383
	Tree	0.831	131.421	1	0.522	33.348	0.000	383
Communicational	Staircase	0.541	461.222	1	0.524	44.524	0.000	383
	Slope and Roughness	0.275	475.214	1	0.619	29.325	0.000	383
	Flooring	0.963	215.309	1	0.162	22.421	0.000	383
	Ease of Access	1.000	216.667	1	0.902	13.342	0.000	383
Perceptual	Scale	0.624	511.219	1	0.532	45.525	0.000	383
	Memorable	0.646	369.256	1	0.852	28.163	0.000	383
	Legibility	0.262	219.544	1	0.725	30.811	0.000	383
	Weaknesses	0.735	865.420	1	0.911	31.011	0.000	383
	Making Meaningful	0.881	411.159	1	0.147	47.452	0.000	383
	Breeze	0.843	572.633	1	0.436	54.218	0.000	383
	Skyline	0.782	152.485	1	0.274	91.398	0.000	383
	Spatial Diversity	0.274	5.117	1	0.688	1.219	0.000	383
	Security	0.374	731.252	1	0.821	11.256	0.000	383
Social	Territoriality	0.867	37.781	1	0.835	12.321	0.000	383
	Social Interactions	0.895	652.312	1	0.625	77.741	0.000	383

The graphic correlation between various dimensions of bridges' sense of place is examined in the next step, which indicates the highest correlation between social and communicational dimensions followed by the correlation between perceptual and communications dimensions. However, the lowest correlation belonged to functional dimensions, and the correlation between spatial and physical dimensions

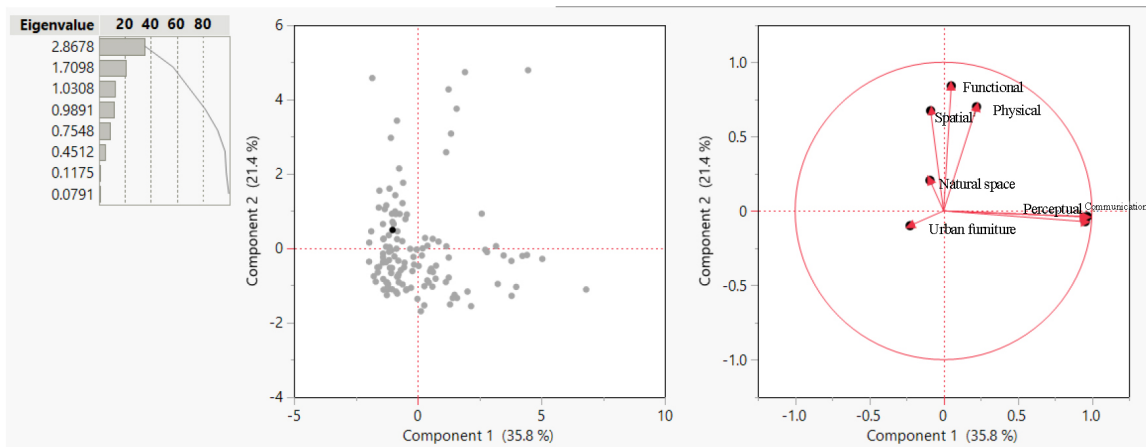
is at the last rank. No significant correlation was seen between other dimensions. As seen in Table 9, all four graphs have positive slope, but the intensity of the linear relationship is stronger between two social-communicational and perceptual-communicational dimensions. A positive but weaker correlation exists between functional-physical and physical-spatial dimensions.

**Table 8. Graphic Correlation between Sense of Place Dimensions in Selected Bridges**



According to the dimensions mentioned in the sense of place and PN modeling of components, communicational and perceptual dimensions had higher effectiveness in creating a sense of place, and respondents followed each other in answering items related to components, while the answers of spatial users were different in case of urban furniture. The obtained results show that components can be classified into three categories, so simultaneous

application of them would amplify their effects. Functional, physical, and spatial dimensions can amplify their effects, for instance. Moreover, the individual effects of components mentioned in the questionnaire can be seen, so that communicational-perceptual components show a high moving average in all questionnaires, but spatial users believe that urban furniture had no effect alone for creating a sense of place.



**Fig. 8. PN Modeling of Sense of Place Components in Selected Bridges**

**5. DISCUSSION**

The obtained results indicate a difference between descriptive and inferential statistics, and the analysis must be done based on the inferential statistics. Activity components had high correlation coefficients and regression results in creating a sense of place for all historical bridges, so it can affect other components defining more dimensions. In this case, various activities for particular age groups contribute to defining further dimensions and aspects in the space. Because the selected bridges (that are linking or connector bridges) are functional and other

activities are eliminated, various uses that support activities in the space can make more relationships between individuals in the environment. Evaluation of the historical bridges on Zayandeh Rood indeed shows some similarities and differences between them. This study investigated the bridge-construction experiences and traditions available in this area and emphasized Zayandeh Rood as a factor that can create landscape and urban life for people living in Isfahan. In addition to the comparative studies in case studies (Zayandeh Rood bridges, from source to wetland), holistic information was obtained for those

historical bridges that were influential at that time. Research findings indicate that some ideas shaped based on these theories and traditions for historical bridges have been developed to complete the theories and opinions of ancestors. In addition to innovation and creativity, ancestors considered various functions for each bridge when they were constructing these historical bridges. Their structures had a firm construction and more importantly, the architecture of these bridges considered structural construction of Persian bridges and their numerous functions, including individuals' presence and their needs that must be satisfied. Consideration of the social and recreational needs of individuals led to the advent of a sense of place in these bridges. Moreover, these bridges were constructed on the path of natural rivers, so a green space appeared around these bridges. Since human intrinsic originates from nature, such green space creates a close mental relationship between visitors' minds and historical bridges because green space is a part of space dimensions. Since these bridges are historical and their functional use is eliminated, they must become accessible for visitors allowing them to revisit them and be present in the space again. Multiple functions in selected bridges require supporting various activities, which can be accepted not only as functional aspects but also as members of the city and urban body. The studied bridges had basic and sometimes different functions, so could provide various functions. However, the main practical function and role of bridges was movement development. The main function of bridges is to make crossing and movement easy, but sometimes a combination of functions is seen in Persian or Iranian bridges.

## 6. CONCLUSION

Experiences have been continued traditionally in the old architecture of Iran. The continuation of these traditions for satisfying the new needs has created a basis for modernization and the invention of new works that are also acceptable by society. Historical bridges of Isfahan are a sample of the development and evolution of such a trend, which reached its peak point during the Safavid Era. This development was along with the renovation of previous bridges and the construction of new ones, which occurred due to the trade boom, Isfahan became the capital city of Iran, and the expansion of the city towards Zayandeh Rood River from source to wetland.

On the other hand, a sense of place is an inner connection that appears between individuals and their surrounding environment through perceptions, which create some imaginations in their minds that are some hierarchies of the relationship between them and their surrounding environment. This relationship becomes deeper in the environment through time because

this relationship is repeated in different seasons by spending life in space. However, the physical traits of individuals would change after years, and some signs of indifference may appear in people that are different depending on the function type of the structures or the space. Historical bridges have been constructed mainly to create communication in the space, while other aspects were ignored, so such indifference may be seen for such bridges too. According to the obtained results, social-communicational dimensions had the most effect on the sense of place creation in the studied bridges. In terms of the communicational dimension, these bridges had a communicational function and were used to displace individuals allowing them to cross over the rivers. When individuals go on the bridge to do a specific activity or when a bridge supports an activity, a sense of place appears in the minds of individuals, and stronger relationships are made between individuals due to the presence of others in that space. In terms of social dimension, people usually use spaces around the river to spend their leisure time and do recreational activities. Therefore, some spaces were created for people to gather together around these historical bridges along the main paths, so more social interactions and communications were created in those spaces. Therefore, some locations were considered for people gathering together for work or entertainment. The adjacent spaces around the Zayandeh Rood River from the source to the wetland are samples of these kinds of bridges.

This study indicated that three elements (activity, plants, and access) are necessary for maintaining a sense of place in these bridges. In general, some recommendations and solutions are given to achieve more sense of place in the historical bridges:

- Carry out pre-design investigations in all age groups of historical bridges based on the type of open, semi-open, and closed spaces regarding non-objective aspects
- Define activities in line with historical tourism for all age groups in the historical and contemporary bridges to achieve more invitation options for individuals
- Consider different activities for all hours of the day and create security for people's presence and more vitality in the surrounding environments of historical bridges
- Concentration on designing spaces based on the indigenous plants and combining communicational ways of stationery and movement spaces with natural plants and creating various landscapes related to green space and indigenous regional plants
- Emphasis on pedestrian-riding easy access for all age groups, disabled people, and others in all movement paths of bridges and focus on public transportation to achieve more access and invitation for individuals to be present in the space.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

## MORAL APPROVAL

The authors commit to observe all the ethical principles of the publication of the scientific work based on the ethical principles of COPE. In case of any violation of the ethical principles, even after the publication of the article, they give the journal the right to delete the article and follow up on the matter.

## PARTICIPATION PERCENTAGE

The authors state that they have directly participated in the stages of conducting research and writing the article.

## ENDNOTE

1. ATLAS. ti Software is a coherent and visual environment that can find answers to research questions beyond the imagination. Amon software used for analyzing qualitative data, ATLAS.ti provides more deepening and simpler visualization of relationships or equations.
2. JMP Software is a data analysis software designed for scientists, engineers, and other data analysts allowing them to analyze their data by using visual and interactive methods. The professional version of this software provides the possibility for more analyses, including prediction and validation techniques presenting all JMP abilities with more advanced features.

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