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## Review Article

# A Comparative Study on Traditional Architectural Openings Based on Fundamental Concepts (Case study: Persian Orosi and Japanese Shoji)

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## Abstract

Communities, based on their specific cultures and climates, have developed different architectural styles. However, there can be found similarities and differences among the characteristics of some instances of architecture; caused by common human creative thinking and diverse contexts, presenting features of architectural elements. Opening elements in architecture are important, as they control relationships between different spaces, such as the inside and the outside. Naturally, designing them is influenced by some source concepts, that originated in cultures of communities, which appears in the formation of the architectural openings and somehow the whole identity of that architecture. From this point of view, openings have an outer layer, which includes the morphological aspects, and an inner layer carrying meanings and ideas. “Orosi” is a type of opening in traditional Persian architecture and “Shoji” is a type of opening in traditional Japanese architecture. Each is a distinctive element of its region’s architecture. Notwithstanding the evident difference in their appearance, they both are openings that create flexible interaction between the interior space and the exterior. To understand the characteristics of these two openings, especially in their inner layers, this paper investigates their significant similarities and differences through a comparative study of three dimensions: morphological, technical, and inner. Main Similarities are found in fields of spatial influence, adjusting in/out relation, fuzziness and flexibility in enclosure, and cultural/environmental characters. The main differences found are geometric complexity vs. simplicity, dominant function turning to climate or boundary, non-minimalism vs minimalism, and preferring color or shadow designing.

**Keywords:** *Orosi, Shoji, Traditional Persian Architecture, Traditional Japanese Architecture, Inner Layer.*

## Introduction

Architectural components, especially openings, are important organs of any architectural body. But openings generally are misunderstood as mere functional objects, neglecting main conceptual ideas beyond their physicality. Therefore, it is

necessary to have a look at how the formation of objective features has been influenced by subjective concepts rising from the sources of culture and thoughts. So the question is “how the formation of the main features of two Persian and Japanese openings (Orosi and Shoji) have been influenced by the main concepts relating to these two cultures”?

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Orosi and Shoji are two types of openings: Orosi is a type of lattice window with a combination of colored and plain glass which is used in traditional Persian architecture. Orosi slides, i.e. opens and closes, vertically (Amid, 1983; Dekhoda, 1998; Moein, 2007). Its floor-to-ceiling extension (Pirnia & Bozorgmehri, 2002, 192) is probably the reason that some references categorize it as a type of door or window. However, Orosi opening is elevated from the floor and cannot be used as an entrance so does not function as a door. Colored glasses are another distinctive feature of Orosi. The use of colored glasses in Orosi has been probably due to the surge in ornamentation in the architecture of the Safavid period (10th\_11th centuries AH and 16th\_18th centuries AD) (Amrayi, 2018, 17 & 18; Alipour, 2011, 7). In the beginning, this architectural element was mostly considered a luxury ornamental piece (Zarei, 2013, 110), which could only be found in the houses of affluent people or in palaces, masques, or hussainiyas (Amrayi, 2018, 41 & 42; Zarei, 2013, 110). It was not only the Orosi's dimensions that affected its cost but also its intricacy and design made it an expensive element (Amrayi, 2018). The evidence shows that Orosi was not used by the general public until decades later when the extensive construction of Orosi made it affordable for common people, yet with a small "peymoon" (in Persian: پیمون, means scale) (Zarei, 2013, 109). In the Pahlavi period, due to the inattention to the art behind Orosi as well as its costly construction, using this artwork declined and few Orosi windows were built during that time (Khamechian et al., 2018, 8).

Shoji is a translucent panel that originated in traditional Japanese architecture, and it is made from a fine wooden lattice structure and a white translucent paper named Washi, which covers one side of the lattice structure (Engel, 1985, 112; InterAction Green, 2019, 3). Contrary to a common misconception, Shoji is not a door, window, or partition but, it can function as all three. Shoji literally means interceptor (Engel, 1985, 112), which clearly defines its original role: creating boundaries in space (Beita & Fujii, 2013, 29). Shoji is a type of "kyokai" (Belfiore, 2012). Kyokai literally means boundary

(Belfiore, 2012). Shoji's most important role is revealed when it is used as an exterior wall. In this manner, Shoji functions as a shading device, an entrance, a changing picture frame from the outside landscape, a controller of the views, and a light admitting source (Beita, 2010, 15). Briefly, it creates a flexible link between architecture and nature and lets the architecture unite with its surroundings. Connection and interaction with nature are one of the chief principles of traditional Japanese architecture (Beita & Fujii, 2013, 29). The Shoji's paper being translucent makes it a suitable option to be replaced with a window in places like Tokyo, where most of the windows have an obstructed view (Beita, 2010, 16), and that is why the traditional Shoji continues to be used even after the innovation of modern building techniques (Larsen, 2020). Besides houses, Shoji has been used in temples, shrines, tea houses, traditional farmhouses, and Japanese palaces (Beita, 2010, 15). The current form of Shoji became available to a wider population when washi was mass-produced (InterAction Green, 2019, 3; Encyclopedia Britannica, 1999). Contrary to Orosi, Shoji was not a manifestation of wealth or social class distinction (Engle, 1985, 199).

Both are considered important architectural elements that represent characteristics of their origins. Notwithstanding the fundamental differences in their architectural, cultural, and ontological contexts, they have similar functions: both create a link between the inside and the outside, define flexible boundaries, and bring about a dramatic, poetic ambiance by creating a dialect between the two sides. Their similarities despite their differences make them a good choice for a comparative study.

## Literature Review

Although there are a few studies that compare Persian and Japanese architecture (Shayan & Gharipour, 2002; Einifar et al., 2007), there is no research with a focus on comparing the components of Persian and Japanese architecture, like Orosi and Shoji as the most important types of openings in Persian and Japanese architecture.

Shayan & Gharipour (2002) reviewed common cultural features and concepts of Persian and Japanese architecture in seven topics. Also, in another research, Einifar et al. (2007) studied flexibility in Persian and Japanese architecture of housing. As well, some studies have compared Persian architectural components, with corresponding components in architecture of different cultures. For instance, a comparative study focused on the art of manufacturing Orosi and stained glass windows in Iran and Europe (Mehrizi & Marasi, 2017). But as it has been mentioned, no study has compared Orosi and Shoji as two architectural components of two different cultures.

To date, studies on both Shoji and Orosi, have targeted their basic morphological aspects, construction process, climatic features, and renovation process. Morphological dimension is the most reviewed research about Orosi opening. It can be divided into 3 main categories: 1) The proportions and geometry which Pirnia (2009b), Abolghasemi (2013), Zarei (2013), and Amrayi (2018) described the peymoon dimension system, and Khamechian et al. (2018) focused on geometry analysis and proportions of Orosi windows. 2) Divisions and ornaments are the second part of the morphological dimension which were studied in some papers: Alipour (2011) investigated the design of the Orosi openings of the Qajar period and compared them with other kinds of arts of this period; and in another research, Madhoushian Nejad & Askari Alamouti (2017) mentioned that “despite their similarities in construction technique, they have significant differences in design, shape and ornaments”. 3) The last part of the morphological dimension is light and color which is the prevalent feature of Orosi. Nematgorgani (2002) in a research entitled “The history of light in architecture and lighting in Islamic art of Iran” pointed to the colors of Orosi and its presence in Persian miniature. Wahdattalab & Nikmaram (2017) have studied the importance, abundance, and distribution of red color in Qajar period houses in Tabriz. Tokhmechian & Gharehbaglou (2018) also mentioned that elements

such as color, rhythm, and music are important in traditional architecture; and in this study, they used Orosi to investigate color.

Many researchers have studied the technical dimension of Orosi openings. Zarei (2013) and Madhoushian Nejad & Askari Alamouti (2017) studied the construction materials and techniques of Orosi. Also, Valibeig & Ranjbar (2017) have investigated and classified different types of this particular window by introducing the structural features. The subject of climate consists of a large part of research of technical dimension. Many studies have investigated the effects of climatic features on Orosi’s colors: Haghshenas & Ghiabaklou (2009) focused on tinted glazing of Orosi openings and their effects on transmission daylight and energy. Gorji Mahlabani & Mofrad Booshehri (2017) determined the percentage of each color that was used in Orosi glasses of five houses belonging to the Qajar period in Qazvin city. As well, Sultan Qurraie (2019) researched the light transmission, absorption, and reflection characteristics of different colors. Hosseini et al. (2020) also demonstrated the effect of colored glasses on the improvement of daylight performance based on occupants’ position. The other studies have focused on other Orosi’s features: Shahamat (2014) studied Orosi as a component of Sustainable traditional architecture. Atrvash & Fayaz (2016) researched to investigate the airflow in the Orosi room. Sharif et al. (2016) have investigated the climatic function of the lattice art (referring to the Orosi) in the Qajar architectures of Shiraz as a case study.

“Inner layers” is another subject which has been mentioned in a few researches. Ahani (2011); Makani et al. (2012), and Habib et al. (2013), have noticed the inner layers in Orosi openings, by referring to the “light” as a mystery in Persian houses and color which is the main feature of Orosi. The way which Orosi uses sun rays and color in colorful glasses refers to the principles of “Unity in diversity” (Alipour, 2011; Pourmohammad et al., 2020; Shafizadeh, 2019), which show the “possibility of repetition in case of perfection”

and “possibility of maintaining unity and matter while having a variety of shapes” (Shafizadeh, 2019).

It should be noted that most of the studies have dealt with the Orosi opening as an individual component, even though a few have investigated the position of the Orosi opening in Persian architecture (Khamechian et al., 2018). On the contrary, in Japan, due to paying more attention to the whole rather than the details, most of the Shoji openings have been studied in the structure of Japanese architecture; like Beita (2010) who considered Shoji as a boundary and studied different duties of Shoji in Japanese building; or Belfiore (2012) who has studied Shoji as an element of Japanese spatial layering. Also, Beita & Fujii (2013) have investigated “harmonization between architecture and nature through traditional Japanese screens” like Shoji. Therefore, Shoji has less been the subject of research as an independent component.

The most important and comprehensive source about the morphological dimension of Shoji is Engel’s book (1985) “Measure and Construction of the Japanese Houses” which discusses the typical forms of Shoji, its position on the wall, its proportions, and measurements, different types of the openable part of Shoji and its construction system and joints. Some studies are also about technical and climatic issues and how to renovate Shoji, like Odate (1988) who studied Japanese woodworking tools and their use, in this way indicated Japanese architecture construction. Eastin et al. (2004) focused on the market for wood windows in Japanese architecture construction. Beita (2010) and Beita & Fujii (2013) also studied climatic features. Also, ibid. (2013) studied Shoji as a Japanese screen in urban space. In the field of inner layers has been noticed a lot to Shoji’s poetry and it has been the subject of many paintings and literary works. Tanizaki (1977) by focusing on shadows, presents Shoji as an emotional component in a literary work. Veal (2002) mentioned Shoji in “Time in Japanese Architecture: tradition and Tadao Ando” as a component that captures

light and shadows, and slows the perception of time through the visual display it generates.

As mentioned, there are few studies considering the morphological dimension of Shoji, due to Shoji’s simplicity which returns to the “Zen” school, and the concept of “Chisoku”. This concept brings purity and simplicity to Shoji (The functional ..., 2023; Radford, 2022).

## Investigating The Similarities and Differences Between Orosi and Shoji

### • Morphological dimension

Both traditional Persian and Japanese architectures follow a modular design. This modular design affects the proportions of Orosi and Shoji. However, the module concept and its application are different in the two architectural systems.

In traditional Persian architecture, geometry played a significant role and has been used as a tool to create order in the building (Ardalan & Bakhtiar, 2011; Khamechian et al., 2018, 13). Dimensions, proportions, and the relative scale of spaces and physical elements of the building were determined following peymoon dimension system (Zarei, 2013); such as the place of the columns, the dimensions of rooms and corridors, as well as the shape of the façade, the [the place of] doors and windows and their proportions XPeymoon has two main types: large and small. The type of peymoon is identified based on the door’s width (Abolghasemi, 2013, 382).

Orosi windows were also designed according to the peymoon dimension system. Therefore, they were in harmony with the geometry of the whole building (Khamechian et al., 2018). In addition to adjusting the dimensions and proportions, due to the complexity of Orosi’s design, peymoon provides the possibility of prefabricating the Orosi window (Abolghasemi, 2013). Traditional Japanese buildings have a modular design and Shoji’s dimension, like every component of the Japanese house, follows standard measures. Tatami, a 3ft by 6ft rectangle mat used for floor

covering, is the module unit in Japanese architecture (Morse, 2016, 131; Einifar et al., 2007, 13). Tatami dimensions are developed based on human dimensions (Einifar et al., 2007, 13), the area needed for an individual to sit, sleep, and eat. The tatami dimensions only determine the dimensions of the building layout and do not specify the height. Tatami dimensions define the width of the Shoji panels (Einifar et al., 2007, 13) but indirectly: The column places are defined according to the module unit. The width of Shoji's structure is determined by halving the distance between the columns (Engel, 1985, 116) regardless of column spacing.

The height of the Shoji's structure is dictated by the width of the Shoji paper available in the market, which is usually 11 inches; as the paper is pasted horizontally on the outside of the structure from the bottom to the top (ibid., 112).

Both Orosi and Shoji openings have an elongated, vertical proportion, which is stretched to the ground and occupies a significantly large area of the wall. Compared to Shoji, Orosi uses more complex geometrical patterns; hence, it needs a more precise measure for construction. The geometry of Shoji's lattice has three main types, which are shown in Fig. 1. The Orosi's lattice design can be categorized into three main types: 1. simple; 2. Gerehchini, a combination of gereh geometrical motifs; 3. circular motifs using arabesque and angelica (Khatai) (Amrayi, 2018, 45). Fig. 2 show different types of Orosi lattice designs. Table 1 indicates differences in Orosi and Shoji morphological dimensions.

#### - Divisions

Orosi structure including its frames and ornamentations has more defined, independent units than Shoji. Whereas Shoji consists of just 2 main parts.

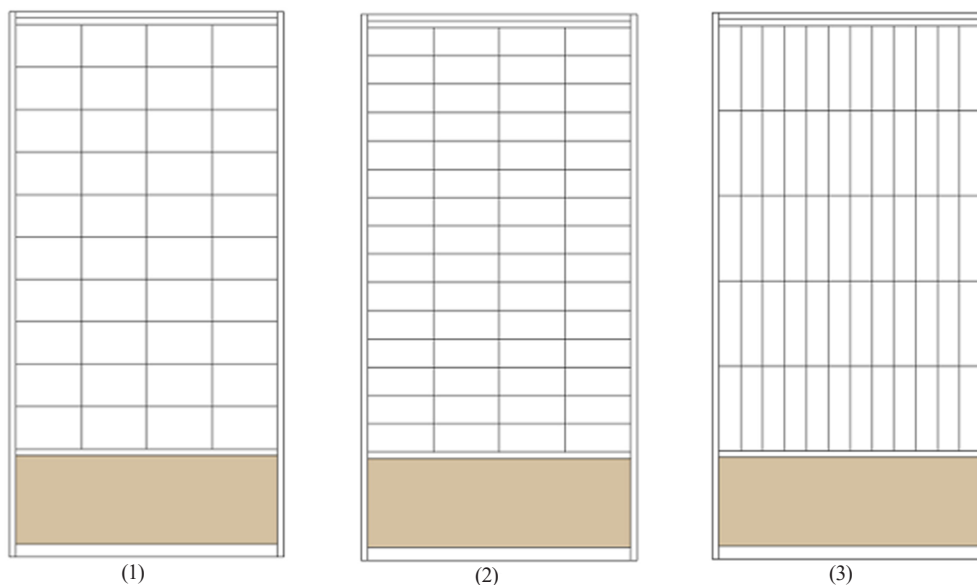


Fig. 1. (1): Shoji with horizontal order (Yokoguni-Shoji). Source: Engel, 1985, 113, (2): Shoji with dense horizontal order (Yokoshige-Shoji). Source: Engel, 1985, 113, (3): Shoji with dense vertical order (Tateshige-Shoji). Source: Engel, 1985, 113.

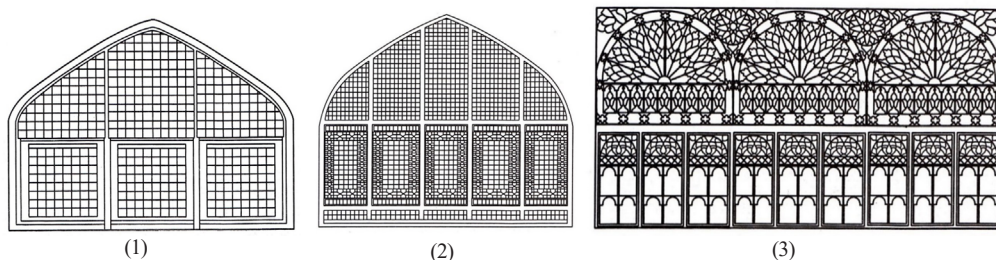
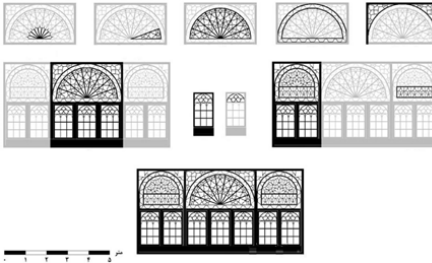
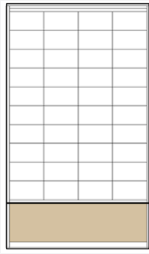
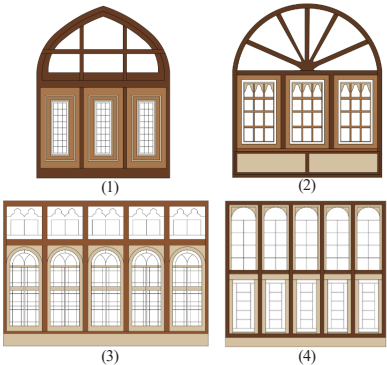
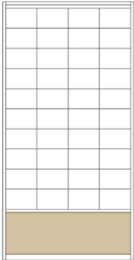
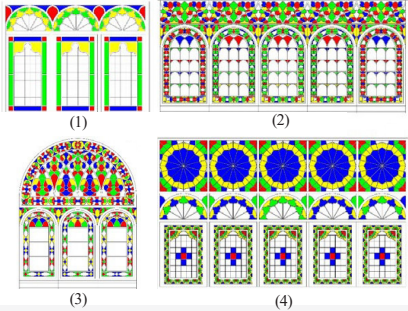

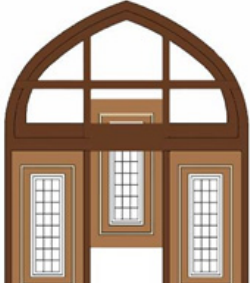
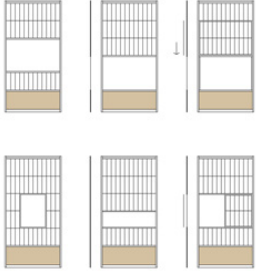


Fig. 2. (1): Three casement Orosi with simple lattice. Source: Amrayi, 2018, 62. (2): Five casement Orosi with a mixture of Gereh geometrical motifs. Source: Amrayi, 2018, 61. (3): Nine casement Orosi with circular motifs. Source: Amrayi, 2018, 61.

Table 1. Comparison of Orosi and Shoji in morphological aspect. Source: Authors.

	Orosi	Shoji
1	 <p>(1): Divisions of a seven-casement Orosi (Wahdattalab &amp; Nikmaram, 2017, 90).</p>	 <p>(2): Divisions of a Shoji.</p>
2	 <p>(1): The upper part of the Orosi is a pointed arch and the openings are rectangular. (2). The upper part of the Orosi is a semi-circular arch and the openings are rectangular. (3). The upper part of the Orosi is rectangular and the openings are semi-circular arches. (4). The rectangular form has been used more than the other forms (Valibeig &amp; Ranjbar, 2017, 522).</p>	 <p>(5): Two parts of the Shoji are rectangular.</p>
3	 <p>(1): An example of colors used in Orosi openings, simulated by AutoCAD software (Gorji Mahlabani &amp; Mofrad Booshehri, 2017, 229).</p>	 <p>(2): Shoji white (Sw 7042). Red 90.2%, Green 87.45%, Blue 82.75% (Shoji White, n.d.).</p>
4	 <p>(1): Opening a sash in a three-door of Orosi.</p>	 <p>(2): Different types of Shoji in terms of a variety of openable parts (Engel, 1985, 113).</p>

**Table 1: 1-1 & 1-2** show these units in a sample of a seven-casement Orosi and a Shoji.

Also, the Orosi structure includes a combination of geometric forms, such as rectangles, semi-circular arches, and different types of pointed arches; whereas the Shoji structure includes only rectangular units. **Fig. 1: 2-1, 2-2 & 2-3** illustrate 4 samples of Orosi and its various combinations of geometric forms, and **Table 1: 2-5** shows the simplicity of the Shoji structure.

#### - Light and color

Orosi is more colorful than Shoji. As shown in **Table 1: 3-1**, a blue, green, yellow, and red are the colors that were used the most in Orosi designs (Mehrizi & Marasi, 2017, 241). In Shoji panels, besides the brown color of the wooden frame, the only used color is the warm, creamy off-white color of the washi translucent paper. **Table 1: 3-2** illustrates the typical color of the Shoji paper.

In addition, the passage of light through the Orosi's colorful glasses makes sharp, colorful patterns in the interior space. While, in the Shoji panel, the washi translucent paper diffuses the light and makes grayscale blurry shadows on the panel.

#### - The openable parts and their proportions

Shoji has more variety in terms of openable parts. Shoji's lightweight and simple modular design makes it easy to play with.

In Shoji's design, each cluster of rectangles (module units) can be replaced with pane glass, creating a window in the panel that can be fixed or slid vertically or horizontally within the Shoji panel. **Table 1: 4-2** illustrates different types of Shoji in terms of a variety of openable parts. Orosi design doesn't have much flexibility due to the complexity of its design and construction, and it just opens vertically as shown in **Table 1: 4-1**.

#### • Technical dimension

Japanese and Persian architectures used resources in their surrounding environment for construction materials and were developed by local construction techniques. Such an approach lowers construction costs

and creates an architecture that matches the collective aesthetic consciousness of the people in the region (Kuma, 2010 as cited in Belfiore, 2012; Pirmia, 2009, 31; Vahdat Zad, 2014, 103).

Both Orosi and Shoji are constructed from two main materials: wood as the construction of the lattice, which adds intricacy and detail to the design (Zarei, 2013; Yagi, 1992), and covering materials include glass in Orosi and paper in Shoji. Since both openings' main structures are wooden, several similarities can be found in their construction process which is due to the common wood crafting techniques. One of the similarities is the use of various types of mortise and tenon joint techniques (Amrayi, 2018, 77; Billing, 2018). Due to the variety of forms in Orosi components, constructing an Orosi requires using more various types of joints. Moreover, the joints between the wooden structure and the covering elements are different in Orosi and Shoji. In Orosi, glasses should be installed individually between the lattice structures. In Shoji, the construction process is simpler and the washi paper is glued over the lattice. Shoji and Orosi are components of different building construction systems. This difference accounts for the basic differences between the two openings. Traditional Japanese architecture has a timber-frame structure, consisting of timber columns and beams which allows walls to be constructed from non-load-bearing materials (Engel, 1985, 109). Hence, the floor-to-ceiling Shoji panels could be built as slim and light as possible and could furnish the space between the columns (*ibid.*). They slide in the grooves mounted on the floor, ceiling, or walls and are not anchored to the building's structure. These features, i.e., being lightweight and separated from the structure coupled with their simple design make their construction process easy, fast, and inexpensive, which in turn renders Shoji easily replaceable (*ibid.*, 117). Replaceability is an important feature as Shoji panels break easily due to their fragility and wear out with age and use or break.

However, in traditional Persian architecture, load-bearing masonry walls have been the prevalent

structural system, and the Orosi frame needed to be anchored to the masonry structure. Also, complex, intricate patterns of the Orosi lattice cause the Orosi construction to be meticulous, slow, and expensive. So, it is not easy to replace an Orosi. However, Orosi does not need a replacement any time soon after their construction.

#### - Climate

The traditional architectural designs around the world are usually in accord with the region's climatic conditions, yet there are examples where the expected accordance could not be found (Rapoport, 1969). Traditional Persian architecture and Orosi design are compatible with the climate of the region (Razjouyan, 2009; Tavassoli, 2002), while Japanese houses and Shoji design are not as effective when it comes to climate (Rapoport, 1969). What follows elaborates on this difference.

Effect of Iran's climate on Orosi design: Most of the Iranian Plateau has a hot, dry climate (Tavassoli, 2002, 6) characterized by intense solar radiation, especially during summer (Kheirabadi, 2000; Tahbaz & Jalilian, 2011), and low humidity (Kheirabadi, 2000; Shahamat, 2014). The latter causes an increase in the diurnal and seasonal temperature ranges (Shahamat, 2014). It is cold and dry in winter; and hot and dry in summer (Foruzanmehr, 2018; Tahbaz & Jalilian, 2011, 89). To use energy efficiently, traditional Persian houses were usually designed to have distinct seasonal rooms; north-facing summer and south-facing winter rooms located on the south side and the north side of the central courtyard respectively (Shahamat, 2014; Foruzanmehr, 2018).

The Orosi window was completely in harmony with the climatic and seasonal design of the houses. Orosi window moderates the amount and intensity of the admitted daylight into the interior space like a smart filter (Sultan Qurraie, 2019, 27; Nematgorgani, 2002, 319). The Orosi's lattice structure and its combination of simple and colored glasses are both responsible for this moderation. The lattice disperses the sunlight that strikes its edges and in turn,

reduces sunlight intensity (Parsa, 2011, 86). The ratio of colored to simple glasses and the percentage of each color used in the Orosi is significantly related to the extent to which an interior space requires the sun's light and heat, which itself depends on the climate and the location of the Orosi in the house (Gorji Mahlabani & Mofrad Booshehri, 2017; Hosseini et al., 2020; Haghshenas & Ghiabaklou, 2009).

Usually, Orosi openings in hot climates are entirely of colored glasses (Haghshenas & Ghiabaklou, 2009), whereas Orosi openings in colder climates are from a combination of colored and simple glasses with usually a higher portion of simple glasses (Gorji Mahlabani & Mofrad Booshehri, 2017, 234 & 235). In addition, if there is an iwan adjacent to the wall that the Orosi is placed on, the iwan's ceiling becomes Orosi's canopy in the summer days (Shahamat, 2014; Makani et al., 2012) and does not block the sun rays from penetrating the depth of the room (Shahamat, 2014).

Effect of Japan's climate on Shoji design: The climate of Japan is predominantly temperate (Fong et al., 2007; Nakamura, 2018) with hot, humid summers; yet cold, dry winters (Nakamura, 2018). However, due to the great extension of the country in the north-south direction, the climate varies greatly according to the latitude. Central Japan experiences a temperate climate, whereas the Northern and Southern Japan have a cool-temperate and a sub-tropical climate respectively (Fong et al., 2007). Notwithstanding the broad climate variation in Japan, the Japanese houses were generally similar in design and the climatic-specific differences were minimal (Rapoport, 1969). A typical traditional Japanese house was designed mainly considering the extremely hot, humid climate of the summer days (Kodama, 1998; Nakamura, 2018; Rapoport, 1969; Beita, 2010; Beita & Fuji, 2013), as it was technically impossible to provide thermal comfort during both summer and winter (Kodama, 1998). Therefore, Japanese houses "sacrificed the heating

performance in return for cooling performance” (ibid., 317). Thus, the traditional Japanese houses were cold and uncomfortable during winter (Kodama, 1998; Rapoport, 1969; InterAction Green, 2019), even in relatively warmer regions (Rapoport, 1969, 22).

In summer, the Shoji panel “works as a shading device” (Beita, 2010, 20), reducing the intensity of solar radiation; while in winter, it works as a source of ambient illumination, gathering and intensifying the sunlight (Beita, 2010; Beita & Fujii, 2013). However, these features were not enough to provide climatic comfort inside the building when Shoji was used as an exterior wall (Eastin et al., 2004; Engel, 1985, 136). So, to protect from wind, rain, dust, and cold and even more protection from the sunlight traditional Japanese buildings used other architectural elements. (Engel, 1985, 136; Marra, 2011).

#### • Inner layers

##### - Lattice patterns

Orosi and Shoji openings have a lattice structure. Shoji lattice is defined with many vertical and horizontal fine lines. One of the reasons that Japanese room designs are simple, and empty is to balance out the many lines added by Shoji (InterAction Green, 2019). Although the Orosi lattice has more complex, intricate patterns, compared to Shoji, it does not add lines to the space.

Another difference between Orosi and Shoji lattices is how humans perceive them. Accordingly, since the

Shoji strips are so slim, its lattice structure is perceived as vertical and horizontal strips framed in a rectangular frame, rather than small rectangle units. The lines are perceptually grouped, and the mind perceives the entire lattice as a single whole.

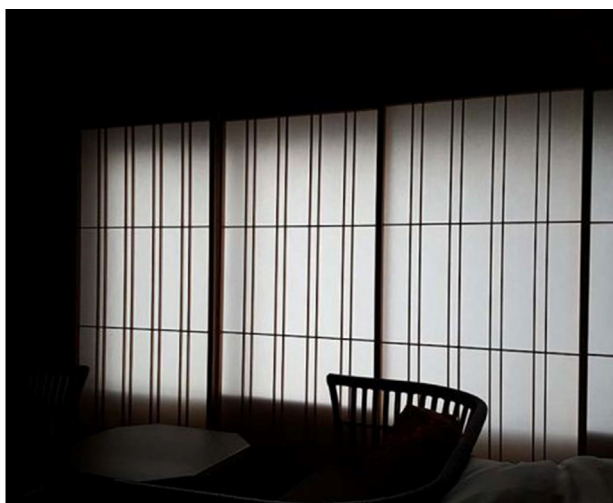
Orosi has more visually complex details. A cluster of small parts in Orosi is perceived as a whole; a whole which itself is still a part and together with other parts forms a larger whole. This makes the Orosi have more independent sections and units in its united structure.

Such differences in visual perception of the lattices can be partly explained by their covering materials. In Orosi, the small colored glasses come between the detailed patterns of the lattice, while in Shoji panels the washi paper covers the entire lattice structure.

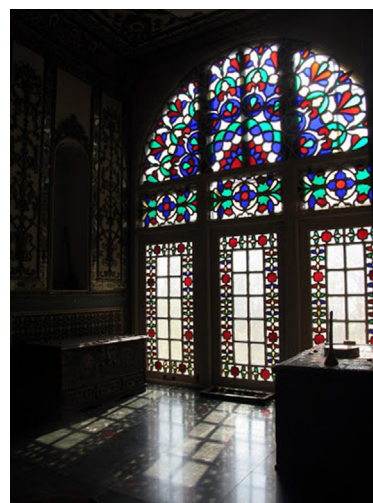
Fig. 3 show these differences in the visual perception of the Orosi and Shoji lattice structure in the daylight when the differences are more evident.

##### - Engagement of senses (color and shadow)

Orosi and Shoji engage and attract one’s senses, though in different ways. Orosi enhances a quality that Bentley et al. call sensory richness of the environment, that is the user’s choice of pleasant sensory experiences (Bentley et al., 1985). In Orosi, the diverse colors of its glass panes; its lattice structure with various patterns; the contrast between the nature of its materials, i.e., the strength of wood and the fragility of the glass; the visual contrast between the brightness of its glass



(1)



(2)

Fig. 3. (1): Lattice patterns in Shoji. Source: Inter ActionGreen, 2019, (2): Lattice patterns in Orosi. Source: www.honaronline.ir.

panes and darkness of its wooden frame and lattice; and the colorful, patterned lights created inside the room as a result of light passing through the Orosi creates the richness quality and appeals the user's senses of sight and touch.

In the case of Shoji, attracting the senses happens due to Shoji's fragility and being high maintenance. Living in such a fragile environment forces users to conform to the environment, shapes their behavior, and makes them conscious and careful of their surroundings, which activates their senses to their fullest (InterAction Green, 2019).

Both Shoji and Orosi express time and its passage through the constant changes in the patterns of light and shadow. Both are manifestations of Tadao Ando's concept of materials, stating that "architectural materials are not limited to wood or concrete that have tangible forms, but go beyond to include light and wind – which appeal to our senses" (Heneghan, as cited in Veal, 2002, 355).

None of these two openings let daylight enter the space as it is, monotonous and colorless; they both play with it, making it more prominent and captivating. Both metaphorically express the passage of time: Fig. 4 show Shoji, through the altering image on its paper; and Orosi through the movement of the colorful, dynamic, patterned lights created on the room's floor and walls as the light passes through the Orosi panes.

Both Shoji and Orosi portray a poetic and imaginative presentation of the world outside by avoiding showing the outside world and its details as they are: Shoji shows the outside world as moving grayscale shadows behind its simple lattice, creating this imaginative image, as shown in Fig. 5-1; Orosi shows the outside world as a fragmented picture through its lattice and filtered by colored panes as shown in Fig. 5-2.

#### - Fuzziness and connections between inside and outside

The concept of "boundary" is one of the primary

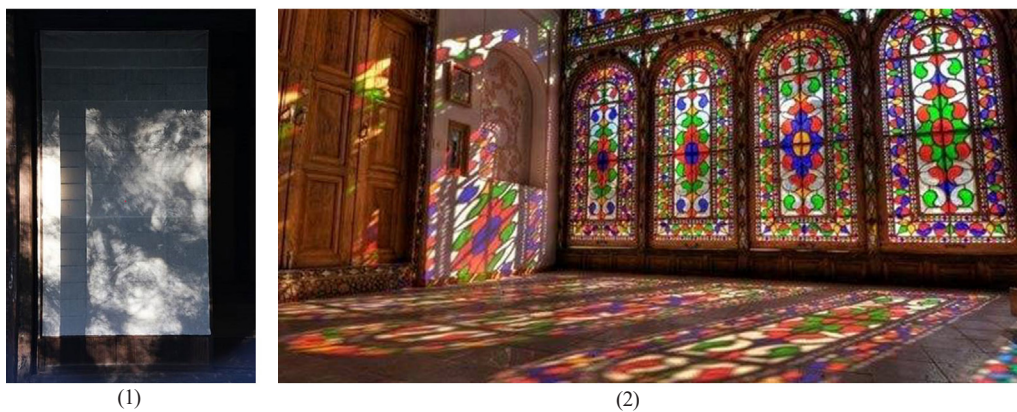


Fig. 4. (1): a. The shadow of trees and light on Shoji screen. Source: [www.commons.wikimedia.org](http://www.commons.wikimedia.org), (2): Colorful lights on the room's floor and walls. Source: [www.honaronline.ir](http://www.honaronline.ir).



Fig. 5. (1): Grayscale shadows on Shoji's lattice. Source: [www.bruceamos.com](http://www.bruceamos.com), (2): Fragmented and colorful pictures through Orosi's lattice. Source: [www.stockphoto.ir](http://www.stockphoto.ir).

concepts based on which architectural spaces are formed (Shahcheraghi, 2003). The boundary between two spaces functions as a joint, a connector, which inherits characteristics from both spaces (Bonyani et al., 2019). Orosi and Shoji both function as boundaries between the inside and the outside. Both present different levels of closeness and openness; allowing the user to experience characteristic closed, semi-open, and open spaces, and create different degrees of continuity and connection between the inside and the outside. Therefore, they create a fuzzy connection between the two sides. This fuzzy connection includes features such as view, amount of admitted light to the interior, and privacy. They are both a single element in a building. However, they have the power to create such a rich environment in their surroundings.

The exterior Shoji panels are designed with multiple sliding panels that create different variations of openness-closeness of the Shoji panels. Such variations bring more flexibility to controlling the view, illumination, and ventilation (Beita & Fujii, 2013). According to Japanese aesthetics, change is a part of beauty, and true beauty is “elusive, undefinable and in transient moments” (InterAction Green, 2019). The

dimness created by the Shoji panels and the effect of the changing light that comes through its papers is in accordance with the Japanese definition of beauty (ibid., 2019). Fig. 6 shows the continuity of different degrees of light admitted to an interior space through Shoji panels.

In Persian architecture, where privacy and creating different levels of privacy is an important design factor, Orosi’s combination of colored and plain glasses creates a hierarchy of lighting, consisting of three layers: the bright layer near the window, the semi-dim layer at the middle of the interior space, and the dim layer which creates a private space across from the Orosi window at the end of the room (Hosseini et al. 2020).

Creating such layers of brightness and dimness and controlling the admitted light and privacy shows that in addition to functioning as a window, Orosi and Shoji also function as a curtain. This curtain function is not seen in the design of the modern window.

In traditional Japanese architecture, a building is not a separate object from its surroundings (Beita & Fujii, 2013). Due to the climate of Japan, Japanese houses were built in the middle of nature (Yagi, 1992). Hence, keeping the connection between the building interior and the surrounding nature was

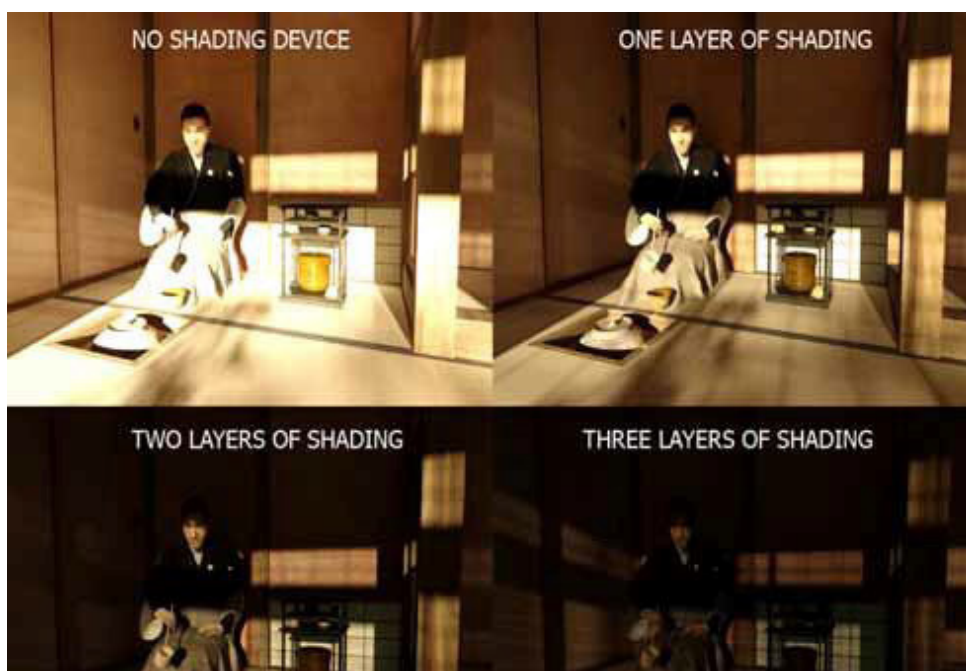


Fig. 6. The continuity of different degrees of light. Source: Beita & Fujii, 2013, 35.

an important design factor. The position of Shoji in the building and its design is influenced by the nature around and Shoji frames certain landscapes, so building and nature are two elements that traditional Japanese architecture regards as one (Beita, 2010). Besides the lightweight material and the simple division of the Shoji easily allow for designing multiple sliding panels on one Shoji screen and creating more flexibility to see nature, and different areas of the garden can be framed (InterAction Green, 2019; Beita & Fujii, 2013).

The juxtaposition of Shoji's simplicity and the diverse, colorful, and unordered trees and plants of the Japanese garden is a dialogue between the contrasts and brings a balance to the view. The same dialogue and balance can be seen in the juxtaposition of the colorful Orosi and the orderly low-color variation of trees in the Persian courtyard. Fig. 7 show these dialogues.

#### - The relationship with the bigger picture of architecture

As previously said, Orosi is categorized as an architectural element that functions between a window (Moein, 2007) and a daylight controller (Hosseini et al. 2020), while Shoji is an element creating boundaries and layering space, which creates the desired layered structure in Japanese architecture. Being placed under two different categories is one of the main differences between Orosi and Shoji.

The interior space of traditional Japanese buildings has been created by the overlap of several two-dimensional planes presenting a spatial layering structure, and Shoji is a part of this system (Belfiore, 2012).

One of the concepts in Japanese building design originated in the spatial idea of "oku" which was coined by Fumihiko Maki (Dan, 2010) and pertains to the idea of "innermost areas" or "inwardness". The concept of oku expresses the peculiar Japanese sense of space (Belfiore, 2012), and the concentric structure of Japanese houses and cities' structure. The onion skin metaphor is a good analogy to describe the sense of Oku, the sense of penetrating the layers of an onion, which are enveloping an empty space (Belfiore, 2012; Dan, 2010); the sense of keeping moving forward and deeper (Dan, 2010). Using translucent paper, instead of glass, in Shoji panels; as well as using Shoji or other types of kyokai in the interior of Japanese houses reflect this concept.

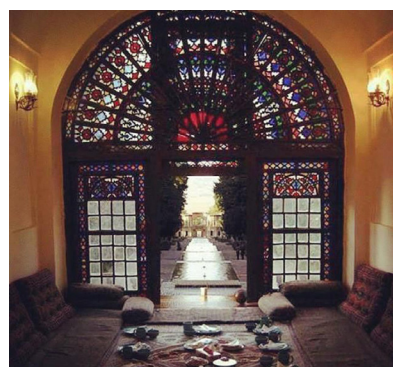
Hence, Shoji is a flexible boundary that functions as a window, a door, or a room divider based on being opened/closed and based on its placement in the building layout. Although Orosi creates flexible boundaries between the interior space and the exterior as well, it is technically a type of window, and the boundaries in a traditional Persian building are predominantly defined by the layout.

In traditional Persian buildings, the position and the general structure of Orosi (i.e., its primary divisions) follow the geometry of both the courtyard and the room with Orosi window, and each Orosi is designed for its house (Khamechian et al., 2018).

Also, the Orosi windows were used only for important rooms. Naming the room with an Orosi window as Orosi (Moein, 2007) is also another evidence of its high-



(1)



(2)

Fig. 7. (1): Simplicity of Shoji in contrary to diverse, colorful, and unordered trees of the Japanese garden. Source: www.istockphoto.com, (2): The intricate and colorful lattice of Orosi is contrary to the orderly low color variation of trees. Source: Aghazadeh, 2015.

value place in Persian architectural culture. However, the Shoji place is more determined by the surrounding nature and the selected views from the diverse and colorful Japanese garden (Shayan & Gharipour, 2002), which Shoji wants to record (Beita, 2010).

Based on these two different roles that Orosi and Shoji have in their own architectural structure, Orosi has a more unique characteristic than Shoji. While removing the Orosi from Persian architecture and replacing it with another case, gives a different identity to the space. There is a mutual dialectic between Orosi and traditional Persian architecture, while Shoji is more influenced by traditional Japanese architecture.

#### - Shoji and Orosi in art and literature

The effect of natural light on Shoji and Orosi is captivating. The surrounding nature cast grayscale images in motion on the Shoji screen, and this shadow play creates the imaginative, poetic character of Shoji. “As the sun moves across the sky and wind agitates the leaves of surrounding trees, so the image on the paper is altered” (Veal, 2002, 355). The altering images on the screen of Shoji are the second hand of a clock showing the time passing. This poetic character of Shoji appears in Japanese art and literature. The novelist Jun’ichiro Tanizaki suggests that Shoji captures the time rather than show its passage. ‘... for me, the most exquisite touch is the pale white glow of the Shoji in the study bay; I need only pause before it and I forget the passage of time’ (Tanizaki, 1977, 21). In addition to literature, Shoji

is visibly present in Japanese paintings, and Fig. 8-1 is an example of this.

The poetic character of Orosi is created by the light and color, by the colorful lights that fill the room, and integrates with the patterns on the Persian rug and the patterns of the wall’s plasterwork. In Persian poems, the use of the word “Goljam”, which is a non-openable lattice window with colored glasses, and has common features with Orosi, i.e., the colored glasses enclosed in a latticed structure, shows the poetic character of colorful lights in Persian houses. For example:

*I feel delighted by the rose-colored wine  
He darkness gets out of the house [as the light comes  
in] through the Goljam*  
(Saeb Tabrizi, n.d.a.)

*The sun feels shy of his colorful Goljam  
[The sun] gives color to the Goljam and takes its color  
from it throughout the day*  
(Saeb Tabrizi, n.d.b)

Also, this is one of the poems of the contemporary poet, in which he refers to the Orosi room:

*“I want to die the dream of acacias at the last.  
Chance of flower  
And be the heavy passage of petunias  
On Orosi hall  
At 7 afternoon”*  
(Shamloo, 2013)

In Persian miniatures, the Orosi itself is not illustrated, but other architectural elements with similar features such as colored glasses, colorful lights, the intricate lattice structure, and the importance of openings



Fig. 8. (1): Shoji in Japanese painting. Painter: Utagawa Kunisada II. Source: [www.commonsm.wikimedia.org](http://www.commonsm.wikimedia.org), (2): Wikimedia Commons, n.d.) b. An example of the presence of colored glasses in Persian miniature. Source: Tehrani, 2013, (3): An example of the presence of lattice (Shebak) and connected openings to the world outside in Persian miniature. Source: [www.harvardartmuseums.org](http://www.harvardartmuseums.org).

as a link between the interior and the exterior have been addressed. In the miniature of the Sufi in the Hammam, Fig. 8-2, from the illustrated manuscript of the Haft Awrang (“The Seven Thrones”) in the Safavid period, a window with colored glasses (red, green, and yellow) at the top of the picture is evident (Nematgorgani, 2002, 322). In Fig. 8-3, an example of a Persian miniature, shebak; a latticed screen, usually with an ornamental pattern; and openings connecting the interior to the world outside are visible.

#### **- Main concepts of Orosi and Shoji (based on their traditional architecture)**

Undoubtedly, the most important principle in the Islamic art of Iran, especially in geometric ornamental patterns and Gereh patterns, is “unity in diversity.” This concept, which is a fundamental ontological principle in Islamic wisdom, plays an essential role in the formation of Persian Orosi.

The geometric patterns of Orosi are extensible, iterable, and generative, and they hold greater significance than mere ornaments. They symbolize fundamental principles such as “unity in diversity” and centrality (Alipour, 2011). Additionally, the principle of “epiphany,” presented in Islamic gnosis through symbols like light, is represented in architecture using components like Orosi. Orosi shows the radiation of unique light from the outside (nature, sun) transforming into diverse, pluralistic internal lights. This transformation can be seen as an epiphany of the relationship between the Unit (Unity, the unit light of existence) and the plural (diversity, the world of beings and creatures) (Pourmohammad et al., 2020).

The essential use of color in the colorful glasses of Orosi frames can also be related to the principle of “unity in diversity.” Ibn Arabi interprets the diverse colors as an allegory for the diversity of the world of beings, and the rising of these diverse colors from one non-colored light as an allegory for the appearance of diversity from a unique source (Nava’i & Haj Qasemi, 2012). Furthermore, the symmetry of the geometric forms on Orosi to

their centers aligns with the symbolism of “unity in diversity”.

Colored glass pieces of Orosi are significant not merely for their shapes or colors, but primarily for the dramatic display of colored lights within the inner space. When sunlight passes through these colored glasses into the interior, an elegant poetic composition of colored light suffuses the entire space, not just its surfaces. This creates a dreamy sense of a poetic and intimate space. The main characteristics of Shoji hark back to the ‘Zen’ school of thought and concepts such as ‘Chisoku,’ which holds significance in the cultures of Southeast Asia, particularly in traditional Japanese lifestyle, culture, and art.

Shoji screens have transcended their cultural origins to become a significant feature in interior design. Characterized by their translucent paper and wooden lattice frames, these screens are more than room dividers; they are functional art pieces. Shoji screens are rooted in Japanese design principles of simplicity, natural beauty, and functionality (The functional ..., 2023).

Zen suggests that “parts and the whole are to be lived in an inseparable relationship through an exercise of nondiscriminatory wisdom, without prioritizing the visible over the invisible, the explicit over the implicit, or vice versa” (Nagatomo, 2024).

“The concept of ‘Chisoku’ is also significant in relation to the purity and simplicity of Shoji. ‘Chisoku’ is the Japanese word for ‘enough,’ signifying feeling sufficient, satisfaction with what one has, and understanding that ‘enough is enough.’ This concept conveys a strong sense of simplicity and purity to the design of Shoji, characterized by minimal and straightforward geometry (Radford, 2022).

Furthermore, Shoji serves as a primary enhancer of a particular harmony between shade and light. Puristic Japanese thinking fosters a minimal yet highly influential dialogue between shade and light, resulting in a depiction of the poetic beauty of shadows (Tanizaki, 1977).

### Discussion and Conclusion

To fully investigate the two openings, this paper studies each opening individually and compares them in three main dimensions: morphological, technical, and inner, as shown in Fig. 9, which covers all aspects of an architectural element. Focusing on the similarities and differences between the categories of Shoji and Orosi resulted in a deeper understanding of each. It revealed the connection between Shoji/Orosi to their cultural region not only in form but also in characteristics.

Both Orosi and Shoji are two architectural elements that improved spatial qualities in their regional architecture. Both are openings connecting inside and outside,

creating flexible boundaries between the two, which in turn creates different degrees of continuity. These cause some similarities and common characteristics between the two opening types. There are also some differences not limited to materials and details, but in deeper layers and source concepts behind them. As a summarily clear result of the comparison between Orosi and Shoji, the main similarities and differences are presented in Table 2.

### Declaration of No Conflict of Interest

The authors declare that they have no conflict of interest in conducting this research.

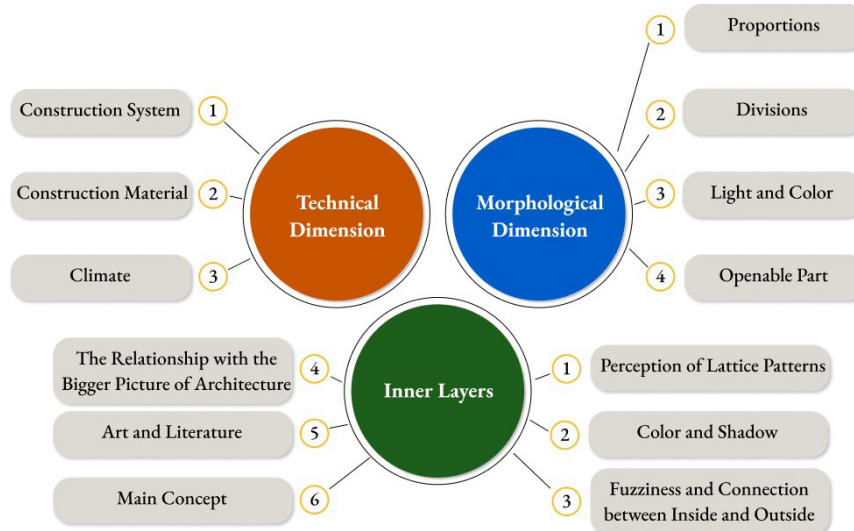


Fig. 9. Comparison of Orosi and Shoji in three main dimensions. Source: Authors.

Table 2. The main similarities & differences between Orosi and Shoji. Source: Authors.

Similarities	Differences	
	Orosi	Shoji
<ul style="list-style-type: none"> <li>- Influence on spatial quality</li> <li>- Adjusting the relation between inside/outside factors</li> <li>- Fuzzy and gradient character from the point of closeness, openness and transparency</li> <li>- Flexibility in the degree of enclosure</li> <li>- High relation to cultural concepts and environmental conditions</li> </ul>	Mid complex geometry	Simple geometry
	Poetics of colored light	Poetics of shadows
	Functions of daylight controlling	Functions of boundary
	Non-minimalism	Minimalism
	Contrast to the orderly low color variation of trees in most of the Persian traditional courtyards	Contrast to the diverse, colorful, and unordered trees of the Japanese traditional gardens
	Based on the “Unity in diversity” concept	Based on “Zen” and “Chisoku” concepts

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