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The analysis of effective Wayfinding and Pathfinding process in the old cities in Iran*

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Abstract

Wayfinding is individual ability to achieve spatial destination in the new and complex settings, as easy and fast as doing this in familiar environments. Wayfinding play an important role, in public places such as shopping malls, airports, railway stations, schools, hospitals and etc, Although when direction losing is discussed in various places, frustration and fear feelings are expressed. Recognizing that in a set of different and complex functions, individuals' location and how they reach their distiantions, are inevitable which is necessary cities and large-scale buildings planning process.With the application of structural elements which increases spatial legibility and imageability and provide clear and perceptible spatial information, infact provide conditions which individuals spend the minimum time and energy and stresslessly to reach the intended aim. The field of Wayfinding and Pathfinding process hasn't been investigated in past cities of Iran, only in some sources referred to landmarks,they can contribute to recognizing direction. this survey investigates this issue for the first time and this process along with pathfinding is considered to emphasize on wayfinding concept as the spatial problem solving. From the seventies up to now, considering this feature capability and its improvement are fundamentally mentioned as the main research subjects in different sections such as urbanism, architecture, environmental psychology and so on.The purpose of this research is to find the elements and spatial properties to facilitate the wayfinding process in old cities in Iran and to find an answer to this question, "Could the components of spatial legibility considered in today's urban design discussions, be found in the structures of Iran's old cities?

The current research and its fundamental and the related results can be practically analyzed. Therefore, they are performed at three stages: The first one is associated to document or library studies that includes analyzing the concepts of wayfinding and pathfinding, sorting the researcher's findings in the field of urban design concerning physical elements of the structures of Iran's old cities. The second one is a case study that, includes reviewing the structures of three old cities in Iran, namely Zavareh, Tabriz and Shiraz ; At the third stage, the analysis of the mentioned findings and conclusion will be discussed. It is concluded that legibility, spatial continuity, spatial contrast and spatial sequences are basically considered the most important factors to facilitate the process of wayfinding and pathfinding in the old cities of Iran. According to the mentioned factors which are used in the design of cities and regions and even in contemporary public buildings, there are some advantages for users include:

- Facilitating and quick access to spatial destinations.
- Increasing the attraction of urban spaces and creating the variety in urban facades and configurations
- Losing disappointment,hopelessness, anxiety sensation due to being lost and losing position and direction for people.
- Increasing the security spatial sensation and people's presentation in public settings with different skills and capabilities.

Keywords

Wayfinding, Pathfinding, old cities in Iran, Environmental Psychology.

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Introduction

People do wayfinding throughout their entire lives. They navigate from place to place, relying on knowledge that is mediated by structures and categories of understanding people's daily experiences in the space they live (Johnson,1987). Wayfinding is a natural skill that people learn as small children (Piaget and Inhelder, 1967) and develop as they grow up. It takes place in many different situations, such as driving across a country, walking in a city, or moving through a building (Gulck,1991; Raubal,1998: 27). In contrast, loss or disorientation, which in fact arises from inability in suitable wayfinding, is an issue which has for long disturbed man's mind and continues to disturb him today with more intensity and complexity. Kevin Lynch in his book "The image of The city" particularly focuses on this subject:"But let the mishap of disorientation once occur, and the sense of anxiety and even terror that accompanies it reveals to us how closely it is linked to our sense of balance and well-being. The very word "lost" in our language means much more than simple geographical uncertainty; it carries overtones of utter disaster" (Lynch, 2010: 14). So far many studies with different approaches have been conducted concerning city structures and components affecting the formation of good cities. Lynch and his quintuple elements are well known among architects and designers in Iran, but individuals such as Zuker, Cullen, Bacon and Moughtin, are less discussed. In this research we try to study the afore-mentioned people's theories and extract the key elements and spatial features of city structure from their point of view, and find equivalents for them through referring to the historical context of Iran's cities. Access to these approaches and principles in designing cities, districts and even large public buildings provide a number of advanatages for the users of these locations, which are presented below:

-Facilitating and quick access to spatial destinations.
-Increasing the attraction of urban spaces and creating variety in urban facades and configurations
-Losing disappointment,hopelessness, anxiety sensation due to getting lost and losing position and direction for people.
-Increasing the security spatial sensation and people's presentation in public settings with different skills and capabilities.

Research Background

Many studies and researches have been conducted on spatial wayfinding and navigation throughout the world, but no unified and attributable study on this subject has not been conducted at the domestic level, and available sources are non-Persian books and essays. The main root of studies on wayfinding1 is the researches which investigated the spatial navigation. The very first references to spatial orientation, without a specific refrence to cognitive maps date from over a century ago and were written by neurologists who reported cases of patients who, as victim of brain lesions, were incapable of even the most elementary understanding of where they were. Among these authors are: Forester (1890), Meyer (1900) and Holmes (1918). Case studies of particular lesions have continued in neuropsychology up to the present (Passini, 2002: 98). Another group of researches related to spatial navigation continued the discovery of recognition maps and mental image concepts which had their root in psychology. Tolman (Tolman, 1948) was among the people whose research results served as an introduction to studies on human behavior. Among others, Kevin Lynch's theory (Lynch, 1960) played an important role in the evolutionary course of studies on spatial navigation and recognition maps. Lynch entered the research on individuals' recognition maps by means of another index. He defined the physical parts on which people rely on during the formation of the maps of urban environment. His research results introduced wayfinding process as something similar to marking. Since the late 70s studies in conceptual and methodological areas continued, and focus shifted from product to process, that is, from recognition map to recognition mapping. Downs and Stea (1973) felt more than others the need to study spatial navigation

process and formation of recognition maps. Thus a new approach was formed which in addition to recognition maps paid attention to the necessary recognition and perceptual processes too. In addition to Downs and Stea, Kaplan (1976) and Passini (1977) were among the people who confirmed the new approach. In Passini's later studies, wayfinding was proposed as spatial problem solving, and was studied as a complementary concept for spatial navigation. In this approach wayfinding concept refers to capabilities of problem solving needed for reaching goals. In addition to the mentioned studies on wayfinding, some researchers have proposed wayfinding models. Farr, et al. (2012) have studied wayfinding models in two groups namely, studies and cognitive models, and mathematical models and quantitative sizes (Table 1).

Thus far no research has been conducted on the wayfinding and pathfinding of Iran's old cities, and only some landmarks in some sources are referred to which contributes to the direction. The present research deals with the subject for the first time. Emphasizing the concept of wayfinding as the process of spatial problem solving, it studies this process along with pathfinding process.

Research Questions

In this research the main question is: how do the structure and spatial configuration of old cities of Iran and their utilized anatomical and visual elements and components help facilitating the wayfinding and pathfinding processes?

Methodology

The present research aims to find the relations between variables, principles, laws and structures, Therefore, this research is of basic types whose results along with those of related researches can be applied to design cities and public spaces. Also since the research subject is related to architectural, urbanizing, and to some extent historical disciplines, the research strategy is of qualitative type; and data collection is done through documental methods and field work (which are subset of qualitative research).

A) Documental part through studying the available texts and sources classifies the experts' theories in the field of wayfinding concept in architecture and urbanization.It also overviews different approaches in urban designing field, the approach of spatial and visual perception (which emphasizes the quintuple constructing elements of the city's countenance, and formal characteristics and spatial legibility); the approach of environmental-behavioral effects (which emphasizes the successive views of pedestrians and the main elements of urban designing); and finally the approach of movement in urban space and expansion of pedestrianism orientation (which deals with the relationship among movement (mainly walking) and urbanspatialconditions,dynamicsystems,astherelating element of the whole city,and continuous movement).

Table 1. Classification of studies done on the wayfinding by naminga number of researchers in each category. Source: authors.

	Studies done on the Wayfinding	Number of researchers in each category
1	Wayfinding as a sense of direction, awareness of the position or direction	Forster (1980), Meyer (1900), Holmes (1918)
2	Wayfinding as a concept related to the cognitive map and mental image	Trowbridge (1914), Lord (1941),Griffin(1948), Tolman(1984)
3	Spatial legibility and physical units influencing the formation of mental images	Lynch (1960), Appleyard (1970), Golledge (1976),Orleans (1973), Beck and Wood(1976),Canter(1975),Weisman(1981)
4	Conceptual and methodological grounds and process of cognitive mapping	Downs and Stea (1973), Passini (1977), Moore (1979), Evans (1980)
5	Wayfinding as spatial problem solving process	Downs and Stea (1973), Kaplan(1976), Passini(1984)
6	Provided the models for Wayfinding	Kuipers (1987,2003), Passini (1981,1984),Chown, et al, (1995),O'neil (1991), Hillier, et al, (1984, 1987, 2004)

B) Fieldwork studies consists of the study of the configuration and old context of Zavareh, Shiraz, and Tabriz and their anatomical structure from legibility, spatial continuity, contrast, and spatial sequence point of view (Diagram 1).

Wayfinding and spatial legibility

Facilitating recognition is one of the initial characteristics which should result from a good image of the environment, and is a basis on which relations and emotional memories may be based (Lynch, 2010: 229). In addition to urban scale, spatial legibility and wayfinding is of high significance in building scale and especially in public places such as shopping centers, airports, railway stations, universities, hospitals, etc. Nowadays, as soon as direction losing in different places is discussed feelings of disappointment and horror are evoked and regarded. So far many studies and researches have been conducted in wayfinding field, which have resulted in stating different definitions of the concept and in proposing wayfinding strategies. From studying the theories and definitions proposed for wayfinding it can be concluded that the effectiveness of wayfinding in urban spaces and architecture depends on two groups of factors as below:

- Human variables: They include physiological (age, gender, physical capability), psychological (perception, cognition, emotion, experience and familiarity with environment, language, etc.), cultural (tradition, religion, and society norms) and social (class, and group and organizational status) characteristics. People's cognitive and perceptual capability which is related to the formation of recognition maps and mental images are placed in this group (Diagram 2).

Environmental variables: They include environmental elements, spatial configuration, sensory stimulants, and marks and signs, which help environment recognition and spatial legibility. In this research we focus on this group of variables which will be dealt with later. Researchers in their studies have studied each human and environmental variable independently or in relation to other elements in urban structures and public buildings, and measured their role in facilitating wayfinding and pathfinding processes, all of which cannot be dealt with in this study.

As Passini and many others have proposed (Downs & Stea, 1973; Kaplan, 1976; Passini, 1984), an effective wayfinding process can be materialized by dint of legible and imagable spaces: By legibility we mean that the environmental components could be recognized easily, and be related to one another in an interconnected framework in the mind. It goes without saying that having a clear image of the environment enables one to move from one place to another (Lynch, 2010:15). Weisman defines legibility as the ease of the navigation. (Weisman, 1981). Similarly, Passini uses the term legibility in

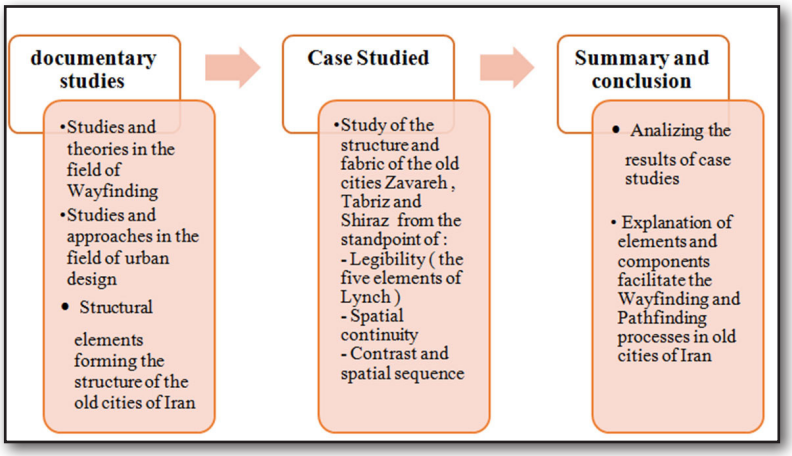


Diagram1. Theoretical model. Source: authors.

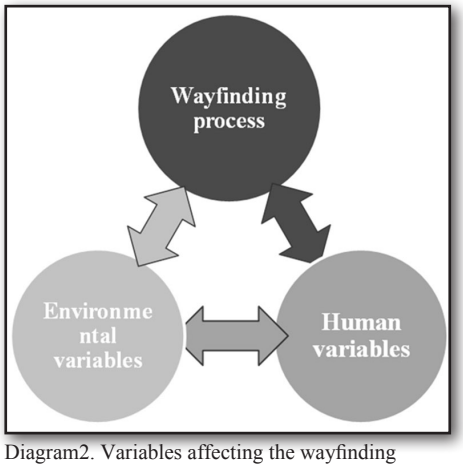


Diagram2. Variables affecting the wayfinding process. Source: authors.

relation to navigation, as an environmental quality which easily opens up and offers comprehensible information (Passini, 1984). According to O'Neill, legibility describes the ability of objects designed to help forming an effective mental image or a cognitive map (O'Neill, 1991). In another words the easier an environment forms a cognitive map in the mind of a visuallyimpaired person, the more accessible it is (Belir, et al, 2013: 2). But what factors are involved in the formation of this image? How can a city and its structure be clear and recognizable for people?

Creditable global theories in urban designing

Pioneers who have studied spatial, local and formal aspects and the role of urban space construction, have each adopted their own methods for the study of some urban samples, and finally proposed their research results as a set of rules for the study of cities (Tavasoli, et al., 2007: 42). Zuker, Lynch, Cullen, and Bacon can be cited as examples. In this research, among many researchers, those experts are selected who have viewed the urban spaces through spatial and visual perception, environmental-behavioral impacts, and monuments in urban space and pedestrianism orientation, and their adopted concepts are more relevant to spatial legibility and wayfinding process. Table 2 shows in sum the most important experts with different approaches which deal with urban spaces along with key elements and concepts proposed by theorists in relevant approaches.

The study of different theories in urban designing shows that despite wide urban studies conducted before and after Lynch's research, his theory and quintuple key elements (path, edge, node, landmark, and district), regarded by him as clear elements which create grounds for urban spaces and legible architecture, are still effective and important in facilitating wayfinding process and many other studies have utilized and confirmed these elements with a slight change in their significance.The study generated a number of corroborative inquiries in Latin American, European,and Islamic cities that confirmed the findings of Lynch.The importance attributed to each of the elements might vary. In tha Islamic city,for example, the "landmark" is not

Table 2. Summary of classification of most important experts and approaches related to urban spaces. Source: Kashanijou, 2010, with little changes.

Time Period	The dominant approach	The most important experts	The Key Elements and Concepts
First period : Industrial Revolution to 1960	The emphasis on visual and spatial perception	Camillo Sitte , Gordon Cullen ,Rob Krier, Aldo Rossi ,Christopher Alexander, Cliff Moughtin , Ali Madanipour , Jahanshah Pakzad , etc	Gordon Cullen : Serial Visions of pedestrian in design Cliff Moughtin : Introduce the basic elements of urban design with emphasis on the role of streets and squares in the city
Second period : 1960 to 1990	The emphasis on environmental-behavior influences	Kevin lynch , Amos Rapoport, Donald Appleyard , Romedi Passini, Moore et al.,Jon Lang , Hassan Bahreini	Kevin Lynch: Node,Edge,landmark,Path,Districts (Five elements create image of the city) Donald Appleyard: Form attributes, Visibility attributes, and use and significance attributes
	Approach to strengthen social interactions	Paul Zucker , Jane Jacobs ,William Whyte, Hannah Arendt,Venna Oldenburg ,Marcus Cooper , etc	
	The emphasis on the pedestrain movement in urban space	Tony Garnier , Lawrence Halprin ,Edmond Bacon ,Hillier ,Michael E.Arth , etc	Hillier : The relationship between the movement (mostly walking) and the status of urban spaces Edmond Bacon : dynamic systems, as the relating element of the whole city ,and continuous movement as element of space experience
Third period : 1990 to present	Approach to security and human scale in urban spaces	Lewis Mumford ,Francis Tibbalds , Andres Duany ,Elizabeth Plater-Zyberk , etc	
	Environmental sustainability	Serge Chermayeff ,Graham Haughton, Colin Hunter ,Hugh Barton ,Richard Rogers	

as popular as the element "path" in comparison to American cities and culture (Passini, 1984: 111). In addition to the proposed spatial components for the creation of a strong urban image, some theorists such as Cullen and Bacon have addressed such concepts as spatial continuity and various and serial visions, which seem to contribute to the strengthening of spatial legibility and achieving wayfinding when they are paid due attention in combination with quintuple anatomical elements. Since the aforementioned features are mainly formed under the influence of the design quality of urban passages and roads, they can be categorized among environmental and visual qualities which affect pathfinding. The elements and components mentioned in this section were proposed for modern cities and in proportion with their features where equestrians and roads along with pedestrians, and in some cases more than that, were focused on.

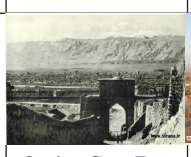
Structural features of Iran's traditional cities

Wayfinding and pathfinding in traditional cities of Iran can be studied in two different scales: Intra-city scale where the components affecting navigation and rout recognition for travelers and caravans is studied; and inter-city scale, that is, within the interior context of the city, which includes the elements affecting environment recognition and movement towards the right destination.

- Intra - City Scale: Since Iran is located at the commercial juncture of East-West and has a vast area, special attention has always been paid to the establishment of commercial and military roads and abundant bridges as well as the security of caravans (Kiani, 1994: 1);(Table3).

Since ancient times, natural landmarks were used to mark and recognize roads, ways and destinations. Mountains, single trees, valleys, and rivers were the simplest landmarks for recognizing right roads from wrong roads. Natural landmarks were not always available in roads. So, people had to make use of hand-made and artificial landmarks as guidance for travelers and caravans. The first hand-made landmarks were outcroppings of stones or high and large boulders beside the road (Memarian, 2010: 506, 494). Guiding Mils are referred to as the most significant of these elements in the writings related to Iran's history of architecture. In addition to guiding minarets and lighthouses, Memarian in his book (Memarian, 2010) refers to special buildings named Kopes or Chartaghi,which were made near villages and on hills whose direction pointed to ancient roads. Although none of the available sources have overtly mentioned caravanserais as stop over landmarks,

Table 3. Factors affecting wayfinding in suburban scale (in past cities of Iran). Source: authors.

	Minarets		Caravanserais	Reliefs		Qanat Path
Visual effect	Sign	Sign	Sign	Sign	Node and Sign	Path and Sign
Example	Gonbad e Qabus and Lajim tower – Mazndaran, Radakan tower and Bardaskan tower-Khorasan,Negar tower,Kerman and etc	The Seyyed Fath tomb in Abshoor-Yazd, Qotbabad Chartaghi - Fars and etc	All Caravanserais in intra city scale	Symbolic gate in mountain pass, leading to the Bishapur Sassanid city	The gate of Shiraz city (Qur'an Gate) and etc	Qanats in the settlements that fed rows of trees
Image	Lajim tower – Mazandaran	Qotbabad Chartaghi - Fars	Dodehak caravanserai – Qom		 Qur'an Gate-Fars	

their effective role as guiding elements for travelers in the heartland of deserts and tortuous mountainous paths, etc. cannot be overlooked. In architectural scale too, many glorious portals, towers and Baroos, and sometimes minarates constructed beside these buildings, facilitated the building recognition from far away. In addition to the above-mentioned items, Ardalan (Ardalan & Bakhtiar, 2011) in his book mentions entrance gates of traditional cities with an inviting look which directed travelers to the cities, carvings on the face of stone walls of mountainous paths, and aqueduct path which watered the line of trees stretched from mountains towards the city, as elements which directed travelers on their ways (Table 4).

Inter-city scale: Many researchers have investigated the structures of Iran's traditional cities and their constructing elements, and have stated their research results in many books and essays. In some studies, the city structures are investigated by the period before and after Islam (e.g, Pirnia, 1995; Shieh, 1999; Habibi, 1996, etc.), and have been stated in some elements of Islamic cities (e.g, Kiani, 1886; Tavasoli, 1990;Naghizadeh, 2006, et al). Some of theoretical sources have also solely dealt with the analysis of one of the urban elements such as square, bazaar, or neighborhood (Table 5). Since dealing with all the available sources is not feasible within the present study, some of the outstanding theories are referred to in table 4.2.

From the study of the proposed theories the Iranian city can be said to generally include worship locations (temple, mosque, Hosseinieh), commercial functions (markets), neighborhoods and residential functions, schools and educational functions, squares, road networks, gardens and parks, sanitarian functions (baths), water reservoirs, and caravanserais. A look at tables 2,3,4 and 5 shows that all structural elements Lynch and others have talked about, clearly exist in the structure of our old cities. But what is of more significance in this study is the spatial features which result from the suitable layout of these elements and help pedestrians to understand and recognize space, way and path recognition. Spatial continuity and

Table 4. Views expressed on the structure of old cities of Iran. Source: authors.

	Author	The main elements of the city
1	Ashraf, A.	Jameh Mosque,District,Bazaar,Caravanserai
2	Kiani, M.Y.	Islamic cities : Fences, gates, palace (Arg), roads, suburban, Highway (Share e Aam), mosque, office organization, school,Bazaar(market), caravanserai, residential neighborhood
3	Dietrich, H.	Sassanid cities: Religious buildings, palaces, residences, castles and fortresses, bridges and irrigation facilities, memorial towers
4	SoltanZadeh, H.	Gateway, palace, square, Bazaar(market), residential zone, mosque, center of district, housing units
5	Pirnia, M. K.	Before Islam : Kohandezh, Sharestan, Rabaz. After Islam: street, Kooy (District), Arsan Bazaar (Market), Square
6	Habibi, S. M.	Square, District,Bazaar (Market)
7	Mirmohammadi, H. R.	Before Islam : Kohandezh, Sharestan, Savad (Suburbs). After Islam: palace (Arg), jameh mosque, bazaar (Market), religious schools, caravanserai
8	Tavassoli, M.	City center, center of district, main passages, square
9	Shieh, E.	Before Islam : Kohandezh (the governmental and office space), Sharestan (around the Kohandezh), Rabaz. After Islam: residential space (district), commercial space (bazaar and bazaarcheh), installation spaces (Abanbar, bath, water routes, open spaces, etc.) and the network of roads, social and cultural space (mosque)
10	.Naghizadeh, M	path and square
11	Pakzad, J.	Entrances, nodes, squares, streets, water edges and types of the stairs
12	Zarrabi, A. & Alinezhad Tabibi, K.	After Islam (Islamic city) : mosque, houses and residential usages, commercial usages (bazaars), district, schools and educational applications, square, network of roads, gardens and green spaces, recreational applications,cemetery, baths, Ab anbars, caravanserais
13	Ghobadian, A.	Wall around the city, organic network of roads, district (integrated complex), center of district (mosque, bazaarcheh,bath, ab anbar), traditional institutions (palace, bazaar, jameh mosque)

variety in spatial sequence are the most important ones. But in addition to these features, there is a degree of complexity which will be dealt with below.

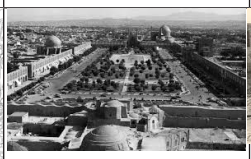
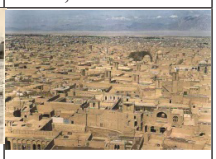
Structural components affecting wayfinding and pathfinding (case study: historical context of Zavareh, Shiraz and Tabriz).

Three cities of Iran namely, Zavareh, Shiraz and Tabriz have been investigated in this research. The historical context of Zavareh is selected as an example of the ancient villages in the region of Iran's central desert (Kavir- e Markazi) (including Na'een, Araan, Kashaan, etc.) which is although of less area compared to Tabriz and Shiraz, its context and the forming elements of its structure are valuable and noticeable. Shiraz structure is an example of cities with warm and dry climate (including Isfahan, Kerman, Yazd, etc.) which have been less dealt with. It has an urban unified complex (Vakil complex) that contributes to the formation of the integrated and close-knit of the city context.

Tabriz is selected as an example of cold and mountainous cities where most urban spaces are covered. This latter feature distinguishes it from the other two cases. The most noticeable urban location of Tabriz is its historical bazaar which forms the main core of the city.

Out of two structures namely, checkered structure in which passages and allies are vertical to one another, and cobweb structure which is like a circle whose center is placed as the main building such asa fire temple and palace (Memarian, 2010: 72), the context of Zavareh can be considered as having an interesting sample of organic checkered (Ghafari, 1996: 25). Two main axes of the city which are vertically connected together (including East-West axis consisting of central mosque, roofed and unroofed Hosseinieh, and bazaar entrance, and the other axis consisting of roofed bazaar, and the large roofed and unroofed Hosseinieh of the city) have a road network including roofed and unroofed allies and dead-ends ending to neighboring units. Just as body's vessels originate from the heart and reach the different parts of the body, they too start from bazaar, and reaching within the residential neighborhoods will find special ramification based on the performance of residential spaces, like capillaries (Shieh, 2001: 217). The main neighborhoods of the city are related to one another and to the city center through this unified network. The main landmarks of the city in the old context of Zavareh include the city gates, mosques (the most important ones are the central mosque with a dome and its single minaret and Bin Kooyeh mosque with its high and famous minaret), the old glacier and the old Sang Bast castle. The city's Hosseiniehs (roofed and unroofed) can also be considered as landmarks. These buildings are recognizable from far away and from the surrounding roads, and can help people find their

Table 5. Factors affecting wayfinding in urban scale (in past cities of Iran). Source: authors.

	Mosque, palace, castle, gateway and etc	bazaar, bazaarche, path network, bridge and etc	city center, center of district, square, char soogh and etc	walls around the town, the edges of the water and etc	Districts
Visual effect	Node and Sign	Path	Node and Sign	Edge	District
Example	Jameh mosque of Zavareh, Portal of amir chakhmaq mosque-Yazd, Arg-e Karimkhani-shiraz and etc	Bazaar in cities such as Tabriz, Isfahan, Shiraz and etc	Amir chakhmaq square-Yazd, Naqsh-e Jahan square – Isfahan, Gangali Khann square – Kerman and etc	Zayanderud – Isfahan	Urban fabric of districts of traditional cities, such as Shiraz, Yazd, Tabriz and etc
Image	Portal of amir chakhmaq mosque-Yazd	Tabriz's Bazaar	 Naqsh-e Jahan square – Isfahan	Khaju bridge – Isfahan	 traditional fabric of Yazd

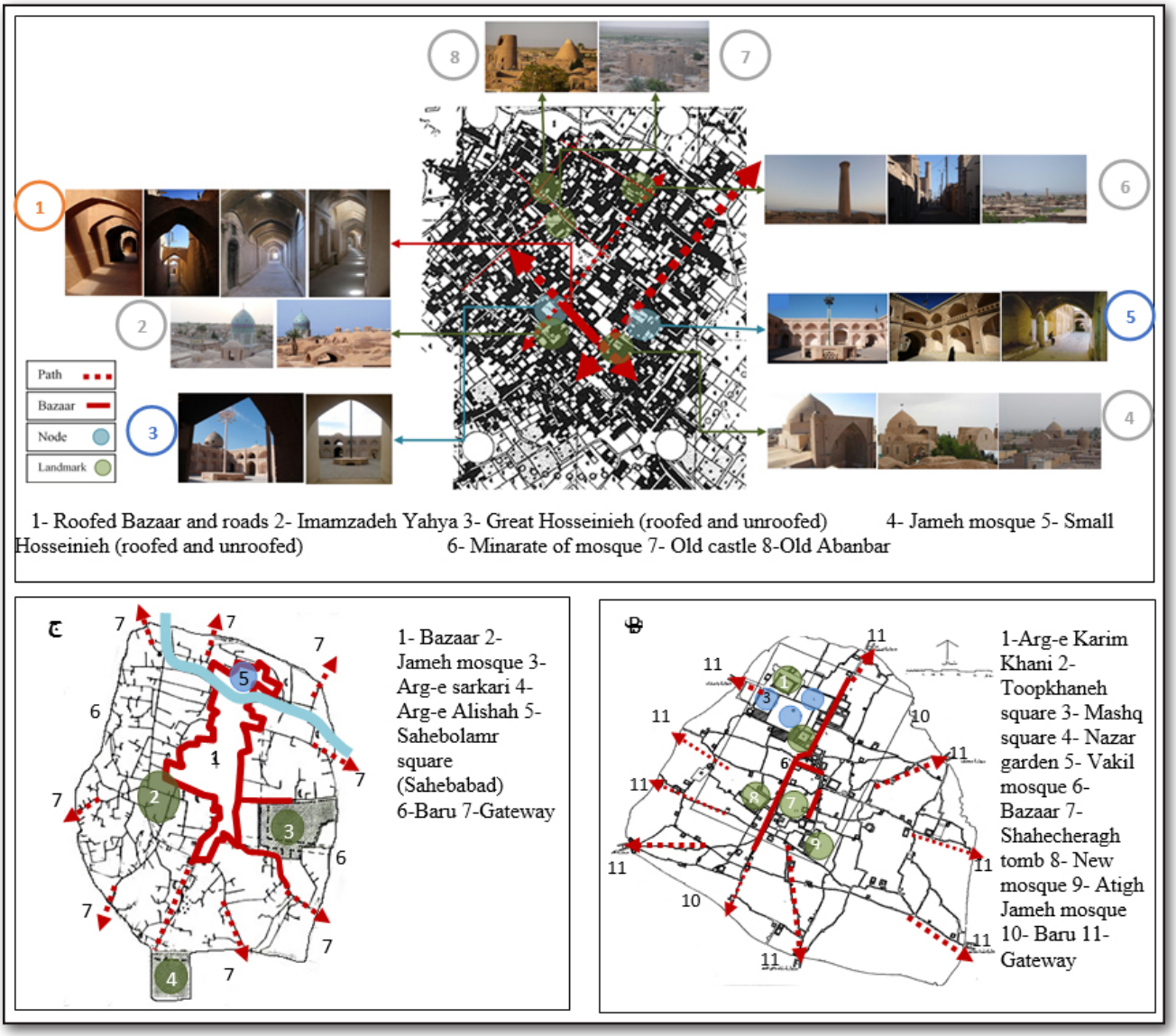


Fig. 1. Structural elements in the old contexts of cities: A. Zavareh. B. Shiraz. C. Tabriz. Source : authors.

ways. Out of the elements identified as landmarks, the central mosque and Hosseiniehs,being centralized for group activities, and gates, serving as the entrance and exit points of the city, play the role of knots as well (Diagram 1-A). The important landmarks which were referred to in the internal appearance of Islamic cities have suitably played thewayfindingrole in cities. For instance, minarets had served as guidance for pedestrians who moved towards mosques or their surrounding locations or neighborhood and city centers (Mashhadizadeh Dehaghani, 1994: 257). The mentioned features hold true for Shiraz and Tabriz as well (Fig.1 - B and C).

Shiraz has had several historical transformations since Gajar but the arrangement of urban elements has not been changed, so that its arrangement is similar to the main structural features of the past time of the city. In fact the origin of the city formation should be sought in the bazaar, the four axes crossing them, and the urban elements which had covered them. The location of urban elements along these axes has been subject to special regulations (Tavasoli, et al, 2007: 68). In case of Tabriz we address the anatomical structure of the central part of the city, which has placed the main core of the city within itself and has established a radial interconnected

system in relation to intra and inter-city ways based on different political, security, and religious conditions. Measures taken to conform to religious commands, such as respecting privacies and the security of the city,caused the different architectural and urban elements to be positioned in a complicated system among themselves and, in later stages, in relation to the whole city. The bazaar complex, central mosque and Arg in combination formed the core of the city, and this in itself was considered as one of the formation factors of radial system of the city (Bolian asil, 2009: 57). This complex had a tower and fortification for itself, and neighborhoods were normally located outside of this tower and fortification, but in some periods they were within them (Yazdani, et al, 2007: 6). In general it can be said that roads along with urban elements and landmarks had an important role in the unified structure of the city. But it is in relation with the city's roofed and large bazaar that this interconnected network gains significance. Secondary spatial systems such as residential neighborhood roads, originate under the branches of a river from the main route of the bazaar. The existence of depending spaces, such as the stores across the bazaar and small traditional stores around schools' yard, caravanserais, or even houses, depend upon main, secondary or even accumulative spaces (Ardalan, et al, 2011: 49).

Spatial complexity (labyrinth forms)

Amos Rapoport (1977: 208), a protagonist of new design values, has made the following perspicacious observation : "The mane environments in different areas, eras and cultures which are liked and preferred have one thing in common: they all seem to be perceptually interesting complex and rich"(Passini, 1984: 160). It should be noted that without complexity of the environment, there is a distinct danger of falling into a simolistic functionalism, a movement that has led to so many uninpiring, even monotonous, environments (Fig. 2).

Labyrinth lore, as expressed through history, points to fear as well as to pleasure. The pleasurable dimension is easily explained if we think of the interest, the curiousity, and the distraction that the challenge of problem solving and exploration brings. Fear may be accounted for by the real danger incurred when being lost. The sensation remains

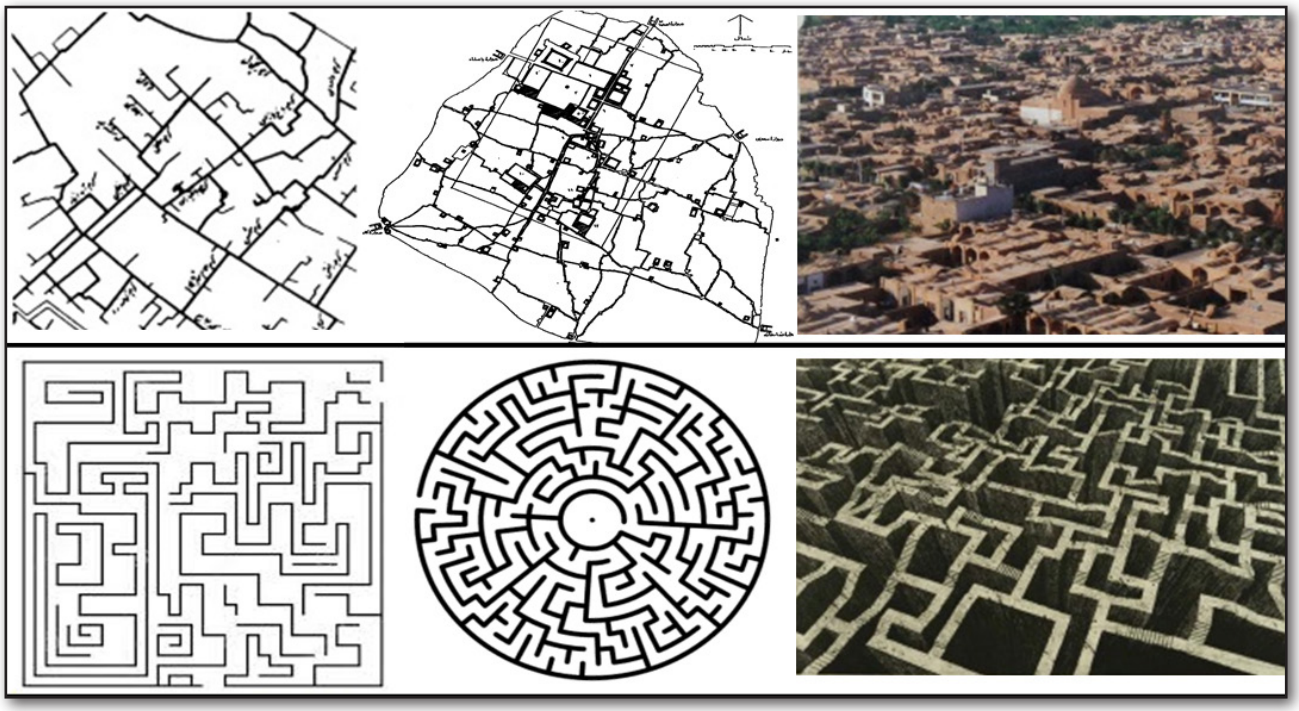


Fig. 2. Above from left to right: part of old contexts of Zavareh and Shiraz, aerial view of a part of old contexts of Zavareh. Down: Plan and volume of examples of labyrinth spaces. Source: authors.

even if the victim reasons that nothing can happen to him. The disappointment of not being able to solve a given wayfinding problem do not seem to account for the distress experienced by some in cases of disorientation (Passini, 1984: 164).

Labyrinths either does not provide any sign for guidance or utilize an indefinite number of them. In such spaces no route should be in any way different from others, no space should be distinguished from another one. Maximum consistency in space is one of the main features of labyrinths. Close similarity between the plan and air image of Iran's old cities and labyrinth forms causes one to speculate that their anatomical and spatial structure is also similar to these tortuous, steady, boring, delusive and even torturing ways (Fig. 2), whereas these cities benefiting from spatial hierarchy, spatial and visual variety and contrast, spatial continuity, etc., in addition to supplying defensive, security, and climatic factors, have transformed the roads and passages to dynamic and varied spaces appropriate for the physical and mental scale of man, whose right direction and route recognition is easily feasible.

Spatial continuity

Positive space continuity system creates an arrangement of dynamic systems, connecting points and spatial relations which renders possible the growth and change within themeta-awareness sense of order (Ardalan, et al, 2011: 47). Bacon has

Fig. 3. Spatial continuity and connection between downtown and neighborhood centers through as: A. Zavareh. B. Shiraz. C. Tabriz. Source: authors.

referred to this feature with emphasis on dynamic systems as the relating factor of the whole city and the continuous movement of space experience factor. He believes that a city should have an overall organization, and that its elements should be formed in relation with one another. Having studied the formation methods of old cities such as the ancient Athens and baroque Rome, he introduced forces that held the whole city together and established city's form unity. Bacon names these forces dynamic systems (Pakzad, 2011: 406). Tavasoli (2007) calls this feature in his book as the spatial continuity principle. Each urban space seeks to be connected to other spaces. If this connection is not established, no word will be uttered, and words will not turn into sentence and houses, domes … and city will not be built (Habibi, 2012: 105);(Fig. 3).

In the anatomical system of Iran's traditional urbanization, there is an integrated relationship among residential, commercial, purchase and cultural atmosphere phenomena. Having main and subsidiary divisions, and depending on the role they take, roads have a logical relationship with the city's residential neighborhood center and then commercial and social centers (Shieh, 2001: 214). Tavasoli names many examples of Iran's old cities where this principle exists, such as the old context of Yazd, Semnan, Shiraz, Kashan, Na'een and Zavareh. In the present case study the whole city Zavareh consisted of 13 neighborhoods. The main passages established the spatial relationship among neighborhoods, their centers and the whole city center in irregular checkered form; today this relationship has lost its significance. The elements of the whole city center including central mosque, large and small squares, bazaar and workshops which related through the main passage, had formed this integrated dessert city in combination with spatial organization (Tavasoli, et al, 2007: 19) (Fig. 3.1). In the historical context of Shiraz, the spatial continuity and relationship among different functions were observed too. One of the main features of the city structure in different periods is functional relations and joints. For instance, Sar-e Hosz-e Agha bazaar and Sar-e Chahar Rah (its literal meaning is "on the crossroad") bazaar can be cited as the connection between religious and commercial spaces, and Vakil mosque can be cited as the connection between governmental and religious spaces (Ibid). These continuity and connection can also be seen in neighborhoods. The whole castle city consisted of 11 neighborhoods. The whole city center including different elements stretched from Isfahan Gate up to Sardozdak neighborhood. The affluent neighborhood centers and houses were located in the routeor crossroads of main passages (Tavasoli, 1997: 16). As stated earlier, the spatial system of Tabriz is affected to a large extent by road networks as well as bazaar. The road axis of Rey-Istanbul and Ardebil-Maragheh in the form of two vertical axes of North-South and East-West have formed on the cross point the central core and city's bazaar. The central area of the city covered the bazaar complex, forum, central mosque and their surrounding context within the city's fortification. Most probably the gates were the entrance and exit points of the surrounding neighborhoods, not the city's entrance and exit gates (Safamanesh, et al, 1997: 52). The main routes and bypasses of the bazaar were often roofed. These roofed routes are the continuation of valuable experiences of conforming to the environment and the various functions of the bazaar. In this design, an exceptional attempt has been made to create integration and unity in various location of the bazaar.The connection form of small and large locations, such as Raasteh (rows), Saraa, Timcheh with one another and with the main axis of bazaar, has created a unique interconnected, integrated and unified complex (Hosseinzadeh dalir, et al, 2011: 50). Also, Bridge-bazaars as a part of Tabriz'z bazaar structure has played an important role in establishing, maintaining and strengthening of this urban complex (Fig. 3b&c)

Variety in spatial sequence

Gordon Cullen introduces "Serial Visions" along with two other concepts (place and content or theme). From

the visual point of view, he considers city as having two groups of elements: Exiting Vision and Emerging Vision; These two elements are, an incidental chain of events He also maintains that the art of relations can change a city to a harmonic scene through dexterous manipulation (Pakzaad, 2011: 156);(Fig.4).
Fig. 4. Contrast and variety in a sequence of spaces. A. Zavareh. B. Shiraz. C. Tabriz. Source: authors.
Tavasoli (2007) points to heterogeneous locations. He states that, "heterogeneous locations are the ones, which differ from one another in terms of width, length and height on the one hand, and surrounding elements and components, on the other hand." Old Iranian cities possess rich heterogeneous and different spaces which differ with those of western cities. The value of heterogeneous spaces lies in their capability in reducing the boredom of connecting spaces (Tavasoli, 1997: 62). The contrast of urban elements and spaces and urban harmony in relation to other elements and spaces at the same time is the principle which frees the urban space from uniformity, conformity, and lack of identity. Through utilization of this principle, urban heterogeneous spaces play a major role in endowing the city with

Fig. 4. Contrast and variety in a sequence of spaces. A. Zavareh. B. Shiraz. C. Tabriz. Source: authors.

identity (Habibi, 2012: 105). In the historical context of Zavareh, the following factors have played an important role in establishing perceptual and visual qualities for the two axes of the city: using different methods and measures such as variety in sizes, closeness level, presence or absence of roofs for some parts of the route like Hosseinehs, roofed bazaar and squares with Hossienieh, unroofed allies, presence of tents, lights and shades in different parts of the route, presence of static and dynamic spaces, and variety in the type and junction of ways and squares (Ghaffari, 1996: 26). This spatial variety is seen in the historical contexts of Shiraz and Tabriz, while climatic conditions also play a role in the type of elements used for constructing locations, so that in Tabriz most parts of the contact locations of bazaar are roofed. As illustrated in the image, in these two samples, as the case is in Zavareh, you can see in a specific route and area a variety of religious, commercial, service-related, and the like spaces with different appearance and anatomy which in combination with one another and with the whole complex form a dynamic system which in turn forms a continuous flow of spatial experience harmony with an orientation toward the center; a combination which originates from the continuation of geometric forms (Hosseinzadeh dalir, et al, 2011: 4); (Fig. 4).

Discussion

As mentioned earlier, two groups of human and environmental variables are involved in facilitating wayfinding process in urban spaces and public buildings; different people with different sex, ages, physical and mental capabilities, languages and cultures behave differently when encountering their surrounding environment, and their level of perception and recognition of environment is different. Beside these variables, spatial configuration, structural elements, and guiding signs and systems play an important role in environment recognition; while the role of the above-mentioned factors in space recognition and environment perception in new and unfamiliar locations is more powerful and effective. In this research the role of environmental variables in wayfinding and pathfinding process in old cities of Iran have been investigated. According to the studies of the present research, the concept of pathfinding serves as a subset of wayfinding. In previous studies, these two concept were sometimes assumed to be identical, while pathfinding has less complexity and vastness compared to wayfinding. Pathfinding is the process of finding and choosing a path between the departure and destination points. Today this process, especially in big cities, is done by means of satellite and navigation software; while in old cities of Iran where walking and human aspects, actions, and vision were the bases of designing, travelers identified the spatial goals and right paths solely through physical and visual features of passages and paths. The spatial continuity in these cities was established by means of connecting elements and functional joints. These elements were in the form of roofed and unroofed passages, marketplace, Hossienieh or mosque, etc. which from visual point of view took the form of path, node, edge, or landmark. We saw some examples in the old context of Zavareh, Tabriz and Shiraz. The different aspects and relations of these locations offer spatial contrast and successive views, enabling the passerby reach his or her destination without being bored by uniform spaces or lost in unreadable and complex spaces and their accompanying sense of disappointment and anxiety. Diagram 3 shows the factors affecting the wayfinding and pathfinding process and the characteristics of old cities of Iran affecting this process.

Conclusion

Facilitation in wayfinding process, or in simple terms the recognizing that in a set of different and complex functions where individuals are, where they want to go, and how he/she will reach his/her destination is an unavoidable necessity which must be considered in designing cities and large buildings. Using anatomical elements and components which enhance spatial legibility and imageability and provide users with clear and

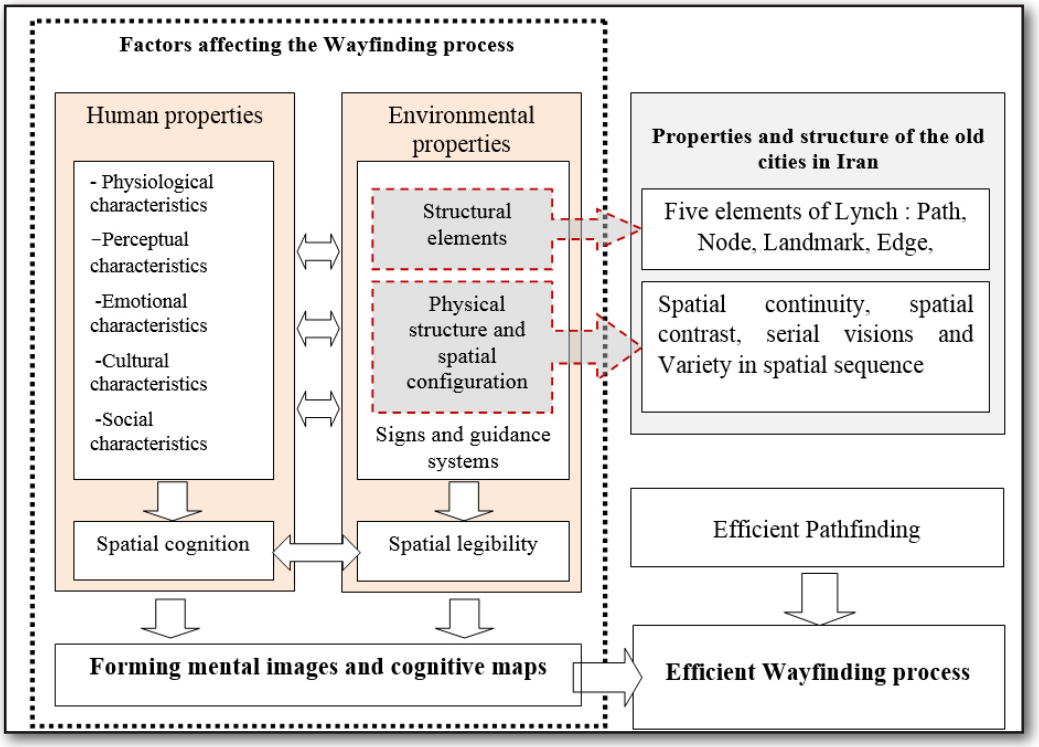


Diagram3. Factors affecting the efficient Pathfinding and Wayfinding processes. Source: authors.

understandable spatial information, people can reach the intended destination with the least possible time and energy. In the historical context of Iran's cities, wayfinding and pathfinding processes are done easily and people easily reach their destination even in tortuous and long paths. Legibility, spatial integration, and spatial contrast and variety are the factors which have existed in these cities. The anatomical features of the structures of these cities can be employed as a pattern for designing cities, towns, neighborhoods, and even public buildings of today, and can help users to reach their spatial destination rapidly and easily. The study of the impact of the above-mentioned factors on the contemporary urban public spaces can be the subject of further research.

Endnote

1. Wayfinding research investigates the processes that take place when people orient themselves and navigate through space (Raubal 2001), and aim to explain how people find their ways in the physical world, what people need in order to find their way, how they communicate directions, and how people's verbal and visual abilities influence wayfinding. Pathfinding is a less complex problem since it does not include the human factor. It is the process of finding a path between an origin and a destination (while trying to avoid obstacles) in a map, which usually involves determining a least-cost path (Sahli,et al, 2005 : 3).

2. In selecting the sources, it has been tried to refer to the issues which have been more frequently referred to. However, a range of creditable theories since 30 years ago have been considered.

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