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Explaining the model of time sense and memorable quality indexes in the formation of time memory

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ABSTRACT

Time is the context in which form is experienced, but it is not itself a characteristic of form; Because the form exists independently of it and the three inherent characteristics of line, surface and volume are enough to confirm its existence. The aim of the research is explaining the model of time sense and memorable quality indexes in the formation of time memory. In defining the sense of time as an introduction, it can be mentioned that the sense of time is one of the most important temporal components of urban design. The current research method is analytical, and in the next stage of content analysis and research background, the factors affecting the subject were first extracted, and after that, using the fuzzy Delphi method, 15 people from the disabled elite answered the relevant questionnaire in three rounds. Based on this, 11 final indicators were extracted as the final model. The findings indicate that the duration of time with an average score of 4.59 and the passage of time index with a score of 4.39 have the most impact. In future studies, the internal relationships between indicators can also be investigated.

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INTRODUCTION

In an abstract view of the urban space, line, surface and volume are the dimensions that give meaning to the shape and form of the space. Time is the context in which form is experienced, but it is not itself a characteristic of form; Because the form exists independently of it and the three inherent characteristics of line, surface and volume are enough to confirm its existence. On the other hand, the form can be understood from one point of view and without movement, and this does not reduce anything from its existence. Only through time does our experience of form develop. Time can be perceived in relation to darkness and lightness, the crowding and quietness of the street in certain hours of the day. The perception of time is not only as the fourth dimension of objective form, but as something that can be analyzed (Kreitzman., 2014). The concept of sense of time, like sense of place, is an internal and personal experience of time perception. This perception is related to various factors. For example, the sense of time depends on the perception of changes and events in time. That is, as we understand phenomena and events, we also feel the time of their occurrence. Poppel has listed the components of the sense of time as: length of time, asynchrony, order, past and present, and change including the passage of time (Poppel, 1998). Another type of sense of time is known as the sense of biological time. This theme is perceived in repeated actions and in the form of rhythms and patterns of life with which we live, such as regular breathing, cycles of birth and death, and also visible in external rhythmic realities such as day and night and cycles of seasons. All these cases are important for creating functional order in the world (Madanipour, 2007). Cremona and his colleagues remember that the most basic sense of time cycle is based on natural cycles. The most obvious example is the 24-hour rotation of the earth, which affects the intermittent human activities, such as sleeping and waking up. Other human activities such as work, spending free time and eating are also

under the influence of this main cycle. (Carmona and Tiesdell, 2003). Rappaport believes that two aspects of space and time influence each other and people live in space and time (Rappaport, 2005). Angirili considers the three components of arousal and emotional states and alertness to be the components affecting time (Banerjee & Southworth, 2017). Lynch states that the passage of time in urban environments is experienced in two ways: through factors that repeat regularly and intermittently, such as heartbeat, breathing, sleeping and waking up, hunger, rotation of the moon and the sun. Repeating seasons. And also, through factors that are not proportional and change exponentially, such as growing and aging. These factors do not repeat again and alternately, but change over time. Time and space are completely interdependent and usually three aspects of time dimension are discussed in urban design. Since the activities are ongoing in time and space and the environments are used in different ways at different times (Montgomery, 2015) the perceptions of an urban environment are multidimensional, so that in the whole meaning They depend on the characteristics of observers, residents and tourists. Collecting mental maps of distinct visual quality by defining how city residents perceive the main visual elements of the city is one of the most important methods in analyzing city perceptions (Abd Elrahman & Mahmoud, 2016). Perception is a behavior or a response that always follows the effect of internal or external movement of humans (Majedi et al., 2010). Perception is a mental or psychological process that is responsible for selecting and organizing sensory information and finally adapting it to the mental meaning in an active manner. He understands affairs, meanings, and objects (Lewika, 2021).

In defining the sense of time as an introduction, it can be mentioned that the sense of time is one of the most important temporal components of urban design. A person's sense of time is an internal sense and experience, and measured time is an external framework for

communication and work (Madanipour, 2007). In other words, the sense of place is an internal and personal experience of time perception. For example, the sense of time is dependent on the perception of changes and events in time (Poppel, 1978). In the book (public places, urban spaces), urban design generally has four dimensions, the fourth dimension of which is time. He believes that with the passage of time, spaces become places where life flows. These spaces acquire more meaning with time-dependent qualities (Carmona & Tiesdell, 2003). Stable place", the sense of time is considered one of the experimental-aesthetic components that Carmona and his colleagues have proposed as one of the six dimensions of urban design. (Asgari & Naghibi, 2015). The sense of time in Bister's urban issues includes the perception of the urban form in the passage of time. (Chandler, 2008) This sense of time acts as a catalyst in the configuration of the transformation of the structure of the form of urban elements and components and provides a connection between the changes in the timeline for the audience. (Saredpanah and Asasi, 2015) The sense of time and the process of perception strongly depends on the space in which a citizen is present, moves and performs his social roles, and can be understood in that context and space. These urban spaces should have different environmental qualities in proportion to their role and importance, and one of the most important perceptual qualities of an urban space is the sense of belonging to the place, the creation of which requires the realization of many other qualities. And finally, the sense of belonging is one of the different but essential components that create a memorable quality. The memory never takes place in the imagination without events, and when the event or incident ends and days pass, what remains in the mind is the space in which the event or incident took place. Memories are the reference of man in thinking about his life. Human life takes place in a range where memories are formed and memory has no meaning

without events (Hartog, 2018). Memories give meaning to our lives and direct the temporal and spatial dimensions of our lives, no matter how many people there are. Is more involved in the event, its importance will increase. The objects and spaces left by the event will also have value. The city is a memory. The formation of urban spaces, It is a response to the need to establish social relations. Such spaces, due to their physical characteristics and the current events in them, give identity and create individual and collective memories in the minds of individuals and society. Time and identity of a person can be found in the city. Urban spaces become memorable due to incidents and events on the one hand and physical elements on the other hand (Seyed Berenii, 2013). Place, the two elements of man and place enter into a process through the third element of interaction between man and place cognitively, emotionally and functionally, in which time can be considered as the fourth dimension. In this way, a place becomes meaningful when a sensory perception is made of it in a context of physical elements, communication and time, and leaves a mental image of itself. Based on this approach, man and place have similar characteristics such as memory and then sense of belonging and identity. (Hartog, 2018). In the field of psychology, perception is a mental process during which sensory experiences become meaningful and humans understand the relationships between things and the meanings of things (Rafieian & Khodaei, 2019).

In the process of perception, the raw information received by Eve enters the mind and becomes meaningful. Therefore, the process of perception includes three consecutive and interconnected stages: feeling, sensory perception and intellectual perception. The first stage is an introduction to any sensory activity that is performed by the body's senses and nervous system. In the next stage, which is sensory perception, information is selected and checked from among the sensory data. In this stage, the primary information is stored and classified in

the brain based on its characteristics. This is the stage of mapping in the brain. Mental exploration, which includes evaluation, conclusion and the formation of mental confirmations. In the final stage, intellectual perception is done. All three stages together cause the environment to become meaningful for humans, which leads to behavior (Paumier, 2015).

MATERIALS AND METHODS

The process of perception in the concept of time has a neurological structure in the human brain, which is more in the face of the mental pattern-making system with the form-oriented structure. It happens, and different urban spaces can change the type and process of this perception longitudinally and horizontally. (Sternberg, 2007) Along with the physical perception of any object or environment, different meanings may also be perceived, a smile may be perceived innocently, indicating sadness, happiness or mockery. The meaning of the object is formed with the passage of time, the effect of experience and according to the conditions and state of the perceiving person, stimulus characteristics and using memory. When the stimulus information is recorded in the perceiver's mind, according to the developed schema, the physical shape of the smile may be noticed and the spirit in it can be deduced, which is similar to the shape of previously experienced smiles, and sadness can be perceived from the face. Therefore, Neisser

considers meaning to be one of the features of schema and believes that what remains in the memory and mind is an object, scene or event that is perceived by the guiding role of schema and schema is somehow involved in the use or modified. In another case, it can be said that perception is a simple process of understanding and awareness of sensory information and our balance between past experiences, culture and genetics of a sensory scene provides our understanding of the situation. (Fig. 1)

Sensory memory has the ability to recall emotional information of past events. When conditions close to past experiences are provided, a set of emotions is simulated through memory and create the desired image in the mind, and in this case, synesthesia recall is activated. Synesthesia is a term that is usually used to describe the ability of the brain to understand a scene through memory or another scene in which it has been memorized and finally perceives a meaning from this understanding. This memory shows itself in a linear relationship with meaning. The meaning is also given to the environment and the created sense of place causes dependence on it. Hershberger considers supply and referential meanings in the stage of representation. Supply meaning are those meanings that the perceiver separates the object from its background and attributes of the whole shape, the group of geometric shapes in which it is placed, pays attention to its color and texture,

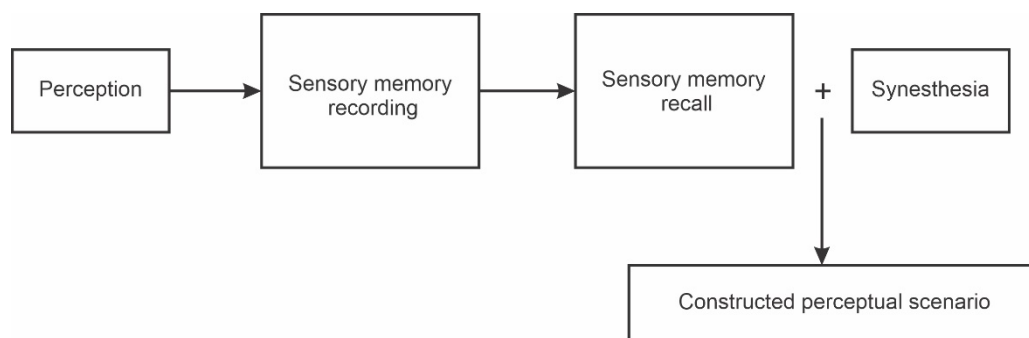


Figure 1: Perceptual structure in the concept of sense of time and environment and its linear explanation in the idea of sensory memory

or may be compared to the size, type, its organization, texture, spaciousness or location can be felt. Although it is expected that there should be a consensus about such meanings, the amount and type of previous experiences (schema) are also involved in how to receive these kinds of meanings. It is possible that the form of an object attracts the perceiver's attention, while another's attention is sensitive to its size or location. As words can be a reminder of an object or an event. Forms also have referential meanings, the most important of which are formed in the mind in relation to its use. In addition to the rectangular form of the door, its size or position may be considered in the first stage, the idea of passing through it (referential meanings) is also formed in the mind and valuable meanings may also be transferred to the mind. (Fig. 2)

The intermediate link between the type of perception, the sense of time, the process of perception and recall in urban spaces, is spatial memory. In cognitive psychology and neuroscience, spatial memory is a form of memory that is responsible for recording and retrieving the information needed to plan a course. In a place and remembering the location of an object or the occurrence of an event (Mirmoghtadee, 2009). Spatial memory is necessary for orientation in space (Brown, 2010). Spatial memory can also be divided into autocentric and allocentric spatial memory (Eisle, 2015). A person's spatial memory is needed to move in a familiar city. Rat spatial memory is required to learn the location

of food at the end of the maze. In both humans and animals, spatial memories are summarized as a cognitive map (Wang, 2019). Spatial memory has representations in working memory, short term and long-term memory. Research shows that certain areas of the brain are related to spatial memory (Poppel et al, 2020).

According to the review of the research background in domestic and foreign studies, the difference of the current research can be explained in the following cases:

1. Most of the similar designs have only paid attention to one of these topics and have focused on the topic of sense of time, memory, perception and issues related to urban spaces in a one-dimensional way. And there has been no research on the specific relationship between the sense of time and one of the qualities of urban design separately.
2. The methods used in most of the researches are mainly qualitative and it has been done by using questionnaires or interviews that according to the statistical population, the difference in the psychology of people and also the environmental structure can change the results.
3. The surveys conducted were generally conducted in a decentralized location and were not conducted based on the overall structure in a period of time.
4. So far, no specific study has been done between the relationship between sense of time and spatial memory.

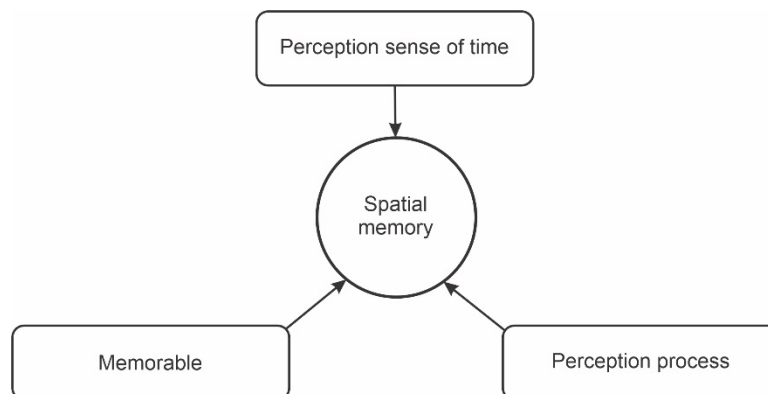


Figure 2: Conceptual connection of components affecting spatial memory

Therefore, so far, there have been no studies in the field of examining the relationship between the components of the sense of time and the process of perception in the field of evocative urban spaces. On the one hand, the relationship between spatial memory and the sense of time and the process of perception, and on the other hand, studies on the relationship between spatial memory and spatial and memorable knowledge have not been seen in the field of urban planning. Also, in other similar researches in the field of sense of time and reminiscing, it is usually re-

ferred to urban spaces located in old and historical or dilapidated contexts, and to urban spaces of new urban contexts and their structural differences with other context spaces. Worn out and historical are not taken into account. Therefore, in this research, an attempt is made to investigate the direct and linear relationship between the sense of time, perception process, reminiscence, urban spaces and spatial memory in urban spaces located in the new contexts of the city. And tried to introduce a new type of view to all these issues into urban planning. (Tab. 1)

Table 1: Research background and factors emphasized in each of the studies

Author	Year	Title	The purpose of the research	Research Methodology	Emphasized factor
Niels A. Taatgen Hedderik van Rijn John Anderson	2007	A unified theory of prospective interval estimation: The role of cognition, attention, and learning	Prospective time estimation, cognitive model, divided attention, exemplar learning, multitasking	Qualitative-experimental	Learning
Perry Pei-Ju Yang, Simon Yanuar Putra and Meutia Chaerani	2007	Calculation of the sense of time in the urban physical environment	Understanding time; Age; timing; passing of time.	Qualitative-experimental	The state of the environment
JULIE ANNE SÉGUIN	2013	Effects of emotion on time perception for complex visual stimuli	Perception of time	Qualitative-experimental	Perception of time
Miyu Kuno	2013	Record the moment	Time, perception of time, light, materials	Qualitative-quantitative	Sense of time
S. Norouzi M.A. Nazari A. Jahan	2014	Gender differences in the perception of time in relation to number and Time interaction	understanding time; Reproduction of time, gender, number, duration	Qualitative	Time interaction
Jeffrey K. Olick and Joyce Robbins	2015	Social Memory Studies: From "Collective Memory" to Historical Sociology	Collective memory, social memory, time understanding, time change, urban context	Qualitative	Collective memory
Brendan Francis Keane	2018	Neural correlates of human time perception	Perception of time, audio-visual, chronological order	Qualitative	Time order
Amir Shakibamanesh, Mahshid Ghorbanian	2018	The influence of urban spatial configurations and physical structures of pedestrians' perception of subjective time	Perception of time, mental duration, physical structure, spatial configuration, virtual reality	Qualitative-quantitative	Spatial configuration

Author	Year	Title	The purpose of the research	Research Methodology	Emphasized factor
Thomas Bruss and Ludger Ruschendorf	2018	Based on the perception of time	Sensory perception, Weber-Fechner law, time paradox, probabilistic modeling, logarithmic thinning, time compression, Pascal processes	Qualitative-quantitative	Sensory perception
Perry Pei-Ju Yang, Simon Yanuar Putra and Meutia Chaerani	2018	Calculate the sense of time in a city The physical environment	Sense of time, perception of time, urban environment, spatial organization	Qualitative	Organization of space
NEJC KUGLER	2018	Perceptions of space in public places organized by the society	Perception of space, organization of space, society, collective behavior, passage of time		
Anit Bakshi	2019	Urban form and discourses of memory: Spatial practices in contested cities	Understanding time, sense of time, form and pattern of activity resulting from the body	Qualitative	Activity pattern
Edmin Noawan	2020	Investigating the mechanism of identity in urban spaces based on the concept of time	Time, urban context, passage of time, collective memory, time change		
Ellham Suri Sina Razaghi Mohsen Faizi	2011	The concept of sense of time and its application in urban design	Time management, urban space, changes, activity pattern, place	Descriptive quality	Sense of time and physical confinement
Nima Ostovar Mostafa Behzadfar	2015	Mixed research on the components affecting the perception of the sense of time in an urban place	Sense of time, environmental factors, environmental norms, combined method, Naqsh Jahan Square, Isfahan	Qualitative-quantitative	Environmental factors and readability
Nasim Hasani Mianroudi, Hamid Majdi, Zahra Sadat Saide Zarabadi	2016	A comparative study of the evocativeness of urban spaces using Semiotic patterns	Memorability, urban sign, individual behavior, behaviorism, collective memory	Qualitative	Individual behavior
Leila Soltani	2017	Analyzing the historical dimension of the place in the social rhythm of the collective space	Collective space, historical dimension of place, civic capacity, rhythm of behavior, urban developments.		
Mansour Rafiei	2018	Qualitative study of intergenerational collective memory of Baft city	Collective memory, urban fabric, perception of space, organization of space, physical identity	Qualitative	Physical identity

Methodology

The current research is an analytical-descriptive research in terms of structure, which in terms of its main goal is considered to be of the type of applied and developmental research, which can also be considered as an exploratory research approach considering the lack of previous research on the concept of sense of time in urban spaces based on the concept Evocative and with a cognitive approach to the concept of spatial memory in a methodical way in the specialized branch of urban design science, psychology and environmental psychology. The method of data collection will be library and field collection using environmental impressions and interview and questionnaire. After examining the basic definitions and theoretical approaches of the components of the sense of time and their impact, memorable components, spatial memory formation components, analyzed and reviewed the information obtained from reviewing texts, library documents and internet resources. It can be said that the focus of the research was on the convergent extraction of researchers' ideas and their interpretation in order to reach the main path of evaluation and analysis. Based on this, first, a proposed model of the course of factors affecting the sense of time in the evocativeness of urban public spaces is presented with an emphasis on spatial memory, which can be explained in line with the concept of evocative urban space, and the main view of the research is on the point The subscription of these two issues is placed. First, the effective factors in the sense of time in urban public spaces are extracted with a memorable approach using the background of convergent studies as well as basic principles, and according to each of the dimensions and structural components, the factors affecting the quality of interaction with the extraction approach the main structure is explained. Specifically, based on the concepts of the conceptual structure and the dimensions of the governing urban design, the basic model is proposed and the effective factors of its linear

sharing are determined. In the following, by using the Delphi method and taking into account the concavity of the opinions of the elites and experts, the effective factors have become the primary suggested indicators that are tested. It is done digitally by researchers using survey software and finally the conceptual model (factors) of the research is extracted.

DISCUSSION AND FINDINGS

In this research, the components of sense of time and evocative quality are used as a prerequisite in the first stage, extracted from the theoretical foundations of the subject, and then the conceptual dimensions of the research structure are presented according to the research hypothesis. These factors have been expressed based on the estimation of the awareness dimension of experts and also the perceptual process of citizenship. These factors have been arranged as a suggested package in the panel of experts and elites so that the Delphi method can be planned and applied. A total of 17 factors that have been tested with this method to reach the final indicators include: the passage of time, the duration of the impact of the space, ethnic cohesion, event ability, neighborhood relations, valuing the space, the quality of familiarity, the spatial type, the amount of historical memory, it is a mental image, spatial connection, adaptability, spatial characteristics, anatomy, semiotics, spatial coherence. First round; In this round, the panel members identified 14 factors out of 17 factors that were extracted from successful researches as having moderate, a high and very high influence in formulating the framework of factors affecting the sense of time and memorable quality in the formation of time memory. Detailed and detailed results related to the implementation of the first stage of questionnaire distribution are given in the following table. The factors of complexity, territorialisation and institutionalization have been removed from the Delphi process due to their average importance of less than 2.5. (Tab. 2)

Second round; After the implementation of the first stage of assessment and evaluation of the opinion of the experts of the panel regarding the factors proposed and extracted from the theoretical bases and also receiving the suggestions of the panel members, in this round, in order to observe caution, all the factors extracted from the theoretical bases are again Together with the average opinion of the members in the first round and the previous opinion of the same member, it was provided to all the experts of the panel. The panel members identified 11 factors out of 14 factors that were presented in the second round as having a high and very high impact (with an average greater than 3) on the research framework. The detailed and extended results related to the implementation of the second stage of questionnaire distribution are given in the following table. Kendall's coordination coefficient for the members' answers about the order of the 13 factors that had a high and very high influence in this round was 0.765. In this step, 5 factors of meaning, dynamism, security, mixed use, and sensory richness were removed. (Tab. 3)

Third round; In the third round of compiling the research framework, the final indicators, along with the average opinion of the members

in the second round and the previous opinion of the same member, were provided to all panel experts. The detailed and extended results related to the implementation of the third stage of questionnaire distribution are given in the table below. At this stage, factors whose average is lower than 3.5 are removed. Kendall's correlation coefficient for members' answers about the order of 9 factors was 0.792. In this stage, 4 factors of collective identity, pedestrian orbit, access and performance were removed. (Tab. 4)

RESULT AND CONCLUSION

Reasons for stopping polling; The results of the four rounds of implementing the Delphi method in the research show that a consensus has been reached among the panel members for the following reasons and it is possible to end the repetition of the rounds:

- In the second round, more than 50% of the members chose 11 influential factors in formulating effective criteria on social interactions based on the concept of the architectural body in open fourth generation commercial complexes, which had an average greater than 2.5 among their factors.

Table 2: Phase one of the fuzzy method in compiling factors of sense of time and memorable quality in the formation of temporal memory

No	Factors	Number of responses	Average	Standard deviation	Min.	Max.
1	Passing of time	15	4.28	0.52	1	5
2	Duration of space impact	15	4.38	0.63	1	5
3	Event-ability	15	3.69	0.42	1	5
4	Appreciation of space	15	3.69	0.76	1	5
5	Spade type	15	3.32	0.51	1	5
6	Mental image	15	4.10	0.34	1	5
7	The amount of historical memory	15	2.72	0.38	1	5
8	Spatial connectivity	15	2.58	0.45	1	5
9	Adaptation	15	3.58	0.65	1	5
10	Spatial characteristics	15	3.42	0.48	1	5
11	Physical	15	4.23	0.53	1	5
12	Semiotics	15	4.12	0.42	1	5
13	Linked	15	2.80	0.24	1	5
14	Spatial coherence	15	3.20	0.71	1	5

• The standard deviation of the members' answers about the importance of the factors in the third round has changed significantly compared to the previous rounds.

• Kendall's coordination coefficient for members' answers about the order of factors in the third round is 0.792. Considering that the number of panel members was more than 10 people, this amount of Kendall's coefficient is considered quite significant.

• Kendall's coordination coefficient for the arrangement of the 11 influential factors in developing the research framework in the third round compared to the second round only increased by 0.005, which shows a significant increase in the consensus among the panel members in two consecutive rounds. Does not give

• The points given to the factors by experts and elites indicate that the effective criteria on social interactions based on the factors of sense

Table 3: Phase two fuzzy methods in compiling factors of sense of time and memorable quality in the formation of temporal memory

No	Factors	Number of responses	Average	Standard deviation	Min.	Max.
1	Passing of time	15	4.38	0.48	2	5
2	Duration of space impact	15	4.45	0.58	2	5
3	Event-ability	15	3.75	0.41	2	5
4	Appreciation of space	15	3.78	0.54	2	5
5	Spade type	15	3.65	0.56	2	5
6	Mental image	15	4.25	0.38	2	5
7	Adaptation	15	3.98	0.40	2	5
8	Spatial characteristics	15	3.89	0.36	2	5
9	Physical	15	4.36	0.25	2	5
10	Semiotics	15	4.25	0.36	2	5
11	Spatial coherence	15	3.85	0.61	2	5

Table 4: Phase three of the fuzzy method in compiling factors of sense of time and memorable quality in the formation of temporal memory

No	Factors	Number of responses	Average	Standard deviation	Min.	Max.
1	Passing of time	15	4.39	0.35	3	5
2	Duration of space impact	15	4.54	0.39	3	5
3	Event-ability	15	3.89	0.35	3	5
4	Appreciation of space	15	3.95	0.45	3	5
5	Spade type	15	3.85	0.49	3	5
6	Mental image	15	4.35	0.41	3	5
7	Adaptation	15	3.99	0.35	3	5
8	Spatial characteristics	15	3.95	0.37	3	5
9	Physical	15	4.52	0.28	3	5
10	Semiotics	15	4.35	0.31	3	5
11	Spatial coherence	15	3.95	0.25	3	5

of time and memorable quality in the form of time memory, mental image factor, passage of time, physical and semiotics have the highest score. And as a result, they have the greatest impact in realizing the extraction of a business model. (Tab. 5)

Table 5: Research framework of the research

Effective criteria on the final indicators of sense of time and memorable quality in the formation of temporal memory		
Index	Index type	Measurement method
Passing of time	Qualitative	Questionnaire
Duration of space impact	Qualitative	Questionnaire
Event-ability	Qualitative	Questionnaire
Appreciation of space	Qualitative	Questionnaire
Spade type	Qualitative	Questionnaire
Mental image	Qualitative	Questionnaire
Adaptation	Qualitative	Questionnaire
Spatial characteristics	Qualitative	Questionnaire
Physical	Qualitative	Questionnaire
Semiotics	Qualitative	Questionnaire
Spatial coherence	Qualitative	Questionnaire

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