



Investigating Physical Environment Factors Affecting Creativity in The Process of Formation of an Architecture

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Abstract: *Creativity, as one of the great manifestations of human thought, is important in today's world. Creativity is a mental process aimed at producing an innovative and valuable product. The creativity process in the mind of a creative architect has two dimensions of imagination and conception. The imagination is the creation of images in the minds of the architect who freely develops ideas for the creation of an architectural work, and conception in the architecture of mental imagery to build an image of the architectural effect that has actually been and has never been seen. Conception and imagination are architectural prerequisites for architectural creativity. Now, if environmental components are in the process of improving the environment, they can help promote creativity and take steps to create innovative and creative effects. Environmental factors in a physical environment have a great influence on increasing of creative growth. The purpose of this research is to recognize the concept of creativity and to study the environmental conditions and factors affecting the promotion of creativity in the process of forming an architectural creation. The research method was descriptive-analytic and collecting library information. This paper, while explaining the concept of creativity and creativity in architecture, will show the role of environmental stimuli in enhancing architectural creativity and the results of this study will provide environmental factors that stimulate creativity.*

Key words: *creativity, creativity in architecture, environmental factors, environmental stimuli*

1. INTRODUCTION

Theories of perception and aesthetic experience in the field of education, known as the aesthetic development theories, are well-known under the category of the theory of growth. Theories of growth are a branch of psychology that examines the changes, physical, mental, emotional and functional changes of human life in life. One of the main fields of psychology for the growth, is the cognitive fields of it, that examine variations in rational abilities such as attention, perception and memory, thinking, reasoning, creativity, and imagination [1]. Alvin Toffler states in the book named Third Wave: "The first wave of agricultural periods that humans are grounded in, came in the second wave of the industrial revolution, and the third wave is the era of the sub-industry and information technology, and the only thought that can be utilized in this age is creativity [2]. Creativity is so important in today's world. There are many definitions of many thinkers and theorists in relation to creativity, which have many common points and differences. According to some definitions, any work that is made without the prior making is a creative work. Creativity and innovation play a vital role in human

life and the discovery of human creativity leads us to the invention of new artifacts. Creativity is the center of construction, the creation that creates a new, beautiful and desirable architecture. Every building that is built has a spirit that its creator, in breathe the spirit in its components, so that the harmony in the components make it possible to create an artwork that has an independent identity. The physical environment has a huge impact on creativity promotion for fostering creative architectural ideas. In this research, in general, the overall focus is on creativity and the role of creativity environmental factors that contribute to fostering new ideas and enhancing creativity in architecture. Therefore, there is no specific study area or limitation for this research, and it is generally discussed in this title.

Creativity

Creativity or innovation, as well as creation, is the most important and essential human ability and the most fundamental factor in creating value, which plays a vital role in all dimensions and aspects of life. Creativity has been adapted from the act of Creation. Creative is one of the main adjectives of God, and the creative power is the force that leads to the production of exquisite faces [3]. Experts from different aspects have provided different definitions for these terms. Most definitions of creativity and innovation are associated with the features of "novelty", "new ", "first-time" and "usefulness" [4]. Creativity is one of the issues that has not been agreed upon by researchers and psychologists on the nature and definition of it. In general, definitions differentiate creativity: some definitions focus on personality traits of others, and others look at creativity based on creative process and other definitions in terms of creative product [5]. Not all psychologists are unequivocally defined in terms of creativity, and see creativity from a variety of angles. Some of them believe creativity means freeing from presuppositions, frameworks, and others say: creativity is the product of the highest level of human knowledge. Some argue that creativity is not talent, talent is limited, and leads the person only in a certain channel of mental and intellectual abilities, while creativity is widespread, and prompts the creative person to think in different disciplines and topics. Some psychologists also say that creativity is the culmination of the ability of human thought to be able to make man progress and help him solve all the problems of life [6]. "The Descriptive Culture of Psychology of Cognition" writes in the definition of creativity: "Creativity refers to the ability to find unconventional and high-quality solutions to problems" [7]. Creativity can occur in all domains and fields and according to the type and scope of the types of creativity can be categorized as follows: scientific creativity, technological creativity, industrial creativity, artistic creativity, creativity of children [4]. There are barriers to creativity, most notably:

1. Lack of confidence
2. Fear of criticism and failure
3. The desire for consistency
4. Mental decentralization [8].

Creativity skill

Factors influencing creativity can be divided into two categories of individual factors and social factors. Individual factors such as intelligence, personality traits, and internal motivation and social factors such as family, school, experience, education, and external motivation [9]. Creativity skills are associated with the following intellectual values:

- Breaking the habit: abandoning previous intellectual and practical practices, using new methods.
- Delaying judgment or delay in evaluating ideas, to avoid losing ideas that may not seem interesting at first.
- Understanding complexity with respect to complex issues and engaging with it.

- Understanding creativity or seeing things differently: Observing things in a new way that has never been taken into account.
- Wide Thinking: Communicating between different ideas [5].

Robert Jysterenberg and Lindaie Ohara in their studies identified six factors in the creativity of effective individuals:

1. Knowledge: Having basic knowledge in limited fields and gaining experience and expertise over many years.
2. Rational ability: The ability to present a creative idea by redefining and establishing new relationships in issues.
3. Intellectual styles: Creative people often choose innovative thinking style in front of the organization's and senior management's approach.
4. Motivation: Creative people are generally motivated to engage their ideas.
5. Personality: Creative people generally have personality traits such as being Egyptians, being resistant to external and internal pressures, and being resistant to the temptation of congregation.
6. Environment: Creative people are generally more likely to emerge within the supportive environments [8].

Theories of theorists about creativity

Undoubtedly, creativity and innovation are one of the essential features of mankind that affects almost all dimensions and aspects of his life and civilization in full.

Table 1: Theories related to creativity

Theories of creativity	Theorist	Year	The theory
	Jean Piaget		-The training for me is to cultivate creative people, even if they are not numerous, even if one's creations are limited to one another. It is necessary for the inventor and innovator to be nurtured, not the follower, and the consequent.
	Guilford	1950	- "Creativity" is a divergent thinking (against convergent thinking). - He believes creativity is a set of abilities and attributes that give rise to creative thinking.
	Taylor	1988	- Creativity is shaping the experience in new organization.
	Tudor Rickards	1997	- "Creativity" means getting out of the molds. He also states that creativity is the discovery of new and significant things.
	Teresa Amabile	1996	- "Creativity" is the production of new and useful ideas in all fields.
	Edward de Bono	1968	- Creativity means lateral (or horizontal) thinking against vertical thinking.
	Gilliam	1993	- "Creativity is the process of discovering what has never been considered and the practice of creating new communication".

Froebel		- Creativity is one of the most important human needs, and he believes a process that begins with a child and ends with death.
Werthamer	1959	- Creativity is the ability to have a new and different look at a subject, the process of breaking and re-creating one's own mind about one subject and gaining a new insight into its nature.
Ellis Paul Torrance	1965	-Creativity is the process of susceptibility to issues, deficiencies, knowledge gaps, missing elements, inconsistencies, etc., identifying difficulties, finding solutions, guessing or arranging hypotheses about deficiencies, testing and re-testing, and finally, linking the results together.
Weinman	1991	- Creativity is the ability to get out of the ordinary world and go away from the trap of repeating and re-sorting the classes.

Reference: (Writers)

Creativity in architecture

Architecture is a kind of art and profession and a statement of mind. It is art, because it deals with composition, aesthetics, color, light, texture, and so on. It is profession, because it needs to be built and requires a variety of specialties. It is a statement of mind, since it is first thought as an idea in mind and then constructed. Creativity is the process by which the imagination is formed in the world. From the conception of something to its occurrence and building up, the process of creativity is evolving, and this is the creative thinking that transforms the idea into the framework. In the classic view (Vitruvius's look 25 BC), architecture derives from three strands of strength, utility, and beauty (form, structure, performance), and creativity can also occur in each of these three layers. Sometimes, structural and physical structure may appear as the most creative part of the work, either the form and beauty be the first letter effect or the function playing the creative role. These three can also emerge in a single project at the same time. Architecture is even applied in its most spiritual form. Because the purpose of architecture is to serve humanity [2]. Antoni C Antoniades [10] said: To create a different and wonderful design, an architect needs two realms of conception and imagination, and only one can create truly wonderful designs that combine both in the realm of conception and imagination.

Creativity is the central word in explaining the design process and creative training in all areas of design. Recognizing and defining the term "creativity" can lead to a better understanding of it and achieve a more successful process in the design process of architecture [7]. Creativity is the same as any other production process which has a product and its product is a new product that does not already exist. These techniques create an innovative form. It should be noted that in the history of architecture, it is rarely invented techniques that fundamentally change the way to achieve the form. Kamran Afshar naderi [11] proposes four techniques for creating creativity in a paper: displaying value, creating ambiguity, creating tension, changing form and deconstruction [2]. Recognition of the stages of the formation of an innovative idea in architectural design is one of the questions that have long been the focus of great art and architecture professors. Some thinkers believe that the creative design process is so complicated that the design and introduction of the components of the design cannot be separated. Based on the division into authoritative classic books of creative thought, the stages of the process of architectural creation are: insight, readiness, latency, illumination, and proof [7].

The prerequisites for architectural creativity

Antoni C Antoniades [10] said: To create a different and wonderful design, an architect needs two areas of imagination and conception. And the only one can create truly wonderful designs that combine both the realm of conception and imagination.

Imagination: The mental ability to create images of objects or situations that have not previously existed, for example, a person's vision of a walk on the water is a kind of imagination. Imagination exists only in the mind and cannot be real. Dreams and fantasies are components of imagination and are part of fantasy action. Like the doctrine of expressiveness, derived from the human imagination and rooted in the psychoanalytic doctrine of thought (as in the project of Anthony Gaudi), as well as the concept of a burst of rapture or creepy architecture, which was recently raised by Jenkes, is also rooted in imagination.

Conception: The ability of the mind to see things that exist. Conception is related to reality and it is the re-creation and repetition of what is exist. The constructive idea is that things can happen or happen, such as the concept of planting a tree and fertilizing it.

Imagination is an accelerating factor in conception, and conception is a kind of smoothness that imagination must adhere to connect reality. Dreams and conceptions that are formed in the mind must first be conceived in order to find an objective and physical symbol. Imagination and conception, together, help create new works and enhance the reality [2].

Influencing environmental stimuli on creativity

If environmental components help improve the environment, they can help creativity and take steps to collaborate with more inventions, and this can also be applied to individual creativity and convergence as a creativity. One of the most important things at the beginning is to focus on designing creative environments on many aspects. In many general research in this field, work has been done on wider workplaces such as creativity management and the social environment of work, politics, and culture, but at this stage, the focus on the physical dimensions of the environment is very important, as well as the environmental aspects of the environment, through which we can talk about the importance of creativity and the new definitions of creativity in the recent period. This set of physical components can be defined as a group of tangible and visible objects in space that have two functions; in the first dimension, they provide the physical space needs for the realization of its functions, and in the second dimension, they must have a creative approach to creativity. Therefore, the most important need in this process is the relationship between the components and the large organizational system that governs them, and needs are identified by this macro structure. On the other hand, the components of the learner's mentality and their perception of the environment will also affect these decisions [12].

Different research on the impact of physical environment on creativity, expresses the independent influence of some environmental factors on increasing the process of creativity development. The factors include the natural factors of the environment, the shape and extent of spaces, decorations, the stimulation of the natural elements of the environment, participation, flexibility of functions, and fantasy [13]. The two influential environmental factors are:

Natural environmental factors: Creating a natural environment landscape is effective in creativity development. Even the existence of plants in the interior is influenced by the creativity and creativity process.

The shape and extent of the spaces: The shape and size of spaces can be the basis for gathering people and creating groups for interactions and social relationships. The degree and type of group communication has a positive effect on creativity. Therefore, the design of space in terms of (shape, size, and performance) in such a way as to increase the amount of communication and to have a positive impact on the quality of these interactions, also affects creativity [14].

One of the environmental factors affecting creativity is the stimulant factor of the natural elements of the environment such as water, light, plants, and the like, which is associated with questions that question the relationship between the utilization of natural elements with curiosity and the motivation for imagination. For example, the use of colored glasses (which produces various colors of the spectrum of light) may stimulate curiosity. Light elements, which are a natural factor, are the stimulants of creativity;

Another factor motivating creativity is the flexibility factor of the functions. The flexibility of the functions is to allow space to be adapted to educational programs with minor variations for various purposes. For example, you can use the great space to perform a show; the other day, using the moving walls and moving them, the same large space can be divided into several smaller spaces. In fact, a space is used at different times for different purposes and functions, and has the flexibility to do so [15]. Zaha Hadid, in her style of work, says, "When we pass quickly through a horizontal realm, we can find space and ideas that relate to space, and then move and flexibility will play an important role. Hadid expresses the importance of mobility and flexibility in her plans, and we know that flexibility is one of the important roots of creativity. Hadid's working style is in line with those like Rem Koolhaas and Peter Eisenman who have always kept their creativity [16].

Table 2: Characteristics of with Low and High Creativity Potential

Physical Characteristic	Low Creativity	High Creativity
Complexity	High	Low
Light	Dim	Bright
Color	Warm	Cool
Plants	Absent	Present
Window	Absent	Present
Furniture	Inappropriate	Appropriate
Natural materials (wood, stone, etc.)	Absent	Present

Reference: [17]

Theories of theorist on creativity environmental factors

- Ernest Ville believes that one of the most important ways of flourishing creativity, is creating a stimulating, proneing and generally creative space. He believes that creating a creative and innovative environment is the most important factor for the introduction of new ideas. The environment can motivate people to express their creative thinking [18].
- The power of choice depends on the amount of mobility. A space that can encourage the user to move and discover space and inspire his curiosity can be effective in improving creativity. Unlike some other arts, such as dance, instead of moving an artwork or artist, the architecture is expecting the user to move [19].
- Attractive visual elements and symptoms are effective in creating readability of space and either in large-scale spaces for the sake of security and non-perplexity. Combining form, movement, color and light in these elements makes them attractive and worthwhile [20].
- The process of environmental perception is formed by receiving news of the environment. The news is divided into active and passive groups. Inactive news does not attract our attention, and on the contrary, we want to know more about the news. No matter how news is more active, it's new and more attractive, it challenges the mind more and makes people tense [19].
- Encouraging the user to move in space requires dynamic space. Dynamics is achieved through components and elements, dynamic forms and combinations. The tension that a diagonal line creates, is one of the issues of depth perception [19].

- Antagonism of order and disorder, full and empty, light and heavy, natural and artificial, new and old, inside and outside, leads to fresh thoughts and effective creativity development [11].
- Creating complexity because of the probability of being equal to the occurrence of each component and the lack of prediction, causes the less losing of information and the most possibility of creating new and innovative combinations [19].
- The effect of nature on creativity is also indisputable, so that its footprint in any creative research can be searched [10].
- The nature and its mysterious existence are filled with spaces that incite people at any moment. The current ambiguity in nature makes people think. Therefore, the combination of nature and architecture enables man to use natural spaces as a platform for activating thought.
- A variety of space experiences implying the environmental characteristics of places that have different forms, uses, and meanings.
- With a variety of space, one can compare and understand similarities and differences. In contrast, uniformity contains an information gap that undermines human mental and intellectual powers [21].
- In order to create a variety, the use of flexible spaces is recommended. The ability to separate and combine space, the use of light furniture, the multi-functional use of space, the appropriate breadth, the use of desirable shape and form, and the attention to the location of fixed elements such as stairs in space, are effective in generating flexibility [22].
- The sense of movement is a good motivator for learning, but paths that create a sense of confusion in humans do not provide a sense of security for learning.
- Zaha Hadid said: When we pass quickly through a horizontal realm, we can find space and ideas that are related to space, and then move and flexibly play an important role [16].

Table 3: Creativity Stimulus Environmental Factors

Creativity stimulus	Environmental factors stimulating creativity	theories
Environmental factors	Natural elements	<ul style="list-style-type: none"> - The effect of nature on creativity is also indisputable, so that its footprint in any creative research can be searched. - The nature and its mysterious existence are filled with spaces that incite people at any moment. The current ambiguity in nature makes people think. Therefore, the combination of nature and architecture enables man to use natural spaces as a platform for activating thought.
	Aesthetic Indices	<ul style="list-style-type: none"> - Antagonism of order and disorder, full and empty, light and heavy, natural and artificial, new and old, inside and outside, leads to fresh thoughts and effective creativity development. - Attractive visual elements and symptoms are effective in creating readability of space and either in large-scale spaces for the sake of security and

		non-perplexity. Combining form, movement, color and light in these elements makes them attractive and worthwhile.
	Variation	<ul style="list-style-type: none"> - With a variety of space, one can compare and understand similarities and differences. In contrast, uniformity contains an information gap that undermines human mental and intellectual powers. - A variety of space experiences implying the environmental characteristics of places that have different forms, uses, and meanings. - Creating complexity because of the probability of being equal to the occurrence of each component and the lack of prediction, causes the less losing of information and the most possibility of creating new and innovative combinations. - The power of choice depends on the amount of mobility. A space that can encourage the user to move and discover space and inspire his curiosity can be effective in improving creativity. Unlike some other arts, such as dance, instead of moving an artwork or artist, the architecture is expecting the user to move.
	flexibility	- In order to create a variety, the use of flexible spaces is recommended. The ability to separate and combine space, the use of light furniture, the multi-functional use of space, the appropriate breadth, the use of desirable shape and form, and the attention to the location of fixed elements such as stairs in space, are effective in generating flexibility.
	Engaging active and inactive environments	- The process of environmental perception is formed by receiving news of the environment. The news is divided into active and passive groups. Inactive news does not attract our attention, and on the contrary, we want to know more about the news. No matter how news is more active, it's new and more attractive, it challenges the mind more and makes people tense.
	movement	- When we pass quickly through a horizontal realm, we can find space and ideas that are related to space, and then move and flexibly play an important role.

		<ul style="list-style-type: none"> - The sense of movement is a good motivator for learning, but paths that create a sense of confusion in humans do not provide a sense of security for learning. - Encouraging the user to move in space requires dynamic space. Dynamics is achieved through components and elements, dynamic forms and combinations. The tension that a diagonal line creates, is one of the issues of depth perception.
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Reference: (Writers)

Conclusion

According to the exhaustive results of this research, creativity is a mental process consisting of the power of initiative and flexibility that aims to produce an innovative and valuable product. There is a common aspect in all architectural works and that is creativity. This creativity comes in two forms in the form of architecture: one theoretical creativity, that is, the basis of thought that the architecture is based on, and the other is the space creativity that forms the architectural part of the work. The most commonly accepted perception and definition of creativity by researchers is the creation of a new, valued and proportionate design. Creativity has the same techniques as any other production process that is the product and its product is a new product that does not already exist. These techniques create an innovative form. On the other hand, it can be deduced from the review of discussions related to the relationship between creativity and architecture and the achievement of an innovative architecture that the environmental characteristics and environmental conditions can have a great influence on creativity promotion.

In this study, due to the fact that it was generally discussed on the topic and subject, no specific study area or limitation was considered. In the literature of this research, after the recognition of the concept of creativity, the topic of creativity in architecture was investigated and the factors influencing creativity in architecture that lead to the promotion of creativity for the development of new ideas, were examined. Different studies on the effects of physical environment on creativity show the independent impact of some environmental factors on the growth of creativity. The result of this study is the achievement of environmental factors such as natural factors of the environment, the shape and extent of spaces, decorations, stimulation of the natural elements of the environment, participation, flexibility, imagination and movement, which are factors that stimulate creativity in the environment and that will affect the growth of creativity. With this explanation, the most important achievement of the present research is the achievement of the physical components of the environment that can stimulate creativity to achieve creative architecture.

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