Virtual Reality of Fantasy Travel Utopia

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Abstract

Virtual reality can be considered as one of the most influential technologies of the human future. Architecture as human life container is the most important platform for this technology. In order to understand outlook of virtual reality in architecture it is necessary to get familiar with this technology and its evolution. Many years ago, intervention of virtuality and reality was an impossible dream in the human mind. But when Jason Lanier, American scientist, announced realization of this dream, a new horizon was opened to the human. Although this technology initially was regarded mostly as fun and computer games, over the time, the virtual reality technology has become one of the controversial issues in art and science world. At first, non-immersive virtual reality came to existence and despite of evolution in human special imaginations, created challenges for the human in 3D world. However, after a while, immersive virtual reality made it possible to experience every spatial imagination foe the human. Architecture science was no exception in experiencing changes due to close relationship with special imaginations. Meanwhile, possibility of confronting the space designed in human scale, possibility for movement in the designed space as well as possibility for observing changes in different scales with lowest costs were changes in architecture world. But what which can fundamentally change future of architecture is combination of virtual reality and augmented reality, which allows the full integration of virtuality and reality.

Keywords: cybernetic knowledge, cyberspace, virtual world, virtual reality, virtual architecture, augmented reality

Introduction

If it is to classify human life over the history in three areas, it would in this way: first wave can be called agriculture era/ by start of this era, human residency in one region was raised and the architecture literally happened. The second wave can be called industrial age and the era after the Industrial Revolution in Europe, which modernism is one of its outcomes. The third wave is called electronic age which is defined by the invention of the computer and Apparent (father of current Internet).But if it is to investigate the relationship between architecture and computer, following classification is developed: first stage is the adage of involvement with digital technology under influence of cyber bank and deconstruction which also known as "hive seekers" stage. The second stage is visual influence of digital technology as "new mastering in work finishing". The third stage is composed of new generation of architects completely trained in a digital system. This era can be called era of scientific influence of computer on architecture. This generation of architects considers computer merely as something inevitable. Computer and generally novel technologies caused emergence of various software and hardware for designing and it was possible to draw many conceptual plans in a short time with high quality and evaluate their implementation feasibility in real space (Rivard, 2000). Computer played significant role in primary designs in architecture field. This role may be manifested in areas of plan infrastructure computation, needed components and feasibility of plans (Fig. 1). Generally since the advent of the computer and designing various

software applications, designing conditions, implementation and evaluation of the plans was made possible in the shortest time (Schmidt et al., 201). The building plan is viewed through smaller lens in the work of architects who use computer, which can be extended over the time. In the view of these architects, the main thing is not achieving new forms; rather it is achieving new working formats. Final aim of this work is investigation of the definitions in virtual reality area and especially virtual architecture as well as investigating effect of this new looks to architecture in daily life.
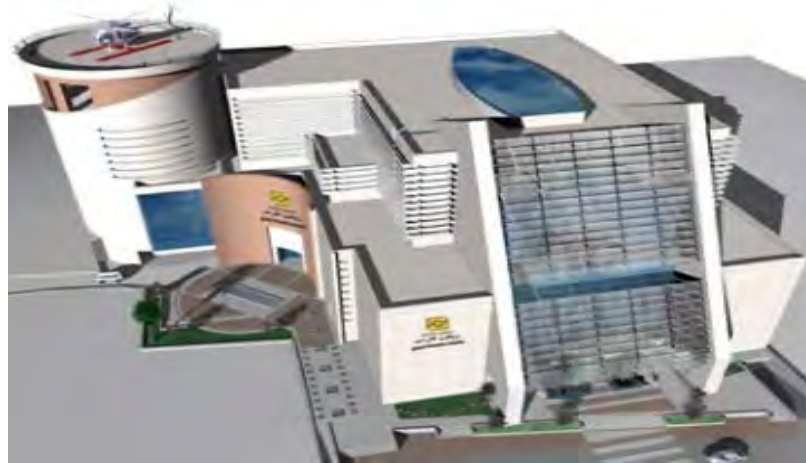

Figure 1. Computer output sample in building designing

Cybernetic Knowledge

In terms of genealogy, the he word "cybernetics" comes from the Greek word κυβερνητική (kyvernitikí), which has different meanings such as guide, rudder and mediator. Verb origin of the word κυβερνητική is κυβερνώ which means steering. *LouisCouffignal* (1958) defined this knowledge as the art of action efficiency guarantee. Cybernetics can be defined as effective organization. Aim of this knowledge is preserving a system in sustainable balanced state in order to study effects of the system inputs for obtaining perceivable outputs with sustainable state. This knowledge deals with controlling the operations by complex systems (*Dreyfus*, 2009). Meanwhile, cyber space can be defined as the cross-media network in which a varied collection of communications and relations are connected via hypertext applications. Two main notions of cyber space can be divided in this way (Sysmondo, 2010):

- Steer notion, it is available through space of electronic data.
- Control notion, it is possible by manipulating data.

Virtual World

Some technologies seem interesting even in their naming. One of such technologies is virtual reality. Nowadays art or technology of virtual reality is one of the controversial issues inscience and art worlds. Unfortunately while advanced countries have entered a new era in terms of using this technology in education, cinema industry, industrial production, testing inventions, ultra-reality conceptualizations and even architecture, its techniques and methods are fully unknown in our country and even a group of experts including architects, who could be its main users, are unaware of its definitions and its optimal usage cases (Eftekharzadeh, 2012). Virtual reality, as its name represents, would create real sense of virtual images. But it does not confine to this point, and virtual reality has penetrated in various fields and it has distanced considerably to its primary form. At the

beginning, this technology was mainly regarded as a fun, but the trend has changed essentially now. For the people who deal with computer and internet, understanding the virtual world, which would be called as virtual world in the near future, is not so difficult. In fact, virtual world would be turned into a part of your unconscious mind and the boundary between real and virtual world would be vanished (Eftekharzadeh, 2012). Most experts consider virtual reality technology as the most influential technology of the human future after internet. And they provide predictions based on which. For example, last year, Forbes magazine held a contest in which designers, journalists, and IT professionals were asked to predict the future of technology world. It brought up very interesting results and most people considered virtual reality as the most important event of the future years. According to experts, in the next years not only the computer would penetrate in all aspects of the life, but also it would become a main part of us. This technology would penetrate in all aspects of our life and influence these aspects. For example, as a result of technology development in the future, the way of trading, traveling and even health care would be changed and thus the way if interaction of the people in the community will be considerable changed (Bell, 2009). Experts state that the cell phones and glasses which use virtual reality technology will change the way if commercial transactions in the future. There might be no need for large stores that their showcase occupies one side of the street. Perhaps the whole streets turn to showcases in the future. For example, a lady or man likes cloth of a passer-by, she can check the cloth brand and price instantly and if she tends, she can order for its purchase at the same instant. It is a very small example for the changes which virtual reality may create in our future life. Assume that you sit in a restaurant; you can instantly see how much calories, protein, carbohydrates or fat enter your body by any food you order using virtual reality. Virtual reality also may create changes in routine social networks. For example, when you sit in coffee shop, you can see your social network profile on the wall or table in the environment you sit using smart glasses. According to experts, all of these changes will occur by 2020, and all of us will be involved with virtual reality in our real life (Mahian, 2012). Thus importance of special loo to this technology especially in architecture is felt.

Virtual Hyper-Reality

Human future is surrounded by digital world so that a concept known as digital footprint makes human accessible as data and everything in this space are turned into data which can be manipulated and managed. Human beings living in this space live actually with data instead of living in reality. Such data denote realities (Bell, 2009). It is in such space that Baudrillard's concept ofcritical simulation helps human to explain distorting phenomenon of images series. According to Baudrillard, increase of media images in the community causes decline in human perception and understanding of what is real, so that the human himself becomes media and lives in between screens or as screens. The culture resulting from hyper-reality is the state where distinctions between real and imagery and surface and depth are eliminated due to sign *Simulacrum*s which are all copies without originals.Baudrillard talks about Simulacrums which refer to the other without any reference to the reality (*Dreyfus*, 2009). The famous quote by Baudrillard as "the gulf war did not place" suggests mediated western world which uses simulation for ideological purposes. The situation which is talked by Baudrillard is the world where Media such as radio and television and other visual media dominate. If Baudrillard's critical literature is used for virtual space, it should be said in the world of digital data everything includes an infinite chain of symbols where refer to each other. In such space, where the human beings have turned to data and it is argued realities are also ordered as data, no symbol directly refers to reality (Sysmondo, 2010). In this situation, human beings become mere media users, because they lives as data among data which are lost symbols in infinite chains that refer to versions without original (Bell, 2009).

Look at Virtual Reality

The term virtual reality was originally used late at 1989 by Jason Lanier, American scientist and author in computer sciences who can be known as virtual reality father. Later other terms were proposed for this new technology with advancements in this field. Myron Krueger, American scientist with PhD degree in the field of computer controlled environment and one of the pioneers of virtual reality technology applied the term "artificial reality" to these spaces. Virtual environments are essentially applied on the environments which are fully embedded in the memory of the computer. Virtual spaces as computerenvironments which include a large number of computers, users, and datacompose an integrated virtual space. Virtual reality can be classified to three levels:

- Level of Interaction: interactive virtual reality is related to the experiences which majority of the people deals with in their daily life. Experiences such as watching TV, watching movies and reading book.

- Level of Exploration: explorative virtual reality means exploring in a 3D environment through computerscreen.

- Level of Immersion: immersed virtual reality is the perfect stage of virtual reality where the user confront virtual environments and almost simulation has been done for all senses and behavior of the user directly influences virtual environment.

By advancement of the science, along with the virtual reality, human achieved such technology which might be impossible. It was called augmented reality. Augmented reality is a technique which combines a living view with virtual images created by computer and an augmented reality beyond what is seen seemingly is developed. Augmented reality was developed since 1990. Its initial idea was provided by Thomas Caudell, Boeing Company's employee in 1990. Augmented reality is related to reality rather than virtual reality, because in augmented reality, there is a reality in the current time and then realities which are not seen in surface are added to it. In fact, augmented reality is surface between virtualenvironment(totally virtual) and ulterior understanding (totally real). Other terms such as additional reality or ulterior reality can be used for it. It should be noted virtual reality has a different concept and it is older than augmented reality. Augmented reality term was initially used by a French poet and playwright in 1938. He regarded theater as virtual reality. This technology have been used in various sciences such as medicine and military and it has been common (Shintani, 2009). Augmented reality includes following main features:

- Combination of reality and virtual world
- Instantaneous interaction
- Creating a 3D space.

Virtual Reality

By definition, virtual reality includes induction of sense observing objects, scenes and phenomena and real creatures to the viewer, while these things are not true and in fact have been created by a variety of technologies. These technologies mostly use computer techniques for creating objects, and simple and complex 2D and 3D graphic methods and techniques are used in this process for representation ofobjects and scenes better to the users. Virtual reality has been used as a powerful method for presenting non-real scenes as real ones to the user. One of the small and common applications of virtual reality is computer games. In these applications which have many users, the users face a collection of 3D and sometimes 2D images which give sense of presence in a real space through proper arrangement of the scenes.

Three areas which changed virtual reality in architecture include as follows (Bell, 2009):

- Action and interaction process of architecture is directly influenced by advances in information and communication technology.

-        Creation of altered cognitive spaces which are product of new conceptual – experimental areas, and may have brought possibility of imaginations of other types.

-        Interaction between architecture and virtual reality technology, designing cyberspace.

However, virtual reality has brought two major achievements:

-        Interaction and ability to engage and influence with the virtual reality world.

-        Ability to immerse in this world, on the other hand.

Tools Used in Virtual Environments

HMD (Head Mounted Display): HMD include a head in which two display screens are placed. Represented images can be observed easily in these screens using visual tools, or it is possible to change their dimensions. By increasing dimensions of the images, such image can be shown to the user which covers all his view.

Movement Trackers and 3D Input Tools: one necessary technology for confronting virtual environment is use of 3D movement trackers. These tools are available in various forms and are used for tracking body organs (such as head, hand, foot) and objects (such as mechanical components devices) which have movements. Trackers are used for finding situation of the objects in real world.

Receiver: receivers are usually connected to a HMD or Cyber Glove. If the receiver is connected to HMD, if the head moves in real world, necessary changes are developed also in the virtual world. If it is connected to Cyber Glove, his hand movements can be simulated in virtual world using data received from the receiver.

Data Glove: it is an input device which works like Joystick. This device works like a hand in virtual world. The user can move this device in real world by his hand movement in virtual space and accomplish the task assigned.

3D Audio Tools: new spaces can be simulated by development of these tools. These spaces include multi-dimensional private spaces. Using hardware and software packages of this group, it is possible to create and change virtual spaces. People in these virtual spaces can have ordinary experiences of the life and also experience non-conventional activities such as travelling to another planet.

Virtual Reality Applications

Application of this technology is growing more and more due to rapid progress of virtual reality and many scientific and industrial fields will be able to use this system. The main applications of virtual reality include: (Shintani, 2009)

-        modeling system behavior and performance
-        simulated accident
-        simulating artifacts under repair
-        correcting errors in architecture of system
-        scientific hypothesis testing in virtual environments
-        simulating movement of vessels
-        virtual simulation of yachts
-        simulating shipwrecks
-        virtual prototyping of yachts
-        use of robots in manufacturing
-        constructing virtual prototypes in automobile industry
-        use of augmented reality in design, construction and maintenance
-        discovering hazards using augmented reality

Augmented Reality

Augmented reality is one of the latest technologies applicable in smart phones, tablets, urban kiosks, etc. which integrates real view with virtual visual elements and opens a new world to you. Augmented reality is a living physical view in interaction with the user which adds virtual elements in the real world surrounding the people. These elements are created based on computerized production through receiving and processing images taken from smart phones' camera and geographical situations (Sadeghipoor, 2012).

Using most today systems is very difficult due to complex user interface. It is relatively because of lack of adequate competence in designing interfaces and user interfaces which cause difficulty for many engineers. More importantly, considering growing computational power of modern systems, tools and applications which would be more complex should contain more features in more integrated manner. Hardware and software tools which were accessible only to a small part of the experts several decades ago are now completely integral part of everyday human life. To this end, using one appropriate user interface design is not considered as an option, rather is a crucial need for development of applications which should be highly capable (Shintani, 2009). The aim of studying augmented reality (AR) is development of new computer – human interfaces. Instead of showing data on separate systems, this system would place data exactly where they belong: that is, in real world. To this end, augmented reality would cause distinction between real world and user interface diminishes and they are combined in a natural way so that human being is able to develop simple and inherent user interfaces even for complex applications.

Virtual Reality and Augmented Reality Difference

Unlike virtual reality which immerse user totally in the virtual environment, user is adding augmented reality freely to the interacted environment and virtual objects represents issues which are ignored by the user. Virtual and real world are not simply summed, rather they are in interaction. Characteristics of the augmented reality system and environment include: interaction of virtual world and real world, three-dimensionality, time-located (Mohegh, 2012).

In virtual reality programs usually the whole scenes are implemented as 3D models, while a combination of real world and modeled world is used in augmented reality approach, so that real world scenes are placed beside 3D models and their combination provides high variety to the program producers.

For example, a populated street with large number of buildings can be shot and 3D or even 2D graphical objects can be placed simultaneously in parts of the environment as simulated form. This technique is somehow similar to special effects in some films in recent decades. That is, addition of deficiencies in the real world by a computer techniques. Difficult activities such as matching perspective of objects with the scene, image processing to identify objects in the real scene and matching them to graphic objects and artificial intelligence techniques for intelligent graphic and real scenes are used (Research & Development Department in Rah Shahr Consulting Engineers Co., 2012).

Augmented virtual reality has various applications including simulation of traffic operations in streets, simulation of combat operations, simulation of objects or advanced equipment available or actual scenes or simulation of very large or very small objects in the ordinary environments. One interesting application of this approach is helping education. For example, several modeled military equipment with the best quality and compatibility with the real world in a desert can be represented. It means putting graphical objects beside natural scenes which is a very difficult task in terms of modeling and especially programming. In fact, it can be said with the aid of virtual reality and augmented reality technologies, it is possible to add any type of object and device at any location

(for example, a sea, a forest, a desert or a city environment). This application may bring interesting results in education, research and industrial simulations and especially military areas.

However, an important point in augmented reality is the way of presenting scenes to the user. Various options are available in this regards. The most common way of representation is using a display screen. This display screen may be flat or rounded or dome-shaped, each of which can offer special applications. The other way is using special HDM glasses. The user can wears it and views the scene before his eyes. Also, simultaneous shooting the scene and inserting graphic objects to filmed stage is possible. This technology recently has created extensive application in military industries (Shintani, 2009).

Paul Milgram (1994) provided interesting definitions for these concepts. He believes that in visualization, range of real world to virtual space has a continuous path, in which virtual elements can be entered into real world or real elements can be included in the virtual environment.
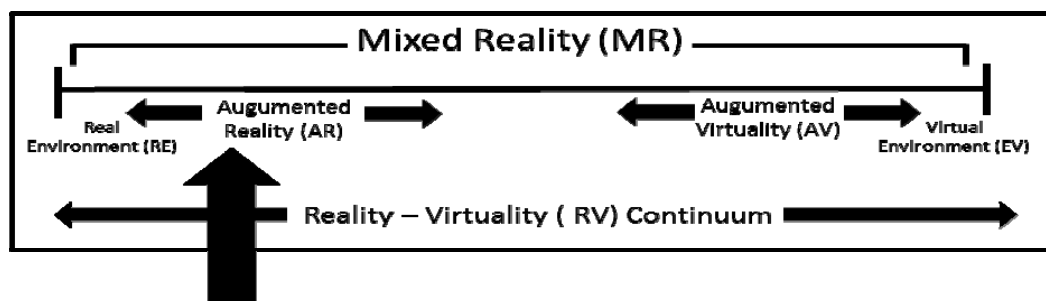

Figure 2. Range of virtual reality and augmented reality

Fig. 3 shows block diagram related to virtual reality. As emphasized in the figure, what is considered as the environment in virtual reality is a model of the real environment, not itself. In order to achieve the goal of augmented reality, it is necessary to use a special type of HDM which allows user to see the environment.
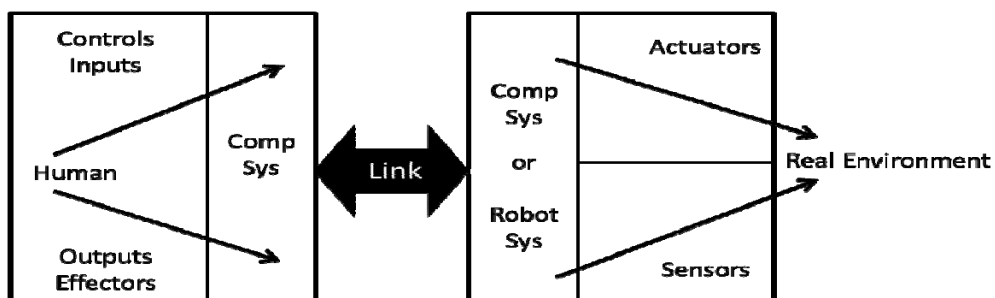

Figure 3.Block diagram of virtual reality

Virtual Reality in Architecture

Virtual reality process, in the sense that representing virtual thing which is not real in real form, is not a new concept. Architects always have utilized this property and deception of human perceptions for creating special spatial qualities. However, another thing is considered here, which is known as virtual reality.

Virtual reality is in fact a Computer emotional experience. It is such experience which sometimes so real and attractive whichtotally puts the experiencer in wrong. Withtechnological advances and invention of advanced super computers, it is possible to experience and control the

whole plan before birth and perceive it in human and real scale, and it can be used in reconstruction and representations of the buildings with the minimum cost. Virtual reality technology is classified into two classes:

Non-Immersive Virtual Reality

This method of virtual reality is also called screen-based, since the designer or audience is not entered into the space in this method, but he sees representation of the spaces on the screen, tracks them, approaches or distances objects virtually and can see this movement and angles of view matched with human and real space scale. This method, which is highly common, is suitable for training architecture and visiting inaccessible or destroyed buildings with their original historic sense. There are many historic remaining from great buildings in our country. Restoration and realization of them through virtual reality may help their repair and reconstruction in proper way with minimum cost. It is the best way for providing understanding of the ups and downs eras of Iran for contemporary artists.

Figure 4. Designing with non-immersive virtual reality (source: Eftekharzadeh, 2012)

In this method, all spatial, lighting, construct, volumes, relations, etc. can be controlled and ideas can be created in a more realistic way (Fig. 4). This method can be considered as the advanced method of model scope use, with this superiority that scaling and approaching or distancing to the components and details are directly controlled and it is more natural.

Regarding specific use in design process, this method is not too far-fetched; nowadays most design offices are equipped with advanced software and computers which allow them to use this method. Volumes can be constructed in architecture software and be placed in spaces and even it is possible to create animations. The point is proper use of this technology in design process so that the design is not affected (Eftekharzadeh, 2012).

Immersive Virtual Reality

In this method, the observer is placed in the imaginary space with some measures and experiences a space with all his senses which is not real. Of course, although this system is more efficient and powerful, it is also more costly and less accessible. However, it is the best method for

architecture space creation and experience. In fact, virtual reality system can be considered as composed as three elements: listing, behavior making, and establishing mutual relationship. In this method, the observer achieves necessary results through observation of a real and accurate compute shape after analysis. Shapes may be virtual or real, but have real behavior. Here, the user communicates with the computer through investigation in the environmentand pointing in order to moving objects or talking to someone, or even observing the scenery from different angles (Fig. 5) (Eftekharzadeh, 2012).
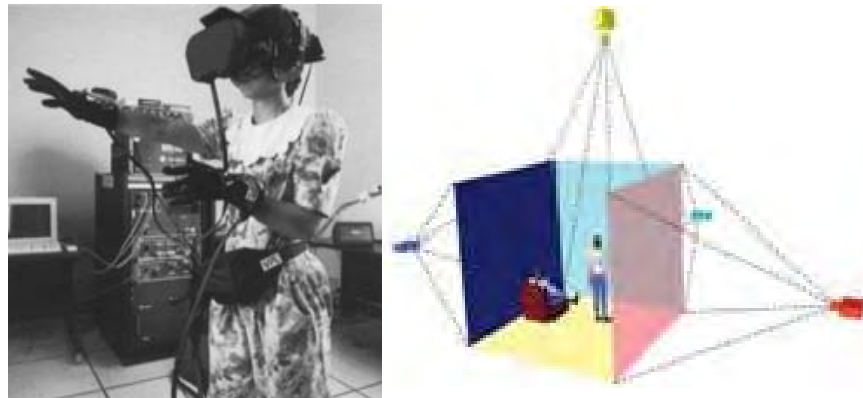

Figure 5. Designing with immersive virtual reality (source: Eftekharzadeh, 2012)

Using this method the designer can enters its idea's space and applies any change step by step. He can perceive and observe unconstructed spaces and control any elements. More importantly, he can take employer also to the space and show his ideas to him and is formed of the employer's demands and opinions. As it was observed, it is possible to extend limited real boundaries to infinite using virtual perceptions. Such spaces are now used extensively in art and cinema industry (Eftekharzadeh, 2012).

Virtual reality can be very powerful tool for creating any type of space. This space cannot be developed easily. Its creation requires expertise and professional programming. Although two systems, Fly through and Walk through, are currently used for urban designing and setting, making it common and public requires training and skill. This system, in which the design and designer are integrated and all perceptual issues are provided in real manner to the designer, not only is the best tool for mapping the plants, but also it is the best tool for experience and knowing architecture and its instruction at the university. Now that there is not opportunity of living and direct experience like situation of the past architects and there is no space for Trial and Error, this tool can be the best alternative (Eftekharzadeh, 2012).

In addition, who knows? Perhaps the future needs no physical constructions anymore and everything would be shaped based on virtual reality. Even if it is not happened, it is clear that demand for this type of spaces will be increased for different reasons. The next generation of the architecture and space creation is on the way; thus, why architects are not the designers of these spaces? In case of negligence, architects would lose their role as architect engineer in the community, as experience of architect designers has been questioned now because of dominant presence of computer and other modern tools and superiority of information and communication needs over physical needs in many areas especially in business and administrative centers (Eftekharzadeh, 2012).

Virtual architecture can be considered as an approach toembodiment of the physical architecture based on virtual reality technology. Virtual architecture is a foundation for combination of visualization and design using virtual reality technology aiming at reduction of environmental limitations and common methods for architecture designing. Virtual reality technology attempts to be turned into a transparent and communicative media so that a range from presentation techniques on the scene to providing a type of media involution for architecture designing is provided.

Turning virtual reality technology to designing flexible media enables architects to conceptualize their plans inrevolutionary manner. On the other hand, they will be able to impose more controlson plan. Imagination of new space and time in media age is created by virtual if invention of perspective is considered in optical revolutionary Renaissance for change in architecture, simulation technology in 1980s and virtual reality in 1990s can be considered as mutation which is regarded as turning point in application of the tool and its domination. This view provides an introduction on emergence of new opportunities and concepts with reliance on new media of life revelation and offers it to artists and architects (Eftekharzadeh, 2012).

This technology is as important as invention of telephone, TV and automobile. Virtual reality technology would become a daily necessity after a while. The beginning of this turn is a full-scale change which occurred in communication with the aid of virtual reality technology. Virtual technology enables communication in which there is no need for physical contact. Thus, travels around the world are reduced,and fossil fuel burning is prevented. Environmental risks can be reduced and international tradeis facilitated (Mahian, 2012).

Future of Virtual Reality

If you think augmented reality and virtual reality have no place in technology industry in the future, you are working, and if you are going to change your view rapidly, it is good to have a look at smart phone advances over recent years. One expert in this field states: I don't think if we return to 2005 and someone gives you a smart phone and says it is to be able to have computer processing power, you could hardly believe. Perhaps even no one can predict buying these tools and having such great market all over the world. Thus, we might not express opinions correctly now about such technologies as virtual reality; however, it can be ensured if there is suitable hardware, bright future will await this technology. For example, it should be stated a new headset with virtual capability was introduced in Quakecon Conference which was highly welcomed. One of the individuals who supported this idea was John Carmack, ID Software programmer, who said: "if I believe something, I certainly will expect a bright horizon for it and I will simply express my opinion in relation to technologies that may fail in the future too, but it is different regarding virtual reality, and those things which are related to neural interface will be interesting in the future for all". In fact, the virtual reality will approach to its real sense in the future and you will see a reality which has a very real influence, but it lacks the original shape of the reality it represents. Perhapsmanyindividuals introduce virtual reality as a kind of simulator or truth alternative in simpler definitions. Today creating virtual environment is not a simple task and it is because of technical limitations. It is also because processing speed of computers, resolution of images and communication bandwidth are not the same everywhere. Knowledge of virtual reality is experiencing a huge leap compared to the past (Mahian, 2012).

Future of Virtual Reality in Architecture

Future of virtual reality is not clear exactly and no one knows where it is going, however, it should be accepted virtual reality has entered the human life and is progressing considerably. According to Moore's Law where technology advances doubles every 18 months, it can be said virtual reality would be extended generally to our homes by 2037. It is development of immersive

virtual reality and augmented reality combination which can promote this technology in the architecture future. Suppose that the designer can enter his idea's space in the respective site and performs any change and design step by step simultaneously. He can perceive and observe unconstructed spaces and control any elements. More importantly, he can take employer also to the space and show his ideas to him and is formed of the employer's demands and opinions.

Virtual reality technology so far has been able to simulate sight, hearing and touch senses. Virtual reality future can be imagined in taste and smell simulation, which makes this tool unique at level of architecture presentation and design. Involvement of all human senses in virtual architecture can open bright windows in architecture science. This approach can also change architecture educational system. It can change design process, it can change combination of architecture science and cybernetic science of architecture structure (Fig. 6). Architects can explore architectural designs in various dimensions at the site location with the minimum cost. Designing based on human view and designing from inward to outward will be changed significantly and it can be educated easily. The other future change of virtual architecture is analysis of architecture in various points of the world in different views and possibility to develop architecture education system. It can be said in the near future, it would be interwoven to idea to realization process.

Figure 6. Combination of architecture science and cybernetic science

Conclusion

Considering studies on virtual reality and obtained results it can be said this technology is at the beginning of the way. However, significant achievements have been obtained so far using this technology. Thus, scientific and financial investment in development of virtual reality applications can bring about bright future (Research & Development Department in Rah Shahr Consulting Engineers Co., 2012). Overall, it can be stated the most applications of virtual reality are pun in three categories:

Simulation, visualization, reality escaping.

Higher user safety, low designing and implementation cost, flexibility of virtual environment and easy change based on the goals and conditions are advantages of virtual environments. Virtual reality has many applications and extraordinary potential so that the users are able to experience near life model or walk in a secure environment and they can have control over this environment, which might be impossible in real world. However, at the end of 2013, virtual reality took new shape: new augmentation of the physical world and virtual world. With these definitions and changes, it seems augmented reality will be new member of our world.

Meanwhile, possibility of confrontation with virtual space at any scale, movement to virtual space, observing changes at any scale and interference of virtual environmentand real environment in virtual reality have provided broad range in virtual architecture which is highly important. Development of immersive virtual reality and augmented reality combination and inducing smelling and tasting senses in virtual reality may create great changes in architecture science. Virtual reality

future can change architecture education system, architecture design process and employer and architect designer relationships fundamentally.

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