Developing Internal Designs Synchronized By Outstanding Hologram Technology

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Abstract

Holographic technology is a unique technique that gives the ability to re-create a three-dimensional image of objects in space depending on the laser and the principle of overlays. Until now, research seeks to highlight the importance and role of holographic technology in developing interior designs and designs processes. This special technology and its potential compared to other new techniques are investigated through a realistic questionnaire which is done on the specialists and field workers to achieve reliable results. This technology can be implemented to be used in architecture education and architecture firms to develop the design aesthetically and functionally synchronized with modern technologies.

Keyword: Hologram, Interior design, furniture design, architecture education.

1. Introduction

Holography can be referring to as a method of obtaining photographic image in three-dimensions. The word hologram is Greek, the root words are holos, "whole"; gram, "message") and translates into 'whole picture'. Holograms differ from ordinary photographs, because the holograms record an extremely accurate three-dimensional (3D) image of the original object. A hologram is a three dimensional record of the positive interference of laser light waves. A hologram is a physical structure that diffracts light into an image. The term 'hologram' refers to both this material encoding and the resulting image. A hologram is an image and a shaping of light.

The structure of a synthetic hologram is made of thousands of 3D computer graphic images corresponding to as much points of view on a three-dimensional scene. These can be done without a lens, that is why is sometimes called lens less photography.

Dennis Gabor in 1947 had the credit of father of holography for theorizing the modern holography's principles. A hologram looks so realistic because it is an exact recording of the light waves reflected from the object. Holograms do not usually reproduce the true colours of the original object. The image's colour mainly depends on the colour of the laser used to make the hologram and processing

methods. Multi-coloured images are created by using different lasers. The most common type of laser used is helium-neon (HeNe). Even though some holograms are made from diodes from red laser pointers, they are usually unstable and less coherent. Although, holography is generally referred to as "lens-less photography," it requires lenses. Unlike photography, holographic lenses spread out beamed light in hologram (1).

The hologram captures light as it interests the whole area of the film, hence being described as a 'window with memory'. By contrast a photograph captures a single small area 'aperture' of perspective, the photographic image being created by focusing this light onto film or a digital sensor. The physical medium of holographic film is photo-sensitive with a fine grain structure204. The physical structure of a hologram is recorded by the interference pattern of two or more optical-wavefronts. With display holography, this is usually an 'object' beam that emanates from an illuminated scene or the projected image on a screen, and a 'reference' beam that is shone directly onto the holographic recording medium. These wavefronts combine at the recording medium as an interference pattern of constructive (intensity peaks) and destructive (elimination) of the superimposed electro-magnetic field. By using a coherent laser light-source and a stable geometry (or short 'pulse' duration), the interference pattern is stationary and can be recorded into the hologram's photosensitive emulsion. The hologram is then chemically processed205 so that the emulsion has a modulated density, freezing the interference pattern into 'fringes. (2)

2. Holograms process

The hologram process involves using a laser, a beam splitter, two mirrors, two lenses and the object itself. The laser beams light into the beam splitter, which divides the light into two, figure 1.

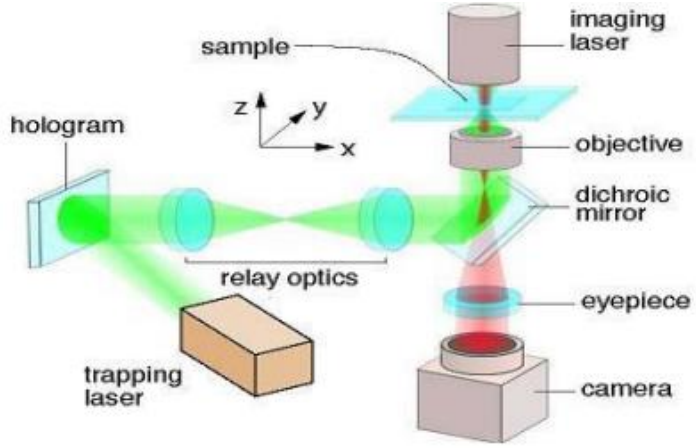

Figure 1: Diagram of the hologram (4)

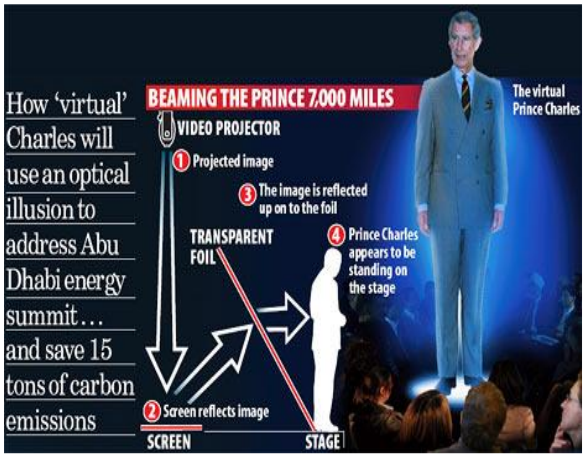

Figure 2: Prince Charles appear in Abu Dhabi as a hologram (4).

Before the first lasers, the first holograms weren't three-dimensional, but flat two-dimensional transparencies made from the very slightly coherent light of a sodium vapor lamp. In 1962, Emmett Leith and Juris Upatienks, at the University of Michigan started making of three-dimensional holograms. Now hologram can be projected in a complete 360 degree holographic display. Also, the "Holograms" evolved from stationary to animated, such as we saw in science fiction movies as a Star wars 1977, etc. or in Holographic studio at the VVC (All-Russian Exhibition Centre), Moscow. (3)

Sometimes back the president of the Microsoft Corporation Bill Gates appeared holographically in Kuala Lumpur to address a group of people. Prince Charles also addressed a crowd in Abu Dhabi via holography (Figure 2). One of the most famous uses of "Holograms" in Arab world was used to produce projections of dead celebrities and politicians in MBC famous Television programs.

The way holography operates is by creating the illusion of three-dimensional imagery. A light source is projected onto the surface of an object and scattered. A second light illuminates the object to create interference between both sources. Essentially, the two light sources interact with each other and cause diffraction, which appears as a 3D image, as shown in Figure (1).

The research aims to explain the importance and role of holography technology in the development of interior designs and processes.

The research also discusses the ability of this technical tool to modify the design without any material loss or waste of time.

3. Latest applications of Holograms in interior design and furniture

Hologram is a revolution in architecture and interior design. Perhaps one of the most obvious uses for holography in an architectural environment is the recording of models used to pre-visualize new

buildings and urban regeneration and development plans. Architects, planners and developers produce detailed models of their structures as a method of presentation to clients.

Embossed holography, apart from offering an economical mass-produced material for packaging, promotional printing and novelty items, has given artists and designers a new material to work with permitting large areas of holographic pattern to be used in buildings and sculpture. The use of these holographic tiles becomes a useful source of decorative material for interior design and the production of cladding for larger structures.

Also, Glass top furniture including holographic diffraction material became popular. These are purely visual effects incorporated into products which can be used to ‘decorate’ an environment, but the same idea of diffraction and tiling has been used by artists as a way of building larger scale objects and installations, while at the same time allowing them to ‘move’ or distort space and the objects which appear in those spaces.(5)

The opportunity to use holography for the incorporation of different spaces into sculptural and painted objects has attracted artists since the early days of the medium. Optical illusion (the shape and placement of the holograms and paintings), figure 4, is used to enhance the impression of depth in this work, along with the actual three-dimensional space in the hologram sections and the multiple thin layers of paint on the canvases, which help to give an impression of "infinite depth". (6)

One recent project, which moves this concept out of the refined atmosphere of a gallery and into a more public space, combines floor placement as well as hanging, mobile elements, is "Perpetuum Mobile" by artist Dieter Jung (7) installed in the European Patent Office, The Hague, Netherlands, in 2001. This includes a holographic floor area of 16 square meters with a 4.5 meter mobile structure hanging above; as shown in figure 5.

Figure 3:Glass top furniture including holographic diffraction material (8)

Figure 4: Hologram usage in Optical illusion (6)

Figure 5: holographic floor (6)

Lately, Microsoft has envisioned a world of holograms which is set to have a profound effect on the building and design industry. The company's new wearable technology, entitled HoloLens, figure 6, is a headset device affixed with ski-mask type lenses to create holograms.

It allows the user to interact with an augmented reality version of their surrounding environment by navigating with their view. It also uses voice recognition and hand motions to create the new reality. The device's ability to scale items in real time, add details to existing products and visualize what a building might look like could make it invaluable to the architecture and interior design . Microsoft describes the technology as "extension" of Trimble's tools, converting 3D models to life as full-scale holograms.

The technology is founded on the basis of improving accuracy and providing easier collaboration between project users.

Figure 6: HoloLens as headset device affixed with ski-mask type lenses to create holograms. (9)

Figure 7 : Hologram converting 3D models to life as full-scale

In a video detailing the partnership, Ben Sugden of Microsoft said HoloLens will give architects "much higher confidence around decision making."

"One way we can do that is see them literally immerse themselves in the building and see the street side and how the buildings going to look," he said.

With connectivity also comes the sharing of software, which allows users to share their ideas and holograms with others. There is even Holo studio, which will let users turn their physical objects into 3D print compatibility, figure 7.

According to Microsoft, the device itself contains more computing power than the average laptop but requires no wires, external cameras or phone or PC connection. It is passively cooled with fans and allows the user to move freely, walking about as they would on a project site.

The headset itself is adjustable and there is an option for prescription lenses.

Another key benefit for the architecture and design industry will be the ability for everyone to visualize what the building, product or other item will look like.

Currently, people working on a project work through "paper" or plans. Interior designers can show clients exactly how a coffee table will look in a room or move furniture around in virtual real time.

Architects can show developers what a building will look like from each angle.

Still, many forecast that wearable technology is the way of communicating in the future.(9)

4. Hologram technique and similar design program

In the last couple of years, digital realities have become a more and more stable part of the software landscape. While these technologies aren't as main stream as apps for your iPhone or a website for your favorite pizza place, they certainly are pushing their way forward and popping up their digitally

distorted face in all kinds of places. Companies like Oculus, Facebook, Google and Microsoft are all heavily involved in developing digital realities for the future of computing.

However, they aren't all created equal. In particular, there are three main areas of digital reality.

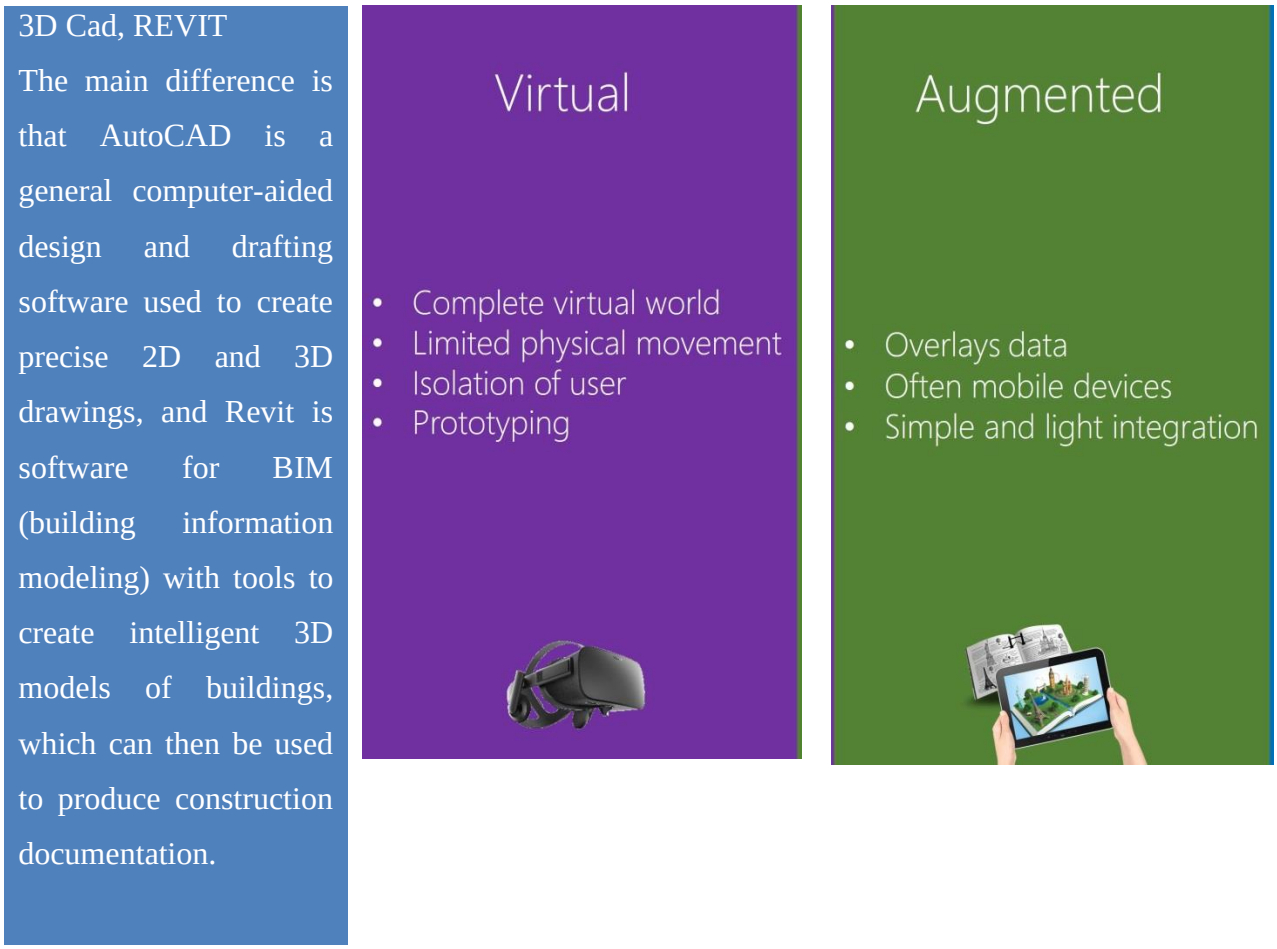

Figure 8 : Similar design program to hologram

4.1 3D Cad, REVIT

Autodesk AutoCAD and Autodesk Revit are the two primary applications of architecture industry. AutoCAD is an amazing tool for drafting of interior and exterior of buildings while Revit is a smarter solution for creating exact plans to build information modelling (BIM) for larger projects. The main difference is that AutoCAD is a general computer-aided design and drafting software used to create precise 2D and 3D drawings, and Revit is software for BIM (building information modelling) with tools to create intelligent 3D models of buildings, which can then be used to produce construction documentation. Revit is exclusively for building design and engineering. In other fields AutoCAD may still dominate or there may be different better options.

4.2 Virtual reality

The principle of virtual reality has been around since the 80s, where the promise was great and the

application was less. Virtual reality is a complete virtual world that someone has designed and built for the user. It encapsulates everything around you and removes the physical world completely. This also means that users are confined to sitting or standing still, as they can't see where they are going (it's amusing for the spectators though). The majority of use cases I have seen for VR are either gaming or simulation, and VR lends itself well to prototyping as you have full control over the environment and reality the user experiences.

Figure 9: Virtual reality usage in interior design

4.3 Augmented reality

Often involving a token, shape or other physical object, AR is the idea of taking your reality and altering it slightly. It could be a kid's book coming to life when looking at it through your phone's camera or a t-shirt showing the latest movie when activated through an app. It is an overlay of data, often activated through a mobile device. (10)

Figure 10: Augmented reality usage in interior design

5. Methodology

The research is based first on a descriptive analytical methodology, in which a brief description and analysis of the origin and use of hologram were presented.

The researchers also collected data by distributing questionnaires physically and by email to academic and non-academic professionals with decisively selected questions to highlight the hologram

technology importance and to compare it with corresponding techniques in specialization. In order to maximize validity by standardizing the sample, the researcher explained the purpose of the study and gave an introduction to the hologram of all respondents to know what the meaning of this technology. The researcher carried out follow-ups with the participants according to what participants identified as areas in which they needed help and once the questionnaires were completed, the researcher has collected them.

Each question in the questionnaire has been evaluated by using a pilot study before the final administration. Furthermore, it is also important to evaluate how to phrase each question, layout, check the wording in the questions to avoid potential confusion (11). The pilot study suggested that the questionnaires appeared to be an effective method of collecting a large amount of relatively basic information in a short space of time.

A questionnaire form was then developed on the Internet through the following link; https://forms.gle/kgLbC977KoAnkcd98. The core of the questionnaire depended on comparing hologram other technologies such as 3D MAX drawing and Revit, Virtual and augmented reality.

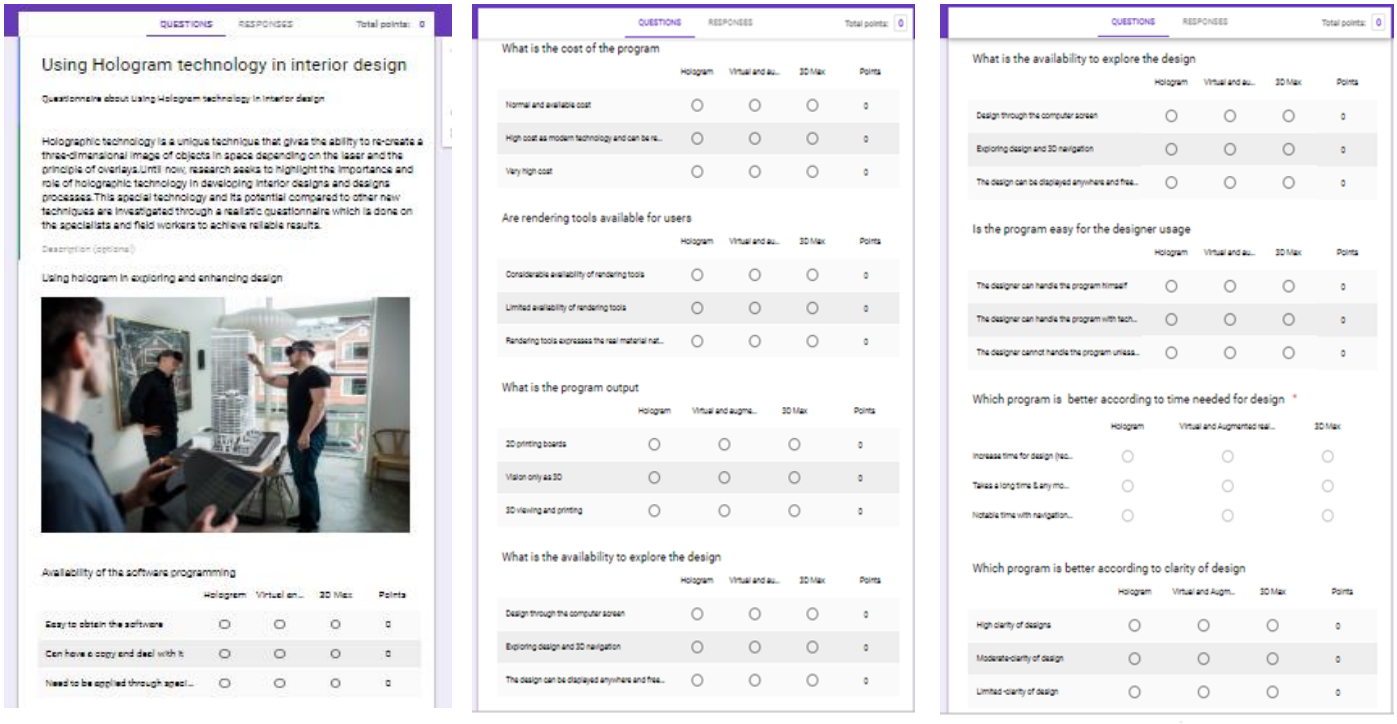

Figure 11: Questionnaire that has been distributed from a site designed on Google forms

6. Data analysis and results

It was necessary to conduct a questionnaire and survey the opinion of the specialists and the students of the final year in the interior design and architecture through a form distributed to determine their awareness of this technology effect on design development and advance.

6.1 First question parts about software programing availability

It is clear that 93% of the sample choose 3D software as the easiest to find. The second part concerning obtaining the program and dealing with shows that 27% of the sample was selected3D, while 67% chose augmented reality, 7% chose hologram.. The third part dealt with facility to apply through specialized laboratories and technicians, it was clear that 6% express 3D, while 25% chose augmented reality, 69% for the new approach.

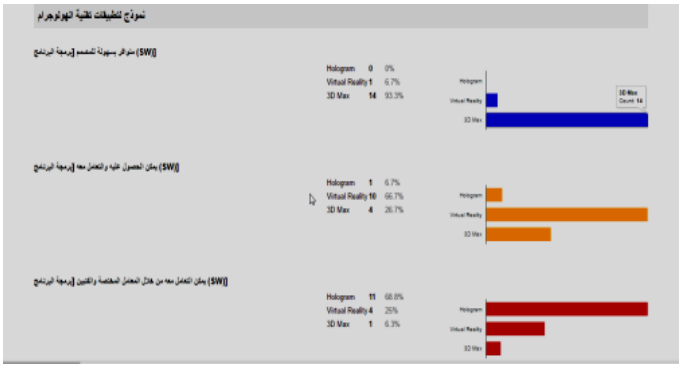

Figure 12. Graphs of questionnaire results for the first question

6.2 Second question parts about Financial cost

Through the first comparison alternative (normal and available cost) it is clear that 81% of the sample selected 3D, while 6% chose augmented reality, 13% for the new approach. Alternative two concerning (high cost of modern technology and can be reduced after extent of the technology) 6% chose 3D, 67% chose augmented reality and 27% chose the hologram. For the third alternative (very high cost) 6% of the sample selected 3D, 20% chose augmented, and 74% of them chose hologram.

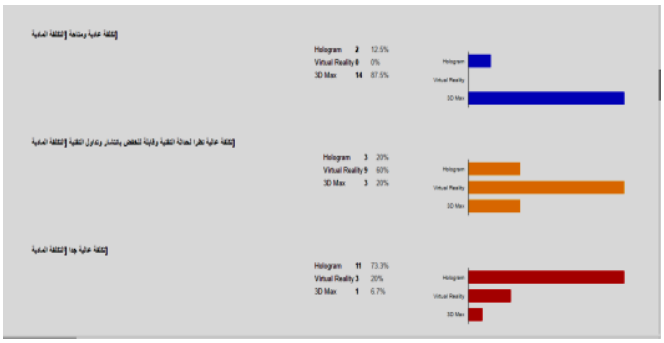

Figure 13. Graphs of questionnaire results for the second question

6.3 Third question parts about available rendering tools

Through the first variant of comparison (considerable availability of rendering tools), 56% of the sample chose 3D, while 13% chose Augmented reality and 31% chose Hologram.

For the second variant, (limited availability of rendering tools) It is clear that 40% of the sample selected 3D, while 33% chose Augmented reality, 27% for hologram. The third alternative (Rendering material expresses the real nature of the design), 13% of the sample selected 3D to express this variant, while 40% chose Augmented reality, 47% for the new approach; hologram.

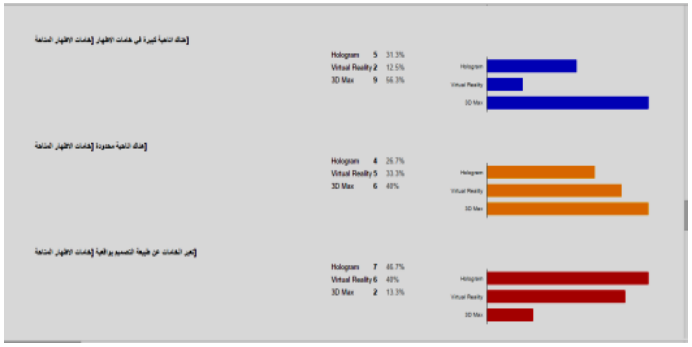

Figure 14. Graphs of questionnaire results for the third question

6.4 Fourth question parts about program output

First option to compare (2D printing boards), It is clear that 73% of the sample selected 3D, while 20% chose Augmented reality and 7% chose hologram.. The second variant (view only) revealed that 13% of the sample selected3D, 67% chose augmented reality and 20% chose the hologram. For the third variant (3D viewing and printing), 31% of the sample selected 3D, while 13% chose augmented reality and 56% chose hologram.

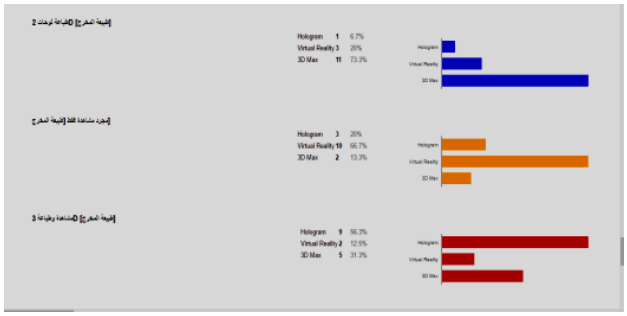

Figure 15. Graphs of questionnaire results for the fourth question

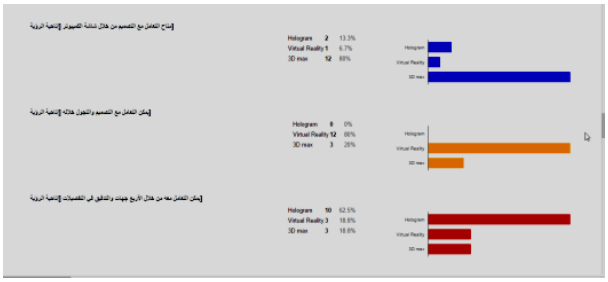

Figure 16. Graphs of questionnaire results for the fifth question

6.5 Fifth question parts about available space to deal with the design

First option of comparison dealing with (design through the computer screen); 69% chose 3D, while 12% chose the augmented reality and 19% chose the hologram. Second option of comparison dealing with design and 3D navigation; 26% chose 3D, while 67% chose the augmented reality and 7% chose the hologram. Third option about (The design can be displayed anywhere and freely navigation around it 4D); 20% chose 3D, while 7% chose the augmented reality and 73% chose the hologram.

6.6 Six question parts about easy handling of the designer with the program

Through the first comparison alternative (the designer can handle the program himself), it is clear that 87% chose 3D, while 0% chose augmented reality, and 13% chose hologram.

The second alternative (the designer can handle the program with technical assistance) shows that 20% of the sample selected 3D to express this alternative, while 60% chose augmented reality, 20% chose hologram. Third alternative (The designer needs technical assistance). It is clear that 7% of the sample was selected to express this alternative, while 20% chose augmented reality, and 73% chose hologram.

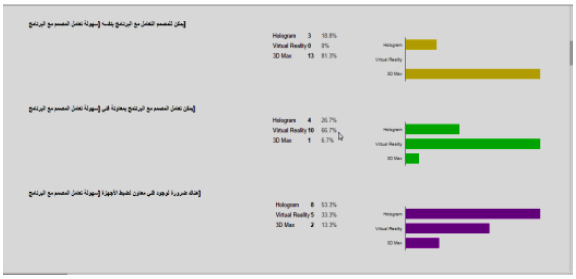

Figure 17: Graphs of questionnaire results for the six question

6.7 Seventh question parts about design time

Through the first comparison alternative (increase time for design (record time), 37% chose 3D, while 44% chose augmented reality and 19% chose hologram. The second option (uses a long time as any modification takes additional time also) shows that 53% chose 3D, while 20% chose augmented reality, and 27% chose hologram.

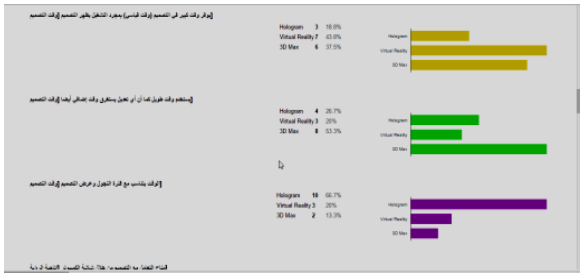

Figure 18: Graphs of questionnaire results for the seven question

The third alternative (notable time with navigation and design view); 13% of the sample selected 3D, while 20% chose augmented reality and 67% chose hologram.

6.8 Eight question parts about clarity of design

Through the first comparison alternative (high clarity of designs); 44% of the sample s selected 3D, while 19% chose augmented reality and 37% chose hologram. Second variant (moderate-clarity of design) 20% of the sample s selected 3D, while 67% chose augmented reality and 13% chose hologram. Third variant (limited -clarity of design) 67% of the sample s selected 3D, 0% chose augmented reality, and 33% chose hologram.

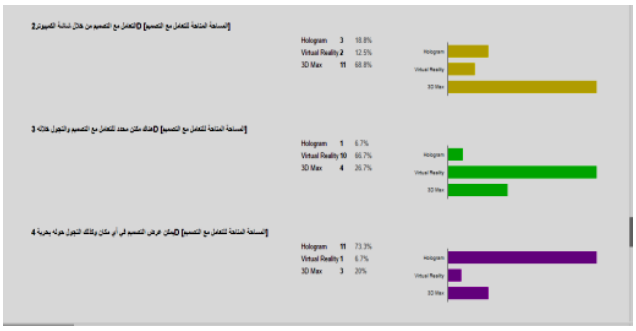

Figure 19. Graphs of questionnaire results for the eight question

6.9 Nine question parts about available vision

Through the first variant of comparison (available handling the design through the computer screen) ; 80% chose 3D, while 7% chose augmented reality and 13% chose hologram. For the second variant (handle design and navigation around it), it is clear that 20% selected, while 80% chose augmented reality and 0% for the hologram. The third alternative (can be dealt with four directions and examine details); 18% selected, while 18% chose augmented reality and 64% for the hologram.

Figure 20. Graphs of questionnaire results for the nine question

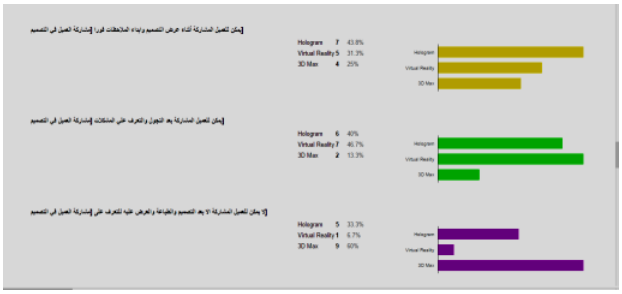

Figure 21. Graphs of questionnaire results for the ten question

6.10 Tenth question parts about cooperation of the client in the design

Through the first variant (the customer can participate during the presentation of the design and make the notes); 25% of the sample selected 3D,, while 31% chose augmented reality and 44% chose hologram.

Second alternative (the client can participate after navigation and identify the problems); it is clear that 13% chose 3D, while 47% chose augmented reality, 40% chose hologram.

Alternative three (The customer can only participate after design, printing and presentation to identify notes); that 60% of the sample selected 3D, while 7% chose augmented reality , 33% chose hologram..

From the above it is clear that the hologram compared to the other alternatives is characterized by the following; final results of the questionnaire:

1. Hologram is a modern technology available only on a small scale and through specialized laboratories.
2. The need for a laboratory and technician to deal with the devices in view of the sensitivity of the technology and any detection or change of the laser beam can change the result design.
3. Being a modern technology, it is highly cost effective and more suitable for large enterprises and mega projects.

4. It uses a short time to display through technology compared to other technologies but is more ideal in display large, high-cost designs that reflect the potential of supply from all sides .The project is implemented through a very small design to identify its problems and the required modifications saving time and obtaining deign clarity.
5. One of the advantages of hologram technique is the ability of client cooperation in design modifications saving money and effort for post-implementation reforms.

7. Conclusion

- The designer uses 3D applications and technology to capture, visualize and distinguish the design using more mysterious and impressive technology.
- The use of modern technology in interior design processors contributes to the development of visual and sensory perception through the third and fourth dimensions, as Holographic images give perspective similar with the truth.
- Using the Holograph technology, the client can participate in the design and modifications required through the "interaction" with them - leading to a better understanding as well as getting better results for designs.
- Holograph technology is a modern high-cost technology that is more suitable for large enterprises and giant projects.
- Hologram is very impressive display tool enable the client viewing all around the design model in four dimensions sight reducing limitations in design development.

Recommendations

- Researcher recommends the need to develop specialized software, equipment and materials used to produce holographic images and holograms to keep pace with modern development and awareness of the latest technologies applied in the field of interior design.
- The development of holographic laboratories through universities and research centers
  To enable researchers and students to learn about modern techniques and how to use in their specialization either interior design or architecture design models.
- The need to raise awareness about this new technique, through workshops and lectures whether through universities or syndicates, among specialists and professionals in the field.
- Nowadays, merging programs is the new trend. The virtual-holographic experience has a futuristic vibe to it and reinvents the computer interface as we know. By blending the physical world with a sensory-rich virtual world that people can naturally and spontaneously manipulate

and navigate, the way we solve problems is advanced. We also learn, teach, and communicate better create new interactive world saving time and money.

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