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The Reflection of Effective Interactive Graphic Design

Abstract

Graphic design has a rich history as a creative practice, which connects different design elements to build effective message. It combines typography and visual elements like illustrations or photos to create a visual message, graphic design is considered as an important branch in the modern communication technology. Graphic design nowadays has becoming more advanced and moves from the static phase to the dynamic phase which includes unlimited technologies like virtual reality, 3D motion and interactivity, which becomes one of the important factors that affects the successes of the visual communication or the message that has to be sent via the design, where interactive design is the management and meaningful transferring of information through different media as its the intersection point between graphic design, different media and technologies. This interaction in design will affects positively the perception of the design by the target audience especially if it was scientifically studied based on the target audience's criteria.

Keywords

Multimedia, Interactivity, Virtual Reality, User Interface, 3D Printing, Animation, 3D Display.

1. INTRODUCTION

Interactivity is becoming one of the most important features in the field of graphic design, whether it's an advertising, game, film or wayfinding system.....etc., as it gives the opportunity to interact and integrate the target audience with the advertising, game, film or wayfinding.... etc. for sure reading a static poster is totally different from reading a dynamic one, clicking on the images and videos which are the main elements that build the interactive advertising creates interest atmosphere and help to attract the audience more than the static one. For Example in case of the Electronic journals adding an interactive element like a video gives the news more credibility. On the other hand in the field of games, interactivity covers a wider range of attraction and interaction with the game stages specially if it includes virtual reality technics with its multiple instruments like the eyeglasses and gloves, which help to immerse the player from the real life to the virtual life of the game.

All these types of interactive technologies increase the audience attention and attract creating an integration with the graphic design and increase the acceptance of the design message.

Graphic design has an important role in the culture and economy of societies, besides its role in the commercial and creative practice. It is Usually Defined as the and design to be printed with the multiple types of printing whether the artistic ones or the commercial ones, but this definition is not sufficient in explaining the nature and value of its practices (e.g. Heller, 2006). Recently in the 20th century, the concept of graphic design has been changed from being an explanation of the types of printing and the translation of artwork through print surfaces, to become a key role in communication and information due to the revolution in the printing media, animation and interactive technologies (Haslem 2009). The design is the way of combining form and content together. The design in general is not simple and is very complex, needs many preparations and studies to be understood (Paul Rand).

The process of graphic design is based on the best use of images to communicate the idea and the link between symbols and signs in the surrounding environment, the ability to criticize and discuss visual ideas between a group of individuals and the ability to convince and communicate a visual idea with knowing what is available and how to do it (Timothy samara 2007).

Creative vision is the most important reason for scientific and civilizational progress. Developing the creative capabilities of designers contributes to the development of their abilities to face current problems and future challenges.

Creativity has evolved as a concept and application because of a number of rules and theories, the most important of which are:

1. Establish the logic of discovery and innovation
2. The development of philosophical and psychological concepts associated with imagination
3. Development of modern social psychology
4. Fast and continuous change in all fields

Jessica Helfand says that graphic design is a visual language that unites the relationship between balance, homogeneity, light, color, exterior and internal content and a terminology and language that expresses the advantages, disadvantages, symbols and tricks that have a perceived cultural dimension that stimulates both the eye and the mind (Jessica Helfand, 2008)

The Main Problem Issued that:

The contemporary definition of graphic art can include art used in communication, which teaches and intervenes persuasive, supplying visual expertise, which combines art and technology to deliver an important and vital message to our daily life which is simply the power of culture that we can talk and shape by choosing the best way to explain it This relationship should be discussed at the first stage of the design process and before reaching the final solution of graphic design.

The Objective of this paper is to compare, explore and explain the importance of the new technologies and 3D interactive displays in enriching the interactive graphic design, focusing on the graphic designer's role in such interactive designs.

2. DIGITAL TOOLS IN DESIGN

Design is an essential process for every human in which both utilitarian and aesthetic values occur at the same time, it's an area of artistic activity as it is impossible for any artwork to appear without design.

Design is the organization and co-ordination of the sum of elements or parts in a coherent whole, the harmony that combines both aesthetic and utilitarian aspects. Which reflects the psychological reasons that motivate the artist to express himself, those primitive motives of the aesthetic instinct inherent in us are the same that drives the designer to organize his thoughts and feelings to create a design according to a specific plan.

Nowadays graphic designers often use electronic publishing and design software to reach their goals, so the concept of design has evolved into a science based on a mixture of science and art activities, where Human being design is the constant change and development of ideas in order to keep up with the new possibilities of development, where the elements of beauty and scientific logic exists. The process of design evolves from collecting information in the field of design then analysis these information to build on this analysis.

The design process depends on the creator's ability to innovate because he exploits his culture, translate his imaginative abilities and skills to create a work that leads to the achievement of the purpose for which he create.

The process of creativity is not only a unique phenomenon subjected to a purely psychological process, but a civilized reality that has its roots in the cultural and social soil of the environment in which the designer lives.

The Designer has to go through a process of selecting and arranging a set of elements, in order to use these elements as a means of visual communication. It is by nature, People arrange things around them, and reshape the material of nature to suit their needs and purposes. It is therefore the process of developing an integrated plan for the content of visual communication. It arises at the point of convergence between humans and the primary environment, expresses the intentions, desires and hopes within humans through the combination of text and graphics to deliver an effective message to the recipient.

3. MULTIMEDIA TOOLS

Multimedia refers to the product resulting from the combination of the media language with certain data that have so far been invested separately, such as text, sounds, video and photographs, thus most of the applications are called "multimedia" because of the blending of these simple basic terms (text, sound, image and video). Which enriches the field of communication, affect all areas of economic activity or serve the public interest. Multimedia combine both text and photos in a magnificent harmony serving the design message.

The success of multimedia message is based on the presentation of words, images and sounds contiguously in the same design clearly, which help in attracting the audience by all means of multimedia. Thus the combination of animation with sound enrich the design and produce advanced solutions for the communicational message problem.

4. ANIMATION TOOLS

The animation is an essential factor in digital graphic designs. It helps in well receiving the visual message and attract the audience to the digital graphic designs in general and digital advertising in particular.

Types of Motion:

1. Diversity of motion levels:

The diversity of levels and the abundance of elements provided through the advertising attract the attention of the audience and increase its effectiveness with the advertisement. Movement perception is usually described as the stimulation of successive parts of the sensory surface (Bevlin, Marjorie Elliott, 1984).

- **Animated Images:**

Animated images consist of an average 10 or more moving images together. The background is static, but moving parts are distributed in different places. By changing the viewing angle, it gets the impression that the image is moving.

- **Zoom effect**

The attraction comes as a result of the effect of magnification, when displaying the design from different angles and changing the sizes to get the impression that the elements change in size as if moving, this is very similar to what is called visual deception. But in fact, the image itself is fixed not moving, but the shapes are the ones that vary in sizes.

- **Morphing images**

It is the transformation of image from one to another. The transformation takes place in different stages, in order to get the illusion that the image gradually transforms into another image. So the better quality of photo the better result.

- **3D "Depth"**

Three-dimensional simulation is creating depth in the image; it takes the visual experience to a higher level. 3D Printing is the only solution that allows you to see 3D images without the help of your own 3D glasses. Images with 3D simulations are more complex. Special programs can be used in this type such as 3D Studio Max, or others like Maya, etc.

Another application: is to create 3D images of live scene or people. This can be achieved by a portable camera on the slide bar. This type depends on the number of shots, image type, and resolution.

5. METHODOLOGY OF RESEARCH

Comparative Studies to differentiate between Interactive digital design, printed design and 3D Interactive Displays

This Part will talk about the characteristics and requirements of interactive electronic design compared to the printed and 3D Interactive Displays:

There are some principals for the design of printed publications that are not changing, but there are also many special aspects that must be taken into consideration in order to obtain an effective electronic and Physical display (Table.1)

Table1: Comparison studies between Interactive Digital Design, Printed Design and 3D Interactive Displays

	Criteria	Interactive Digital Design	Printed Design	3D Interactive Displays
1	User Experience	The navigation elements in the interactive digital advertising dominates the digital presentation whether the elements are designed in fixed places or elements already exist on the toolbar of the program that displays the electronic design. The successes of this design is measured according to the degree of its friendly use.	The design is static no navigation tools, the audience read the information and see the images in a static state.	The deign can be static or dynamic according to the topic and to the technology used.
2	Number of Colors	Any number of colors can be used at no additional cost. However, care must be taken	Care must be taken in using colors in the design because of the cost of the design as the	Any number of colors can be used, but the cost should be taken in

		when using colors in digital advertising. Accurate calculations must be made to maintain the quality of graphic elements high in the display on all kinds of screens. In addition, colors has a link to the interactive function of digital advertising design because it has global connotations.	more colors used the much expensive the printing process, also the designer should be aware of the color separation methods as well as the digital printing process, to avoid miss interpreting of colors between the digital and printed copies.	consideration, if it is paintings or adhesive printouts. Some 3D displays use laser beams or screens to demonstrate the idea. In this case number of colors don't affect the cost.
3	Color Coding	The colors used are RGB, there can be noticeable differences in color coding display between what users see for different computer systems, and individual settings for each screen (such as brightness and color balance) that also have a significant impact on visibility.	The colors used are CMYK The difference between the color coding printing systems for printings and the colors coding system for digital display devices and the colors value in addition to the type of paper and its ability to absorb to the ink affect positively or negatively the result of the printings.	Color code is determined according to the material used whether it is wood, metal, plastic or paper, etc.....
4	Cost	Number of copies is endless and Costless	The cost is calculated according to the number of colors and copies	Depends on the size, Idea, materials and the technology used.
5	Design elements	The electronic means are characterized by special characteristics such as animated forms of graphics, animation and navigational elements. The movement and sound component, whether it is a sound of a moving or separate elements, is an effective and influential design element. The movement component is also one of the elements and strength which have the power to attract the recipient's attention to the message.	No sound or animation in the printed designs however there are multiple techniques of printings like the golden lamination or the emboss of some design elements or the spot UV which enrich the design and increase its attraction.	Varies according to the structure and the idea behind it.
6	Size	For digital design, the designs are small in size and can be uploaded quickly to the web and look good relative to the display screen resolution.	For paper-based printing, very high resolution is needed which make the files bigger in size.	Based on the place its going to be placed, indoor or outdoor, also the target audience ages.
7	Flexibility	The electronic designs need to be updated and developed continuously.	Once the designs are printed on paper, they cannot be changed until they are reprinted again,	It can be flexible at some point, but this should be taken in consideration in a prior stage before thinking in the design and definitely before the execution.
8	Attraction	Only Target Audience that are capable to use technology, computers, mobile phones or any other electronic devices	All kindly of people are capable to be attracted to the printed designs according to some factors:	It attracts the attention of all user kinds and ages, as it is usually a physical object place in an attraction point and doesn't need any

Continue Table 1

	are attracted to this kind of interactive digital advertising	<ul style="list-style-type: none"> - The computability of the design with the target audience. - The place where the design is exposed to the audience i.e. Outdoor banner differs in the attracting degree than an indoor poster. - The efficiency of the design, colors, text and photos to attract the audience. -The quality of the printing 	qualification from the side of the audience to be understand.
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6. INTERACTIVE DESIGN

Interactive Design is a field and approach to designing interactive experiences, interactive design is concerned with a user, customer, audience and participant's experience flow through time. Interactivity is not related to animation in which objects may move on a screen. Interactivity is about being part of the action of a system or performance and not only watching the action passively. In electronic interaction design a set of skills are needed to design the application through which the audience can effectively use information technology (Shedroff, 1994).

According to Gerret (Garret, 2000) the interaction design is 'The development of application flows to facilitate user tasks defining how the user interacts with site functionality'.

Interactivity reflects technical and technological experience therefore most designations on the design field not commonly agreed with original explication of interaction design as simple graphical user interface GUI. The most used GUIs represent a desktop metaphor, which simulate natural communication in specific applications (for example simulators and games) by integrating multimedia, virtual reality and augmented reality. Scientists, engineers as well as artists and designers work on the interfaces, which could involve more human senses.

By switching to interactive advertising, we can visualize many of the corresponding characteristics that characterize the relationship between advertising, designer, receiver and environment. Interactive art systems are known as static, Negative dynamic, interactive dynamic, Reactive Dynamic.

Static: Advertising does not change and is seen by the person and there is no interaction between them.

Negative dynamic: The ad has an internal mechanism that enables it to be modified by environmental factors such as heat, sound or light.

Interactive dynamic: It applies all the conditions in the dynamic section with the additional factor that the recipient has an active role in making advertising changes.

Reactive Dynamic: All conditions of the above-mentioned static and dynamic interaction patterns are applied with the addition of an adjustment factor that changes the original specifications of the ad. This factor can be a person or program, so the interactive process that occurs makes the advertising effect unexpected.

Interactivity has become one of the basics of the design, especially the 3D interactive designs printed with 3D printing technology or any other technology because they are based on the idea of interacting with the recipient and creating experience, it is one of the approaches that are interested in research and designs.

7. VISUAL COMMUNICATION PROCESS

Communication is the art of communicating information, ideas and views from one person to another or from one society to another (Edwin Emery Phillip, H. Ault Warren, K. Ageem, 1965). Communication in English is derived from the term *communis*, which creates an atmosphere or agreement communes with someone - to share information, ideas and attitudes, it is used in different meanings (W. P. Davidson, 1965).

"Communication is a process of transmission facts, opinions, feelings, feelings, attitudes, performance methods and ideas through symbols from one to another. It is the process by which a meaning is transferred between individuals (C. h. Wright, 1959), where an individual affects in others. The behavior changes to a certain direction. It includes all the interactions that have taken place since a message was sent by means of a picture that contains several elements and drawings. ... etc. and this picture can be also an interactive one which enrich the message and help to attract the receiver more and built a friendly user experience which attract the receiver or the audience to the content of the message and interact with it to reach the target result.

The contemporary technical definition of interaction between man and the interactive design is a property, process or function created by designer in his design of objects or environments (physical or virtual) characterized by the ability to accurately detect and then respond dynamically and intelligently to movement, signal, expressions or changes in physical conditions, expression of human desires, changes in geographic location, environmental condition, or any combination of these elements. This dynamic intelligence can be achieved through Programming, Embedded Micro Controllers, Sensors, Satellite positioning devices or networks connected to other information systems.

Therefore Interactive Communication is the process of conveying and receiving facts, opinions, feelings, sensations, trends, performance methods and ideas by person-to-person through ideas and concepts associated with interactive applications usually reach the recipient through a User Scenario developed by the interactive system designer.

This does not mean that the idea of interactivity stands at the limit of human interaction with the system, but there are types of interactive systems that provide the opportunity to interact between humans with each other such as the Internet and communication networks in general, which makes these systems important in the field of human dialogue and cultural dialogue, the importance of art lies in the fact that it is a universal language for aesthetic, cultural and intellectual dialogue in the first place. This resulted in the integration of art with modern digital media and systems of new forms of artistic expression, which depends on the positive interaction of the recipient or viewer with the work of art.

7.1 User Interface (UI)

The user interface is a system that enables people (users) to interact with the machine. It is used in graphic design is the space where humans interact with the design, device or application. This interaction through the user interface aims to operate the application or device and control it efficiently, and to get feedback from the device itself, which helps the user to make decisions. Examples of the user interface include aspects of interaction in computer systems, manual tools, heavy equipment operation control, and process control. Considerations such as user-friendly design and psychological factors should be considered when designing user interfaces.

During the 1980s, other researchers developed tools and methods to design the user interface. User interface is one of the basic components of computer systems and being an operating system or database.

The user interface exists in many systems as a means of:

- Inputs: allowing users to use the system skillfully.
- Outputs: allows the system to indicate the user's operating effects.

In general, the goal of interaction between human and electronic device is to reach a user interface that facilitates the operation of the device efficiently and makes it enjoyable in a way that leads to the desired result from the device. This means providing the user with the minimum amount of input that leads to the desired result and reduce the rate of human access to undesirable results.

7.2 Guideline Criteria of Effective Interactive Design

The friendly use of interaction of a design confirms that the product is easy to benefit from and can be used effectively and can be fun to use from the perspective of the user and this includes the degree of interaction of people with each other as well as their interaction with the product in order to enable them to transfer these interactive experience to work, schools and so can be used in all areas of life and more specifically objectives can be divided into the following:

- Efficiency of use (effectiveness)
- Efficiency in use (efficiency)
- Safe use
- Have great benefits
- Easy to learn
- Easy to remember and special method of use (remembering).

Efficiency of use: An important goal is to know how well these products can be used.

Efficiency in use: refers to the way in which the product can provide new bases that can support the user and enable him to accomplish his tasks.

Safe use: measures include protecting the user from potentially hazardous conditions and protecting the user from unwanted and unexpected situations; also protect the user personal data in some cases.

Benefit: refers to the expansion of products and the extent to which they have functional standards that can meet user needs.

Easy to learn: refers to how easy the system is and can be learned and used. It is known that people do not prefer to spend a long time learning a system.

Remembering: refers to the degree of ease of the products and the ease of remembering the use of these products as soon as the user uses them. This is particularly important with regard to the interaction of products that are used frequently and if the user has not used these processes for several months or more must be able to remember the action done before.

8. Case Study (Application 1)

The *Book Bench*,





Fig.1: The Book Bench, Designed by the author, placed in the outdoor plaza area at the Bibliotheca Alexandrina, Promoting the Big Read Project, Reference: Photographed by the author December 2016

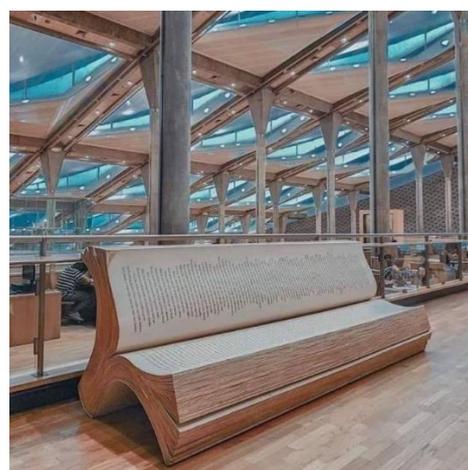
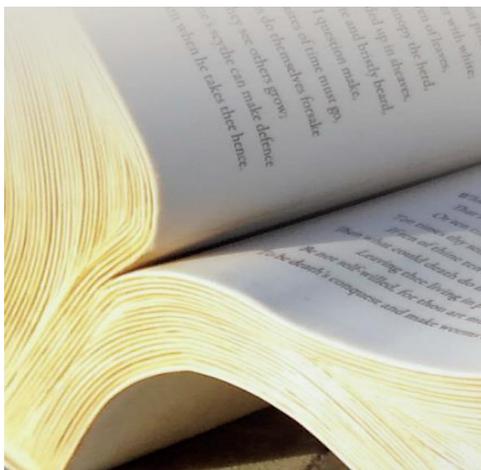
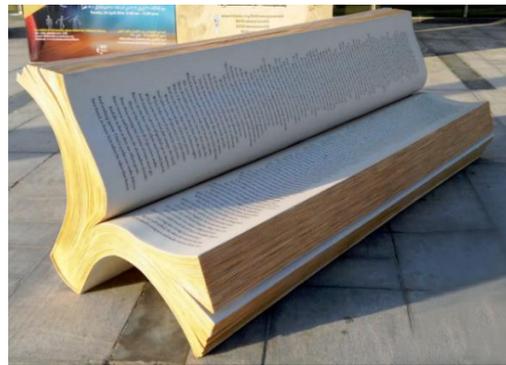


Fig.2: The Book Bench, Designed by the author, placed in the outdoor plaza area at the Bibliotheca Alexandrina, Promoting Shakespeare's celebration, Reference: Photographed by the author April 2017

The Idea of this Bench was to be an interactive 3D Promotional display for a project that was held at the Bibliotheca Alexandrina, Alexandria, Egypt, 2016. Organized by the Bibliotheca Alexandrina (BA) in cooperation with the American University in Cairo (AUC) Called the Big Read Project, It's about republishing one of the old English literature books and translating it to

Arabic, the idea of the project was to promote reading among young people age and youth, through different activities based on the story behind this novel, where the reader can participate in different contests organized by the BA and AUC like drawing and painting, Photography, Essay, performances etc. As shown in Figure.

From my experience as a graphic designer for library settings and cultural programs more than 15 years, I found out that the youth age didn't interact easily with traditional posters, it is not attractive to this age specially if the topic is concerning a literature. So I tried to come out with a new idea that promote the reading, reach the goal of the project and attract this critical age at the same time.

So I designed this Bench, the Idea of the bench was very attractive to the audience, it stimulate the curiosity in them to ask some questions about it like:

What is this bench for?

What is this novel talking about?

I need to read the first page written on this bench?

Is it a huge book?

Is it made of Paper or which material?

Can I sit on it?

Can I take photo as a souvenir on it?

How can I get this novel?

I need to participate in this program

The Bench is made of wood, its size is 260cm x 100cm x 120cm, painted off-white with light brown shades for paper texture. The book cover as well as the opened page (the sitting area) are printed on a transparent adhesive vinyl material laminated with a plastic coated material to protect it against winter and sun light to maintain the brightness of the colors. It's placed at the Bibliotheca Alexandrina, Alexandria, Egypt, at the Entrance Floor.



Fig.3: The Book Bench, Designed by the author, placed in indoor at the Bibliotheca Alexandrina, Entrance floor Promoting Reading, Reference: Photographed by the author

This experience achieved a very good result, and become very attractive mark at the BA, that all its visitors have to come and take a photo on it, it transferred from being a promotional material for a specific book or project to be an interactive 3D display to promote the BA in Alexandria and to promote reading in general. As shown in Figure.2

After the success of the bench and after 3 years I changed the cover of the book and the opened page's text (the sitting area) and add another one to promote another event and another book which is Shakespeare (Celebrating Shakespeare's 400 years). At that time I added an imaginary design that was designed by me for Shakespeare poems and also added one of his poems to the open page (the sitting area).

Evaluating the Bench:

User Experience: This application is static as it does not include dynamic machines or dynamic screens.

Number of Colors: No limit in colors number as the cover of the book and inside pages depends on printing vinyl material digitally so there is no limit in the colors.

Color Coding: It has two types of color coding the first one is the bench's body painting on wood using the Pantone colors and the second type is the CMYK colors for the printed vinyl.

Cost: Its cost was moderate concerning the wood material but concerning the printed vinyl, it was cheap and easy.

Design elements: the design in this case follows the sculpture rules as it has to be seen from 3D perspective and has to be seen from all directions and angles. It deals with the harmony in balance between space and objects.

Size: 260cm x 100cm x 120cm and it is not heavy as it is hollow from inside.

Flexibility: Its flexibility comes from its flexible ability to promote easily any kind of books or reading by simply removing the adhesive vinyl and add another one printed for another book or design.

Attraction: it attracted many people with different ages and nationalities.

9. THE EVALUATION OF INTERACTIVITY

Successful design is what requires some thought to understand and even stimulate the viewer thinking, it is clear and understandable without the need to explain it. The concept of modern media in its general concept is all about digital and mobile applications such as the internet, computer games, digital interactive education and interactive environments as well as digital papers, while in the field of advertising, 3D printing and virtual reality programs are represent.

The role of the graphic designer towards modern media is not merely to impress or show the possibilities of technology, but it all rely on innovation, which is basically in facilitating and connecting the user to the same medium therefore the graphic designer has the great role to complete the successful communication between the user and what it offers.

Therefore, the benefit of the experiences of the fine art, Interactive technology and 3D art technology, which can be defined as the search beyond the relationship between form and space in order to take advantage of its apparent and symbolic characteristics in the creation of ideas used in the design of advertising that combines two-dimensional and three-dimensional forms, and based on values Imagination, movement, visual illusions and some symbolic values, characterized by strangeness, ambiguity and attraction to the mentality of modern man, and the level of awareness, consciousness and intelligence to be more involved in communicative interaction without abandoning the connotation that refers to the advertising message.

Therefore, interactive visual communication combines reality, fiction and traditionalism in modern visual formulation through the advertisement that attracts the attention of the recipient and acquire it as long as possible, and satisfy his desire for curiosity and knowledge to use elements and forms in an unusual manner within the framework of advertising communication and achieve its goals.

In order for traditional and non-traditional graphic design to achieve its communication goals, it passes through a set of aspects that clearly affect the effectiveness of the graphic design. These aspects are as follows:

- **Communication aspect**

Where the message behind the graphic design should be clear and obvious, created with all the artistic principals of successful design.

- **Functional aspect**

Every graphic design should have a specific function, for example: awareness, advertising, educational...etc., and therefore the successful design is the one which fulfil its goal.

- **Psychological aspect**

The graphic designer should go through some steps before designing any graphic design, one of this steps is knowing the target audience and their age, knowledge, interest, in order to achieve a successful design that attract them.

- **Visual perception Aspect**

The designer should be aware of the target audience culture, as every culture has different perception in receiving the visual message, as the fast development of technology and communication tools help in the development of the visual perception of the audiences in any culture. (Abbas, & Aldalalah, & Alhalaq, 2014).

10. CONCLUSIONS

Interactive design and the different types of technology that arose in the last years have a big role along with the successful graphic design to attract the target audience to the visual message. This interactivity is endless as long as the technology is growing. This can have good results in attracting the society to the message and have variable feedback.

Interactivity is not only about touch screens or virtual reality but it goes beyond every transferring information and getting response or desired feedback, for example Smart ink in packaging is a way of interactivity, where the packaging color may change totally in its color when being expired, 3D printing and its endless materials is a way of interactivity where the designer can make a 3D advertising for a product by the same material of the product so the target audience can experience the material of the product from the advertise before buying it.

Virtual reality with its visual, audio and touch technologies are a way of interactivity and so augmented reality. And still remains other endless technologies and materials that can be used by the graphic designer and can be a very helpful source of interactivity which enriches the visual communication process. So I found that Critical thinking and Problem Solving is the way every designer has to follow in his research as well as his professional work or teaching methods in order to develop new interactive graphic design approaches. The graphic designer should use the critical thinking and information analysis to reach new results to get creative outcomes through the journey of the problem solving of a new project which will definitely enhance the message transferred by the visual communication design and facilitate the acceptance and understanding of the message by the target audience which directly increases interaction towards the message.

So Finally after my practice application experiences, I found that the 3D interactive displays is a kind of interactive messages that effectively attract the audiences and have very good effect in reaching the goals of the advertising in and interesting innovative method.

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