Aesthetic perception of contemporary ceramic art considering augmented reality applications

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Summary:

Contemporary ceramic art is one of the arts that reflect cultural diversity and innovation, as it combines traditional heritage arts and modernity, and with the advancement of digital technology, which has become an effective means that can affect the aesthetic perception of ceramic work, the current research presents an artistic experience that allows the recipient new contexts to see the artwork to enhance its interactive aesthetic experience, which contributes to appreciating the value of arts and the culture of understanding the other.

Research problem: The research problem revolves around how augmented reality applications affect the aesthetic perception of contemporary ceramic work through the following questions:

-To what extent does augmented reality contribute to enriching contemporary ceramic work inside the galleries?

-How does augmented reality affect the interaction of the recipient with contemporary ceramic work?

-How do augmented reality applications contribute to enhancing aesthetic perception of contemporary ceramic work?

Research Objectives:

-Study the impact of augmented reality on contemporary ceramic work.

-Study how augmented reality applications affect the recipient's experience and aesthetic perception of ceramic works.

Importance of Research:

Shedding light on the impact of augmented reality applications on the aesthetic perception of contemporary ceramic art, which contributes to enhancing the artistic and cultural understanding of the other.

Research Methodology:

The research follows the experimental approach by implementing flat ceramic works with drawings and prominent formation, and by Unity3D augmented reality is developed to process the images of the ceramic work of the researchers, present the work to a group of recipients, and apply the aesthetic perception questionnaire to verify the objectives of the research.

Keywords:

Augmented reality - aesthetic perception - contemporary ceramic work.

الملخص:

لقد مرت علوم تكنولوجيا المعلومات بثلاث مراحل، الأولى ظهور الكمبيوتر الشخصـي، والثانية تمثلت في ظهور الانترنت وشـبكات التواصـل الاجتماعي، والثالثة فتمثلت في ثورة الوسـائط المعلوماتية التي أحدثت نقلة جديدة، كما ظهرت الهواتف المحمولة، والكتب المنشورة الكترونيا، والتسوق الالكتروني بكل انواعه في كافة مجالات الحياة.

وقد واكب التعليم وتعلم الفنون ذلك التطور التكنولوجي ووظف التقنيـات المعتمـدة على التحول الرقمي داخل الفصـول الدراسـية وخارجها، كما دمج بين تلك التطبيقات المصـممة للترفيه والالعاب داخل المناهج الدراسـية عن طريق تطبيقات الواقع المعزز(AR) ، حيث يتم توجيه وتدريب الطلاب بشـكل أفضـل، وحل المشـكلات بشـكل أسـرع، وتحسـين الكفاءات، والاستعداد بشكل أفضل للمستقبل.

فيعتبر الواقع المعزز " نسخة تفاعلية محسّنة لبيئة العالم الحقيقي يتم تحقيقها من خلال العناصـر المرئية الرقمية والأصوات والمحفزات الحسـية الأخرى عبر تقنية التصـوير المجسـم. يتضـمن الواقع المعزز ثلاث ميزات: مزيج من العوالم الرقمية والمادية، والتفاعلات التي تتم في الوقت الفعلي، وتحديد دقيق ثلاثي الأبعاد للأشياء الافتراضية والحقيقية. "

مشكلة البحث: تتمحور مشكلة البحث حول كيفية تأثير تطبيقات الواقع المعزز على الإدراك الجمالي للعمل الخزفي المعاصر من خلال التساؤلات التالية:

-الي اي مدي يسهم الواقع المعزز في اثراء العمل الخزفي المعاصر داخل قاعات العرض؟

-كيف يؤثر الواقع المعزز في تفاعل المتلقي مع العمل الخزفي المعاصر؟

-كيف تساهم تطبيقات الواقع المعزز في تعزيز الادراك الجمالي للعمل الخزفي المعاصر؟

اهداف البحث:

-دراسة مدي تأثير الواقع المعزز على العمل الخزفي المعاصر.

-دراسة كيفية تأثير تطبيقات الواقع المعزز على تجربة المتلقي وادراكه الجمالي للأعمال الخزفية.

أهمية البحث:

القاء الضـوء حول تأثير تطبيقات الواقع المعزز على الادراك الجمالي لفن الخزف المعاصر مما يسـهم في تعزيز الفهم الفني والثقافي للأخر.

فروض البحث:

-يسهم الواقع المعزز في اثراء العمل الخزفي المعاصر داخل قاعات العرض.

-تساهم تطبيقات الواقع المعزز في تعزيز الادراك الجمالي للعمل الخزفي المعاصر.

حدود البحث:

-مفهوم الواقع المعزز (AR) وتطبيقاته.

-مفهوم الإدراك الجمالي لفنون الخزف المعاصر.

-التطبيقات العملية لأعمال خزفية مسطحة (بلاطات خزفية ـاطباق)

-استخدام برنامج Unity3D في معالجة الصـور وتحليل البيانات وبرنامج CupCut لتكوين التأثيرات البصرية والصـوتية للعمل الخزفي.

منهجية البحث:

يتبع البحث المنهج التجريبي من خلال تنفيذ اعمال خزفية مسطحة ذات رسوم (اطباق) وتشكيل بارز لمسطحات خزفية (بلاطات) وعن طريق استخدام برنامج Unity3D يتم تطوير الواقع المعزز لمعالجة صور العمل الخزفي للباحثين وعرض العمل على مجموعة من المتلقين وتطبيق استبيان الادراك الجمالي للتحقق من اهداف البحث.

الكلمات المفتاحية:

الواقع المعزز،الادراك الجمالي،الخزف المعاصر

Introduction:

Information technology science has gone through three stages, the first is the emergence of the personal computer, the second is the emergence of the Internet and social networks, and the third is represented by the information media revolution that has made a new shift, as well as

mobile phones, books published electronically, and electronic shopping of all kinds in all areas of life.

Education and learning the arts have kept pace with technological development and employed technologies based on digital transformation inside and outside the classroom, and integrated those applications designed for entertainment and games within the curriculum through augmented reality (AR) applications, where students are better guided and trained, solve problems faster, improve competencies, and better prepare for the future.

Augmented reality is "an enhanced interactive version of the real-world environment that is achieved through digital visuals, sounds and other sensory stimuli via holographic technology. Augmented reality includes three features: A combination of digital and physical worlds, real-time interactions, and accurate three-dimensional identification of virtual and real objects."

Research problem:

The research problem revolves around how augmented reality applications affect the aesthetic perception of contemporary ceramic work through the following questions:

- To what extent does augmented reality contribute to enriching contemporary ceramic work inside the galleries?
 - How does augmented reality affect the interaction of the recipient with contemporary ceramic work?
 - How do augmented reality applications contribute to enhancing aesthetic perception of contemporary ceramic work?

Research Objectives:

Study the impact of augmented reality on contemporary ceramic work.
Study how augmented reality applications affect the recipient's experience and aesthetic perception of ceramic works.

Importance of the Research:

   Shedding light on the impact of augmented reality applications on the aesthetic perception of contemporary ceramic art, which contributes to enhancing the artistic and cultural understanding of the other.

Research hypotheses:

 - Augmented reality contributes to the enrichment of contemporary ceramic work inside the exhibition halls.
 - Augmented reality applications contribute to enhancing the aesthetic perception of contemporary ceramic work.

Research Limitations:

 - The concept of augmented reality (AR) and its applications.
- The concept of aesthetic perception of contemporary ceramic arts.
- Practical applications of flat ceramic works (ceramic tiles - dishes).

- Using Unity3D in image processing, data analysis and CupCut to create visual and sound effects for ceramic work.

Research Methodology:

The research follows the experimental approach by implementing flat ceramic works with drawings (dishes) and the prominent formation of ceramic surfaces (tiles) and using Unity3D program, augmented reality is developed to process the images of the ceramic work of the researchers, present the work to a group of recipients, and apply an aesthetic perception questionnaire to verify the research objectives.

Search terms:

Augmented Reality (AR)

An attractive interactive technology that brings the virtual object (text, graphics, video, sounds) or a combination of all of them in a three-dimensional form to a real environment with a digital dimension, designed and developed by the computer to perform many purposes in areas of life: medicine, engineering, computer and educational technology."

Aesthetic perception:

The term aesthetic perception is given to the mental processes involved in the acquisition of knowledge and understanding, so that it includes the processes of thinking, knowledge, remembering, judgment, and problem solving, and the process of perception includes both language, imagination, and planning, and includes all the processes of awareness and unconsciousness through which science and knowledge can be collected, hence the most important characteristic of perception as a state or experience of knowledge.

Theoretical Framework:

Aesthetic perception

It is a complex process that includes an interaction between the sensory, motor and emotional aspects of the human being, which leads to a unique experience that depends on self-artistic taste, and this experience varies from person to person based on artistic and aesthetic experience, when focusing on the artwork, the senses are stimulated objectively, which leads to attraction and absorption in the artwork and a state of emotional interaction arises between the recipient or artist and the artwork, and this has a continuous impact when realizing the work as a single unit, and the process of evaluating the artwork is purely subjective and varies between individuals, so the evaluation can be spontaneous and automatic or a conscious and rational evaluation that depends on specific criteria to critically analyze the artwork.

Aesthetic perception is a personal experience that reflects the individual's interaction with the artwork, and includes the cognitive, sensory and emotional aspect, which contributes to the formation of an aesthetic judgment influenced by the personal and cultural experience and the environment surrounding the recipient.

Augmented Reality (AR) concept

Augmented reality incorporates a composite student presentation that blends the real scene being viewed with the computer-generated virtual scene that enhances the real scene with additional information. A computer-generated virtual scene aims to improve the sensory

perception of the real world that the student sees or interacts with. It aims to create a system in which the difference between the real world and what was added to it cannot be perceived using augmented reality technology.

Types of augmented reality:

• Tag-based augmented reality: Using image recognition to identify objects already programmed in an augmented reality device or application.

• Tagless augmented reality: The most complex where there is no point in.

• Focus your device: Projection: The most common type of augmented reality, and relies on the use of artificial images such as projecting them on actual reality to increase the proportion of details.

• Shape Recognition: This type recognizes the shape by reading the angles, borders and curves of a specific shape, such as the face or body.

• Location: A method used to identify locations in conjunction with other software, such as GPS.

• Outline: A method of combining augmented reality and virtual reality, based on the principle of giving a person the possibility to merge the outlines of their body or any selected part of their body with another virtual body.

Augmented Reality and Contemporary Arts:

Augmented reality applications and programs have provided many artistic entrances to formulate his work, starting from the idea and developing different perceptions of it, as well as the possibility of experimenting with plastic solutions of dimensions, colors and other elements of the artwork, and augmented reality works to take out works of art from traditional display methods to a space in which it allows enriching the artistic vision of the work with what is added from complementary elements such as images or sound effects, as it makes the artistic experience interactive between the recipient and the artist, which gives it new life, using technology to superimpose images, text or sounds on top of what anyone can actually see. It uses a smartphone or tablet to change the image in an app. The recipient stands in front of the work, carries his devices and shows him a modified version of the reality shown.

Augmented reality has added a huge evolution to the arts as it gives creators a new way to express themselves. As a dynamic and engaging medium that integrates artistic expression with the real world, augmented reality (AR) offers huge possibilities for storytelling and theatrical performances, and many museums and galleries are starting to experience immersive AR performances.

Some contemporary augmented reality artists:
Susie Vetter:

She is an AR artist based in Berlin who creates her work with Adobe software that also offers us great filters for social media. I've created great surreal masks that make you wish you could wear them outside the virtual world.

Vetter describes herself as a painter, multimedia artist, and digital product designer. It focuses on storytelling with blurred lines between physical and digital reality. Her pieces look incredibly fastenable and seem to blend gloomy motifs in a soft and delicate way. Its augmented reality works range from simple innovative logo drawings to complex and elaborate collage-style graphics. It has a great way to combine shapes, colors, and lines to create a world that makes us see nature from a new perspective.
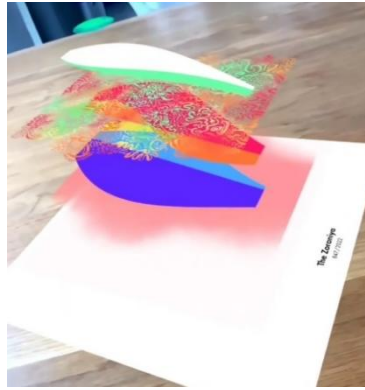

Fig (1)
Susi Vetter (@susivetter) • Instagram photos and video
https://www.instagram.com/susivetter/?utm_source=ig_embed&ig_rid=c8826852-5584-40dc-9e5c-ea04d4953ea5

* When you click on the link below the figure, you can access the site to see the work if connected to the Internet

 Yunuen Esparza Yunuen:

She is a contemporary painter and AR artist from Mexico City who uses multiple materials, known for incorporating augmented reality into her deconstruction art. She considers herself obsessed with dominance when it comes to her paintings, giving a unique color to each piece of the intricate geometric pattern that represents her signature style. The longer she looks at this pattern, the more convincing it becomes, but Yunuen expresses her interest in both celebrating the power of individuality and wanting to understand the random origins of nature. Fig (2) Multimedia Exhibition on Canvas 2018.

It also designed the application for watching its works with (AR) technology, through its own site, some of its paintings can be downloaded, and when viewing the application, the recipient enters a unique artistic experience that combines creativity and technology.

Official Artist Website
Yunuen Esparza - Noticias https://www.yunuene.com/art/news-p01.php?loc=es
Art Exhibitions Website
Yunuene - Augmented Reality Art https://www.yunuene.com/art/index.php?loc=en

AR App for the Artist's Augmented Reality
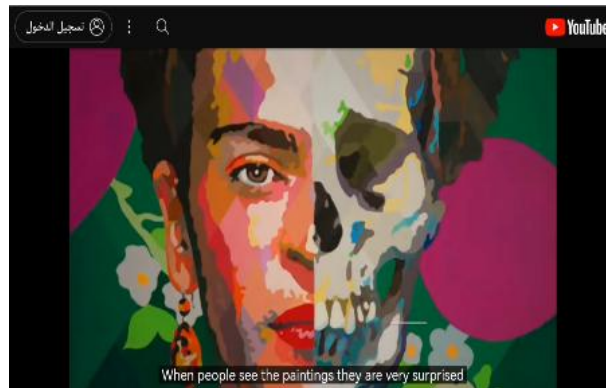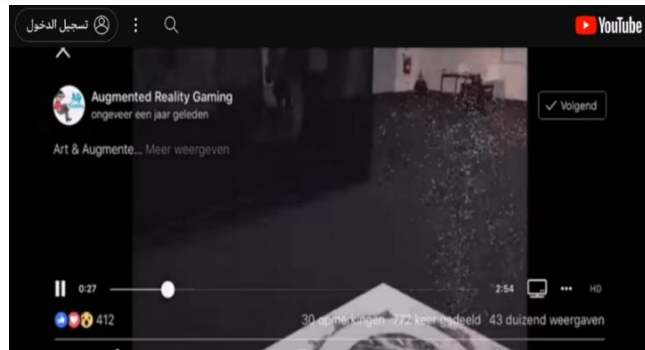**https://youtu.be/NrzsZSnJGCM**

Fig 2

* When you click on the link below the figure, you can access the site to see the work if connected to the Internet

Claire Bardainne and Adrien Mondot

Two artists from Paris were able to combine technology and contemporary technology from augmented reality (AR) and virtual reality (VR) with artwork, and their works, fig (3) is an exhibition entitled "A precise coincidence between the virtual and the material" - Paris - April 2016. It is full of sculptures and drawings that, when displayed through augmented reality, flourish with a moving layer of media. The show was conceived by the artists.

Fig (3)https://youtu.be/PTs61ZivzYo

* When you click on the link below the figure, you can access the site to see the work if connected to the Internet

Fig (4) Crossing the mirror A pop-up book whose drawings and paper volumes represent the décor of the story, and can only be seen in augmented reality. Looking at a tablet or smartphone, the ten double pages of Acqua Alta - Crossing the Mirror become the scene of a short dance performance – thanks to a custom-made augmented reality app, ink graphics and folded white paper combine to reveal the virtual life of dancing miniature beings and dive into the fantasy worlds of water.
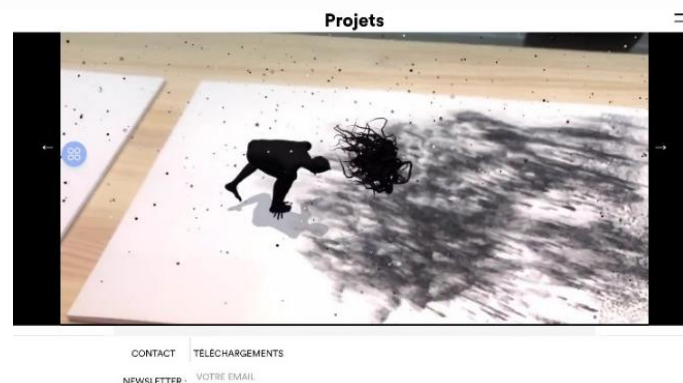

Fig (4)
Acqua Alta – Adrien M & Claire B https://www.am-cb.net/projets/acqua-alta

* When you click on the link below the figure, you can access the site to see the work if connected to the Internet

Museum display experiences supported by augmented reality applications:

Fig (5) "Scenes from the Nineteenth Century Joseon" exhibition on display at Ewha University Women's Museum December 2020 South Korea Visitors can explore some of the exhibits using augmented reality technology.
https://youtu.be/iZauyJp3bZM?si=SIXg-fpRI-04A-Ku

* When you click on the link below the figure, you can access the site to see the work if connected to the Internet

Practical Framework:

Within the framework of achieving the goal of designing and building a mobile application based on augmented reality technology to develop the artistic vision and add new dimensions to ceramic works in an innovative and unconventional way. A set of programs and tools were used for the purpose of use in the design and construction of the application, in which the specificity and ease of use of each program was considered, as well as the use of free open-source software as much as possible for ease of experimentation and development, and the following is a simplified presentation for each of them:

First, Unity3D program:

The main program in the process of designing, creating and developing an augmented reality application. The importance of the program (Unity 3D) is that it is one of the most important multi-tasking programming platforms and capabilities that can be used to design and implement virtual reality applications easily and without cost as it is a free open source software platform, and it also relies on advanced algorithms in image processing and data analysis to determine the locations and real objects surrounding the user, as well as using the camera and sensors in the mobile phone to determine the location of the work, and then add digital elements above the real image synchronously and integrated, in addition to that the program features an easy-to-use programming interface and supports various programming languages such as Java, #C and Visual Basic, in addition, it provides a large number of libraries and tools that can be used in the design and development of applications.

As well as using the camera and sensors in the mobile phone to determine the location of the work, and then add digital elements above the real image synchronously and integrated, in addition to that the program features an easy-to-use programming interface and supports various programming languages such as Java, #C and Visual Basic, in addition, it provides a large number of libraries and tools that can be used in the design and development of applications.

To help Unity3D in designing and implementing augmented reality applications, this also requires software tools added to carry out additional tasks within the program, which are as follows:

1- Apple's ARKit Library: It is a set of software tools for developing augmented reality applications for iOS devices, with its advanced tools and technologies for facial recognition, motion tracking, and stereoscopic recognition in the surrounding world.

2- Google ARCore Library: It is a software tool directed to Android operating systems that allows adding three-dimensional and interactive models in real time to augmented reality applications.

3-XR Interaction Toolkit: An advanced component-based software interaction system for creating virtual reality and augmented reality experiences. It provides a framework that enables three-dimensional interactions and UI interactions from Unity input events. It enables the execution of interaction tasks.

Second, CapCut program:

It is the program used in the process of creating visual and sound effects for ceramic work, as it has the advantage of being a free open-source program that supports basic video editing means, including editing, cutting, splitting, and making visual and sound effects on clips.

Third, Adobe After Effects:

This program specializes in the work of complex visual and kinetic effects, as it contains more flexible and specialized tools in dealing with videos and still images, which enables dealing with the realistic image of the ceramic work, animation, and merging work, and adding appropriate effects.

Fourth: Photopea website:

It is a free website through which still images can be modified and prepared for use in other stages of work.

Artworks used in the work of the application:

Group I:

This group consists of ceramic tiles that contain prominent and sunken plastic relations and contact and a color group with reduced coatings, in which the focus is on making kinetic effects for the structural and structural basis of the slab using the Adobe After Effects program, through a set of multiple operations of moving, lengthening, rotating, splitting and attracting in the body of the slab and then directing the work in the form of an animated video for use in the augmented reality application, as follows:

1-Implementation of ceramic slab: A few ceramic tiles were formed by free manual forming methods using a slice of Aswani clay, then the formation and treatment of surfaces from drilling, addition and contact followed by surface treatment with a reduced glass coating compatible with the thumb movement of the lines and overlapping paths on the surface of the slabs as in Figure (6).

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مجلة العمارة والفنون والعلوم الإنسانية ـ المجلد العاشر ـ عدد خاص (13)
المؤتمر الدولي السادس عشر ـ (الحضارة والفن وقبول الآخر "تحديات وفرص")

Fig (6)
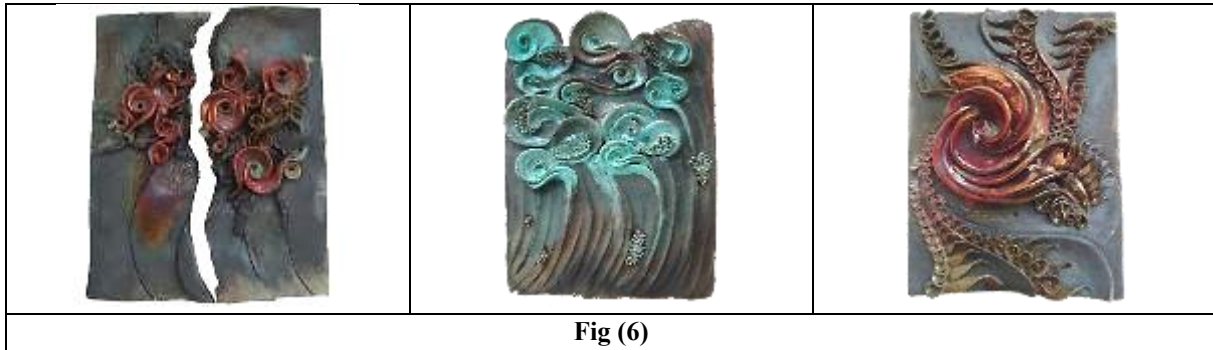
2-Capture and adjust the image of the ceramic tile: After taking still pictures of the ceramic tiles with good quality and in neutral lighting, the free photopea site was used to prepare the images, separate the background, determine the appropriate dimensions and unify them, as the image quality will be a key factor to identify the tile in reality through the augmented reality application using the mobile phone camera.

3-Visual and sound effects: After completing the identification and processing of the tile images, Adobe After Effects was used to create the appropriate kinetic effects for each work, as in Figure (7), which shows the stages of real animation of parts of the ceramic tile structure in line with the pre-existing illusion movement in the foundation resulting from the various lines and touches spread on the surface of the slab in harmonious rhythms.

(a) The second application illustrates free movement in the form of a dancer
(b)Add sound effects and virtual elements.

(a)   (b)

(a) The second application illustrates free movement in the form of a dancer
(b)Add sound effects and virtual elements.

(A)   **(b)**

The third application, (a) which is divided into two parts, has been confirmed to be the movement of attraction and repulsion.   **(b) The addition of sound effects and virtual elements**

(A)   **(b)**

Fig (7)

Group B:

The works in the second group depend on the movement of fixed drawings of plant elements on the surface of the ceramic dish with the work of color and audio effects that suit the animation process to enhance the artistic vision of reality and add more vital and interactive dimensions to modern ceramic work, as in the following steps:

1-Formation of a casserole dish: A few circular dishes were formed using the potter's electric wheel and the pillow flat with a slight concave curvature for ease and clarity of drawing on it.

2-Choosing an animated video: Three animated videos were selected from YouTube for colorful plants and flowers during the growth process (timelapse blooming) and then separated the background as in Figure (8) to suit the design of the dish and extract the starting image in preparation for applying it to the dish and redrawing it in black and white by brush and colors under the glass paint.

Fig (8)

3-Drawing on the ceramic dish: After preparing the still image taken from the moving video, it was printed on a dish-sized paper and the main lines of the design boundaries were transferred to the surface of the clay dish, then the use of colors under the hand-composite glass paint began to paint in black and white tones of the main element with the entry of a variety of simple color tones in the background, then adding a thin layer of transparent glass paint to be the works after the second fire as in Figure (9).
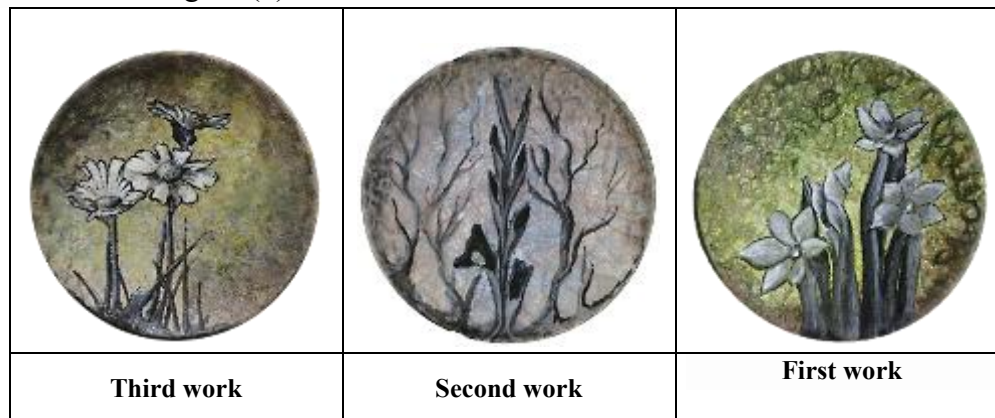

| Third work | Second work | First work |

Fig (9)

4-Adjust the movement and colors: At this stage, the tools of the CapCut program were used to integrate the animated video with the image of the dish in reality, modify the moving video clip of the plant elements, adjust the speed, add the appropriate sound effects, and change the colors at the beginning of the operation to start with black and white tones as in the realistic image, then gradually turn with movement to natural colors at the stage of full maturity and bloom flowers, then re-shrink and reverse the movement and withdraw the colors to return to silence as in the still image drawn on the plate As in Figure (10), it shows shots of the stages of movement from the beginning to the middle and then returning to the same scene in a reverse way.

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Fig (10)

first application

second application
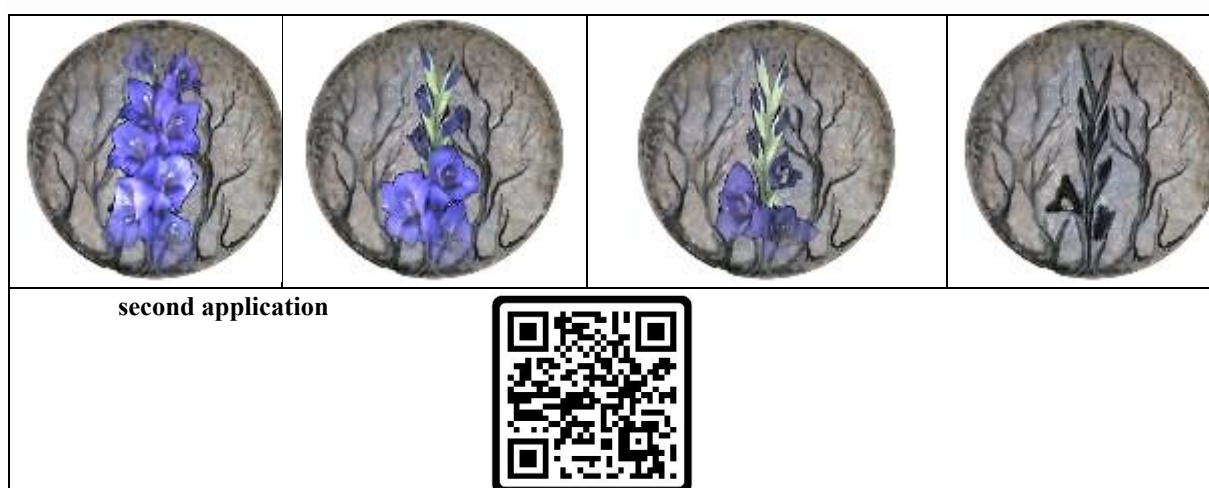
third application

The process of creating and programming an augmented reality application:

The Unity3D program was used to make a link between the still image and moving effects by directing the phone camera to the ceramic work that exists to replace and process the real graphics with animated graphics that have various effects and dimensions through the following stages:

First - Preparing the work environment: The work environment in the Unity3D program is equipped to suit the design of a mobile application running the Android seventh version, the most widespread and easy, and the ARCore library as well as the XR Interaction Toolkit software package were used for ease of use of augmented reality technologies and then adjust the settings for the program.

Second - Create an augmented reality application: After preparing the work environment in the Unity3D program, the stage of building the main screens of the application comes, which were divided into four screens as in Figure (11).

The use of tools and libraries for the augmented reality process and writing code has begun, then adding static images for each ceramic work to be identified through the mobile phone camera, then adding the animated clip for each work to be played automatically when the camera recognizes it and enhancing the realistic works with various kinetic effects and Figure (12) during the creation of the application.

Fig (11)

Fig (12)

Download the

Third: Testing and experimentation: Upon completion of the construction process, a trial version of the application is extracted and tested on more than one Android mobile device and the effectiveness of the application is tested when directing the phone camera towards ceramic work in reality and examining the process of synchronization and matching the kinetic and auditory effects and the extent to which they enhance reality, and in figure (13) the process of experimenting the application and testing the work is illustrated.

Automatic augmented reality playback	Pointing the phone's camera	Run the app.	Ceramic work in reality

Fig (13)

The impact of augmented reality applications on the recipient's experience and aesthetic perception of ceramic works:

To verify the hypothesis of the research on the contribution of augmented reality applications in enhancing the aesthetic perception of contemporary ceramic work, the researchers designed a questionnaire that can answer its questions to identify the impact of augmented reality applications on the aesthetic experience and aesthetic perception of the recipients of the ceramic work presentation.

The questionnaire items were reviewed by a group of arbitrators to determine the validity of the items and their proportion and the current field of research, and the questionnaire was applied to a small sample of specialists in the art of ceramics to verify the sincerity of the questionnaire and then the questionnaire was applied to a number of art students and potters to answer the research question and to verify the imposition of the research:

• How does augmented reality affect the receiver's interaction with contemporary ceramic work?

• Augmented reality applications contribute to enhancing the aesthetic perception of contemporary ceramic work.

Questionnaire of aesthetic perception of contemporary ceramic art considering augmented reality applications:

In the era of accelerated technology, traditional arts have become intersecting with modern technologies to create new innovative experiences, and ceramic art combines ancient heritage arts, handicrafts, and aesthetic creativity, and with the development of technology, augmented reality applications have emerged as a tool capable of reformulating how the public interacts with artworks, which opens new horizons for understanding and appreciating traditional arts.

The questionnaire aims to explore the aesthetic perception of contemporary ceramic art under the use of augmented reality techniques and through this questionnaire we try to understand how these techniques can enhance the recipient's experience and affect his aesthetic

interpretation of ceramic works and how they can contribute to redefining the relationship between art and technology.

Objectives of the questionnaire:

• **Analyzing the impact of augmented reality on aesthetic perception:** How can augmented reality change the way ceramic works are seen?

• **Understanding Audience Interaction:** What are the audiences' impressions when experiencing augmented reality ceramics?

• **Exploring creative possibilities:** How can potters use augmented reality applications when displaying their works to add aesthetic meaning and values to ceramic work?

Importance of the questionnaire:

The importance of the questionnaire comes to bridge the gap between traditional art and technological innovations, as it can contribute to a deeper understanding of how recipients interact with art in the digital age and shed light on the contributions of artists in integrating modern technologies into their artworks.

Questionnaire Methodology:

The questionnaire is based on a set of questions through several axes:

Visual taste: Evaluating the plastic and color aesthetics of ceramic work in an augmented reality environment, do digital layers change the perception of traditional aesthetics of ceramics or are they integrated with a new interactive and artistic dimension?

Emotional interaction: Measuring the feelings and subjective impressions that art evokes when interacting with it digitally, does augmented reality deepen the emotional communication between the work and the recipient or does it shift the focus towards digitization at the expense of artistic content?

Technical Evaluation: Analysis of creativity and traditional and digital skills in the displayed ceramic works, is augmented reality part of the artistic values of contemporary ceramic work or does its role only help in the display?

Interaction with technology: Understanding the impact of the augmented reality experience on deepening the recipient's understanding of contemporary ceramic art, do digital technologies add a new aesthetic dimension or are they an obstacle to spontaneity in artistic taste?

The participants' response comes by choosing one of the answers.

(Yes = 3) (some what = 2) (No = 1)

Questionnaire on Aesthetic Perception of Contemporary Ceramic Art Using Augmented Reality (for Art Learners and Potters)

Thank you for participating in this survey which aims to understand the aesthetic perception of contemporary ceramic art using augmented reality techniques. We aim to explore the views of art learners and potters on the impact of this technology on the artistic and creative experience.

	Questionnaire Items	Yes	Some what	No
First: Visual Taste:				
1	Artistic elements added using augmented reality influenced the ceramic work.			
2	Added AR art elements matched the original ceramic work.			

3	Augmented reality additives helped confirm the meaning of the ceramic work.			
4	The movement of the artistic elements added to augmented reality positively influenced the original ceramic work.			
5	Added music of augmented reality positively influenced the original ceramic work.			
Second: Emotional interaction:				
6	Augmented Reality ceramic works aroused strong feelings in me.			
7	Augmented reality applications have increased the fun and excitement of watching ceramic works.			
8	Augmented reality helped to understand the artistic message expressed by the ceramic work.			
9	Augmented reality is able to communicate the concepts to be clearly expressed.			
10	I interacted with ceramic works in augmented reality more.			
Third: artistic Evaluation:				
11	Augmented reality application compatibility with the artistic concept of ceramic work.			
12	Augmented reality contributed to highlighting the artistic and creative aspects of ceramic work.			
13	Augmented reality has increased my appreciation of the artistic value of ceramic works.			
14	Augmented reality has added a new dimension to ceramics.			
15	I believe that the use of augmented reality helps in the development of contemporary ceramic art.			
Fourth: Interaction with technology				
16	Experience using augmented reality apps with ceramic works is easy and fun.			
17	Use of augmented reality has increased the level of interaction with ceramic works.			
18	Augmented reality has contributed to enriching the artistic display of ceramic works.			
19	Using augmented reality adds great value to the viewing experience.			

Name (optional) .... / Specialization .... / Years of Experience.................

* Thank you for your valuable time and participation." This questionnaire is specially designed for art learners and potters

The questionnaire was judged by experts in ceramic arts (7 contemporary artists and potters) as well as experts in research methods (3 professors in psychology curricula) to verify the wording

of the questionnaire items to ensure its validity and stability before applying it to a sample of students studying the arts.

The questionnaire was applied to 50 students of arts (students of the Department of Art Education, Faculty of Specific Education, Menoufia University) and the results indicated a convergence in the arithmetic averages for each item of the questionnaire:

Statistical processing of data:

To extract the results of the research, the researcher used the statistical program (SPSS), where he used some statistical methods that suit the nature of the required data, such as:

▪ Calculating the "T-test" test for one pain to ensure the significance of the statistical differences between the average scores of the respondents and the mean nominal. The legal mean of the statements for each field was calculated according to the following formula:

Average = Total Questionnaire Correction Scores = (3 + 2 + 1) = 2
Number of weights   (3)

2- Use Pearson Correlation coefficient to verify the validity of the internal consistency of the scale.

3- Alpha Cronbag coefficient to ensure the stability of the scale.

4- The percentage weight of each statement as well as the percentage weight of the field were calculated according to the following equation:

Percentage weight =
Arithmetic mean
The biggest response is (3)

5- The degree of estimation of responses was calculated according to the value of the arithmetic mean as follows:

• If the arithmetic mean is from 1 to less than 1.66, the score is low.

• If the arithmetic mean is from 1.67 to less than 2.33, the score is average.

• If the arithmetic mean is from 2.34 to 3, the score is high.

Steps to legalize the study tool:

The truthfulness of a questionnaire means its validity in measuring what it is alleged to measure, and an honest test measures what is set to measure. To verify the validity of the questionnaire, four different methods were relied upon: Logical honesty, apparent honesty or the honesty of arbitrators, formative or constructive honesty, and internal consistency sincerity.

A - Logical honesty (sincerity of content): The researcher relied in building this questionnaire and choosing the phrases that make up its axes on previous studies that took from the aesthetic perception of contemporary ceramic art. Some scale statements were also derived from some measures of previous studies, either directly or indirectly. The rest of the sub-metrics of the questionnaire were supplemented by studies that addressed one aspect or dimension of the use of augmented reality applications. This reliance on the above sources indicates that the questionnaire has an acceptable degree of logical honesty and that the sub-metrics that make up the questionnaire are applicable.

B- Structural or formative honesty: The correlation coefficients between the degree of each dimension of the questionnaire form and its total degree were calculated, in order to find out the extent to which each dimension is related to the total degree of the questionnaire form, and for the purpose of verifying the validity of the form, and this is evident through the following table:

Table (1)

Correlation coefficients between the total score of each subscale and the total score of the questionnaire form

Domain	Coefficient Link	Level Significance
Visual taste	0.565	Function at 0.01
Emotional interaction	0.612	Function at 0.01
Technical Evaluation	0.685	Function at 0.01
Interaction with technology	0.598	Function at 0.01

It is clear from the previous table No. (1) that the dimensions of the questionnaire form have strong correlation coefficients and statistically significant at a significance level less than 0.01, and the correlation coefficients for the dimensions of the evaluation form ranged between (0.565, 0.685) and this is sufficient evidence that the questionnaire form has a high credibility coefficient, and since the form was divided into four sub-scales, the correlation coefficients were made between the paragraphs of each dimension and the total degree of each dimension separately, and this is evident through the table Next No. (2).

Table (2)

Correlation coefficients between the scores of the statements of each sub-scale and the total score of its sub-questionnaire (*)

Questionnaire sub-metrics											
Visual taste				Emotional interaction				Artistic Evaluation			
Ferry number	Coefficient Link	Ferry number	Coefficient Link	Ferry number	Coefficient Link	Ferry number	Coefficient Link	Ferry number	Coefficient Link	Ferry number	Coefficient Link
1	**0.557**	4	**0.672**	6	**0.684**	9	**0.602**	11	**0.478**	14	**0.547**
2	**0.448**	5	**0.824**	7	**0.724**	10	**0.498**	12	**0.456**	15	**0.547**
3	**0.612**			8	**0.715**			13	**0.624**		
Interaction with technology											
Ferry number	Coefficient Link	Ferry number	Coefficient Link	Ferry number	Coefficient Link	Ferry number	Coefficient Link				
16	**0.682**	17	**0.513**	18	**0.703**	19	**0.762**				
* All sub-metric statements function at 0.01											

Second: Stability of the questionnaire form: The stability of the questionnaire is usually intended to be a high degree of accuracy, proficiency and consistency in the data provided to us about the behavior of the respondent, and the fixed test is the one that gives the same results (approximately) if applied to the same people in two different opportunities, and the stability coefficient of the questionnaire has been calculated on a sample of (40) single, in several different ways, and one of the methods that are used to calculate the stability of the questionnaire.

A- Method of re-application: The scale was applied to a sample of 20 individuals, then re-applied again to the same group after an interval of three weeks, then the researcher calculated the stability coefficient between the scores of the respondents in the first and second applications. The correlation coefficients indicated the agreement between the responses to each dimension of the questionnaire form between the first and second application by 0.698, as shown in the following table:

Table (3)
The stability coefficient of the sub-scales and their various dimensions

	Domain	Number of ferries	Coefficient of stability	Significance level
1	Visual taste	5	0.712	Function at 0.01
2	Emotional interaction	5	0.598	Function at 0.01
3	Technical Evaluation	5	0.628	Function at 0.01
4	Interaction with technology	4	0.547	Function at 0.01
	Total Grade	19	0.698	Function at 0.01

It is clear from the previous table No. (3) the extent of convergence of the stability ratio between the different dimensions, and it is clear that the stability coefficients of the different dimensions have ranged between (0.547 – 0.712), which are the stability coefficients of a function at the level of 0.01, and the previous table shows that the coefficient of stability of the total score of the questionnaire form has reached 0.698, which is a percentage that suggests confidence in the validity of the questionnaire as a tool for collecting study data.

B- Half Fractionation Method (S.H): The researcher also calculated the stability coefficient of each sub-scale of the scale that makes up the questionnaire, and calculated the correlation coefficient of the sub-scales that make up the questionnaire with each other, as well as calculating the dimensional correlation coefficient with the total degree of the scale according to the half-segmentation method of Getman and the Spearman and Brown coefficients.

Table. (4)

The stability coefficient of the questionnaire and its dimensions according to (the half-fractionation of Getman - Spearman and Brown).

	Domain	Correlation of dimensions with overall score	Correlation coefficient Spearman – Brown
1	Visual taste	**0.657**	**0.667**
2	Emotional interaction	**0.849**	**0.837**
3	Technical Evaluation	**0.699**	**0.712**
4	Interaction with technology	**0.672**	**0.725**
	Dimensional correlation coefficient	**0.847**	**0.862**
	Correlation of dimensions with overall score	**0.754**	**0.837**

It is clear from the previous table No. (4) that the dimensions of the questionnaire achieved stability coefficients at a reasonable and scientifically acceptable degree, as the stability coefficients of the sub-scales that make up the questionnaire according to the half-fractionation coefficient of Getman ranged between 0.657 – 0.849, while the stability coefficient of the sub-scales that make up the questionnaire according to the correlation coefficient of Spearman and Brown ranged between 0.667-0.837, and with regard to the correlation coefficients of the sub-scales that make up the questionnaire with each other. It was 0.847 according to the half-hash correlation coefficient of Getman, while it was according to the Spearman-Brown coefficient 0.862, which are high stability coefficients and indicate dimensional stability, and with regard to the correlation coefficients of the sub-scales that make up the questionnaire with the total score of the questionnaire, it was 0.754 according to the half-hash correlation coefficients of Getman, and amounted to 0.837 according to the Spearman and Brown coefficient, which are high stability coefficients and indicate the stability of the scale and its suitability for use.

C- Calculating the stability of the questionnaire by the alpha Cronbag method:

The equation of alpha cronbage depends on the variations of the scale items, and requires that the test items measure only one feature, so the researcher calculated the stability coefficient for each dimension individually, and then calculated the stability coefficient of the questionnaire as a whole, and the researcher used the statistical program SPSS to calculate the stability coefficients, where it was found that the value of alpha cronbage for the scale as a whole is 0.887 and this is sufficient evidence of the stability of the questionnaire form and its validity for application.

Table (5)

Cronbag alpha stability coefficient for the dimensions of the questionnaire and the total score of the questionnaire

	Domain	Number of paragraphs per dimension	Alpha value
1	Visual taste	5	**0.658**
2	Emotional interaction	5	**0.545**

3	Technical Evaluation	5	**0.495**
4	Interaction with technology	4	**0.538**
	The scale as a whole	19	**0.887**

The data in the previous table No. (5) indicate the values of the stability coefficient for the respondents' answers, and the value of the alpha coefficient ranged between (0.538 – 0.658), which suggests the stability of the questionnaire, and the value of the alpha stability coefficient on the total questionnaire indicates the stability of the questionnaire and its ability to measure what was set to measure, as its value was 0.887.

Study results and interpretation:
1- With regard to the field of visual taste:
The following table shows the value of "T" to indicate the differences between the arithmetic averages and the nominal mean of the degree of the respondents' estimates to measure the degree of visual taste.

Table (6)
Shows the value of "T" to indicate the differences between the arithmetic averages and the nominal mean of the degree of respondents' estimates to measure the degree of visual taste.

Ferry	Agree	Neutral	Disagree	Arithmetic mean	Standard deviation	Value "T"	Level Significance	Relative weight	Order	Grade
Added artistic elements using augmented reality influenced the ceramic work	48	2	0	2.96	0.20	34.29	Indicate	98.67	2	High
added AR art elements matched the original ceramic work	45	5	0	2.90	0.30	21.00	Indicate	96.67	3	High
Augmented reality additives helped confirm the meaning of the ceramic work	50	0	0	3.00	0.00	0.00	Indicate	100.0	1	High
The movement of the added AR art elements positively influenced the original ceramic work	45	5	0	2.90	0.30	21.00	Indicate	96.67	3	High
Augmented reality added music positively influenced the original ceramic work	24	23	1	2.46	0.54	6.00	Indicate	82.00	4	High
The field as a whole	N=50			2.84	0.27	Paradigm = 2		94.80	--	High

It is clear from the previous table that the field of visual taste obtained a grade of appreciation (high), while the phrases of this field obtained a grade of appreciation ranging from high, and the highest of these phrases in order was "the elements added to augmented reality helped confirm the meaning of the ceramic work", where it obtained a high grade score with an arithmetic mean of 3.00 and a standard deviation of 0.00 , which is confirmed by the value of the relative weight, which amounted to 100.0, and there were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the arithmetic mean, where the value of "T" 0.00, and came in the following order with a high degree of appreciation. The phrase "technical elements added using augmented reality affected the ceramic work" with an arithmetic average of 2.96 and a standard deviation of 0.20, which is confirmed by the relative weight value, which amounted to 98.67. Statistically significant differences were found at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the arithmetic average, where the value of "T" was 34.29, and came in the third place with a high degree of appreciation the phrase "The technical elements added to augmented reality corresponded with the original ceramic work. The movement of the added technical elements in augmented reality positively affected the original ceramic work "with an arithmetic average of 2.90 and a standard deviation of 0.30, which is confirmed by the relative weight value, which amounted to 96.67, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the legal average, where the value of "T" 21.00, and came in the fourth place with a high degree of appreciation also the phrase "The added music affected the augmented reality positively in the original ceramic work" with an arithmetic average of 2.46 and a standard deviation of 0.54. This is confirmed by the relative weight value of 82.00, and there were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the legal average, where the value of "T" was 6.00.

2- Regarding the field of emotional interaction:

The following table shows the value of "T" to indicate the differences between the arithmetic averages and the nominal average of the degree of the respondents' estimates to measure the degree of emotional interaction.

Table (7)

Shows the value of "T" to indicate the differences between the arithmetic averages and the nominal mean of the degree of respondents' estimates to measure the degree of emotional interaction.

Ferry	Agree	Neutral	Disagree	Arithmetic mean	Standard deviation	Value "T"	level Significance	Relative weight	Order	Grade
Augmented Reality ceramics evoked strong emotions in me	35	14	1	2.68	0.51	9.38	Indicate	89.33	5	High
Augmented reality applications have increased the fun and excitement of watching ceramic works	49	1	0	2.98	0.14	49.00	Indicate	99.33	1	High
Augmented reality helped to understand the artistic message expressed by the ceramic work	43	7	0	2.86	0.35	17.35	Indicate	95.33	2	High
Augmented reality is able to communicate the concepts to be clearly expressed	42	8	0	2.84	0.37	16.04	Indicate	94.67	3	High
Interact with ceramic works in augmented reality more	42	7	1	2.82	0.44	13.25	Indicate	94.00	4	High
The field as a whole	N=50			2.84	0.36	Paradigm = 2		94.53	--	High

It is clear from the previous table that the field of emotional interaction got a grade of appreciation (high), while the phrases of this field got a grade of appreciation ranging from high, and the highest of these phrases ranked is "augmented reality applications increased the pleasure and excitement of watching ceramic works" where I got a high grade score with an arithmetic mean of 2.98 and a standard deviation of 0.14, which is confirmed by the relative weight value of 99.33. There were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the arithmetic mean, where the value of "T" was 49.00 in the following order with a high degree of estimation, the phrase "augmented reality helped to understand the technical message expressed by the ceramic work" with an arithmetic average of 2.86 and a standard deviation of 0.35, which is confirmed by the value of the relative weight, which amounted to 95.33, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the arithmetic average, where the value of "T" was 17.35, and came in the third place with a high degree of appreciation The phrase "Augmented reality is able to communicate the concepts to be expressed" Clearly" with an arithmetic mean of 2.84 and a standard deviation of 0.37, which is confirmed by the relative weight value, which

amounted to 94.67, and there were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the legal average, where the value of "T" 16.04, and came in the fourth place with a high degree of appreciation also the phrase "interacted with ceramic work in augmented reality more" with an arithmetic average of 2.82 and a standard deviation of 0.44, which is confirmed by the value of the relative weight, which amounted to 94.00, and found statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the legal average, where the value of "T" 13.25, and came in the fifth place with a high grade also the phrase "aroused ceramic works enhanced by augmented reality strong feelings I have" with an arithmetic average 2.68 and a standard deviation of 0.51, which is confirmed by the relative weight value of 89.33, and there were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the legal average, where the value of "T" 9.38.

3- Regarding the field of technical evaluation:

The following table shows the value of "T" to indicate the differences between the arithmetic averages and the nominal average of the degree of the respondents' estimates to measure the degree of technical evaluation.

Table (8)

Shows the value of "T" to indicate the differences between the arithmetic averages and the nominal average of the degree of respondents' estimates to measure the degree of artistic evaluation.

Ferry	Agree	Neutral	Disagree	Arithmetic mean	Standard deviation	Value "T"	Level Significance	Relative weight	Order	Grade
Augmented reality application compatibility with the artistic concept of ceramic work	40	9	1	2.78	0.46	11.87	Indicate	92.67	2	High
Augmented reality contributed to highlighting the artistic and creative aspects of ceramic work	12	38	0	2.24	0.43	3.93	Indicate	74.67	4	Medium

Augmented reality has increased my appreciation of the artistic value of ceramic works	10	40	0	2.20	0.40	3.50	Indicate	73.33	5	Medium
Augmented reality has added a new dimension to ceramics	42	7	1	2.82	0.44	13.25	Indicate	94.00	1	High
I believe that the use of augmented reality helps in the development of contemporary ceramic art	37	13	0	2.74	0.44	11.81	Indicate	91.33	3	High
The field as a whole	N=50			2.56	0.44	Paradigm = 2		85.20	--	High

It is clear from the previous table that the field of technical evaluation obtained a grade of appreciation (high), while the phrases of this field got a grade of appreciation ranging from high to medium, and the highest of these phrases ranked is "Augmented reality added a new dimension to ceramic work", where it obtained a high grade score with an arithmetic average of 2.82 and a standard deviation of 0.44, which is confirmed by the relative weight value of 94.00. There were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the arithmetic average, where the value of "T" is 13.25, and came in the following order with a high degree of appreciation of the phrase "compatibility of the application of augmented reality with the technical concept of ceramic work" with an arithmetic average of 2.78 and a standard deviation of 0.46, which is confirmed by the value of the relative weight, which amounted to 92.67, and there were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal average in favor of the arithmetic average, where it reached The value of "T" is 11.87. In the third place with a high degree of appreciation, the phrase "I think that the use of augmented reality helps in the development of contemporary ceramic art" with an arithmetic average of 2.74 and a standard deviation of 0.44, which is confirmed by the relative weight value, which amounted to 91.33, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the legal average, where the value of "T" 11.81. In the fourth place with an average grade also came the phrase "augmented reality contributed to highlighting the artistic and creative aspects of ceramic work" with an arithmetic average of 2.24 and a standard deviation of 0.43, which is confirmed by the relative weight value, which amounted to 74.67, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the legal average, where the value of "T" 3.93. In the fifth place with an average estimate also came the phrase "augmented reality increased my estimate of the artistic value of ceramic works" with an arithmetic average of 2.20 and a

standard deviation of 0.40, which is confirmed by the relative weight value, which amounted to 73.33, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the legal average, where the value of "T" 3.50.

4- Regarding the field of interaction with technology: The following table shows the value of "T" to indicate the differences between the arithmetic averages and the nominal average of the degree of respondents' estimates to measure the degree of interaction with technology.

Table (9)

Shows the value of "T" to indicate the differences between the arithmetic averages and the nominal average of the degree of respondents' estimates to measure the degree of interaction with technology.

Ferry	Agree	Neutral	Disagree	Arithmetic mean	Standard deviation	Value "T"	Level Significance	Relative weight	Order	Grade
Experience using augmented reality apps with ceramic work is easy and fun	36	14	0	2.72	0.45	11.22	Indicate	90.67	4	High
The use of augmented reality has increased the level of interaction with ceramic works	40	10	0	2.80	0.40	14.00	Indicate	93.33	2	High
Augmented reality has enriched the artistic display of ceramic works	38	11	1	2.74	0.49	10.75	Indicate	91.33	3	High
Using augmented reality adds great value to the viewing experience	44	6	0	2.88	0.33	18.96	Indicate	96.00	1	High
The field as a whole	N=50			2.79	0.42	Paradigm = 2		92.83	--	High

It is clear from the previous table that the field of interaction with technology obtained a grade of appreciation (high), while the phrases of this field got a grade of appreciation ranging from

high to medium, and the highest of these phrases ranked is "the use of augmented reality adds great value to the viewing experience", where it obtained a high grade score with an arithmetic average of 2.88 and a standard deviation of 0.33, which is confirmed by the relative weight value of 96.00. There were statistically significant differences at the level of 0.001 between the arithmetic mean of this phrase and the legal mean in favor of the arithmetic mean, where the value of "T" was 18.96. In the following order with a high degree of estimation, the phrase "the use of augmented reality increased from the level of interaction with ceramic works" with an arithmetic average of 2.80 and a standard deviation of 0.40, which is confirmed by the relative weight value, which amounted to 93.33, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the arithmetic average, where the value of "T" was 14.00. In the third ranking, with a high degree of appreciation, the phrase "augmented reality contributed to enriching the artistic display of ceramic works" with an arithmetic average of 2.74 and a standard deviation of 0.49, which is confirmed by the relative weight value, which amounted to 91.33, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the legal average, where the value of "T" was 10.75.

In the fourth place with a high degree of appreciation also came the phrase "the experience of using augmented reality applications with ceramic works is easy and enjoyable" with an arithmetic average of 2.72 and a standard deviation of 0.45, which is confirmed by the relative weight value, which amounted to 90.67, and there were statistically significant differences at the level of 0.001 between the arithmetic average of this phrase and the legal average in favor of the legal average, where the value of "T" was 11.22.

It is also clear from the previous table that the arithmetic average of the respondents' answers for the fourth area (interaction with technology) of the paragraphs ranged between (2.72-2.88) and the relative weight of the paragraphs ranged between (90.67-96.00), while the hypothetical average weighted for the field as a whole was (2.79) with a relative weight of (92.83) and it is clear from this that the degree of the field of interaction with technology is greater than the hypothetical arithmetic average, which was (2) and with a relative weight (67.00), which shows that this field (interaction with technology) needs to more acclamation and interest. The interaction with the technology was highly appreciated by the respondents themselves.

Results:
The results of the questionnaire showed:
• Use of AR applications enhanced the aesthetic perception of ceramic work, providing an interactive experience that differs from traditional displays.

• Recipients became more attracted to ceramic works when viewed using their AR app.

• Augmented reality has improved the recipient's experience, allowing them to interact with the artwork dynamically.

• Some recipients expressed reservations about the use of technology, arguing that it might reduce the artisanal and handmade value of ceramics.

• Some recipients disagreed to the use of sound effects during the presentation.

• The statistical results showed an appreciation of the positive interaction of the recipients of the questionnaire elements (visual taste, emotional interaction, artistic evaluation, and

interaction with augmented reality technology), which enriched their aesthetic experience in the aesthetic perception of contemporary ceramic art.

Recommendations:

• Designing specialized applications for augmented reality to support the display of ceramic works in museums and galleries, and an easy-to-use interface.

• Hold workshops for potters on how to incorporate AR into their artwork to improve the quality of presentation and communication with the audience.

• Educating recipients (especially art students) about the importance of modern technologies in understanding traditional and contemporary arts.

• Explore the use of more sophisticated technologies such as virtual reality (VR) or artificial intelligence (AI) in aesthetic perception analysis.

• Emphasize that technology should be complementary and not a substitute for the original manual and aesthetic value of porcelain.

• Encourage hybrid offerings that combine physical pieces and digital elements to achieve an integrated experience.

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