

Using Immersive media to develop the most intuitive way to build an Interactive Animated Augmented Reality (AR) experiences for Product Design taking into consideration the Covid-19 Pandemic.

Dr. Ayman Raafat Elgndy

Lecturer - Media Department - Faculty of Applied Science and Arts - German University in Cairo (GUC)

**Adobe Certified Instructor – Autodesk Authorized Instructor – Apple Certified Trainer
German University, in Cairo, Egypt**

ayman.elgndy@guc.edu.eg

Abstract:

The study explains how to Design and share Augmented Reality experiences using assets you've created in different design formats. we can merge digital content with the physical world to create and deliver next-generation experiences. Everything becomes a creative canvas to all people who wants to tell their stories in new and exciting ways specifying in this research the Product designers who can build deeper emotional connections for their brands and can connect in a more meaningful way with their customers.

Visualization is the core activity in the design process. In the early stages of development, product and user experience concepts are typically envisioned and shaped through sketching and CAD modeling. their concepts are disconnected from realities of scale and spatial context in the physical real-world due to creating their digital content on paper or on the computer screen.

Using Augmented Reality (AR), tomerge digital content with the physical world and to create and deliver next-generation experiences.

Recommending Adobe Aero as a powerful tool that can be used for interactive Animated Augmented Reality experiences for product designers and the result has demonstrated that it is possible to Anchor your project to your physical space, and then position objects and size them as desired. taking into consideration the Covid-19 Pandemic.

We used Adobe Aero because its automatically optimizes your assets so you can see them in real time and because of its packed full of features that let you craft engaging Augmented Reality experiences quickly and easily, Pitch concepts and prototypes to clients by putting your work right in front of them

With AR you can customize behaviors and add attractive interactivity to your product designs so that the experience flows just the way you envision it.

Keywords:

Augmented reality, digital media, Immersive media, Adobe Aero, Animation, Interactive design

الملخص:

تتناول الدراسة شرح كيفية تصميم ونشر تجارب الواقع المعزز التفاعلي Interactive Animated Augmented Reality (AR) باستخدام التصاميم والعناصر المستحدثة بامتدادات وصيغ مختلفة، فباستخدام الواقع المعزز التفاعلي Interactive Animated Augmented Reality (AR) المستحيل قد يصبح حقيقة جديدة والحدود قد تفوق تخيلاتنا وتصورتنا حيث يمكننا دمج كل من العناصر الرقمية مع العالم والواقع الفيزيقي physical world للوصول الى تجارب الأجيال التالية، فكل الاسطح قد تصبح ابداعية التصميم والتفكير لكل مصمم يختار تلك التكنولوجيا ليروي قصته بشكل جديد وشيق.

مصممي المنتجات product designers قد يستطيعوا التواصل مع عملائهم بطرق أكثر حداثة وفاعلية مستخدمين تلك التقنيات لتوصيل المعاني والمفاهيم للتصميم في منتجاتهم. Product designs ان التوصية باستخدام برنامج أدوبي ايرو Adobe Aero بسبب قوة ادواته في تصميم الواقع المعزز التفاعلي المتحرك Interactive Animated Augmented Reality (AR) المصممي المنتجات. أظهرت النتائج أنه في الإمكان ارتكاز مشاريعك ومنتجاتك في الفراغ من حولك ثم التحكم في تغيرات المكان والحجم للمجسمات طبقا لرغباتك.

قمنا باستخدام أدوبي ايرو Adobe Aero حيث أنه يقوم اوتوماتيكيا بتحسين وتوفير عناصر التصميم لرؤيتهم بشكل طبيعي في نفس الوقت وبسبب توافر مجموعة من الخواص والمميزات التي تتيح للمصمم التفاعل والتعامل بكل سهولة وسرعة مع تجارب الواقع المعزز التفاعلي Interactive Augmented Reality (AR) ، عرض المفاهيم والنماذج الأولية للعملاء عن طريق وضع الأعمال والمشاريع أمامهم مباشرة بطرق سهلة وسريعة بعد بناء المشاهد باستخدام المجسمات ثنائية او ثلاثية الأبعاد مستخدما اى من برامج التصميم الشهيرة كالفوتوشوب ، اليستريتور ، ادوبي دايمنشن ، سابستانس او سينما فور دي وغيرها من البرامج الشهيرة.

كما اسفرت نتائج البحث ان بناء تجربة باستخدام الواقع المعزز التفاعلي Interactive Augmented Reality (AR) (لمجسمات المنتجات ثلاثية الابعاد بواجهة وخطوات استخدام واضحة سوف يسهل عملية تصميم منتجات متحركة بواقع معزز تفاعلي واستخدام الأيدي و الجهاز في تحديد وضع و مكان المنتج في الفراغ مع تحديد المسار و نقاط التفاعل تساعد المشاهد (المستخدم) على سهولة التفاعل و فهم التصميم عن بعد مع مراعاة جانحة كوفيد ١٩ كما توصى الدراسة باستخدام تكنولوجيا الواقع المعزز مازالت تأتي بالمزيد من البرامج والأدوات لكننا كمصممين نرى انها التغير التالي في مستقبل التجارب الاليكترونية للعروض الرقمية. نوصى بالاعتماد على برنامج أدوبي ايرو Adobe Aero لما يقدمه من قوة في ادوات التفاعل والتحرك للواقع المعزز لتصاميم المنتجات Product designs مع امكانية المشاهدة المباشرة بسهولة وسرعة في التفاعل.

الكلمات المفتاحية:

وسائط الميديا، العروض المتحركة، المعزز التفاعلي، الميديا الرقمية

Introduction

Visualization is the core activity in the design process. In the early stages of development, product and user experience concepts are typically envisioned and shaped through sketching and CAD modeling. their concepts are disconnected from realities of scale and spatial context

in the physical real-world due to creating their digital content on paper or on the computer screen (1)

The study explains how to Design and share Augmented Reality experiences using assets you've created in different design formats .so that Product designers can build deeper emotional connections for their brands and can connect in a more meaningful way with their customers.

Using Augmented Reality (AR), to merge digital content with the physical world and to create and deliver next-generation experiences.

Adobe Aero is one of the powerful tools that can be used for interactive Animated Augmented Reality experiences for product designers by Anchoring your project to your physical space, and then position objects and size them as desired.

With Adobe Aero intuitive menus and tools, you can customize behaviors and add attractive interactivity so that the experience flows just the way you envision it. taking into consideration the Covid-19 Pandemic.

Problem of study

The problem was how can we build and improve Product design presentations quickly and easily, taking into consideration the Covid-19 Pandemic

Aims

Using modern Immersive media methods to develop product design presentations using Augmented reality.

Research Questions

1. What are the modern Immersive media methods to develop product design interactive presentation?
2. What will designers do with Aero?
3. How do Augmented Reality applications affect product design process?
4. Do these methods save time, money and reduces the risks associated with human's field localities taking into consideration the Covid-19 Pandemic?

Research Methodology

The study works on the experimental method by using Augmented reality modern Immersive media methods on 3D product design objects.

Research Hypotheses

The study method was developing a modern Immersive media model that could locate these unique digital media features through product design presentations, thus saving time, money and reducing the risks associated with human's field localities taking into consideration the Covid-19 Pandemic.

Augmented Reality (AR)

Augmented Reality (AR) direct or indirect the view of a physical real-world environment with enhanced or augmented by adding virtual computer-generated information CGI to it (2)

AR relies on principles of good design and compelling content by merge digital content with the physical world to create and deliver next-generation experiences.

Using Augmented Reality (AR) for Product designers can build deeper emotional connections for their brands and can connect in a more meaningful way with their customers. (3) Milgram's

Reality-Virtuality Continuum is defined by Paul Milgram and Fumio Kishino as a continuum that spans between the real environment and the virtual environment comprise Augmented Reality and Augmented Virtuality (AV) in between, where AR is closer to the real world and AV is closer to a pure virtual environment, as seen in Fig.01 (4).

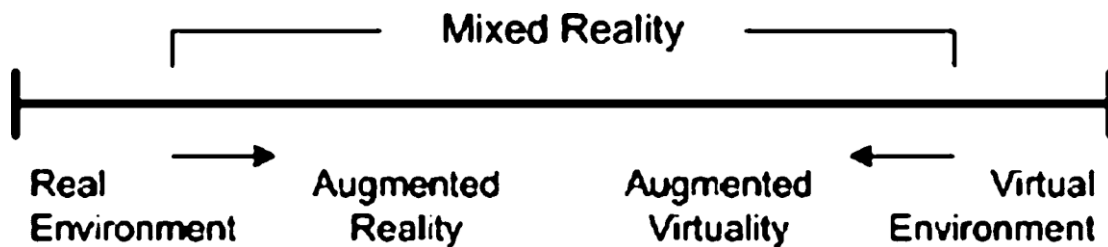


Fig. 01 Milgram’s reality-virtuality continuum (4)

Adobe Aero is one of the latest powerful tools that can be used for interactive Animated Augmented Reality for product designers, which made it possible to Anchor your project to your physical space, and then position objects and size them as desired , using Immersive media to develop the most intuitive way to view, build , and share Interactive Animated Augmented Reality (AR) experiences (3) taking into consideration the Covid-19 Pandemic by taking some simple precautions, such as physical distancing, avoiding crowds, cleaning your hands (5) but using AR will Pitch concepts and prototypes to clients by putting your work right in front of them By pulling the idea out of the screen and drop it into the real world at full scale. We're then able to walk around it, or walk within it, and get a far better feel for form, proportion and relationship to the environment. (1)

bringing a better solution for product designers adding a whole new dimension to the way they tell stories and Audiences can experience your ideas like never before. (3)

Augmented Reality aims at simplifying the user’s life and enhances the user’s perception of and interaction with the real-world. While Virtual Reality (VR) technology or Virtual Environment as called by Milgram, completely immerses users in a synthetic world without seeing the real-world, AR technology augments the sense of reality by superimposing virtual objects and cues upon the real-world in real time. Note that, as Azuma et al. (6)

Augmented reality is an immersive experience in which can be used to see, hear, and feel on our physical world any digital content as seen in fig. 02

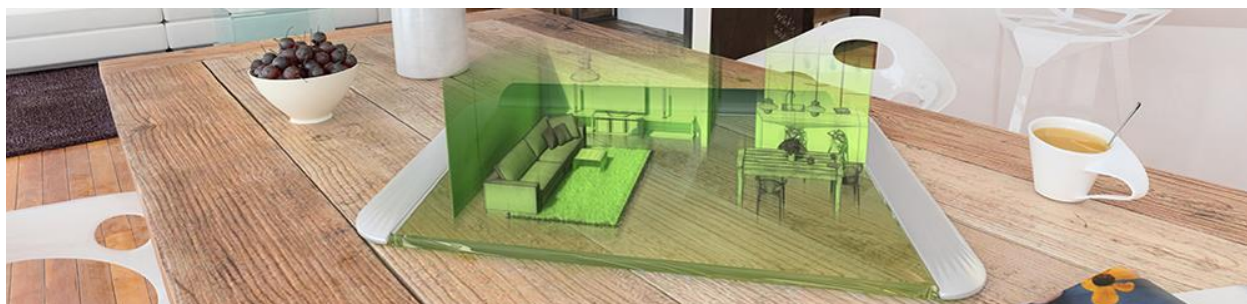


Fig. 02 AR in real-world

Augmented Reality (AR) refers to a live view of physical real-world environment whose elements are merged with augmented computer-generated Content to create a mixed reality. (3)

By using the latest AR techniques and technologies, we can push the boundaries of reality and makes it more intuitive, immersive, and the information about the surrounding real world becomes interactive and digitally usable. (7)

Augmented reality AR in reality



Fig. 03 AR in reality (3)

AR is being used today in gaming, manufacturing, services, retail, education, healthcare, and so on. (7) AR can be used to enhance the way consumers experience products.

Augmented reality AR is mostly used by marketers to promote new products online. Most techniques use markers that the users present in front of their webcam either on special software or simply on the advertising company’s website. For example, in December 2008, MINI, the famous car company, ran an augmented reality advertisement in several German automotive magazines (8)



Fig. 04 Mini ran AR

The reader simply had to go to the MINI’s website, showing the ad in front of their webcam, and a 3-D MINI appeared on their screen, as seen in Fig. 04

AR can also be used to improve the productivity and precision of work being done.

The ITIA of CNR in Milan has created a system with the Magic Mirror, which combined with high-tech footwear technology for measurement, enables the user to virtually try on shoes prior to buying/ordering them which considered an important way of keeping safe from Covid-19.

The user is able to see his/her reflection in the Magic Mirror with a virtual model of the pair shoes s/he would like to try on. The advantage of such a system over going to the of store is that once the user selects shoes for trial, s/he has the ability to change a few details, such as the color, the heel, and/or even the stitching. To do so, the user puts on some special “socks” with spherical, infrared reflective painted-on markers that serve as a tracking system for the Magic Mirror, which is in fact an LCD screen that actually processes the information from the electronic catalog and inputs data from the client to see if the model chosen is approved, to detect and mirror the movements of the customer. (9)

So, there is no limit to creativity and storytelling. How would you want to augment reality is up to your own imagination and needs?

AR and Adobe Aero



Fig. 05 Adobe Aero App

Adobe Aero makes it easy for designers to build AR experiences without the need to code. All you have to do is import your 2D and 3D digital assets into Adobe Aero, place them in physical space and add interactivity. Adobe Aero makes AR creation fluid and intuitive. (3)

AR terminologies

Defining the common AR terminologies is important to help you get familiar with the terms associated with augmented reality as for example the most common AR terminologies in Adobe Aero is as follow:

- **.REAL :** (.real) is the Aero document format.
- **Action:** An action is the "do something" and its part of a behavior.
For example, object can take these actions of spinning, bouncing, and path.
- **Anchor:** can be used to position AR content using an indicated 'trackable' point or area (10)
- **Location Anchors:** is to Place AR experiences at specific places, such as throughout cities and alongside famous landmarks. Location Anchoring allows you to anchor your AR creations at specific latitude, longitude, and altitude coordinates. Users can move around virtual objects and see them from different perspectives, exactly as real objects are seen through a camera lens. (11)

- **Image Anchor:** An image which is used for an AR tracking engine to recognize and attach content to. A good marker image has edges and other visual features.
- **Surface:** A real world surface that is trackable by AR. Surfaces are often interpreted by AR apps from a collection of plane-aligned feature points. For example, the surface of a table.
- **Surface anchor:** An anchor that is used to position and orient digital content on a trackable surface.
- **ARKit:** Library for AR features provided on iOS devices by Apple. (10)
ARKit 4 introduces a brand-new Depth API, creating a new way to access the detailed depth information gathered by the LiDAR Scanner on iPad Pro.

Also, the ARKit have more advanced Features for AR defined as follow

- **- Scene Geometry**
Creating a topological map of your space with labels identifying floors, walls, ceilings, windows, doors, and seats. This deep understanding of the real world gives you more information to power your AR workflows.
And unlocks object occlusion and real-world physics for virtual objects.
- **- Instant AR**
The LiDAR Scanner enables quick plane and surface detection which allows instant placement of AR objects in the real world without scanning.
- **- People Occlusion**
AR content realistically passes behind and in front of people in the real world, making AR experiences more immersive while also enabling green screen-style effects in almost any environment.
- **- Motion Capture**
Capture the motion of a person in real time with a single camera. By understanding body position and movement as a series of joints and bones, you can use motion and poses as an input to the AR experience while placing people at the center of AR.
- **- Simultaneous Front and Back Camera**
You can simultaneously use face and world tracking on the front and back cameras, for example, you can interact with AR content in the back-camera view using just your face.
- **- Multiple Face Tracking**
Tracks up to three faces at once, using the True Depth camera on apple devices like iPhone X, iPhone XS, iPhone XS Max, iPhone XR, and iPad Pro to power front-facing camera experiences like Memoji and Snapchat.
- **- Collaborative Sessions**
With live collaborative session between multiple people, you can build a collaborative world map to develop AR experiences and for users to get into shared AR experiences like multiplayer games. (11)

- **Behavior:** A behavior is an interactive property that can be added to an object in the scene. An object can have zero, one, or multiple behaviors attached. A behavior is made up of a trigger and an action.
- : A trigger is part of a behavior. A behavior is usually in a "waiting" state until the trigger tells it to "run".
- **Bounding Box:** A visualization of the extents of an object or selection of objects.
- **Feature Points:** Distinct recognizable features of an environment that can be automatically recognized by tracking engines. These are often cornering and other joining edges where there is a detectable difference in color from their surroundings. (10)

8.4.1: Preparing 3D content for AR

we should keep some few things in mind while preparing 3D content for AR for example while using Aero which is needed like simplifying your 3D model is the better it will perform in AR, like in Aero it supports models up to 130K Polygons. (3)

8.4.2: Defining 3D Polygons and meshes:

Polygons consist of geometry based on vertices, edges, and faces that you can use to create three-dimensional models .

Polygons are useful for constructing many types of 3D models and are widely used in the development of 3D content for animated effects in film, interactive video games, and the internet. (12)

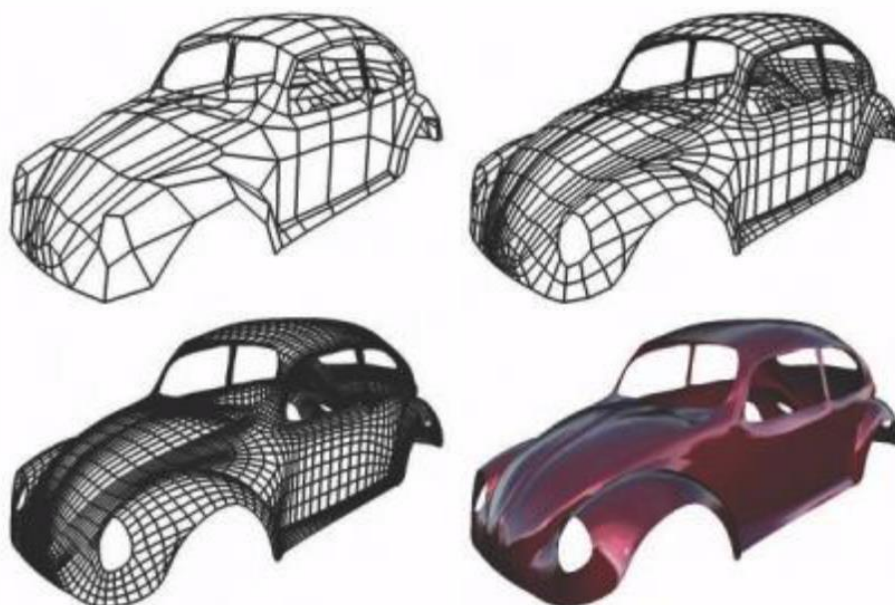


Fig. 06 subdivision surfaces generated by iterative uniform refinement (13)

Polygon terminology

Polygons are straight-sided shapes (3 or more sides), defined by three-dimensional points (vertices) and the straight lines that connect them (edges). The interior region of the polygon is called the *face*. Vertices, edges, and faces are the basic components of polygons. You select and modify polygons using these basic components.

When you model with polygons you usually use three-sided polygons called *triangles* or four-sided polygons called *quadrilaterals* (quads). Some 3D softwares like Autodesk Maya supports

the creation of polygons with more than four sides (n-gons) but they are not as commonly used for modeling. (12)

An individual polygon is commonly called a *face*, and is defined as the area bounded by three or more vertices and their associated edges. When many faces are connected together they create a network of faces called a *polygon mesh* (also referred to as a *polyset* or a *polygonal object*). You create your 3D polygonal models using polygon meshes. Polygon meshes can be created using a variety of techniques.

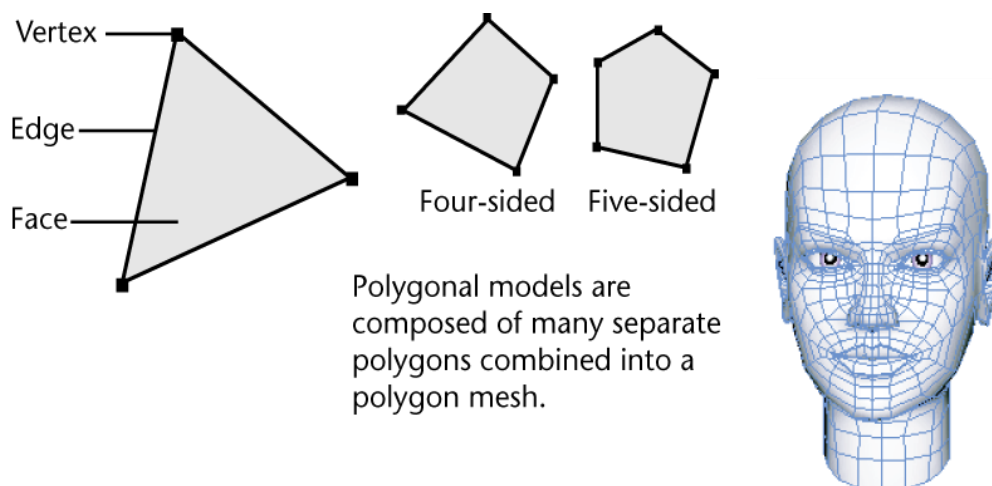


Fig. 07 Polygon meshes shares the vertices and edges.

Polygon meshes normally share the vertices and edges that are common between the individual faces. These are referred to as *shared vertices* or *shared edges* as seen in fig. 07

A polygon mesh can also be composed of several disjointed sets of connected polygons called *shells*. The outside edges of a mesh or shell are referred to as *border edges*. (14)

3D content for AR

AR relies on principles of good design and compelling content. You might already pose the skills needed to work with 2D digital assets. To work with AR-ready 3D content, you need to begin by 'thinking in Z'.

8.5.1: how to navigate X, Y and Z axis?

X and Y coordinates represent a distance relative to an origin point which usually is the upper left corner of a 2D image, window, or any other rectangular container.

- X is the distance left or right.
- Y is the up or down distance relative to the origin.

For example, if there is a digital image that is 20 pixels wide by 20 pixels tall, then the pixel at "10, 10" is near the center of that image.

3D allows you to move that single pixel forward or backward by using the "Z" axis (X, Y, Z). A pixel location of "(10, 10, 10)" tells you that the pixel is still within the middle of the screen when looking straight on, but it's 10 pixels away from you or the viewer. "(10, 10, -10)" means the pixel is still in the middle of the screen when looking at it straight on, but it's 10 pixels towards you or the viewer as seen in fig.08

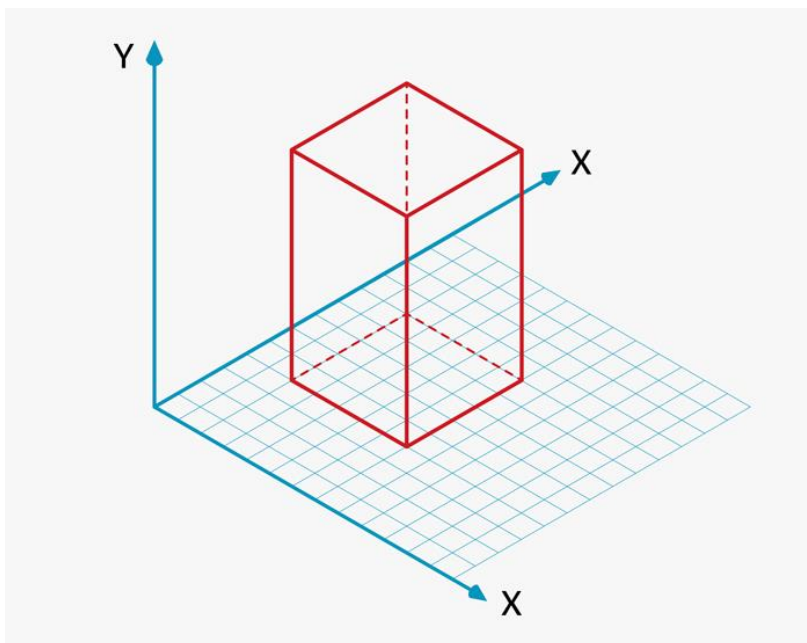


Fig.08 3D axis (X, Y, Z).

AR and Animated 3D objects

AR supports animated 3D objects so Defining the common AR animation types is important to help you get familiar with the terms associated with augmented reality

- **Rigid body animation**

A rigid body animation is an animation consisting of rotation, scaling, and translation (movement) of an object as a whole over time. This is often used to move solid objects, such as vehicles, doors, or machinery

- **Skeletal animation**

Skeletal animations are animations consisting of movement, rotation, or scaling, of a structure of bones over time. Often one or more 3D meshes is mapped to the bones with “painted weights” that indicate which areas of the mesh should deform based on which of the bones. This is often used to animate bendy things, such as animals and plants.

- **Keyframes, Mocap, and Procedural animation**

Rigid Body and Skeletal animations are often created using “key frame animation”, in which an animator decides where each object should be at certain “key” frames, and all in-between frames are computed automatically. Key frame animation results in the smallest file sizes for animation. (16)

Motion Capture animation is animation data that is acquired using motion capture cameras. This type of animation data can be extremely large. Procedural animation is animation that is automatically computed from equations in software. Procedural animation will need to be converted into keyframe data when exporting, which is likely to make it large like motion capture data. (17)

Other types of animation

Other types of animations such as fluid or cloth simulation output, morph shapes, and animations of textures, cannot be imported by Aero at this time. Fluid and cloth simulations are used for realistic movement of liquids, gasses, and cloth. Morph shapes are often used for facial expressions, but can also be used for many other purposes. Texture animations are often used for rippling water surfaces or similar effects. (18)

Materials

AR should use physically-based rendering system of materials with modifications to enable real-time performance.

All textures should have their resolution scaled upon being used for AR and may be further reduced automatically like in Aero during playback if memory / real-time performance requires it. (3)

touchscreen gestures

the touchscreen gestures in Adobe Aero works with objects in a three-dimensional environment on a flat screen.

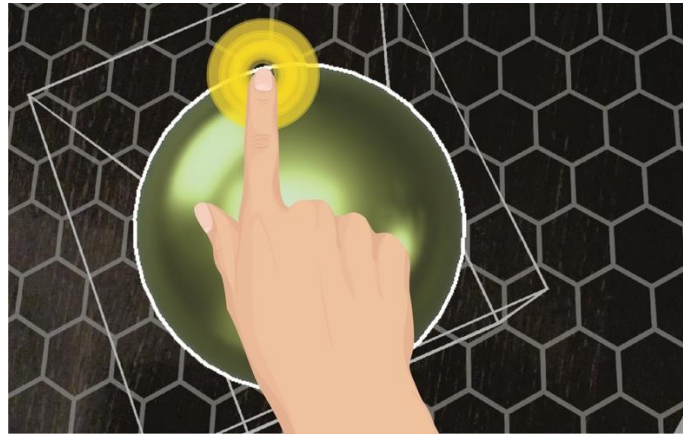


Fig. 09 Tap on an object

Also, you can Tap on an object to select it or Tap anywhere on the screen to deselect it as seen in fig. 09

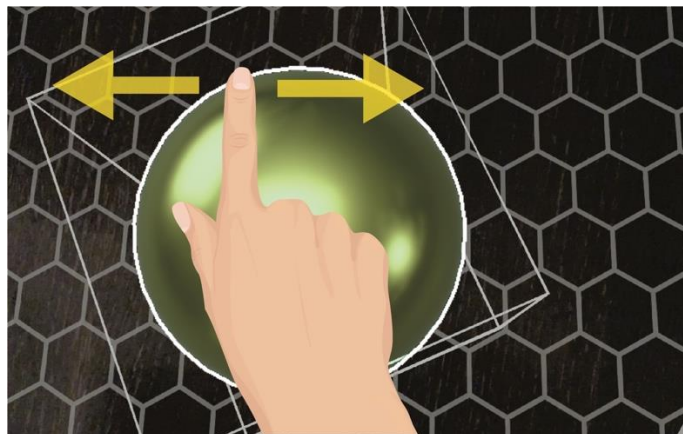


Fig.10 moving your finger upwards on the screen

by moving your finger upwards on the screen, you can move an object away from you and to move an object towards you by moving your finger downwards as seen in fig. 10

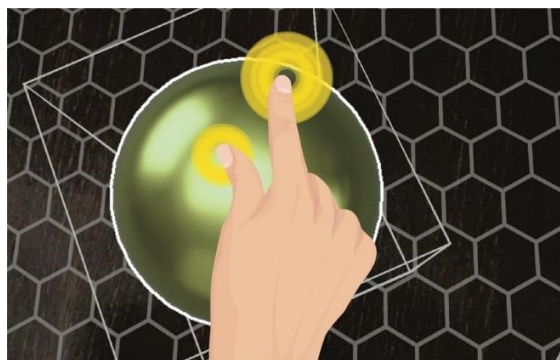


Fig. 11 pinch your fingers on screen

but to scale an object just pinch to make an object smaller and widen your fingers to make the object bigger and to rotate it just keep your fingers at a uniform distance and twist them over the screen in the direction you would like to rotate the object as seen in fig. 11



Fig.12 Using three fingers

By Using three fingers and swipe up or down to lift you can move the object upward or downward on the vertical plane in the scene as seen in fig. 12 (15)

Adobe Aero helps you design immersive experiences by overlaying digital content over a live view of your mobile device's camera without getting closer or touch any object in front of you taking into consideration the Covid-19 Pandemic.

Assets



Fig.13 Assets libraries

Some AR software's like Aero comes with several 3D starter assets for primitive shapes, furniture, plants, product packaging, frames, typography, animated assets and so on as seen in fig. 13.

Using your own assets

You can import your own assets, created by you, sourced from clients, or even purchased from a stock service as seen in fig. 14

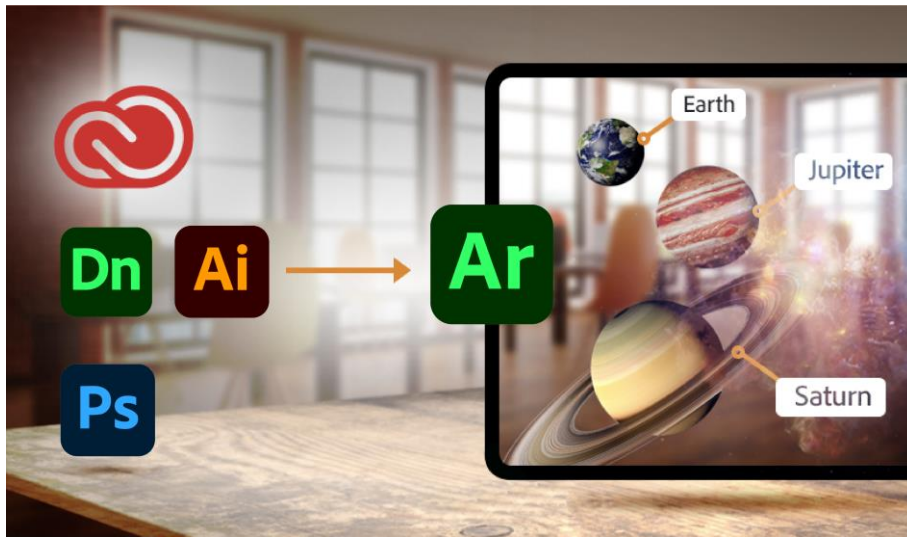


Fig. 14 Aero optimizes the imported assets for an augmented reality environment.

- AR experiences without coding.

Intuitive block-building approach in Aero makes it easy to add interactivity. You do not have to rely on a developer to create interactive moments. It's as simple as placing the assets and adding interactivity. You are all set.

But also, XCode and other programming languages can help you extend your AR designs into branded apps.



Fig.14 exporting an AR experience as a .usdz and .reality files.

By embedding these files into an XCode project

Sharing creation

When your AR content is ready for a wider audience, most AR mobile apps supports sharing a video or photo that is perfect for social media sharing or share a link to a stakeholder for review right from the app. (3)



Fig.15 Sharing creation

AR content is best experienced in various physical spaces so its recommended that if it's possible to create and try our AR products indoor and outdoor to Push the limits of creativity and storytelling and to Keep our projects moving toward the finish line.

Results

- 1- Build AR experiences with a visual UI, and step-by-step instructions will take you through creating your first augmented reality scene quickly and easily.
- 2- Using your hands and your device to place objects in space, shape their paths, and add triggers help viewers to interact with their objects remotely in augmented reality taking into consideration the Covid-19 Pandemic.

Conclusion

AR can free us from boundaries of the screen and transform any environment to a digital stage. using immersive media to bring “impossible” visions to life considering Covid-19 Pandemic situation while blending reality with the surreal in innovative, unexpected ways.

- Models that contain animation and hi poly objects will unable to load if they are too large.
- Aero supports both rigid body animation and skeletal animation when importing GLB or FBX files but only one animation (or “take”) per file is supported Currently.
- For skeletal animation, each bone can be animated, but weights / blend shapes / morph shapes cannot be animated and only up to 6 bones can influence any given vertex.

Recommendations

AR is still coming together with several hardware and software components, but we see it as the next logical frontier to transform digital experiences from artistic renderings to retail experiences.

working in interactive media can bring things off the screen and into the real-world, taking into consideration the Covid-19 Pandemic while keep causing an amazing effect in people where they don't realize how this is possible.

Recommending using Adobe Aero as a powerful tool for interactive Animated Augmented Reality experiences for product designers so that you can see objects and products in real time and let you craft engaging Augmented Reality experiences quickly and easily.

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