The Conceptual Design Framework for XR Marketing

Baris Atiker

Abstract The concept of XR (Extended Reality) Marketing is growing rapidly and businesses across many different fields are using virtual and augmented reality more than ever before. Despite the ability of XR technology to create immersive and engaging experiences, there is still a lack of understanding about how marketing experiences should be designed using this technology. The aim of this paper is to explore and analyze the conceptual design framework for creating engaging and immersive marketing experiences in XR. The findings of the study show that storytelling, gamification and User-Centered Design (UCD) are the most effective key elements for designing engaging and immersive XR marketing experiences. Storytelling enables the design of a narrative that captures the consumer's attention. Gamification adds a layer of interactivity and competition to the design, making the experience more fun and memorable. User-Centered Design (UCD) ensures that the experience is designed around the needs and preferences of the consumer, making it more effective and personalized. Ultimately, this research aims to provide a guide on how the design framework can be used to create well-functioning XR marketing experiences.

Keywords Design · Framework · XR · Marketing

1 Introduction

XR is a term for a group of technologies that enable the creation and sharing of immersive experiences. It stands for Extended Reality and includes Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR). XR technology enables people to interact with digital content in a way that seems real, making it difficult to tell where the real world ends and the digital world begins. Kunkel and Soechtig describe this as "virtual and real worlds colliding to create new environments where digital and physical objects and their data can coexist and interact with each other"

B. Atiker (✉)
Aydin Adnan Menderes University, Aydin 09010, Turkey
e-mail: barisatiker@gmail.com

[1]. This can include virtual environments, augmented displays and other forms of computer-generated sensory input.

With the rise of the "metaverse" concept, digital marketing, like all other industries, has found a new playground. Frey et al. define the metaverse as "a system of multiple, interconnected, typically user-created virtual worlds (or meta-worlds) accessible through a single user interface" [2]. The metaverse is often regarded as an embodied Internet that can create an enhanced sense of presence and bring online interaction closer to the real world [3]. Providing a platform and tools to create, access and interact with a virtual world, XR technologies are critical for enhancing realism and immersive consumer experiences along the continuum between AR and VR as defined by Milgram and Kishino [4].

This move toward XR means that marketing needs to be more creative and hands-on, since traditional methods may not work as well. Jessen et al. argue that AR enables a unique form of consumer creativity that differs from previous conceptualizations of creativity through its relationship with consumer engagement [5]. As the metaverse continues to grow and change, XR marketing will be an important part of how advertising and consumer engagement is done in the future.

There is a close and important relationship between design and XR marketing because design is an essential part of creating and shaping the user experience in XR environments and the metaverse. Designers are responsible for creating the look and feel of virtual environments, including the architecture, levels, objects and graphics that make up the immersive experience. They also determine how consumers interact with and navigate the virtual world by designing the user interface and interaction mechanisms. Slater et al. believe that good design is more than just a requirement to immerse consumers in XR environments for effective marketing [6]. Design can enhance immersion in virtual environments by creating a sense of presence. According to the authors, immersion can be enhanced by using high-fidelity visual, audio and tactile cues, as well as storytelling techniques.

Consumer habits are fundamentally changing and are increasingly shifting towards digital consumption [7]. As the 4P theory (product, price, promotion, and place) developed by McCarthy [8] and at the core of traditional marketing is revisited for XR marketing, designers must have a deep understanding of consumer experience and technology to create engaging and immersive virtual environments in the metaverse.

Flavián et al. propose a new taxonomy of technology and experience based on technological (embodiment), psychological (presence), and behavioral (interaction) perspectives to add value to the customer purchase journey and better understand the changing XR customer experience landscape [9]. Similarly, this paper presents a conceptual design framework that addresses interactivity, personal expectations and immersion in a flow according to consumers' behavior.

2 The Conceptual Design Framework

The conceptual design framework (Fig. 1) for XR marketing is based on three key factors: Storytelling, Gamification and User-Centered Design. It also frames attributes called Immersive, Interactive and Personal, which provide a fluid transition between the key elements.

Storytelling and gamification have a core purpose in terms of fostering immersion inside their respective mediums. Immersion, as a notion, relates to the user's interaction with the medium, in which the user feels completely immersed in the experience, resulting in a heightened sensation of presence and engagement. While the shape and structure of these two mediums differ, they share fundamental features in terms of how they elicit and maintain immersion.

The capacity to create and maintain a sense of flow lies at the heart of both storytelling and gamification. Flow is the best sensation of being entirely absorbed in a task or activity, where the person is fully engaged and time seems to fly by. Flow in storytelling is done by using an engaging narrative that captures the user's attention and keeps them engaged with the plot, characters, and setting. Similarly, gamification is based on the usage of game mechanisms that challenge the user while also delivering a sense of progression and achievement, resulting in a sense of flow that motivates users to stay engaged with the game.

Another important parallel between storytelling and gamification is their capacity to instill a sense of agency in the user. The user's perception of control and influence over the experience is referred to as agency, and it is a vital aspect in establishing immersion. Storytelling allows customers to relate with the characters, making them feel invested in the story's outcome. Similarly, gamification allows users to make choices and decisions that influence the game's result, giving them a sense of control over their experience.

Both storytelling and gamification rely on feedback to build immersion. In this context, feedback refers to the user's ability to perceive the outcomes of their activities, whether favorable or negative. Feedback in storytelling is obtained by the user's

Fig. 1 The conceptual design framework by B. Atiker
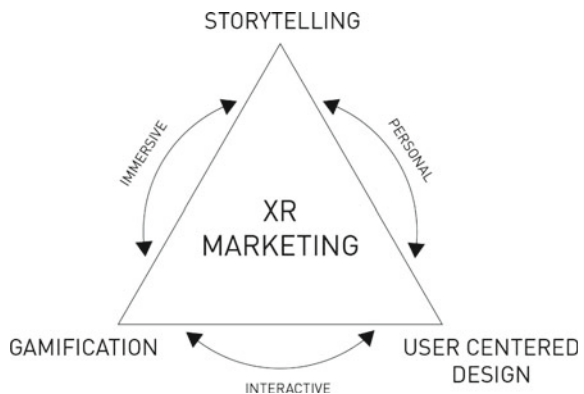
emotional reaction to the story's events, where their actions and decisions have a real affect on the characters and the story's outcome. Feedback is achieved in gamification through the use of rewards and punishments, where the user's activities result in good or negative effects.

Gamification and UCD have a focus on interaction design in common. Both approaches prioritize user wants and preferences, rely on feedback to convey information to the user, apply interaction design principles to produce engaging experiences, and are iterative processes involving constant testing and improvement. Knowing these similarities is crucial for designers and developers aiming to create compelling and effective interactive experiences that prioritize the requirements and preferences of the user.

The emphasis on knowing the user's goals and motivations is one of the fundamental similarities between gamification and UCD. Designers in gamification aim to understand the user's motives for engaging with the game and build game mechanics that correspond with those goals. Designers in UCD aim to understand the user's goals and create interfaces that support those goals. These techniques stress user needs and preferences over other factors, ensuring that the experience is relevant and meaningful to the user.

Gamification and UCD share an emphasis on feedback. In gamification, feedback is utilized to provide the user with information on their progress, accomplishments, and failures. Examples of feedback include visual, auditory, and tactile stimuli. UCD uses feedback to aid users in comprehending the outcomes of their activities and the current status of their work. Visual cues, such as progress bars or confirmation messages, as well as audible cues, such as confirmation sounds, can be utilized to convey feedback.

Another thing that gamification and UCD have in common is that they both use interaction design principles to produce engaging experiences. Designers employ game concepts such as points, levels, and badges to create a sense of growth and achievement in gamification. Designers at UCD employ interaction design ideas like as affordances and signifiers to build user-friendly interfaces. Both approaches rely on interaction design concepts to create intuitive and engaging experiences.

User-Centered Design (UCD) and Storytelling are two design methodologies that share a focus on personalization. Both techniques aim to produce experiences that are personalized to the needs and preferences of the user, which can result in increased engagement and pleasure.

Understanding the user's background and perspective is a crucial component of both user-centered design and storytelling. In UCD, designers aim to comprehend the user's objectives, tasks, and preferences in order to create interfaces that meet their requirements. In order to develop stories that resonate with an audience's interests and experiences, storytellers aim to comprehend the audience's preferences and background. Both strategies promote personalization and customisation above one-size-fits-all solutions, thereby ensuring that the user's experience is relevant and meaningful.

Another similarity between user-centered design and storytelling is the usage of personas to portray users. In UCD, designers develop personas to reflect various

user types and their demands, ensuring that the interface is suited to the user's requirements. In storytelling, authors develop characters that represent many types of individuals and their experiences, thereby ensuring that the story is interesting and relatable. These approaches leverage personas to generate individualized and tailored user experiences based on their requirements and interests.

The use of user feedback to enhance the experience is a third commonality shared by UCD and storytelling. Both approaches rely on user feedback to identify areas for improvement and adjust the experience repeatedly to better match user requirements.

This framework can be used to gain an understanding of the link that exists between storytelling, gamification, and personalization in XR marketing. The framework focuses on the ways in which these methods collaborate to provide marketing experiences that are both engaging and effective. This framework, at its core, places an emphasis on the significance of comprehending the requirements and preferences of the user and adapting the XR marketing experiences in accordance with those particulars.

2.1 Immersive Storytelling

The word "immersive" in XR refers to how involved a user is in a digital experience [10]. An immersive experience aims to make the user feel like they are really there in a virtual or augmented world. This can be done through a combination of visual, auditory and haptic feedback that makes the digital world feel like a real place. The main goal of an immersive experience is to create a sense of realism and allow the consumer to interact with the digital environment in a natural and intuitive way.

Storytelling has long been recognized as a design principle in fields such as user experience design, game design and product design. Using stories can make the user's experience memorable, engaging and meaningful [11, 12]. XR technologies make it possible to create and experience immersive stories that can bring a brand to life. These stories can help convey a brand's values, personality and points of difference to the consumer in a way that traditional media cannot.

Compared to traditional marketing, XR technologies have been shown to make a brand look good while at the same time increasing engagement, recall and desire to buy [13]. Sung states that AR makes it easier for people to share their social experiences, which can lead to user-generated viral marketing and give a business an advantage, especially during seasons when marketing is prominent [14]. Pepsi (Fig. 2) partnered with artist The Weeknd to create an AR portal that allowed consumers to experience the Superbowl Halftime performance in 360-degree video as if they were at the concert, shaping the social sharing experience with a positive brand image.

Contextual relevance is a design factor that focuses on making experiences relevant to the consumer's current situation [15]. This can be done by using information about the consumer's location, time and activities to provide them with information and content for storytelling that is relevant to them in the moment. Designing for contextual relevance is crucial for creating immersive and engaging storytelling

Fig. 2 Pepsi's XR app bridges the gap between product packaging and digital experience

experiences, and this can be achieved with personalization techniques in presence and within the story.

Klein's research on how computer-mediated environments can create successful virtual experiences shows that user control and media richness both help create a sense of telepresence and influence how consumers think [16]. Sylaiou et al. have shown that high levels of "perceived presence" can be linked to feelings of satisfaction and fulfillment that make using simulation systems a pleasant experience [17].

In recent years, numerous social VR platforms such as VRChat, AltspaceVR, Rec Room and Horizon Worlds have emerged, offering users a new format of online social interaction. Barreda-Ángeles et al. emphasize the importance of social connection in XR marketing, stating that consumers are more likely to engage in experiences that allow them to connect with others [18].

Éternelle Notre-Dame (Fig. 3) is a 45-min virtual reality tour inside Notre-Dame, starting from the time it was built to the ongoing restoration after the fire. Accompanied by a builder, people can take an immersive journey together from the Middle Ages to the present day and learn the secrets of the monument as it is painstakingly reconstructed digitally.

In digital marketing, brand authenticity refers to the extent to which a brand's communication and actions and are perceived as reflecting its true character and values by its customers and stakeholders. As a form of immersive media, XR has the potential to create experiences that foster deeper emotional connections between customers and brands. These connections, in turn, can promote authenticity by enabling customers to experience a brand's core values and identity in a visceral way.

Consumers want experiences that are not only interesting and entertaining, but also correspond to their own particular ideals and principles. XR technologies make it

Fig. 3 Sample scene from Éternelle Notre-Dame

possible for brands to develop experiences that fulfill these requirements by supplying immersive and individualized narratives as well as interactions with products and services.

Chen and Lee examine the use of Snapchat for social media marketing, focusing on young consumers [19]. Snapchat attracts young people by offering funny face filters through its AR feature. The results of the study show that Snapchat is a very personal, casual, and fast-paced platform that allows users to experience a brand through information, socialization, and entertainment. As an example, Beats (Fig. 4) launched a sponsored Snapchat Lens over Thanksgiving weekend in 2015.

XR apps can elicit strong emotional responses from consumers [20] as they use visual, auditory, and haptic cues to create unique, engaging and memorable experiences that align with brand identity and connect with consumers on an emotional level. The stories told in XR experiences are directly linked to how people continue to think about and buy from these brands.

The authenticity that brands capture in the stories they create for XR environments also forms the basis of a smooth flow. According to Chen and Li, augmented realism and technological fluidity have a strong impact on consumers' flow experiences and lead to increased cognitive and emotional responses to the brand and/or AR interface environment, as well as purchase intent [21].
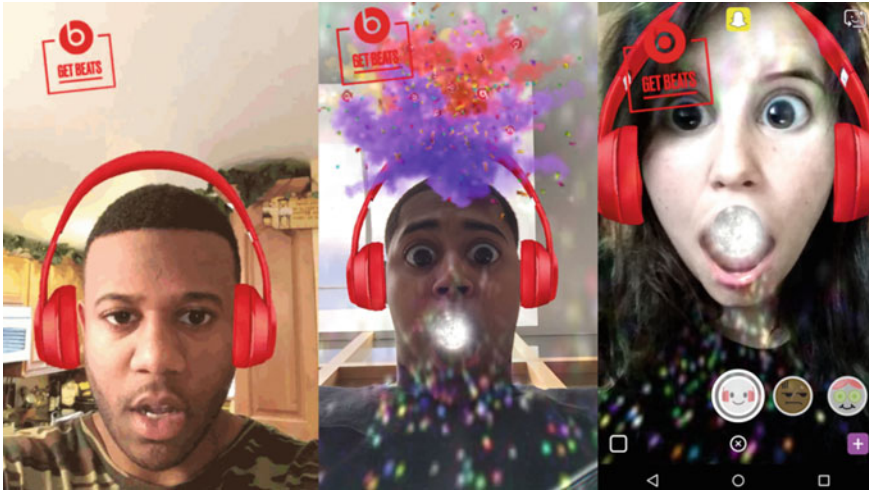
Fig. 4 Beats campaign for Snapchat lens application

2.2 Interactive Gamification

Interactivity has been defined in the context of technology mediated communication as "the degree to which users can change the form and content of a mediated medium in real time" [15]. XR allows consumers to interact with the virtual environment in a way that is not possible with traditional media. Designers must think about how people will interact with the virtual environment and how this will affect the experience as a whole. This interaction can create brand awareness, increase brand loyalty, and create a deeper emotional connection with the brand. Yim et al. argue that XR marketing will become more interactive and offer new and exciting ways for people to interact with brands and products [22]. This is because XR technologies make it possible to create interactive and unusual experiences that give people a sense of agency and control.

Virtual interfaces are moving away from the traditional 2D plane towards a more immersive 3D space. The 2D window paradigm [23] called WIMP (Windows, Icons, Menus, Pointers), is not easy to fit into a 3D virtual environment because users can now interact with virtual environments in a more immersive way by moving their bodies and making gestures. For example, Ultraleap 3Di (Fig. 5) is a camera that follows the user's hand and lets him or her connect to and control interactive displays without touching them.

A growing number of marketers are using gamification, which refers to the use of game design elements in non-game contexts, such as service experiences, to create value for consumers and improve the buying experience [24, 25]. This can include elements such as points, badges, leaderboards, and rewards in purchase experiences related to products or services. Gamification in XR has received a lot of attention

Fig. 5 Ultraleap's no touch interface with advanced hand-tracking

in recent years as a way to get people more engaged and motivated by their digital marketing experience.

One of the first steps of gamification is exploration and discovery. Designers can create interactive experiences by allowing people to explore and learn about XR experiences in their own way. Interfaces that allow people to explore the XR experience and find new content and information make the experience better and more personalized. Gamification is not only about digital technology, as media convergence and ubiquitous computing make it difficult to distinguish between digital and non-digital [26].

"Digital twins" are computer models that simulate, mimic, mirror, or "twin" the life of a physical object, process, or person [27, 28]. Digital twins are therefore one of the best ways to realize the interaction between the physical space and the virtual space [29]. For example, in XR marketing, virtual try-on apps use digital twins to allow people to "try on" products without having to buy them. This can be used for a wide range of products, from clothing and accessories to makeup and furniture. Consumers can look at themselves in a digital mirror using an XR or mobile device, while virtual products are superimposed on their own image. This technology can also be used to customize the product, such as changing its color or size to see how it looks in different variations. Therefore, digital twins are one of the best ways to realize the interaction between physical space and virtual space.

Walmart (Fig. 6) has developed a new strategy called "Be Your Own Model", which allows customers to use their own photos to see how clothes look on them instead of choosing from available models.

In gamification, "social interaction" refers to how people interact with each other through game-like activities and mechanics. This can be done through competition, collaboration, communication, and other types of social exchange in an

Fig. 6 Walmart "be your own model" application

augmented system or game. Deterding et al. state that the relationship between gamification and social interaction is the most important part of creating gamified systems and applications [26]. They point out that social interaction in games can be designed in many ways, including direct player-to-player interactions, information and resource sharing, and the creation of social groups or communities within the game environment.

Fortnite is a next generation platform that uses the sense of presence and digital twins to make digital communication feel more surreal. It is a place where world-renowned music artists appear as digital twins and concert events are organized in the metaverse. At Fortnite's Rift Tour (Fig. 7) event, Ariana Grande took the dream-like stage with her digital twin and was enjoyed by millions.

Research by Potseluyko et al. shows that gamification can be an important part of making XR better in a holistic sense [30]. By adding game-like elements and mechanics to virtual experiences, XR developers can engage people and increase their motivation. By recognizing the unique needs, interests and behaviors of each consumer, companies can design more personalized and positive experiences, which can contribute to consumer brand loyalty and advocacy. However, it is important to keep in mind that gamification needs to be designed carefully and in a balanced way to ensure that it enhances the XR experience rather than detracting from it.

Fig. 7 Ariana Grande's digital twin on rift tour stage by Fortnite

2.3 Personal and User-Centered Design

Personalization is important in marketing because it allows businesses to tailor their messages and products to each customer [31]. By making marketing efforts more relevant and engaging, personalization helps customers feel more satisfied and builds stronger relationships with them. Personalization also helps companies understand their consumers on a deeper level and make informed decisions about their products, services and marketing strategies.

User-Centered Design (UCD) is a design method that emphasizes the needs, goals and perspective of the consumer in the design process [32]. This method seeks to understand the consumer's situation, needs and motivations so that solutions can be created to meet their needs and provide them with a good experience.

User-Centered Design is often contrasted with more traditional, technology-centered design approaches that prioritize the design of technology over the needs of the consumer. A user-centered design approach has been shown to make products and services more useful and easier to use, increasing consumer satisfaction and adoption. Therefore, designers and developers who want to create successful and user-friendly XR marketing products and experiences need to incorporate UCD into the design process.

Consumer profiling is the process of collecting and analyzing information about consumers to get a complete and detailed picture of their characteristics, preferences, and behaviors. This process is an important part of modern marketing and customer relationship management because it helps businesses learn more about their customers and provide them with better, more personalized experiences. It can also give companies useful insights into how customers behave and what they like,

Fig. 8 Gucci Town at Roblox

which helps them make smart choices about their products, services, and marketing strategies.

Consumer profiling is becoming a more prominent need, especially for luxury brands. According to Javornik et al., while there are many reasons for luxury brands to use AR, especially those that cater to a more diverse consumer profile, it needs to be used in ways that suit the specific needs of the luxury industry [33]. Otherwise, they risk resembling non-luxury brands and products in XR environments. Luxury brands should pay particular attention to building and protecting product value in XR environments.

Gucci Town (Fig. 8) is marketed on Roblox (an app that allows users to play and make games) as a place where consumers can learn about the luxury brand's history, express themselves and meet like-minded people from around the world.

In the XR world, the actions of the consumer are the main source of personalized data that was previously difficult to access. Data collection has a huge impact on XR marketing because it gives businesses valuable insights into consumer behavior, preferences, and feedback. This information can be used to segment audiences into smaller groups, resonate with them and design experiences that are likely to convert them into customers.

Data can also be used to ensure that marketing messages, experiences and recommendations are relevant and engaging for each individual consumer [34]. Data is a reliable source for monitoring and measuring how well marketing campaigns are working, which helps businesses improve their efforts and return on investment (ROI). User journey mapping, which examines how a customer interacts with a business across different channels, also helps businesses learn more about their customers' journeys and provide them with a better experience.

Mourtzis et al. state that personalization can be used to create unique experiences by allowing the user to adjust and design the products in the XR experience to their liking [35]. This can be achieved using interactive and adaptive methods such as allowing the user to choose their own characters, settings and scenarios.

Avatars are a virtual representation of the physical user in a virtual space. Depending on the type of XR environment, avatars look like anything and are an important part of how social structures are formed in virtual communities [36]. An avatar can be a simple two-dimensional picture of the user or a very detailed three-dimensional model that looks, moves and even shows facial expressions just like the user.

The use of avatars in XR applications is an important part of creating immersive and interactive experiences that allow consumers to connect with each other and interact with digital content in a natural and intuitive way [37]. Often, the user's hand or head movements and inputs are used to control the avatar. This allows users to move, speak and interact with other avatars or digital objects in a virtual environment. Avatars thus enable social experiences such as virtual meetings, events and even games. Avatars also enable anonymity, so people can talk to each other without revealing who they really are.

Ready Player Me (Fig. 9) is a hub that connects users to hundreds of virtual worlds and experiences with a single, fixed digital identity just like a digital twin. It allows users to design their own avatars, enabling creativity and self-expression.

The ability of XR apps to track and monitor what consumers are doing raises privacy concerns [38]. This can make it difficult to enforce accountability and protect against cyberbullying or other harmful behavior. Designers and developers must be careful to protect users' personal information while collecting, storing, and using data responsibly.

Fig. 9 Avatar creation interface from ReadyPlayerMe

XR apps can have a high impact on people's minds, especially when experiences are very immersive and intense. Some people may feel fear, anxiety, or other bad emotions when they are in virtual environments that simulate danger or fear [39]. Moreover, XR applications that rely on social interaction can make people feel isolated and lonely or have other bad feelings if the interactions are not well designed or well managed.

To make sure XR apps are safe, developers and designers should think about the physical and mental impacts of the technology and make sure XR experiences are safe and easy to use for everyone. There should be clear instructions, warnings, and safety information, as well as user testing to find and fix any safety issues. Furthermore, the privacy and security of users should be a top priority and XR applications should be built with the right data protection measures in place.

NXRT's MISHBILD technology is used in the design of the XQ Avatar Porsche (Fig. 10), allowing the user to see their own hands and the interior of the vehicle together while driving in a virtual world. This experience can not only introduce the user to the vehicle, but also provide clear instructions on how to drive safely without harming themselves or others.

Fig. 10 XQ Avatar Porsche experience by NXRT

3 Design Elements for XR Marketing

The most important design component of the XR experience is undoubtedly the interface design. The main goal of a good XR user interface design is to make it easy for people to interact with the virtual world in a joyful way [40]. Design elements like visual, auditory, haptic cues, color, texture, graphics, and movement have a big impact on how people see, interact with, and use these immersive environments.

Keeping a good design flow in the user interface will help the user stay focused on the purpose of the application. The flow and reward should always be guided by level design, and the environment should be limited to a specific space. Clarity and a sense of control are essential interface design elements that can improve the user experience [41].

Clarity is the interface's capacity to effectively communicate its purpose, functionality, and features, whereas control is the user's perception of being in command of the interface. When both clarity and control are present in an interface, the user experience is more likely to be positive, because the user is confident in their ability to use the interface and rapidly comprehends what it offers. This enhances consumer engagement, customer satisfaction, and conversion rates. The interface of Oculus Quest 2 (Fig. 11) for using the platform's applications is tidy yet thorough.

As with traditional marketing, it's important to find out what users want and how they feel about different kinds of messages and communications [42]. Studies have shown that color, lighting, and texture, as well as other visual design elements, have a big effect on how people feel and act in XR environments.

Color can be used to set a mood or atmosphere, draw attention to certain things, and evoke a sense of excitement or calm. It can also give an impression of depth
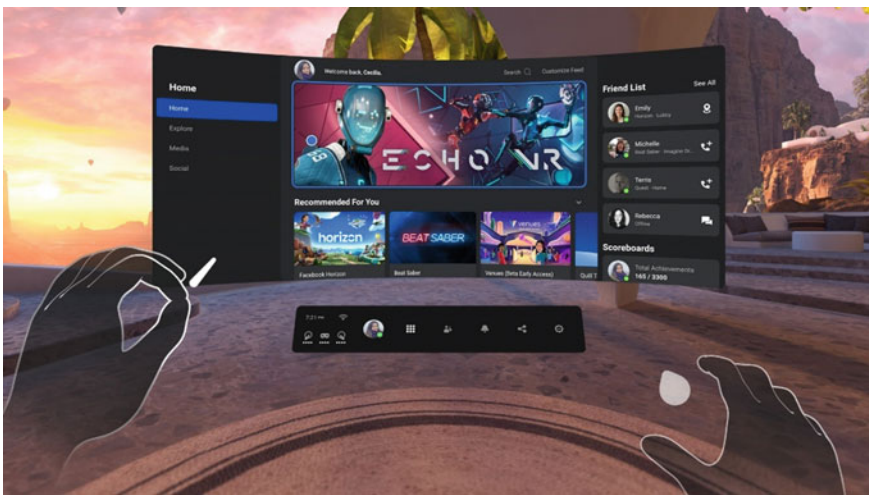

Fig. 11 Oculus Quest 2 interface

and perspective, helping people understand the three-dimensional environment they are in. Additionally, color can be employed in XR marketing to give an impression of depth and perspective, helping people comprehend the three-dimensional environment they are in.

Lighting can also set the atmosphere and mood for XR experiences. For example, darker lighting is often associated with danger or suspense, while brighter lighting makes people feel safe and at ease.

Lupton states that design is an important part of creating a cohesive and recognizable visual identity [43]. This can be done by using consistent design elements and colors that match the visual identity of the brand. Color can also be used to give a brand a consistent look that makes it easy for people to recognize and connect with a certain company or product.

Sound design elements have a big effect on the XR experience as well as visual cues. Gospodarek et al. state that sound can be used to provide important information, set the mood and atmosphere, and make the user feel more immersed in the virtual environment as a whole [44]. Spatial sounds can make virtual environments feel more realistic, while adding background music or sound effects can make the experience more interesting and dynamic. Sound design can also be used to draw attention to specific parts of the XR environment, such as a product being sold, making the experience more memorable and powerful for the consumer.

In order to help Japanese people get back in touch with their local sounds and culture in a new and modern way, Spotify Japan has created the "Sound Tour" (Fig. 12), a series of events that use ambient Spotify codes to trigger special sound effects and music through the XR experience.

It is important to focus on the senses to emphasize and develop the sense of reality and being in XR environments. Design for haptic feedback is becoming an increasingly important part of creating XR experiences, as it makes virtual environments

Fig. 12 Sound tour experience by Spotify Japan

feel more realistic and embedded [45]. Haptic feedback can also be used to simulate vibrations, forces, tissues, and temperatures, among other physical sensations.

Sensory marketing aims to stimulate consumers' senses and influence their perceptions and behavior. Haptic feedback can be used to create subliminal hints that affect how people think about the product in general [46]. Flavian et al. argues that a user's immersion experience is partly based on the interface devices they use. Optical feedback can be used to simulate the user's feeling of walking on clay, sand, or ice, or holding and moving virtual objects. Using such haptic feedback, designers can create a more realistic and immersive experience that allows users to better understand and interact with their virtual environments. Thanks to a patented microfluidic system, HaptX (Fig. 13) gloves use a technology that can provide real contact headsets.

As a fundamental design element, typography can influence how consumers perceive, read and understand text in these complex XR environments. While hardware and software for XR are evolving rapidly, it's a fact that engineers and developers are mostly ignoring typography. The need for more processing power to make the text look correct has long been an excuse. This means that XR designers avoid using text and display it in a way that uses less CPU power, but in XR experiences, as well as visual factors, mood and atmosphere can also be created using typography.

Research has shown that typography in XR environments can affect reading, readability, and overall aesthetic appeal [47]. Clear and legible fonts may make it easier for people to read and understand text in virtual environments, while decorative or fancy fonts can contribute to the visual design and aesthetic appeal of the virtual environment in general.

Fig. 13 Haptx gloves with haptic feedback

As another design element, texture can also influence people's feelings and behavior while influencing the presence and realism. Textures are essential for realistic display of objects and environments, as they often add surface details that are too difficult to directly model [48]. Researchers find that 3D objects and the stylistic textures of the virtual object make people feel safe and comfortable, while sharp- or rough-edged textures can make them feel safe or uncomfortable.

Textures help people understand the physical properties of virtual objects and feel their depth and three dimensions better. Different textures can help direct people to specific objects or places and can create a sense of order and organization by using the same texture repeatedly.

Motion graphics are used to create visual content that changes over time and attracts people's attention. Motion graphics are an important part of the design of XR environments because 3D virtual interactions feel more realistic and make it easier to get lost in. Motion graphics can help users simplify tasks and understand complex information by paying attention to important details or directing them to specific locations [47]. By adding graphics from the real world, users can interact more naturally and get a better feel for the virtual world.

Motion tracking is also an important part of XR applications up to the least moving graphics, as it allows the system to detect and track user movements in real time. Motion tracking is required to place virtual objects above the real world or change their positions and directions. While it is used to combine the real world and virtual objects, this makes it easier for consumers to interact with the virtual objects and environment in a natural and intuitive way. For example, Move.ai (Fig. 14) is an application allowing users to move avatars by extracting 3D motion data from a video.

Fig. 14 Move.ai application is extracting 3D motion data from a video

It is important to remember that design elements in XR environments need to be carefully planned and considered to enhance the user experience. Using too many motion graphics animations that are inaccurate or poorly made for the experience can lead to issues such as anxiety, disorientation, and a feeling that something is not real. Therefore, design elements should be carefully placed in XR environments and should be done to enhance and support the user's experience rather than take away from it.

4 Design Tools for XR

XR applications gain functionality through an effective and efficient combination of hardware, software, and other components. With the right tools, designers and developers can work together to create XR experiences that are engaging, immersive and deliver real value to consumers.

XR applications often require different programs than traditional design tools. "3D modeling" is the process of creating virtual and visually interactive three-dimensional models on a computer [49]. People like 3D applications more than traditional 2D applications because they make the experience more dynamic and interactive. Wu et al. examined how animated and 3D models in virtual reality advertisements influence consumers and found that interacting with 3D models can make viewers more entertained and more likely to have positive attitudes and want to do things like remember products, buy them, and watch more ads [50].

Many file formats such as OBJ, DAE, FBX and GLB have been developed to use and share 3D models in XR applications. In this way, it is possible to use the digital twin of a product across different platforms for marketing purposes. 3D objects and environments can also be animated, creating dynamic and interactive experiences. This is particularly useful in industries such as gaming, education, and training, where consumers can interact with virtual objects and environments to learn new skills or complete tasks.

Another important aspect of XR design and development is prototyping, and design tools play an important role in this process. With these tools, designers can quickly and easily create prototypes of their ideas. This is crucial for testing and refining ideas quickly and making the necessary real-time changes to the design when feedback comes in.

VR prototyping tools such as Vuforia, ARKit and A-Frame have many features and functionalities such as 3D modeling and animation, physics simulation, real-time rendering and user interaction. They enable designers to create interactive and immersive virtual reality experiences that can be used in games, education, training, product design and digital marketing.

Game engines such as Unreal Engine and Unity are used in XR applications because they provide a powerful and flexible platform for creating interactive 3D content. They have advanced tools for creating 3D graphics, animation, physical

Fig. 15 The Matrix Awakens experience by Unreal Engine

simulations and sound effects, making them perfect for XR applications. Furthermore, their game engines are tuned for real-time performance, which is important for XR applications that need smooth, responsive and high-quality graphics. This allows developers to design immersive and interactive XR experiences without compromising performance. For example, The Matrix Awakens (Fig. 15) experience developed by Unreal Engine impressed users with its ultrarealistic imagery.

The use of machine learning and DL in XR is expected to become even more important in the future as these technologies continue to develop and improve. As XR experiences become more complex and interactive, they will require more sophisticated algorithms that can process and understand large amounts of data.

Recently, XR applications have been paired with blockchain infrastructures. A blockchain is a distributed database or ledger shared between the nodes of a computer network. It stores information in a digital format and is best known for its role in systems that use digital currencies such as Bitcoin. It ensures that a data record is accurate and secure and builds trust without the need for a trusted third party.

Blockchain technology offers a number of advantages when used in XR applications. It can make XR experiences more secure, more open, and less centralized. It can also stop counterfeiting and fraud in virtual marketplaces where users can exchange ownership of assets in the virtual world and conduct real business in a virtual environment [35]. Like NFTs, blockchain technology can also be used to verify the authenticity and authenticity of content [42]. This completely changes the way content is created, commoditized, exchanged, and stored for both content creators and consumers [51]. Nike (Fig. 16) collaborated with artists to create a collection of NFT sneakers that didn't really exist, and they fetched hundreds of thousands of dollars.

Fig. 16 Nike 'cryptokicks' sneakers NFT sold for $130 K

As with blockchain, the use of Artificial Intelligence as a design tool in XR environments has recently come to the fore [52]. AI is used to create personalized levels and interactions, especially in gamification experiences. This means that XR interactions can be tailored to consumers' needs and preferences. Machine learning (ML) and deep learning (DL) are AI tools used to make XR applications more useful [53]. These algorithms can be used to recognize and track objects, track hands and bodies, recognize and process natural language, understand what is happening in a scene and make predictions. It also offers opportunities to respond to user actions in real time and improve the user experience by understanding what is happening in the scene.

AI tools can collect and analyze data and predict future behavior, allowing marketers to target ads based on what the audience likes and how they are likely to buy. Marketers can use this information to target ads based on what the audience likes and how they are likely to buy [42]. According to Blasco-Arcas et al., consumer data is an important way for companies to learn how to navigate increasingly competitive markets [34].

Finally, collaboration is one of the most important factors in designing and developing XR experiences [28], and design tools play an important role in facilitating this process. Design tools allow designers, developers, and companies to work together on a common goal and make sure that everyone is on the same page about the vision and goals of the project. Collaborative practices ensure that the development process moves smoothly and quickly, and that the final product is of high quality and meets consumer needs. Using design tools that facilitate collaboration, teams can work together to create XR experiences that are new, interesting and deliver real value to consumers.

5   Conclusion

XR technologies are revolutionizing the world of marketing by enabling brands to create realistic, multi-sensory experiences that make people feel more connected to them. It also enables marketers to gather useful insights about how people behave and what they like, enabling them to gain new insights about their target market and tailor their marketing efforts accordingly.

Storytelling is an important part of designing immersive XR experiences. It can transport users into a world that is not their own, grab their attention, make them feel something, and give them an experience they will never forget. In this regard, designers should always work to create a coherent and immersive environment that supports the narrative. This means that everything from visual and audio design to haptics must work together to create a seamless experience. The goal of design is to create an experience that feels natural and intuitive, so the design must be clear so that the consumer can focus on the story, not the technology.

Gamification is widely used in XR experiences to increase user engagement, motivation, and interaction. Designers play a key role in making XR experiences more like games because they must think about consumers, their goals and what makes them tick, as well as the brand story and the XR technology being used. Designers should create environments that encourage interaction and exploration while also guiding the user towards specific goals or learning outcomes. Feedback loops help users maintain interest and motivation by giving them a sense of progress, achievement, and mastery. The relationship between gamification and XR design is complex because designers must find a balance between the interactivity of gamification and the brand value creation goals of the XR experience.

User-centered design is a design approach that places the user at the center of the design process. Through XR marketing, consumers can have immersive, engaging, and interactive experiences. User-centric design is particularly important in marketing, as XR experiences are often complex and require a high level of personalization. The design of XR marketing experiences should be easy to understand and use and aligned with consumers' needs and expectations.

Ultimately, the success of next-generation XR marketing campaigns depends on the effective use of XR technology, immersive storytelling, interactive gamification and user-centered design, which in turn increases brand awareness, consumer engagement and sales.

References

1. Kunkel N, Soechtig S (2017) Mixed reality: experiences get more intuitive, immersive and empowering. Deloitte University Press. https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/technology-media-telecommunications/deloitte-cn-tmt-mixed-reality-2017-en-171109.pdf

2. Frey D, Royan J, Piegay R, Kermarrec A, Anceaume E, Le Fessant F (2008) Solipsis: a decentralized architecture for virtual environments. In: 1st international workshop on massively multiuser virtual environments. Reno, NV, United States

3. Clegg N (2022) Making the metaverse: what it is, how it will be built, and why it matters. https://nickclegg.medium.com/making-the-metaverse-what-it-is-how-it-will-be-built-and-why-it-matters-3710f7570b04

4. Milgram P, Kishino F (1994) A taxonomy of mixed reality visual displays. IEICE Trans Inf Syst 77(12):1321–1329

5. Jessen A, Hilken T, Chylinski M, Mahr D, Heller J, Keeling DI, de Ruyter K (2020) The playground effect: how augmented reality drives creative customer engagement. J Bus Res 116:85–98

6. Slater M, Lotto RB, Arnold MM, Sanchez-Vives MV (2009) How we experience immersive virtual environments: the concept of presence and its measurement. Anuario de Psicologia, 40(2)

7. Shah D, Murthi BPS (2021) Marketing in a data-driven digital world: implications for the role and scope of marketing. J Bus Res 125:772–779

8. McCarthy EJ (1960) Basic marketing: a managerial approach. Irwin

9. Flavián C, Ibáñez-Sánchez S, Orús C (2019) The impact of virtual, augmented and mixed reality technologies on the customer experience. J Bus Res 100:547–560

10. Slater M, Sanchez-Vives MV (2016) Enhancing our lives with immersive virtual reality. Front Robot AI 3:73

11. Norman DA (1998) The design of everyday things. Basic books

12. Robin S (2017) Don't make me think, revisited: a common sense approach to web usability. New Riders

13. Van Berlo ZMC, Van Reijmersdal EA, Smit EG, Van der Laan LN (2021) Brands in virtual reality games: affective processes within computer-mediated consumer experiences. J Bus Res 122:458–465

14. Sung C (2021) The effects of augmented reality mobile app advertising: viral marketing via shared social experience. J Bus Res 122:75–87

15. Steuer J (1992) Defining virtual reality: dimensions determining telepresence. J Commun 42(4):73

16. Klein LR (2003) Creating virtual product experiences: the role of telepresence. J Interact Mark 17(1):41–55

17. Sylaiou S, Mania K, Karoulis A, White M (2010) Exploring the relationship between presence and enjoyment in a virtual museum. Int J Hum Comput Stud 68(5):243–253

18. Barreda-Ángeles M, Hartmann T (2022) Psychological benefits of using social virtual reality platforms during the COVID-19 pandemic: the role of social and spatial presence. Comput Hum Behav 127:107047

19. Chen H, Lee YJ (2018) Is Snapchat a good place to advertise? How media characteristics influence college-aged young consumers' receptivity of Snapchat advertising. Int J Mobile Commun 16(6):697–714

20. Ding N, Zhou W, Fung AYH (2018) Emotional effect of cinematic VR compared with traditional 2D film. Telematics Inform 35(6):1572–1579

21. Chen Y, Li CA (2022) Consumer behavior in an augmented reality environment: exploring the effects of flow via augmented realism and technology fluidity. Telematics Inform 71:101597

22. Yim MY-C, Chu S-C, Sauer PL (2017) Is augmented reality technology an effective tool for e-commerce? An interactivity and vividness perspective. J Interact Mark 39:89–103

23. Smith DC (1975) Pygmalion: a creative programming environment (PhD thesis). Stanford University
24. Huotari K, Hamari J (2017) A definition for gamification: anchoring gamification in the service marketing literature. Electron Mark 27(1):21–31
25. Tanouri A, Mulcahy R, Russell-Bennett R (2019) Transformative gamification services for social behavior brand equity: a hierarchical model. J Serv Theory Pract 29(2):122–141
26. Deterding S, Dixon D, Khaled R, Nacke L (2011) From game design elements to gamefulness: defining "gamification. Paper presented at the proceedings of the 15th international academic MindTrek conference: envisioning future media environments. Tampere, Finland
27. Barricelli BR, Casiraghi E, Fogli D (2019) A survey on digital twin: definitions, characteristics, applications, and design implications. IEEE Access 7:167653–167671
28. Stacchio L, Angeli A, Marfia G (2022) Empowering digital twins with eXtended reality collaborations. Virtual Reality Intell Hardware 4(6):487–505
29. Ke S, Xiang F, Zhang Z, Zuo Y (2019) An enhanced interaction framework based on VR, AR and MR in digital twin. Procedia CIRP 83:753–758
30. Potseluyko L, Pour Rahimian F, Dawood N, Elghaish F, Hajirasouli A (2022) Game-like interactive environment using BIM-based virtual reality for the timber frame self-build housing sector. Autom Construct 142
31. Tang H, Liao SS, Sun SX (2013) A prediction framework based on contextual data to support mobile personalized marketing. Decis Support Syst 56:234–246
32. Chi Y-L (2009) A consumer-centric design approach to develop comprehensive knowledge-based systems for keyword discovery. Expert Syst Appl 36(2):2481–2493
33. Javornik A, Duffy K, Rokka J, Scholz J, Nobbs K, Motala A, Goldenberg A (2021) Strategic approaches to augmented reality deployment by luxury brands. J Bus Res 136:284–292
34. Blasco-Arcas L, Lee H-HM, Kastanakis MN, Alcañiz M, Reyes-Menendez A (2022) The role of consumer data in marketing: a research agenda. J Bus Res 146:436–452
35. Mourtzis D, Angelopoulos J, Panopoulos N (2022) Personalized PSS design optimization based on digital twin and extended reality. Procedia CIRP 109:389–394
36. Book B (2004) These bodies are free, so get one now!: advertising and branding in social virtual worlds
37. Mennecke BE, Peters A (2013) From avatars to mavatars: The role of marketing avatars and embodied representations in consumer profiling. Bus Horiz 56(3):387–397
38. Lammerding L, Hilken T, Mahr D, Heller J (2021) Too real for comfort: measuring consumers' augmented reality information privacy concerns. In: tom Dieck MC, Jung TH, Loureiro SMC (eds) Augmented reality and virtual reality. Progress in IS. Springer, Cham
39. Awada M, Zhu R, Becerik-Gerber B, Lucas G, Southers E (2021) An integrated emotional and physiological assessment for VR-based active shooter incident experiments. Adv Eng Inform 47
40. Sun C, Hu W, Xu D (2019) Navigation modes, operation methods, observation scales and background options in UI design for high learning performance in VR-based architectural applications. J Comput Des Eng 6(2):189–196
41. Low Tze Hui S, See SL(2015) Enhancing user experience through customisation of UI design. In: Ahram T, Karwowski W, Schmorrow D (eds) 6th international conference on applied human factors and ergonomics (AHFE 2015) and the affiliated conferences. AHFE 2015
42. Dwivedi YK, Ismagilova E, Hughes DL, Carlson J, Filieri R, Jacobson J, Jain V, Karjaluoto H, Kefi H, Krishen AS, Kumar V, Rahman MM, Raman R, Rauschnabel PA, Rowley J, Salo J, Tran GA, Wang Y (2021) Setting the future of digital and social media marketing research: perspectives and research propositions. Int J Inf Manage 59
43. Lupton E (2011) Graphic design thinking: beyond brainstorming (Design Briefs). Princeton Architectural Press
44. Gospodarek M, Genovese A, Dembeck D, Brenner C, Roginska A, Perlin K (2019) Sound design and reproduction techniques for co-located narrative VR experiences. In: AES 147th convention. New York, NY, pp 1–7

45. Schölkopf L, Lorenz M, Stamer M, Albrecht L, Klimant P, Hammer N, Tümler J (2021) Haptic feedback is more important than VR experience for the user experience assessment of in-car human machine interfaces. Procedia CIRP 100:601–606
46. Krishna A (2012) An integrative review of sensory marketing: engaging the senses to affect perception, judgment, and behavior. J Consum Psychol 22(3):332–351
47. Atiker B (2021) Exploring the future of spatial typography in immersive design applications. In: Game + design education
48. Dischler JM, Ghazanfarpour D (2001) Survey of 3D texturing. Comput Graph 25(1):135–151
49. Remondino F, Sabry E (2006) Image-based 3D modeling: a review. Photogram Rec 21(115):269–291
50. Wu D-Y, Lin J-HT, Bowman ND (2022) Watching VR advertising together: how 3D animated agents influence audience responses and enjoyment to VR advertising. Comput Hum Behav 133:107255
51. Malhotra A, O'Neill H, Stowell P (2021) Thinking strategically about blockchain adoption risks and risk mitigation. Bus Horiz 65(2):159–171
52. Hackl C, Wolfe SG (2017) Marketing new realities: an introduction to virtual reality and augmented reality marketing, branding, and communications
53. Das A, Day TW, Kulkarni V, Buchanan A, Cottrell K, John NW, Chatterjee K (2022) Towards intelligent extended reality in stroke rehabilitation: application of machine learning and artificial intelligence in rehabilitation. In: Augmenting neurological disorder prediction and rehabilitation using artificial intelligence, pp 309–329