# THE INFLUENCE OF AUGMENTED REALITY ON ONLINE USER EXPERIENCES

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## Abstract

The subject of this paper is the analysis of the impact of augmented reality on online user experiences. The analysis was performed on users' experience with the *Ikea Place App* by IKEA. Users were surveyed through the *User Experience Questionnaire* (UEQ), through which the information about their online experiences related to the analyzed application was collected. The aim of this paper is to determine whether augmented reality and augmented reality applications complement the online user experience, based on the analysis of their user experience and experience related to the dimensions of the presented application. The intention is to contribute to the creation of  the business and academic public' interest in the concept of augmented reality as a model, which, by offering a 'customized' shopping experience, contributes to improving the level of consumer satisfaction.

**Key words**:      augmented reality, virtual reality, online user experiences, IKEA

# УТИЦАЈ ПРОШИРЕНЕ РЕАЛНОСТИ НА ОНЛАЈН ДОЖИВЉАЈЕ КОРИСНИКА

## Апстракт

Предмет овог рада је анализа утицаја проширене реалности на онлајн доживљаје корисника. Анализа је извршена на примеру коришћења апликације проширене реалности *Ikea Place App* компаније IKEA. Извршено је испитивање корисника путем Упитника о корисничком искуству (енгл. *User Experience Questionnaire* - UEQ), на основу којег се дошло до спознаје њихових онлајн доживљаја у вези са анализираном апликацијом. Циљ рада је да се на основу анализе корисничког искуства и доживљаја у вези са димензијама представљене апликације утврди да ли проширена реалност и апликације проширене реалности употпуњују онлајн доживљаје корисника. Намера је да се допринесе креирању интереса пословне и академске јавности за концепт проширене реалности као

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модела, који понудом „прилагођеног" искуства куповине доприноси унапређењу нивоа сатисфакције потрошача.

**Кључне речи**:    проширена реалност, виртуелна реалност, онлајн доживљаји корисника, IKEA

## INTRODUCTION

Imagine there is a technology that allows you to see more than others can see, hear more than others, and feel the touch, smell and taste that others cannot. Well, that technology complements the real world with virtual (computer-generated) objects that seem to coexist in the same space as the real world (Krevelen & Poelman, 2010). Imagine being able to bring to life the book you are reading, to be able to hear the music and sounds from the pages of the book, to be able to see animated scenes that evoke the ambience and events that are being described. Imagine being able to visualize your wishes and ideas about arranging your garden by virtually placing and moving different types of plants around the yard until you get the image you want. Imagine an architect being able to show you the conceptual design for the construction of a house, bridge, shopping center, etc. using 3D projection, and being able to conjure up for you how these constructions would fit into a natural or urban environment in a way simpler and more exciting than drawing or merely describing them. Imagine being able to study the anatomy of the vegetative and reproductive parts of plants, and to find out with your virtual plant what the optimal conditions for its growth are. Imagine: being able to visit hotels or tourist destinations and to get all the information about them without moving from your home; or being able to reconstruct the past, visualize the future, and interact with virtual objects in museums or some historical localities, thus enriching your experiences and knowledge; or being able to see in advance the portion of food you want to order in a restaurant and to get all the information about its ingredients and way of preparation; or being able, while buying a bag of your favorite coffee, to see the coffee plantation where the beans are grown or watch a video of the process of roasting the coffee; or being able, as a medical student, to practice surgeries in a secure virtual environment; or being able to clearly see certain constellations and the position of individual planets at any given moment, wherever you are, with the help of an application on your mobile phone. Imagine firefighters being able to see the layout of buildings, even though nothing can be seen from the flames engulfing everything in front of them, or soldiers being able to see the positions of enemy snipers spotted by unmanned reconnaissance aircraft. Members of the older generations would probably understand all this as science fiction, as something that will never be available to man. However, owing to the constant progress of informatics and the technological achievements of the 21st century, all this is possible, and is even used almost every day.

Present in the realm of science fiction, time travel to some past and future worlds has always inspired and enchanted man, and moved him to the boldest fantasies. At the current level of the development of civilization, virtual reality has allowed mankind to escape from the real world and to step into some new, unknown and imaginary worlds, creating completely immersive experiences: visits to the battlefields in the Napoleonic Wars, a journey in the footsteps of Columbus, participation in lively debates in the Roman Senate, and even walks among the brachiosauruses and tyrannosauruses from the time of the Jurassic. Less immersive, augmented and mixed realties (AR and MR respectively) bring information and virtual objects into real environments, providing incredible opportunities to master new skills, gain new experiences, create new forms of art and entertainment, and communicating and experiencing the world around us in a revolutionary way. While virtual reality replaces the real world with the simulated one, AR and MR improve the user's perception of their own reality. Augmented reality provides visible information about the real world by increasing the interactivity of physical space and virtual objects, while mixed reality, in a similar way, adds realistic virtual objects and characters to the real world, in a manner so sophisticated that they blend in flawlessly (Schwab, 2018).

We are members of the 'new' modern generation that is witnessing the creation of technologies that provide access to the virtual world. Technologies that give a small, completely ordinary human the opportunity to 'dive' into another, physically untouchable world, in which we can play without limits, and in which we can hear, feel, and see some occurrences and things that are not part of our current environment with the help of the necessary equipment, but which we can fit into it. A world in which we feel as if these virtual occurrences are part of our reality. That is why it is not surprising that the achievements in the fields of informatics development and its application is called augmented reality. The constant development of the aforementioned technologies is supported by the efforts of companies to achieve competitive advantages in modern market conditions, through abandoning traditional economy and switching to digital economy. This type of economy, thus, becomes a condition for the smooth operation of companies. The digital economy is creating an economic revolution marked by great economic performance and the longest period of continued economic expansion (Đorić, 2020).

Earlier, when talking about the virtual and augmented reality, we would first think of some complex and massive devices and particularly specialized teams for their launch. Today, augmented reality is easily accessible to all users of smartphones and tablets. By launching only one of their applications, an individual reaches the world of augmented reality, which is as a continuation of the user's reality, and a new and exciting type of human-computer interaction is established.

The research presented in this paper refers to the analysis of augmented reality accessed through the applications on 'smart' phones. The analysis is aimed at obtaining answers to the questions: how familiar users are with the very existence of the concept of augmented reality, whether this type of advertising is represented when making purchasing decisions, and whether the use of such applications increases their shopping experience.

The paper consists of five parts. In the first part of the paper, the theoretical part and the basics of augmented reality are presented through two titles: "Augmented Reality vs. Virtual Reality - theoretical and practical aspect" and "The role of augmented reality in experience marketing". The first emphasizes the differences between augmented and virtual reality, and the second defines the marketing of experiences, as well as the place that augmented reality has in this concept. Information about the application that was analyzed, as well as the company that owns it, is given in the following section of the paper, titled "From matches to augmented reality - data and methodology". In addition, the basic hypothesis, and the questionnaire on the basis of which the research results were obtained were presented in this section. The description of the sample and the duration of the research is given in the fourth chapter, "Method or Research Methodology". "Research and discussion" presents the *User Experience Questionnare* - UEQ, based on which the analysis of the impact of augmented reality applications on online user experiences was performed, as well as the research results. In the last part of the paper, the conclusions and basic recommendations of the author are made.

## AUGMENTED REALITY VS. VIRTUAL REALITY - THEORETICAL AND PRACTICAL ASPECT

Augmented reality, as a product of the human ingenuity of the Fourth Industrial Revolution, is a recent topic about which most people know little to nothing. *Augmented Reality* (AR) is the creation of a virtual world that enriches the real world but does not replace it (Gervautz & Mazuryk, 1996). Azuma (1999) defines augmented reality as an extension of human perception which receives, processes and stores information that is usually not recognizable to the human senses. The same author, in his earlier research, points out that AR is a combination and connection of real and virtual objects within a real environment, where the system thus created is interactive and displayed in three dimensions, in real time (Azuma, 1997). According to Stoyanova (2014), augmented reality mixes the real with the simulated, or synthetic, and projects images and information into the user's field of vision. It provides us with a layer of virtuality that extends to the perception of the real environment, at a given moment. Usually, the virtual layer consists of 3D objects or 3D scenes, with or without sound, and sometimes only textual information is added

(Loijens, Brohm & Domurath, 2017). As Schwab simply illustrates (2018) *virtual reality* (VR), *augmented reality* (AR) and *mixed reality* (MR) are versions of an immersive audio-visual set of technologies that allow people to move to a virtual environment or add virtual elements to their real environment. Moreover, their immersive nature blurs the lines between the computer-simulated world and the real world.

Azuma (1997), whose scientific work is a good starting point for starting research in this field, observes and describes AR as a reality in which 3D virtual objects are integrated into a three-dimensional real-time environment. Such a version of reality, upgraded with computer-generated data and objects, improves the user's current perception of reality. Although some authors, despite the existing significant differences, believe that AR is a variation of the *virtual environment* (VE), or *virtual reality* (VR), it is necessary to emphasize the existence of an essential difference. Namely, virtual reality technologies completely exclude the user from the physical reality, completely immersing him in a synthetic, computer-constructed and generated artificial environment, and removing him from the real world in which he actually is. As an ambient simulation of reality, VR represents the process of transforming the real human world into a virtual digital world in which users can completely immerse themselves. In contrast, AR, as the name suggests, only expands physical reality by allowing the user to see the real world around him complemented by virtual three-dimensional objects and accompanying sounds that are combined with the real world. Unlike VR, AR magnifies the real world by adding scenes, objects, and textual information to the existing world instead of creating new non-existent worlds from scratch (Mealy, 2018). Thus, AR is an essential 'addition' to the real world, not its virtual replacement, which means that AR complements reality, instead of completely replacing it. Ideally, the user gets the impression that virtual and real objects coexist in the same space (Azuma, 1997). It is clear that both VR and AR are enabled by the current development of digital technologies and that, by integrating real and virtual worlds, they offer a mixed reality in which physical and virtual objects complement, support and communicate with each other (Ohta & Tamura, 2014), blurring the line between the real and the virtual.

The areas of augmented and virtual reality have inevitably evolved over time, and have become easily and increasingly accessible to users, so that everyone can use them with the help of appropriate technology, which has also advanced to smaller and lighter formats and more attractive designs. As *Plastic Hava* points out on the website of the world's leading digital experience advisor, although the areas of augmented and virtual reality are very similar, there are differences between them (www.plasticmobile.com). Augmented and virtual reality are complementary, but they represent the application of different technologies: aug-

mented reality applies digital information to the physical world, and virtual reality replaces physical reality with a computer-generated environment (Porter & Heppelmann, 2017).

Opting for the generally accepted definition of augmented reality given by Azuma (1997), it remains for us to agree that the main characteristics of the augmented reality system are manifested through three basic criteria:

▪ Combining and merging virtual elements with the real world, which allows for the enrichment of real space while achieving the visual impression that virtual elements are part of the real world;

▪ Real-time interactivity, which means that the user communicates the request via input devices (in the simplest case via mouse and keyboard), and depending on the dynamics of movement, virtual objects can be moved in relation to the stationary observer; and

▪ Display and registration (*calibration*) in three-dimensional space (real and virtual objects are in a 3D relationship), which are identified as the main problems that currently limit augmented reality applications. Namely, augmented reality requires great precision, since the impression of reality, i.e. that the virtual element belongs to real space and creates the illusion of coexistence of real and virtual within the same field of view, is achieved only in that case. In this regard, objects in the real and virtual worlds must be properly and accurately 'aligned' with each other so that the illusion of the coexistence of the two worlds is not jeopardized (Azuma, 1997). Without accurate registration, augmented reality will not and cannot be accepted in many applications.

Therefore, the goal of augmented and virtual reality is to broaden the horizons of users, to expand the real world in which a person is currently located and to allow them to experience the atmosphere of a new, virtual environment from their office or home. The technology that enables these experiences, which 'teleport' a person to the world of virtual frames, is intended for wide application. The purpose of augmented reality is to enrich the perception and knowledge of the real environment by adding digital information to the environment. In most augmented reality applications, the user visualizes synthetic images through glasses, headphones, video projectors or via mobile phones / tablets / notebook PCs.

Augmented reality applications generally use one of two approaches: a marker-based or a location-based approach (Lojiens et al., 2017). When a marker-based application is used, the software tracks a specific object, for example a barcode, using a camera and scans it onto the screen of the device. Location-based applications use the device's ability to remember and record data about a specific position on Earth, and to provide all the necessary information related to some location.

Based on data from the Statista website, the increasing presence of augmented reality and, above all, an increase in the number of users of

mobile augmented reality can be noted (www.statista.com). Namely, the analyses indicate that in 2020, there were 1.73 billion users of AR on a global level, which is an increase of slightly more than 1.5 billion as compared to 200 million users in 2015 (Graph 1). In 2021, the number is estimated to have reached 1.96 billion mobile AR users worldwide. Based on Graph 1, it is clear that the number of mobile augmented reality users grew in the observed period. From 400 million mobile augmented reality users in 2016, there is a noticeable increase to 1.73 billion in 2020, with a constant tendency of growth. It is believed that the number of mobile augmented reality users will keep to this trend in the future, because it is predicted that the number of this category of users in 2023 will reach 2.4 billion.



■ Number of mobile augmented reality (AR) users worldwide from 2015 to 2023 (in billions)
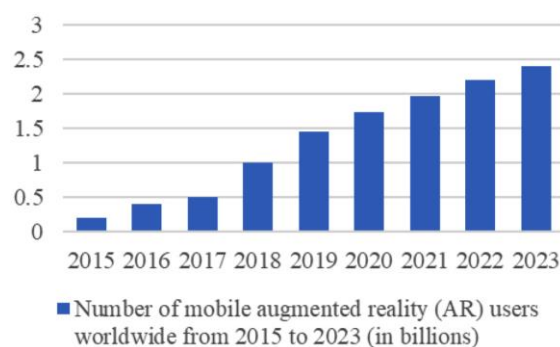
*Graph 1. Overview of the number of mobile augmented reality (AR) users worldwide from 2015 to 2023 (in billions)*

That this is a fast-growing market is evidenced by forecasts that the global augmented and virtual reality market will reach 18.8 billion US dollars in 2020, which would be an increase of over 78% as compared to 2019 (www.statista. com). Additionally, it is estimated that the market will reach a value of 50 billion US dollars by 2024 (www.threekit.com).

Reality-altering digital technologies have been in development over the last five decades (*Ivan Sutherland* in 1968.), although, due to the convergence of improved, increasingly powerful hardware, mobility and interactivity capabilities, recent years have witnessed their accelerated progress and increasing application (Schwab, 2018), so it is quite certain that AR will become an element increasingly integrated into the daily lives of an increasing number of people. Although augmented and virtual reality are mostly used in the domain of games, there are other sectors in which these two types of reality have found application. According to the research conducted on the Statista website (www.statista.com), which re-fers to the comparative analysis of the size of AR/VR for 2020 and 2025, it can be concluded that, in 2020, the largest AR/VR market was right in

the domain of games, and it can be predicted that, in 2025, this will still be the case. However, as augmented reality technology becomes increasingly popular and accepted by consumers and companies, all predictions go in the direction of increasing application in other sectors by 2025 (see Graph 2).
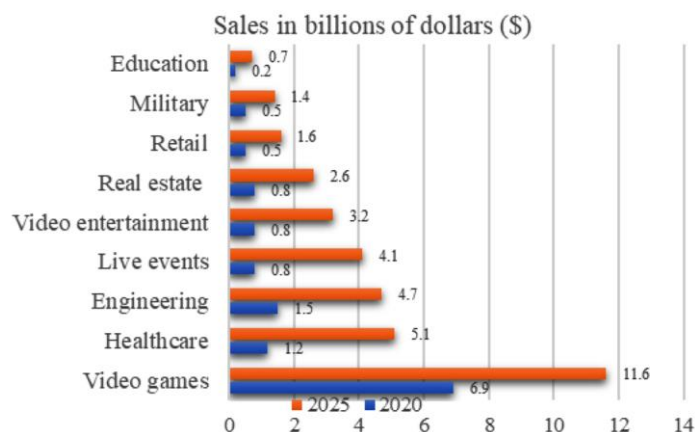


*Graph 2. Forecast of the size of the AR/VR world market by segments (2020-2025)*

## THE ROLE OF AUGMENTED REALITY
## IN EXPERIENCE MARKETING

In order for companies to be competitive, it was necessary for them to abandon the traditional ways of advertising and communicating with potential and existing customers, and to turn to the application of modern methods. The term 'traditional marketing' refers to the canon of principles, concepts, and methodologies that marketing professionals have collected over the last thirty years of the 20th century (Schmitt, 1999). Traditional marketing, and the traditional way of doing business imply that companies advertise their products on television, radio, and by placing ads in newspapers. However, the increase in the number of Internet users and the growing level of digital literacy have led to the disappearance of audiences following traditional media and to the constant need for change in business in the digital era (Singh & Pandei, 2014). Information and communication technologies (ICT) can improve access to basic services and create new opportunities for employment; they have significant potential to improve the quality of people's lives and to fundamentally change the way people communicate among themselves (Nedić, Cvetanović & Despotović, 2018). According to the *Global Digital Intelligence 2017 report,* the role of information technology directors has begun to

grow, new positions dedicated to innovations have 'sprung up' in organizational schemes, significant investments have been made in technology and the entire business, and models have been transformed (www.pwc.com). Commercial relations in augmented reality imply the psychological involvement of consumers, through the existence of interactivity and through the realization of the experience of 'immersion' (Huang & Hsu Liu, 2014). Where the company's goal is to improve and establish lasting relationships with the users of its products, one of the ways to introduce customers to the company's products and ensure their psychological involvement is to use augmented reality applications, as one of the novelties of the digital era. With augmented reality, new models of competition are established in an increasingly sophisticated market which, offering a completely new experience for the customer, leads to increased sales and increased levels of consumer satisfaction after purchase, ultimately providing the company with loyal consumers, which are its most valuable asset. Hence, engaging customers in the purchasing process is becoming an increasingly important factor in differentiating and constructing the competitive advantage of companies.

The experience is characterized as unforgettable, unlike products that are tangible and services that are intangible (Štavljanin, 2017). The experience arises "when a company intentionally uses a service as a stage and a product as a support to engage the consumer" (Pine II & Gilmore 1999, p.11). Schmitt (1999b) defined a new marketing approach - an experience-driven approach that is the opposite of the traditional marketing approach. This new type of approach he called experience marketing. Experience marketing has shifted the focus of customer reactions to certain stimuli they encounter, as opposed to the traditional one whose focus is on the characteristics and benefits of manufactured products. Traditional marketing arose from the understanding that customers are rational beings who do not employ emotions during the act of buying, but only approach shopping rationally. Experience marketing defines customers as rational, but also emotional beings, for whom a holistic experience must be created. The customer experience is achieved by the interaction between the customer and the company at all possible contact points (Grewal et al., 2009). Holbrook & Hirschman (1982) define an "experiential" view of consumption that manifests itself through "fantasies, feelings, and fun" by focusing on the symbolic, hedonistic, and aesthetic factors associated with consumption.

Online customer experience is the implementation of the concept of customer experience in the online environment (Štavljanin, 2017). The concept of online customer experience appears in the field of digital marketing and is associated with the effectiveness of the interactions with online users (Novak, Hoffman & Yung, 2000). The online user experience consists of a subjective, multidimensional psychological-logical response of the customer to the online presentation of the product (Bleier et al., 2018).

*FROM MATCHES TO AUGMENTED REALITY -*
*DATA AND METHODOLOGY*

The company *IKEA* is included in the analysis, because it provides its consumers with the opportunity to use the *Ikea place* application. For years, buying furniture required a great deal of luck and was a 'lottery' for most customers. Although they would measure the available space for an armchair, bookshelf, chest of drawers or dressing table, and perhaps take some pictures, and choose a piece of furniture in the store that they think would functionally and aesthetically best suit the given space, buyers usually had to hope for the best. In 2014, *IKEA* conducted a research whose results support the stated challenges that customers face in choosing furniture. Namely, more than 70% of respondents said they did not know the dimensions of the rooms in their homes, 14% of the customers stated that they purchased wrong-sized furniture for their rooms, while 33% said they were in doubt as to how to properly measure for furniture (Peddie, 2017). In order to minimize mistakes when choosing, and thus minimize the dissatisfaction after buying furniture from its range, the company has created an augmented reality application.

With this application, consumers who are not sure how certain furniture would fit into the space they intend to equip can 'fit' the desired product into their living and working environment and assess how it 'fits' with the rest of the interior; they can approach it, look at it from all sides and experience it in three-dimensional space. This technology creates the illusion of the existence of the selected pieces of furniture in a real environment and provides an opportunity for consumers to 'discover' which products are most suitable, and which best fit into the selected space and their exciting and practical "accommodation" in home, without leaving the comfort of their armchairs, thus improving the user experience and increasing consumer satisfaction. As it is pointed out on the company's website, the *Ikea place* application is currently available on the *iPhone 6S* and *iPhone, iPad* and *Android* devices of the newer generation.

The *Ikea Place* application allows its users to place virtual replicas of the *IKEA* furniture of their choice in their homes and the existing ambience with the help of AR technology. At the same time, it gives customers an impeccable view and knowledge of how the selected furniture and the desired product could look in the real world, once placed in the intended place (Ozturkcan, 2020). Simply put, the application uses augmented reality to provide users with the opportunity to visualize their wishes and ideas by virtually equipping their rooms and apartments with items available in the catalog, placing digital IKEA furniture in a real physical environment next to existing items through the device screen (tablet, smartphone).

The *IKEA place* application was presented to the public in September 2017, whereby the Swedish company provided an opportunity for

their customers to 'equip' their home, cafe or office with well-designed and affordable furniture from their seasonal collections before buying it, all without ever stepping into the store. The application enables the definition of the space that the customer wants to equip, offering unique and relevant recommendations based on the entered preferences and existing knowledge about *IKEA* furniture. By launching the AR application, the company took advantage of new technologies in creating added value for customers by raising the level of service, with the basic intentions to turn the often traumatic experience of choosing furniture into a fun digital engagement, and to contribute to solving practical problems when buying furniture. With this free application, IKEA signals that it understands the obstacles involved in the process of buying furniture and provides innovative, digital, technology-based support to its customers in an attempt not only to facilitate the decision to buy furniture that will visually and aesthetically best match real space but also to eliminate the unwanted and unsuitable results of wrong choices (Ozturkcan, 2020).

Initially, the application was limited to testing only one piece of furniture or items for space decoration, but the company has updated the application so that users can now simultaneously test several products from the *IKEA* range in augmented reality and with the help of a 3D display, which faithfully depicts the dimensions and layout and allows customers to see how 'selected' virtual furniture fits into the real space of their home. By selecting pieces of furniture and items for decoration, the user is given the opportunity to see how different pieces look together until, based on precisely defined dimensions and shapes, he gets the impression of an ideally furnished and decorated home. The three-dimensional views of more than 2,000 products are available from a variety of angles before users select the ones they want using an app that directs them to an Ikea website to complete a purchase. In addition, by using the phone's camera to focus on any piece of furniture, the application provides potential users with the opportunity to immediately 'discover' similar alternatives available in the *IKEA* range and virtually fit them into real space. In this way, with the synergetic effect of the useful and fun aspect of buying, the *IKEA Place app* creates certain advantages that are reflected in: providing an educational experience, minimizing product returns, growing customer engagement, the growth of trust due to the virtual testing of products before purchase (Mitrović, 2020), and in the existence of a unique, unusual and extraordinary shopping experience. Therefore, AR has the potential to improve consumer visualization of products, to increase consumer engagement, and thereby to improve perceptions of the shopping experience and improve the level of consumer satisfaction.

This research, and the analysis of augmented reality and its impact on online customer experiences was performed on the basis of the *User Experience Questionnaire* (UEQ). The conclusion drawn was based on

the answers of the respondents. Additionally, a general hypothesis was defined, which reads: "Online user experiences are complemented by the use of augmented reality applications." Based on the general hypothesis, the following were defined and derived:

H1: Attractiveness, as a dimension of user experience, increases by using AR applications;

H2: Efficiency of product, as a dimension of user experience, increases by using AR applications;

H3: Stimulation, as a dimension of user experience, increases by using AR applications;

H4: Perspicuity, as a dimension of user experience, increases by using AR applications;

H5: Novelty, as a dimension of user experience, increases by using AR applications;

H6: Dependability, as a dimension of user experience, increases by using AR applications;

Without deviating from *The Testament of a Furniture Dealer*[1] and Kamprad's legacy of self-imposed efforts to 'reduce' prices so that even people with very limited resources can afford to shop in IKEA's giant winding labyrinths, and daring to be different and transforming adversity and obstacles into opportunities, the company has grown into an empire and a global home furnishing chain. The example of the company confirms the notion that companies not only produce material artifacts or offer services, but also create brands that are by no means limited to the logo, or the image printed on the label and product, given that the competitions between manufacturers is no longer only a matter of price and quality, but and a corporate value narrative that constructs a recognizable and authentic company identity. Likewise, as part of contemporary consumer culture, IKEA perfectly illustrates the fact that corporate brands often play an important role in branding countries (Kristoffersson, 2014).

*IKEA* stores have also managed to serve customers in lockdown conditions due to the global corona virus pandemic. Sales in *IKEA* retail stores reached 39.6 billion euros in 2020, marking a decrease of only 4.2% compared to the previous year's sales and an increase of 2% as compared to 2018, while online sales increased by 45% as compared to 2019 (www.ikea.com).

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[1] The company's values, visions and attitudes are summarized in nine theses of the testament, which is the most important artifact and manifesto of corporate culture, but also the *IKEA* mantra, which as a 'sacred record' is based on the idea "Create a better everyday life for many people."

## *METHOD OR RESEARCH METHODOLOGY*

For research purposes, the User Experience Questionnaire (UEQ) was made available to users of products from the IKEA product range via the Internet. The research period covered April and May 2021, when 30 respondents were interviewed. All respondents are between the ages of 16 and 33, considering that it was assumed that the younger population owns newer generation phones and that they have the knowledge and skills needed to use the mentioned application.

## *RESEARCH AND DISCUSSION*

In today's competitive market, the achievement of a superior user experience is a condition for the commercial success of any product, and therefore a condition for the realization of a positive financial result for companies. User experience is a subjective impression, so it is difficult to measure it, but its measurement is necessary, given that it provides important information for a possible change in some instruments of the marketing mix. This measure can be used, for example, to check whether a new version of a product offers an improved user experience, or whether the product is better or worse than competing products (Schrepp et al., 2014).

To research the online customer experience, the authors used the User Experience Questionnaire (UEQ). The goal of this questionnaire is to quickly measure customer experience. The questionnaire takes into account the feelings, impressions and attitudes of the respondents, and presents a format that supports the direct expression of these elements (Stumpp et al., 2019). Information about aspects of product usability (efficiency, comprehensibility and reliability) and aspects of user experience (stimulation, novelty) is collected, and thus the questionnaire offers a comprehensive impression of the user experience of brand touch points (Schrepp, Hinderks & Thomaschevski, 2017).

*Attractiveness,* as one of the six scales of the questionnaire, shows the overall impression of the user about the product. *Attractiveness* encompasses aspects of the pragmatic and hedonistic qualities. *Efficiency* shows how effectively product users can solve the problems that caused them to buy the product. *Perspicuity* indicates how clear and easy the product is to use and understand. *Dependability*, as a scale of UEQ, shows how satisfied users are with the product, or whether the product met their expectations. *Stimulation* is aimed at getting an answer to the question of how a product affects users, whether it is interesting or not, and whether it motivates them to buy again. *Novelty* shows how innovative and creative the product is for users. *Efficiency*, *Perspicuity* and *Dependability* are aspects of the pragmatic quality, while *Stimulation* and *Novelty* are aspects of the hedonistic quality. Each of the presented UEQ

scales has its own pairs of opposite answers. The structure of the User Experience Questionnaire (UEQ) is presented in Figure 1.
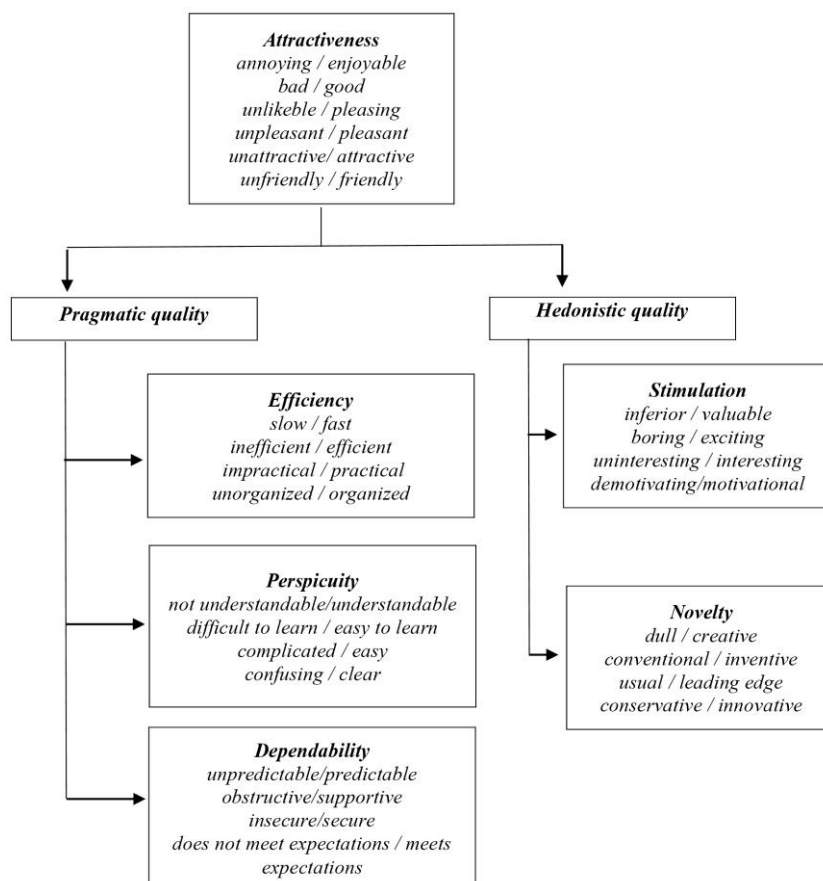


*Figure 1. Assumed scale structure of the User Experience Questionnaire (UEQ)*
*Source: Adjusted to: Schrepp, M., Hinderks, A., & Thomaschewski, J. (2017).*
*Construction of a Benchmark for the User Experience Questionnaire (UEQ).*
*International Journal of Interactive Multimedia and Artificial Intelligence, 4(4), p. 41*

The task of the respondents was to fill in this questionnaire in order for their perceptions of the *Ikea Place App* to be assessed. The UEQ questionnaire scale has the following format (the Attractiveness scale is taken as an example):

| My overall impression of the product is that it is: | | | | | | | |
|---|---|---|---|---|---|---|---|
| annoying | ○ | ○ | ○ | ○ | ○ | ○ | ○ | enjoyable |
| bad | ○ | ○ | ○ | ○ | ○ | ○ | ○ | good |
| unlikeble | ○ | ○ | ○ | ○ | ○ | ○ | ○ | pleasaning |
| unpleasant | ○ | ○ | ○ | ○ | ○ | ○ | ○ | pleasant |
| unattractive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | attractive |
| unfriendly | ○ | ○ | ○ | ○ | ○ | ○ | ○ | friendly |

The survey contains pairs of opposites related to product properties. The circles between the opposites represent the grades. The ratings range from 1 (if they do not agree at all with the product description) to 7 (if they think that the description fully corresponds to the product). Appropriate product dimensions, or characteristics, are given by user assessment in the semantic differential from -3 to +3. Values between -0.8 and 0.8 represent a more or less neutral score on the appropriate scale, values > 0.8 represent a positive assessment, and values < -0.8 represent a negative grade. Table 1. shows the middle value and variance based on the given answers of the respondents. Based on these values, it can be concluded that the scales *Attractiveness, Perspicuity* and *Dependability* were rated as positive scales, which means that users of the *Ikea Place App* have positive experiences with these features of the app itself. On the other hand, the scales *Efficiency, Stimulation* and *Novelty* have values lower than 0.8, but these values did not fall below - 0.8. This tells us that the respondents did not give a negative grade for the overall scales of this questionnaire. In addition, a graphic presentation of the respondents' experiences was derived, where their estimates are expressed in the semantic differential from -3 to +3 (see Graph 3).

*Table 1. UEQ scales, middle value and variance*

| UEQ scales (middle value and variance) | | |
|---|---|---|
| Attractiveness | 1.539 | 1.58 |
| Perspicuity | 1.100 | 1.63 |
| Efficiency | 0.758 | 1.28 |
| Dependability | 1.492 | 0.61 |
| Stimulation | 0.717 | 1.20 |
| Novelty | 0.400 | 0.98 |

Source: Author's calculation
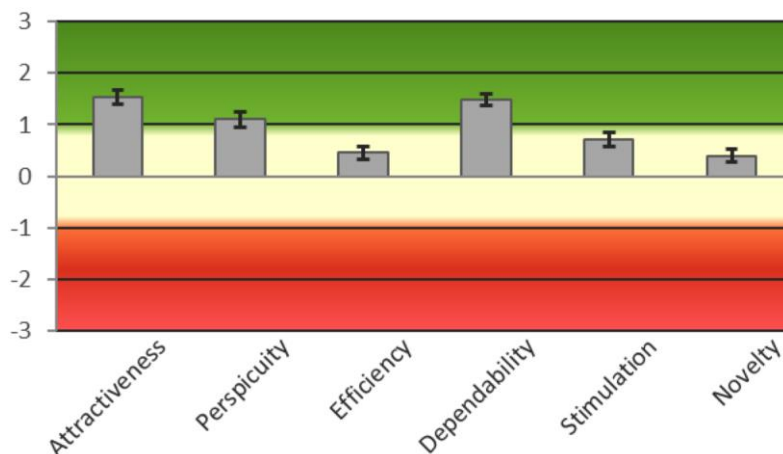
*Graph 3. User experiences related to UEQ scales*

However, if we look at pairs of the examinees' responses individually, there are not so positive assessments of certain product characteristics. Namely, based on this research, it was concluded that the majority of users are dissatisfied with *Perspicuity* as a scale of this questionnaire. First of all, this refers to a couple of *not understandable/understandable* answers, where the middle value was -0.4. Then, the results based on the pair of answers *impractical/practical* within the scale *Efficiency* amount to -0.5, and in the aspect of *Novelty*, when choosing between the *usual / leading edge* answers, the result was -0.4. All this affects the formation of the mean value of the pragmatic and hedonistic qualities, which is shown in Table 2.

*Table 2. Middle value of the pragmatic and hedonistic qualities*

| Pragmatic and hedonistic quality | |
|---|---|
| Attractiveness | 1.54 |
| Pragmatic quality | 1.12 |
| Hedonistic quality | 0.56 |

Source: Author's calculation

## CONCLUSION

In the era of digital transformation, augmented reality technology offers an innovative framework for differentiating and constructing companies' competitive advantage. Many retail chains have recognized the positive effects of augmented reality and are working to create AR applications that will allow customers to visualize products, make the right choices based on personal preferences and experience a 'customized'

shopping experience by simply using their smartphones. Based on the conducted analysis, all dimensions of the user experience related to the *Ikea Place App* have achieved positive results. Above all, it means a positive impact on the dimensions of *Attractiveness, Perspicuity* and *Dependability*. Therefore, the pragmatic and hedonistic qualities of this product were also assessed positively. This begs the conclusion that augmented reality applications, such as the analyzed application, are represented in the life of modern man and that the hypothesis "Online user experiences are complemented by the use of augmented reality applications" is true. Since the respondents did not give a negative assessment to any UEQ scale, which refers to the dimensions of their experience with the IKEA AR application, the derived hypotheses are also proven to be true. However, the dimensions of the user experience related to the analyzed application, such as *Stimulation, Efficiency* and *Novelty*, did not receive enviable results, which indicates that there is room for its further improvement through the removal of objections related to the mentioned dimensions. In addition, the hypotheses cannot be fully accepted, because the conclusions of this research were drawn from the analysis of the answers of a small number of respondents. Since this research yielded positive results and proved a positive correlation between augmented reality applications and online user experience, the authors recommend that companies operating in the Republic of Serbia start presenting their products through similar augmented reality applications, which would contribute to the improvement of visualization products, and provide a unique adventure, and an unusual and extraordinary experience when choosing and buying. This recommendation is based on one of the main limitations of this research. A small number of companies in Serbia base their business on the analysis of the online experience of their customers through augmented reality applications. They mostly base their business on traditional measurements of their clients' experiences, not on online experiences, which greatly limits this research. The directions for future research refer to the critical review and analysis of the existing literature and research on the topic of customer experience, and especially online customer experience. In addition, there should be more studies on the development and implementation of AR systems and applications in order to expand the analysis of the impact of augmented reality on society and its members' online experiences.

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# УТИЦАЈ ПРОШИРЕНЕ РЕАЛНОСТИ
# НА ОНЛАЈН ДОЖИВЉАЈЕ КОРИСНИКА

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## Резиме

У условима савременог пословања, чије су основне карактеристике дина-
мичност и дигитална револуција, компаније се све више ослањају на коришћење
технолошких достигнућа ради постизања својих циљева. Проширена реалност
омогућава корисницима апликација проширене реалности да прошире свој фи-
зички свет, допуњујући га виртуелним објектима. За разлику од проширене реал-
ности, виртуелна реалност у потпуности замењује реални свет корисника вирту-
елним светом, уз помоћ адекватне технологије. Без обзира на разлике, основни
циљ проширене и виртуелне реалности је да, пре свега, кориснику пруже ширу
слику физичког света у коме се он тренутно налази и да му омогуће да „закорачи"
у свет виртуелних оквира. Дигитална ера диктира нове услове пословања услед
повећања броја корисника интернета и нивоа дигиталне писмености. Бројне
фирме су се одлучиле да креирају апликације проширене реалности и да на тај
начин омогуће својим купцима да визуелизују производе и доживе „прилагођено"
искуство приликом куповине. Циљ компанија је да на тај начин креирају натпро-
сечни доживљај својих купаца, па своје пословање заснивају на тзв. „маркетингу
доживљаја" и на остварењу супериорног корисничког искуства. Зато компаније
све чешће доносе одлуке да психолошки укључе своје купце у процес онлајн ку-
повине. Један од начина оваквог укључивања потрошача је управо њихово при-
ступање апликацијама проширене реалности. У раду је извршена анализа утицаја
проширене реалности и апликација проширене реалности на онлајн доживљаје ку-
паца на основу Упитника о корисничком искуству (енгл. User Experience
Questionnaire - UEQ). Анализа се односи на утицај апликације проширене реално-
сти компаније IKEA на онлајн доживљаје њених купаца. UEQ упитник, кроз њего-
ве дефинисане димензије, пружа реалну слику корисничког искуства у вези са про-
изводом. На основу анализе дошло се до закључка да су све димензије у вези са
апликацијом Ikea Place App оствариле позитивне резултате. Одлични резултати се,
пре свега, односе на димензије Привлачност, Разумљивост и Поузданост, док су
димензије Стимулација, Ефикасност и Новина постигле добре резултате, али уз по-
стојање могућности даљег усавршавања ових димензија анализиране апликације, те
и могућности њеног напредовања у будућности. С обзиром на то да је истраживање
у овом раду дало позитивне резултате и указало на позитиван утицај апликација
проширене реалности на онлајн доживљаје корисника, закључак је да би све компа-
није требало да се усредсреде на креирање ових апликација како би на тај начин
омогућиле својим купцима супериорно искуство приликом онлајн куповине.