Ambient Advertising in Metaverse Smart Cities

Nikola Vangelov,
Chief Assistant Professor, St. Kliment Ohridski Sofia University, Sofia, Bulgaria
E-mail address: nikolavangelov@gmail.com

Abstract
The paper analyzes the main aspects of ambient advertising, metaverse and smart cities. This type of advertising is creative, relatively inexpensive and uses the context of a city's area to provide a new experience to its residents and tourists. The article aims at displaying the overlapping of this marketing communication with the urban context and how both companies and municipalities could benefit from using it. The types of ambient advertising are studied, as well as their application in the communication of organizations with people in cities. Through content analysis and case studies the connection between ambient advertising and metaverse urban areas with its residents is studied. This paper adds on several previous studies [1, 2, 3] and some others in the context of smart cities and metaverse ambient advertising, while proposing an additional method of tracking user experience – eye tracking. Key elements of ambient advertising, the metaverse and smart cities are studied, as well as interactivity and connectivity. Through the analyzed examples the positive aspect of using this marketing communication is displayed, since it makes it possible for the residents to see the same environment in a new and interactive way. Thus, the connection between them and the urban space becomes stronger and more entertaining. This paper could be of interest to academicians and practitioners in the sphere of marketing and advertising, as well as representatives of municipalities, who aim at providing their residents an additional level of experience with the urban areas of the future.

Keywords: Ambient advertising, digital advertising, outdoor advertising, metaverse advertising, marketing communication, smart cities, metaverse.

1. Introduction
It has been just a year since Facebook announced its rebranding to Meta Platforms or just Meta. The change implies the shift in the focus of the largest social network in the world to its quest of new adventures in the digital realm. This time the leap into the unknown seems more dangerous than ever before but the higher the risk, the higher the reward. Indeed, from amassing up to almost 500 billion US dollars in 2020 the metaverse market is expected to be worth 800 billion US dollars in 2024 and that it could add 5 trillion US dollars to the global economy in 2030 [4]. So, it seems the right way to go for the big tech companies, since it is not only Facebook or Meta that is developing its own version of the online universe. There are Google, Amazon, Nvidia Omniverse, Microsoft, Roblox and Zepeto, to name a few. And it is not only technological giants that want a piece of this pie. There are also brands such as Coca-Cola and Gucci, which are selling their NFTs (nonfungible tokens). The formation of the metaverse ecosystem is already at hand and all the players in it, small and big, are helping one another to create a digital world that resembles the real one. With over 400 million monthly active users in 2022 the metaverse fanbase is only expected to grow at a rapid pace [5]. And with more and more people spending more and more time in the metaverse, as expected that by 2026, 25% of the people worldwide would spend an hour or more on it each day [6] it seems obvious that more and more businesses would like to jump in this adventure. And the more businesses take part in it, the more the ubiquitous advertising would make its way into this new reality. Throughout history advertising has always followed where people go. First it was outdoor advertising, which is still going strong today. Then it was the print, which has seen a decline in advertising budgets in the last decade is expected to shrink in terms of market share and

growth [7]. Then came the radio and the TV, which were paramount in the 20th century. Then at the end of it came the Internet era and with it the endless possibilities for businesses and organizations to reach their target audiences. Now, it seems that the next big thing is still the Internet, however through its latest creation – the metaverse. One of the best options for choosing to advertise on the Internet has always been its ability to strictly manage the advertising budgets due to the fact that online advertising is able to closely monitor consumer behavior and gather consumer data for further analyses and improvement of the efficiency of advertising. The latest platforms that attracted customers and scrutinized their actions and still continue to do so are the social networks. The metaverse is simply a "small step for man but man but a giant leap for mankind" as Neil Armstrong put it more than 50 years ago when he stepped out of the lunar module and onto the moon surface thus entering the new realm. The same goes for the metaverse – it would take small steps for tech companies to make the giant leap for humanity possible.

2. Ambient advertising

Ambient advertising is not a novel type of advertising. However, its application in smart cities environment and especially the metaverse smart cities of the future holds potential for businesses and organizations to reach their audiences in a new and intriguing way. In addition, it would aid in tracking and evaluating user experience, as combined with several methods of analyses that would also be discussed. Ambient evolved in the late 1990s with the need to apply different tactics in advertising since client wanted something with bite from the agencies. Eventually, this request from clients was met by creative agencies which started placing ads in unusual places: floors, ceilings, door and petrol pump handles, even backs of toilet doors. All positions that were previously not considered appropriate for advertising.

Defining ambient advertising was at first an ordeal since it shared a lot with other known types of advertising and yet it was something new that needed a definition, a model, a typology, etc. Firstly, if we take on the unusual part it might be arbitrary because what is unusual for one person might be completely usual for another. For example, the transport advertising (taxis that take a different form and painted busses), balloon or airplane (sky writing) advertising, digital billboards and so many others – we would not call them "ambient". So, the unusual placement or position should not be considered the only differentiating element. The method of application or execution should also be unusual. Take the role plays, the graffiti and the holographic projections – these all are instances of an unusual method. So, bearing in mind the essential elements of ambient advertising (location, execution and temporality) Luxton and Drummond [8] propose a definition that include all three "The placement of advertising in unusual and unexpected places often with unconventional methods and being first or only ad execution to do so". This way key ingredients of ambient advertising are creativity, novelty, newness and timing. A more succinct definition is that "ambient media is a type of contextual advertising which actively uses the characteristics of the surrounding environment" [9]. Some specialists also refer to ambient advertising as unconventional advertising. A few of the advantages of this type of advertising are:

- The lower price. The surrounding environment enables advertisers with great opportunities for a nearly free advertising. The simple reason lies in one of the most

essential semiotic axioms that anything that surrounds us could be used to convey meanings. It is all up to the capacity of the creative advertiser to see these opportunities and to act on them. For instance, when advertising a weather website we could use a billboard that is just a frame through which we could see the sky. At both left and right ends there are inverted commas. Thus the message is clear – the weather prognosis is as accurate as it possibly could. This way we pay only for the billboard but we use the sky for free.

- Creativity. By definition creativity is a key component for advertising. And it is even more important for ambient advertising since most of these advertisements are more creative or take more creativity to be developed than the other types of advertising. Thus, the admen create an extraordinary added value to the advertised goods or services.
- Involvement. Ambient advertising relies on tactics such as humour, surprise and overall creativity. They all result in better consumer involvement since people become part of this marketing communication and are more willing to participate in it by acting, by taking pictures or video or just by commenting on it. This participation on behalf of the receiver is key for message reinforcement [10].
- Builds a relationship. One of the ways ambient works, as mentioned above is through creativity and surprise which lead the recipient to discover the communication. This is vital to the effectiveness of the communication because the consumer is lead to believe that s/he has found something new. Thus they become empowered and can better identify with the brand. A relationship between the brand and the consumer is created that uses the pull rather than the push strategy.
- Interaction. The characteristics of ambient advertising suggest an interaction between the communication and the recipient. As mentioned above, it may consist of taking photos or video, or acting in the communication itself by using the smartphone to unlock specific features of the advertising and using augmented reality to immerse the recipient even more. Being part of the communication itself builds a stronger bond between the consumer and the brand and thus it is more likely that s/he would form a positive opinion of it and possibly by the product later and become a loyal customer.
- Viral communication. This type of communication suggests that users willingly and for free are disseminating the advertisement. Social media and social networks are perhaps the most popular means for it. When a user sees a creative, interesting and involving ambient s/he would take pictures or video and post it on his her social profile. Thus other users are able to see the post and engage with it – like, share, re-share or comment. Journalists are on the constant search for a sensation and an ambient which has drawn the attention of a massive group of social network users is bound to become a hot topic thus entering the news, swiftly and for free.

Karimova [11] presents a typology of ambient advertising which consists of three types based on the dimensions of time and space. She uses Bakhtin's [12] take on the chronotope as a base for her research. Karimova distinguishes between three major types of ambient:

- Static. Ambient advertising integrates the time and space of the ad itself and the time and space of the recipient. Time is regarded as a movement along the line of

"what was" and "what is" within space (actual or cognitive). Static time could be regarded as the absence of any movement in space. Static ambient has the recipient move thorough space that is shared with the advertising.

- Dynamic. The dynamic ambient suggests a movement of the advertisement between what is and what was. This ambient suggests a shift in the state of being. For instance, an advertisement of a traffic accident that has happened because we have not drunk our coffee in the morning. It is apparent that the situation of the car and the passengers has changed – at first all has been well (what was) and then the unexpected has happened and the car has crashed (what is).
- Multi-dynamic. In this type of ambient the space and time between the advertisement and the recipient is shared. An ambient that advertises watches using a bus handle (figure 1). In this situation both the ad and the recipient share the same space (the bus) for the same period of time. This way the bus becomes the advertising chronotope. The advertising message interacts with the passenger but s/he is willing to interact because s/he might not choose to hold that handle.

Fig. 1.
Source: Ads of the World [13]

The presented typology of the ambient advertising would be of interest to the following analysis of the possibilities that the metaverse presents for organizations and businesses for communicating with their audiences because in this new digital reality people are both present on the real and the digital world as are companies and their products.

3. The metaverse and the smart cities

Metaverse is contesting for Oxford Word of the Year 2022 and it is only in a few days (December 5th) that the winner would be announced [14]. According to Oxford University Press the word has been used four times more in one year's time. This is as a consequence of the trend in usage of the word as many professionals in the area of communications and just ordinary people see it as the next big thing. The definition by the Oxford Dictionaries is "a virtual reality space in which users can interact with an environment generated by computer and with other users" [15]. However, the idea of people interacting this way is not something new. On the contrary, it has been almost 60 years since the first movie that

used this idea became popular – The World on Fire (1973). Ever since, many other blockbusters intrigued movie lovers all over the world taking pretty much the same road – Tron (1982), Total Recall (1990), The Matrix (1999), Avatar (2009), Ready Player One (2018), to name a few [16]. The metaverse would enable users to immerse in a digital world and tangibly connect to everyday object and to real lives and bodies of humans [17]. This digital world would be possible thanks to the cross-point of the physical, the virtual and the augmented reality which live together in the online space in 3d format and represents people, places and things [18]. And as Mark Zuckerberg put it – not only the expert working for Facebook would work on the project but they would be aided by institutions, policymakers and other organizations. This large scale collaboration would ensure the safety of data exchanged in the metaverse and the possible applications of it in the sphere of many physical industries, helping smart cities become smarter, as well. Across the wide range of definitions among practitioners, researches and the academia, the most common elements for the metaverse are the shared environment, the use of avatars (the digital personalization of the users), synchronization, the continuity of one's identity, the three-dimensional world the interactive, immersive and social user experience. Thus, Kim [19] proposes the following definition of the metaverse "an interoperated persistent network of shared virtual environments where people can interact synchronously through their avatars with other agents and objects".

Historically speaking, as presented above, the idea of the metaverse is not something new. The first usage of the word was in Neal Stephenson's science fiction novel "Snow Crash" in 1992. The storyline tells how people escape the harsh reality of a world which economy has collapsed. The novel proposed the idea of the headsets or goggles that are used to immerse people in the fictional world. Although Stephenson did not shake the market as to boost the mass production of such devices, several industries took interest and applied the technology in the areas of urban planning, entertainment, digital business, thus attracting the attention of the big technological giants such as Meta, Microsoft and Google. Besides novels and movies that were the first to open the gate for the virtual world, there was also the gaming industry, which has attracted the attention of a large number of people, with approximately 3 billion people over the world playing video games [20]. It is expected that by 2025 the gaming sector would accumulate over 46 billion US dollars worldwide. Having said that, nowadays most companies are exploring the possibilities that the metaverse has to offer as to develop new games and technologies. It has been 20 years since this concept was applied to video games such as The Sims (2000) and Second Life (2003). Today, with games such as Fortnite and Roblox users can easily interact with the world by customizing avatars which speaks of the possibilities that lie ahead.

In addition to aiding the development of the gaming industry, the metaverse would also enable local governments to improve their interaction with residents, offer services that are efficient, fast and real-time, and also better manage urban spaces. The local governments would also be able to implement projects that are complex and capital-intensive since new incomes from various funding would be present. "Aside from governance entities, different institutions, including businesses, education entities, large corporations, etc., will offer opportunities to conduct their activities in the virtual world, enabling better interactions with existing and new clients, as well as improving the quality of their products by

capitalizing on technologies such as DT that will be enhanced in the metaverse. They will further have opportunities to explore other frontiers such as creating virtual products that will be on-demand, as people seek to enhance their avatars, being future commodities, as the metaverse becomes more apparent" [21]. DT or Digital Twins technology is basically a computer programme that scientists could use to create digital replicas of objects, processes or services in the virtual world. This process enables the gathering of data from a simulation model that would help to test and predict how a product, a process or a service would perform in the real world [22]. Using this technology, companies would more accurately build scenarios and model the application of a precise urban planning [23]. So, customers would be provided with the best solution for goods and/or services by having digital city models that enable the real-time assessment of models and scenarios or interventions. This new technology would be beneficial since it is cost-effective through reducing the costs for tests and models that usually require expensive or labour intensive force and takes significantly more time. There are already US cities, such as Boston, Las Vegas and Orlando that have adopted such technology and have created digital replicas of the city which allows local governments to address and predict different scenarios such as future land usage or new streets impact [24].

4. Methods for evaluating online user experience

The evaluation of user experience is essential for all industries where potential customers are interacting with companies' goods and/or services. From improving the qualities of an electric device, through adding new characteristics to the packaging of a product to creating a better picture of the user path and experience online, substantial resources, both temporal and technological are needed. The following paragraphs would analyze some of the methods at hand and their application in the science so far, as well as the opportunities that lie ahead in implementing them into the digital world.

The implementation of software and hardware for eye-tracking is a well-known method for analysis that companies use for studying consumer behavior. This technology is on the rise for the present lower costs of the devices for analysis, as well as their advanced calibration and proven positive results. The digital environment presents lots of opportunities for evaluating how, why and where consumers turn their eyes thus marking significant progress in the development of commercial websites, social networks, mobile devices, video games, email marketing and mostly advertising in these and other online channels. "Eye-tracking is a methodology that helps scientists understand visual attention. Through this method we could identify where a consumer is looking at a certain point in time, for how long and what path the eyes have gone through" [25]. This method is widely applied in fields such as cognitive psychology, marketing and advertising, computer mediated communication, etc. It helps understand the consumers' behavior without them having to remember why they did what they did. It is complementary to methods such as the interviews, because sometimes respondents simply do not remember looking or seeing a particular object or are embarrassed to tell the truth. Back in the days when respondents were participating in such analysis they had to be put into a laboratory with their chins fixed onto a stand and they should not move at all. Such an arrangement did not put the analyzed group into a natural environment and this lead to questionable results in terms of validity. Nowadays, this method uses technology that is integrated into the computer screen or small

technical devices that do not disrupt the user experience. This way the analysis is not intrusive and investigates users in their natural setting. One way of implementing the eye-tracking method is by using heat maps. In this case (figure 2) colours are used to indicate the duration of each fixation. The warmer the colour, the longer the duration.

Fig. 2. Eye-tracking software using heat maps
Source: Business Korea

"Heat maps help us understand the sequence and the hierarchy of various qualitative values through a matrix of category combinations. Using a colour scheme with high or low opacity helps for pinpointing the quantity". [26]. Another way of harnessing the power of the eye tracking method is by using a gaze plot. "The gaze plot reveals the points of user fixation from the beginning of a task until its accomplishment." [27]. This method of analysis allows scientists to track the fixations and the saccades (the swift movements of the eyes between two fixation points) for a definite period of time. Most commonly fixations are marked with dots and the saccades with lines that connect the dots (figure 3). The numeration of the dots reveals the order in which they have been accomplished and the size stands for the duration of the fixation.

Fig. 3.
Source: Tobii Connect

Eye tracking as a method for evaluating user experience gives scientists and researchers a precise gaze map of the points of interest in a particular order. However, it does not answer perhaps the most important question – Why do we do what we do as users? To be able to answer this question scientist usually apply other methods of analyses. Besides the interview, there are biometric methods that help reveal the big picture. Some of them are:

- Pupil dilation. Pupillometry is a method that measures pupil size variation. This is a rather old-school method of measuring brain activities. Pupil dilation is controlled by the autonomous nervous system. By carefully analyzing the variations in pupil size scientist could interpret states of interest or emotion closely connected to brain word-load and excitement [28]. However, it should be noted that it is not possible to read the valence of the emotion. "Pupil dilation alone does not differentiate between interest or anxiety" [29].
- Facial recognition of emotion. The non-verbal communication or simply put the body language play an important part when it comes to analyzing consumer behavior. Emotions such as happiness, surprise, fear, anger, sadness, disgust can be pinpointed by using facial expressions regardless of age, gender, ethnical belonging and other segmentation criteria [30]. As opposed to the interview, this method of analysis is rather objective, since human emotions are harder to control.

The combination of these methods of analyses could answer why consumers do what they do. This would aid marketing and especially advertising, so that consumers receive advertising that is interesting, relevant and non-obtrusive.

Virtual reality goggles or the ones that are used to enter the multiverse could be equipped with these features, so that they combine the eye tracking with the biometric methods and thus study consumer behavior. In addition, methods of analyses such as EDA (electro dermal activity) and/or EEG (Electroencephalography) could be implemented as well. However, this would require a larger combined device and this might turn out to be unpleasant for the users to wear.

5. Ambient advertising in the multiverse

In the article so far we discussed what the multiverse and ambient advertising is. We also analyzed some of the methods for evaluating user experience and proposed their application as a combination in the virtual world. The crossing point between the multiverse, advertising and smart cities has already been analyzed with regard to outdoor advertising [31]. In the following lines the ambient would be discussed with examples of extending what we know about ambient advertising with respect to its development in the virtual realm. The characteristics of digital outdoor advertising and its application in smart cities has been analyzed [32]. Ambient advertising in the multiverse is the next step forward in attracting customers through interactive and immersive experience due to the advancements in technology.

Technology indeed is found to play a vital role in the development of smart cities [33, 34]. With its help even the intriguing ambient advertising that we know so far would become even more interactive and immersive which would lead to better connection between businesses and their target audiences. Advertising in the metaverse would also enable new

and effective options for scientists and practitioners to analyze consumer behavior and thus improve their products and services.

As discussed so far, ambient advertising creatively and effectively uses its surrounding environment. With regard to smart cities the urban environment is one such context. Figure 4 displays an ambient that has taken hold of the street and its natural characteristics. The creative artists have transformed the pedestrian crossing into an ad for McDonalds just by adding a few elements and by painting the crossing in yellow colour.

Now just imagine the possibilities that the metaverse could offer in order to develop this ambient. Since everything will be digitalized the crossing could become alive and by stepping on it the pedestrians could elicit some sort of music. In addition, the French fries (the crossing) might start to dance or perform any other movement, so that the walkers become more immersed in the communication.

Thus, a simple street crossing could add entertainment, maybe a chance to win a prize an even without even realizing it a pedestrian could end up in a McDonalds restaurant by the end of the crossing, so that s/he could order from the menu and have the meals sent home in the real world.

Fig. 4.
Source: Bored Panda [35]

The creative ambient (figure 5) advertises a road restaurant in an unusual and intriguing way. If this were to happen in the metaverse, the driver could drive into not just a tunnel but into an adventure. And what better way to have a break from the monotonous driving.

Thus, when entering the tunnel the car could directly end up in the drive through of the restaurant or even better – the car itself could transform into a restaurant and the driver may find himself at the table ready to enjoy a meal.

Fig. 5.
Source: Bored Panda

Not all action takes place above the ground. In cities, the underground space is quite busy, especially during rush hours. The underground escalator ambient by National Geographic is rather realistic (figure 6). If anyone saw it for the first time s/he would be immediately ridden with fear. Now imagine that the crocodiles were actually moving and splashing water in the virtual world. One can only imagine that the rushing late for work people would much rather take the stairs. But for those willing to take the challenge and approach the fearless animals might win a prize – a year's free magazine subscription or even a free vacation to a tropical destination. And since imagination does not have limits nor does the metaverse, why not turn the casual metro rider into an adventurer and submerge him/her into the virtual world of the Amazon jungle?

Fig. 6.
Source: Bored Panda

The underground realm is not only a place of fear and torture. It is also the place where crops grow. The creative ambient (figure 7) advertises chips or crisps (depending on your metaverse language options). Thus, quite a few subway users are turning their heads up in astonishment and amusement.

Fig. 7.
Source: Bored Panda

If the metaverse were to step in it could enable endless possibilities for people to be entertained and immersed into further marketing communication. This experience could become even more interactive if when passing under the ambient the potatoes were to move and all of a sudden the advertised brand pops into the hands of the observer, who has won a crispy prize. Or hundreds of chips could start falling from the ceiling and the more the consumer collects the more virtual money s/he gathers and eventually uses for in-store purchasing. With the application of eye tracking and biometric analyses these metaverse ambient could be analyzed with the best precision as it comes to consumer behavior while interacting with them.

6. Conclusion

In reality, no one knows what the metaverse would actually look like. The big tech companies are putting a lot of effort to develop this new digital realm, so that they could add to their own portfolio and be able to offer other companies, especially ad agencies, a new way to approach their potential clients. For the purposes of advertising, the metaverse could offer a new and effective arsenal of instruments for advertising, as well as known but refined and used with regard to the new digital reality methods of analyses of consumer behavior. All of them combined would enable businesses to form a stronger bond with their audiences while analyzing their virtual experience in order to improve the qualities of their products and/or services. Ambient advertising is still found interesting and interactive in the real world as we know it and the opportunities that lie before it in the metaverse could be endless. In general, advertising has always followed the crowd and the metaverse could be the newspaper of the past. One thing is for sure, we are all still in the down of this new digital reality and most certainly would be surprised what the future holds in store in this regard.

References

[1] Vrabie, C. (2019), *Technological Infrastructure for Building a Smart Ecosystem,* STRATEGICA Upscaling Digital Transformation in Business and Economics. Bucharest: Tritonic Publishing House.

[2] Vrabie, C. (2022), *Smart Cities 2.0 – Connected City, or How to Use Technologic Infrastructure for Improving the Quality of Life*, Central and Eastern European EDem and EGov Days 335:411-24.

[3] Vangelov, N. (2022*), Digital Marketing and Outdoor Advertising in Smart Cities*, SCRD, vol. 6, no. 3, pp. 81–91

[4] Luisa Zhou, https://www.luisazhou.com/blog/metaverse-statistics/, date: 01.12.2022.

[5] Bankless Times, https://www.banklesstimes.com/metaverse-statistics/, date: 02.12.2022.

[6] Gartner, https://www.gartner.com/en/newsroom/press-releases/2022-02-07-gartner-predicts-25-percent-of-people-will-spend-at-least-one-hour-per-day-in-the-metaverse-by-2026, date: 02.12.2022.

[7] Dentsu, https://www.dentsu.com/news-releases/dentsu-ad-spend-forecast-july-2022-release, date: 01.12.2022.

[8] Luxton, S., Drummond, L. (2000), *What is this thing called "Ambient advertising"? Visionary Marketing for the 21st Century: Facing the Challenge*, ANZMAC, p. 735.

[9] Kaftandzhiev, H. (2016), *Integrated Marketing Communications*, Sofia: St. Klment Ohridski University Press, p. 120.

[10] Schiffman, L.G., Watson, B.D., Kanuk, L.L. (1997), *Consumer Behaviour*, Prentice Hall, Sydney.

[11] Karimova, G. (2014), *Toward a Bakhtinian typology of ambient advertising*, Journal of Marketing Communications, 20:4, pp. 251-269.

[12] Bakhtin, M.M., (1994), *Forms of time and chronotope in the novel*, In The dialogic imagination: Four essays by M.M. Bakhtin, trans. C. Emerson and M. Holquist, ed. M. Holquist, 84–258. Austin, TX: University of Texas Press.

[13] Ads of the world, https://www.adsoftheworld.com/campaigns/hanging-straps, date: 02.12.2022.

[14] NDTV Profit, https://www.ndtv.com/business/metaverse-in-race-to-become-2022s-oxford-word-of-the-year-3558687, date: 01.12.2022.

[15] Oxford Learner's Dictionaries, https://www.oxfordlearnersdictionaries.com/definition/english/metaverse, date: 02.12.2022.

[16] IMDb, https://m.imdb.com/list/ls026587395, date: 01.12.2022.

[17] Lee, L.H., Braud, T., Zhou, P., Wang, L., Xu, D., Lin, Z., Kumar, A., Bermejo, C., Hui, P. (2021), *All One Needs to Know about Metaverse: A Complete Survey on Technological Singularity*, Virtual Ecosystem, and Research Agenda. arXiv:2110.05352.

[18] Meta, https://about.facebook.com/meta/, date: 01.12.2022.

[19] Jooyoung, K. (2021), *Advertising in the Metaverse: Research Agenda*, Journal of Interactive Advertising, 21:3, pp. 141-144.

[20] Truelist, https://truelist.co/blog/gaming-statistics/, date: 01.12.2022.

[21] Allam, Z., Sharifi, A., Bibri, S.E., Jones, D.S., Krogstie, J. (2022*), The Metaverse as a Virtual Form of Smart Cities: Opportunities and Challenges for Environmental*, Economic and Social Sustainability in Urban Futures, Smart Cities, 5, 771–801, p. 786.

[22] Samsung, *6G: The Next Hyper-Connected Experience for All*, https://cdn.codeground.org/nsr/downloads/researchareas/6G%20Vision.pdf, date: 02.12.2022.

[23] Bibri, S.E. (2021), *Data-Driven Smart Eco-Cities of the Future: An Empirically Informed Integrated Model for Strategic Sustainable Urban Development*, World Futures, pp. 1–44.

[24] Glickman, J. (n.d.), *How Cities are Engaging in the Metaverse*, https://www.nlc.org/article/2022/04/18/how-cities-are-engaging-in-the-metaverse/, date: 01.12.2022.

[25] Bergstrom, J., Schall, A. (2014), *Eye tracking in user experience*, Elsevier, MA 02451, USA.

[26] Kirk, A. (2012). *Data visualization: a successful design process*, Packt publishing, p. 176.

[27] Gamito, P., Pedro Rosa (2014). *I see me, you see me*. Cambridge Scholars Publishing, NE6 2XX, UK, p. 201.

[28] Tullis, T., Albert, B. (2008), *Behavioral and Physiological Metrics, Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics*, Amsterdam: Elsevier.

[29] Fong, J. (2012), *The Meaning of Pupil Dilation*, http://www.the-scientist.com/articles.view/articleNo/33563/title/The-Meaning-of-Pupil-Dilation/, date: 01.12.2022;

[30] Ekman, P., Friesen, W.V. (1976), *Measuring facial movement. Environmental Psychological Nonverbal Behavior*.

[31] Yoo, S.C, Piscarac, D., Kang S. (2022), *Digital Outdoor Advertising Tecoration for the Metaverse Smart City*, International Journal of Advanced Culture Technology 10:1, pp. 196-203
[32] Vangelov, N. (2022*), Digital Marketing and Outdoor Advertising in Smart Cities*, SCRD, vol. 6, no. 3, pp. 81–91
[33] Vrabie, C. (2019), *Technological Infrastructure for Building a Smart Ecosystem*, STRATEGICA Upscaling Digital Transformation in Business and Economics. Bucharest: Tritonic Publishing House.
[34] Vrabie, C. (2022), *Smart Cities 2.0 – Connected City, or How to Use Technologic Infrastructure for Improving the Quality of Life*, Central and Eastern European EDem and EGov Days 335:411-24.
[35] Bored Panda, https://www.boredpanda.com/33-cool-and-creative-ambient-ads/?utm_source=google&utm_medium=organic&utm_campaign=organic, date: 02.12.2022.