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Original Research Article

An Urban Hyperreality: The Impact of Urban Digital Twin on Citizens' Perception of the City

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Abstract | Digital twin is one of the groundbreaking media innovations in the city domain, which allows us to plan for complicated urban challenges using modeling and a virtual depiction of the actual environment, which reflects the idea of a smart city. Most of the studies and real-world experience demonstrate that such a technology is within the scope of urban management organizations and aligns with notions of smart cities and urban sustainability. With regard to resources, this technology medium seems to have the potential to lend itself to shaping the urban environment through the generation of meaning and urban narratives. In light of this information, the study aims to understand if it is possible to influence citizens' perceptions of the city through urban digital twin technology?. This qualitative research aims to establish a link between accepted assumptions and established concepts from earlier studies. For this purpose, this study draws from available literature to generate a new assumption using the inductive research approach. The research's conclusions demonstrate that by replicating a physical counterpart and modeling the actual world, it is possible to display a hyperreality parallel to what is happening in reality, giving the user a unique virtual experience. Interestingly, this experience, which is associated with a physical counterpart, can serve as a mental background. As much as the digital twin will be able to create a new interpretation of the place in the user's mind, this medium can affect the urban landscape or citizens' perception of it by creating a hyperreality of the real environment.

Keywords | City Image, Urban Landscape, Media, Virtual Reality, Simulation.

Introduction | The phrase “digital twins” refers to a virtual representation of a physical system that has been utilized in many different disciplines recently. Recent years have seen the emergence of this idea as computer modeling capabilities for actual objects have increased. Under the title of “Urban Digital Twin,” this idea has just entered the city domain. It deals with the virtual modeling of the urban environment and serves as a management infrastructure to assist the city domain's decision-makers in planning the intricate details of the city. The analysis of the research and the current practical examples suggest that this technology is thematically focused on topics like urban sustainability, particularly smart cities.

However, the city management, the decision-making body, has been considered to be the sole user of the technology. It seems that the digital twin of a city, due to its capabilities in realistically representing its physical counterpart—and being incessantly updated—can present the city virtually to its citizens. Since one of the functions of media is to produce meaning, if the idea of the cityscape -or how people perceive their city- is understood to be a perceptual phenomenon dealing with citizens' interpretations of the city, then it is imperative to investigate if this technological medium, which is defined within the boundaries of the city causes any problem in interpreting the city. As the current approaches to this technology, serving as a medium capable of meaningful interaction with

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the audience, focus on smart city issues, this study is an attempt to know if technology can impact the urban landscape as well?" For this purpose, the study first examines the meaning of the city as a relative phenomenon. Then, by presenting the theoretical foundations for understanding the media as a tool for the transformation of meaning and the production of hyperreality, it provides preliminary discussions, and finally, by introducing the concept of the urban digital twin and its capabilities, it attempts to answer the research question.

Research Methodology

The current study uses the inductive research method and literature from earlier studies to propose a new assumption by establishing a relationship between accepted assumptions and tested concepts. The qualitative investigation examines how the urban digital hybrid affects citizens' perceptions of the city. The regular combination of known assumptions to arrive at new propositions is the foundation of reasoning procedures. In the process of reasoning, a relationship is formed between many assumptions so that a conclusion arises from their relationship, turning an uncertain and ambiguous relationship into a certain one. Reasoning is the process of integrating affirmations to support another affirmation (Alami, 2009). This article aims to add to the present discussion on the potential influence of digital twin technology on environmental perceptions by integrating new and existing knowledge.

The Relative Concept of City

The relationship between man and the city is based on the interpretation that man gives of the city. Looking back in the last century words such as place, atmosphere, landscape, and concepts related to the interpretation of space suggest that in the past decades, scholars have considered the city not as an objective entity but as a product of the observer's perceptive interaction with it (Bell, 2015; Swaffield, 2015; Keramati Niaragh et al., 2022, 409–411; Bille & Schwabe, 2023). In this view, the city is not only the outcome of physical processes but also the product of perceptual processes. The society is its users (Hemmati & Saboonchi, 2021, 25; Masnavi et al., 2021, 31). If we posit that the perception of the city is the result of the physical thing and the perceptual interaction of its users, then we can admit that the meaning of the city—or, in other words, the view of the city—is not a final and unchanging subject because it depends on the perception of different users over time. It is a very "relative" concept. For instance, Merleau-Ponty describes the undeniable action of "mentality" in

the process of perceiving the surroundings and the impossibility of reaching pure nobility as follows: "The dizzying closeness of man and things both excludes the knowledge of ourselves as pure reason separate from things and also prevents the definition of things as pure nobles who lack any human characteristics" (Merleau-Ponty, 2021, 61). In other words, the mental effects of the user about the same space and phenomena are capable of creating different places and phenomena. As a result, the environment has no meaning in itself, and it is humans who give it meaning (Bonta, 1979, 46). On the other hand, it can be said that the environment in our perception is like a "text," in the sense that the environment as a "symbolic" phenomenon carries concepts that the mind gives certain meanings to when facing it (Duncan, 1990, 56; Barnes & Duncan 1992, 3). Hall also believes that reality does not have a fixed, final, and unique meaning and that its meaning is formed under the influence of the discourse space of minds (Casey et al., 2002, 200; Jhally, 2007, 19). Although Burke considers the interpretation of the environment to have biological assumptions, he also emphasizes its ontological aspect and the role of the subject in its formation and states, "The landscape does not exist without us, and we do not exist without the landscape; this is basically why when we talk about the landscape, we actually refer to ourselves" (Burke, 2008, 88). With this background, it can be said that due to the perceptual essence of the city landscape and its dependence on the interpretation of the environment by different users, the meaning of the city is a relative thing and, as a result, "evolving."

Media as a Means of Transformation

While some scholars view the media as a tool for social interaction and trace its history back to the advent of civilizations (Lister et al., 2009, 52; Lule, 2012, 5), this written media has evolved from being an "intermediary" phenomenon to a "meaning generator" since its inception (The Chicago School of Media Theory, n.d.; McLuhan, 2017, 5; Alimohammadi, 2019, 67–70; Hjarvard, 2021, 4; Hang & van Weezel, 2007). The impact of outside reality on the attitudes of viewers is one of the media's most blatant characteristics. This attribute has made modern media act as more than just a medium (Hemmati, 2022, 52).

As Inglis also puts it, "Telephone, radio, film, and television, along with print and human voice, are all equally acknowledged mediums. The issue is that when we start to analyze how each one works, they are not equivalent in any way, and the word "intermediacy" gets a slippery meaning when it becomes the basis for

manipulation (Inglis, 1998, 37). In addition, Littlejohn believes that the media can present a false image of the truth to their audience to replace their previous narrative of the subject (Littlejohn, 2004, 753). Hjarvard also argues that the media transforms the user's perceptual relationship with reality by changing the three systems of "time and space," "communication system," and "normative system," and after that, a new relationship with reality is organized in the audience's mind (Hjarvard, 2021, 14). Lipman also states that our mental image of the world is influenced by the messages we receive indirectly from the environment. He emphasizes the difference between the world and the realities that we know and act based on, but we deal with everything that we believe is a true image as if it were a part of this environment itself (Severin & Tankard, 2012, 459). Therefore, it can be said that modern media can act as a medium of messaging for their users, but they can also be a tool for the evolution of meaning that can affect the product of the relationship between the perceiver and the perceived.

Media and Hyperreality

According to Baudrillard, the media fabricates "meta-realities" by posing it as an external reality and the portrayal presented by the media becomes a substitute for reality in the minds of the audience (Mehdizadeh, 2021, 293–300). According to Baudrillard's definition, simile or simulation refers to the blurring of the boundaries between reality and image. With the endless supply of images, mass media blurs the border between reality and image and replaces reality with images. Focusing on the media, especially television, Baudrillard states that "this media has nothing to do with communicating the subject with the real world of objects; rather, it seeks to articulate subjects and objects through chains of signification" (Stevenson, 2003, 215). Baudrillard believes that the speed of media messages has fragmented our experience of time and space. He maintains that "The message that is decoded and "consumed" internally and unconsciously is not the obvious concept of sounds and images, but this message is a binding pattern of separating reality into consecutive and equivalent signs" (Baudrillard, 2001, 115). The important issue in the representation of reality by the media is that the media is never considered a neutral tool or an impartial intermediary in presenting the image. Media relies on language and meaning, and language and meaning in the framework of discourse always rely on power (Rabeei & Ahmadzadeh Namvar, 2017, 43). Baudrillard considered the symbols or signs of media

culture—images, sound, commercial advertisements, etc.—to be imitations or copies of reality, which not only seem more real than physical and social reality but also replace it—reality. It is like a map of the world that is so clear, detailed, and comprehensive even looks more real than the world that this map is supposed to represent. According to Baudrillard, the media creates a "hyperreality" (Hjarvard, 2021, 31 & 32). Borstein also argues with the concept of "pseudo-event" that the dissemination and spread of images through media channels at the end of the 20th century is a sign of a graphic revolution, during which there have been extensive changes in the way we look at the reality of the world. He claims that news media do not report real events but create and publish false things, i.e., pseudo-events (Mehdizadeh, 2021, 300–305). Therefore, it can be concluded that the new media can recreate a media image of reality with the help of new tools and present it to the audience, which is seriously similar to reality.

The Digital Twin of the City

In recent years, the digital twin (DT) has turned into the most cutting-edge concept in the digital field and has been used in a wide range of sciences. Although the concept of digital twin was conceptualized before the 1990s with other titles such as "mirror worlds," "mirror space model," and "information reflection model," its first scientific definition was made by NASA to enhance the simulation of the physical model of the spacecraft (Negri et al., 2017, 941; Singh et al., 2021, 2). A digital counterpart is a technology that refers to "a virtual representation of a physical system (and its environment and processes) that is updated through the exchange of information between physical and virtual systems" (VanDerHorn & Mahadevan, 2021, 2; Caprari et al., 2022, 1). This technology, which can provide a realistic image of its physical counterpart, can provide several goals for its creators, such as simulation, monitoring, testing, etc. In the real environment. The urban digital twin (UDT) is also one of the types of digital twins whose current topic is the reconstruction of a city with a management and planning approach in line with technologies such as the smart city (Schrotter & Hürzeler, 2020, 105; Deng et al., 2021, 126; Weil et al., 2023, 1–5). The digital counterpart of the city, which is a kind of reconstruction of reality—here, the city—by the media, basically acts as a mixed reality in which electronic technology, new media, and the infrastructure of virtual environments are inseparably linked with the physical, social, economic, and cultural life of that city. The digital counterpart of the city is the dialectical experience between the real and virtual in which one feeds and influences the other

(Nayar, 2014, 323). These media give us the experience of the real world, which transforms our understanding of space and time. In addition, the experiences, events, organizations, and interactions that people have in virtual space will affect the community in their reality (Ning et al., 2021, 17). For example, some researchers have drawn the “emotional geography” of the users by considering the dialectics of the virtual space and the real space, which indicates that these two interact (Thien, 2005; Frith, 2019) or research on the effectiveness of computer games on perceptions confirm this issue (Shahcheraghi & Bandarabad, 2021, 511). Therefore, it can be said that the digital counterpart of the city, as a technological phenomenon, can present a significant similarity with its physical counterpart and maintain its semantic and formal connection with it. Therefore, it can set a definitive border by presenting believable images of reality while diminishing the duality of real and virtual space for the user and becoming its replacement.

Discussion

As previously stated, the way the city is perceived by its residents determines its meaning. In other words, the perception of the urban environment is a relative phenomenon that changes depending on how the user interprets the city's symbols. We may acknowledge that the meaning of the city might vary and become an ambiguous entity if we acknowledge that it is relative and ill-defined. As mentioned earlier, new media may function as a tool for the creation and transformation of meaning outside of the medium because of the instruments at their disposal. The aforementioned study demonstrated that the media can a different version of reality to the public and provide a credible picture of reality if is supported by the user's reliance.

Due to this media characteristic, signs are no longer a true reflection of the outside world but rather a façade. Simply put, new media can portray a reality that takes the place of the current reality. While most recent research has focused on how this technology can be used by higher education to manage and plan smart cities or address urban sustainability issues, there is evidence that its wider adoption by the general public may provide new perspectives on the urban environment. Rather than being the result of real events, these stories are the result of interactions with digital ones. Simple illustrations of this may be seen in video games such as Grand Theft Auto, where players encounter an extremely realistic representation of the actual world, even if the game is not a perfect replica of reality. Therefore, it can be acknowledged that if the

urban digital counterpart presents a believable image of the urban environment to its audience in which a new narrative of environmental events takes place, which in this case does not correspond to its physical counterpart, then the user may be faced with the next step of associating the virtual narrative with the physical place, in which case it can be claimed that the digital counterpart of the city has been able to affect the meaning of the urban environment, or, in other words, the citizen's perception of the city without physical intervention. In Baudrillard's interpretation, the media presents a simulated narrative of reality, or hyperreality, to the audience. The digital twin of the city, as one of the types of technological manifestations of the new media, since it seeks to continuously provide a significant level of similarity with the real environment, can blur the boundaries of reality and allow the pretending of the reality of the city to pay. Although the functions that are generally mentioned in recent research are the role of this technology in simulating the city to manage and plan in the direction of the smart city or topics such as urban sustainability, which are generally used by the upstream institution, the evidence presented shows that if it is offered and its expansion to the general society is capable of presenting new narratives of the urban environment. Narratives are the product of interaction with digital cognate events rather than their physical counterparts. As the more basic examples of it that are presented in most computer games, such as the Grand Theft Auto 11 computer game, although they are not identical models of physical reality, users still evoke their hyperreal experience by seeing the real environment. In other words, as shown in similar studies by Thien (2005) and Frith (2019), the audience's interaction with the hyperreality produced by the media affects the interaction that takes place in the real space. This leads us to conclude that the digital counterpart of the city can serve as a definitive border by presenting credible representations of reality. It is a technological phenomenon that can both bear significant similarity to its physical counterpart and maintain its semantic and formal connection with it. Therefore, the digital twin can fade the audience's perception of the distinction between actual and virtual space and take its place.

Conclusion

As mentioned earlier, the city is a perceptual phenomenon. Therefore, this phenomenon as a spatial symbolic creation is based on the user's perception of the environment. This leads us to imagine the urban landscape as a symbolic entity that is relatively read by the user. This issue indicates that the meaning

of the city is relative and changeable so that the user interprets it by referring to the symbols of the city concerning their mental background. On the other hand, as mentioned, the media can produce meaning beyond an interpersonal interface, which, along with new media tools for presenting a believable image, provides them with the ability to pretend to be the real world and present a manipulated image of reality to the audience. Such images, as a hyperreality that can travel a parallel path with the real world, can present a new narrative of reality to the audience. In the meantime, it seems that the digital counterpart, as a medium that has much wider tools to reflect the real world, can create a much more believable image of the world in the audience's mind. The digital counterpart of a city also seems to be one of the types of technology that offers the ability to create a hyperreality of its physical counterpart, the

city, for the audience. In other words, by encountering the urban digital counterpart and interacting with its virtual events, the audience gains an experience of a virtual thing that is rooted in reality, and this experience, as mentioned, can be associated with facing the real space. For example, if an event takes place in an urban space modeled in the urban digital counterpart and this event is perceived by the observer, the perceived subject becomes his mental accumulation. In this case, the user experiences an association when facing the real urban space and interprets what they receive from the outside environment in combination with the new accumulations obtained from the digital counterpart. Therefore, this process shows that the urban digital hybrid, by producing urban hyperreality, can affect the urban landscape or the audience's perception of the city without the intervention of the real environment.

Endnotes

1. Mansouri states: "Descartes, in response to the excessive Aristotelian subjectivism of the church, which considered the spiritual world (metaphysics) to be the ruler of the lower world (physics), used "dualism" to classify categories and divide phenomena into objective and subjective. In this division, the city is known as a physical (objective) reality; and otherwise, it must be a metaphysical phenomenon like imagination" (Mansouri, 2009, 30).
2. Atmosphere is also a term used by architects and urban planners, such as Peter Zumthor, the famous architect, or Michael Bayle, the author of the book *Atmospheric City*, to interpret space in a way that not only refers to its objectivity but also to its perceptual aspect.
3. The city is a scenic phenomenon that is fluidly formed between concepts and physics and is the product of people's perceptions of their living environment. In other words, "urban landscape is an interpretation of urban space that considers it a phenomenon with intertwined objective-mental dimensions" (Hemmati et al., 2022, 73). In other words, the cityscape is one of the types of landscape and a category of quality that emerges through a few elements. Human conscience and experience prove that the landscape of the city has physical and material symbols, to the extent that some have mistakenly considered the shape of the body to be equivalent to the landscape of the city and not its symbol (Mansouri, 2009, 2011).
4. It should be mentioned that Inglis, in describing the meaning of medium in the English language, also refers to people who claimed to communicate with the world of the dead in the past (Inglis, 1998,

- 37). These mediums claim that they do not speak for themselves and speak from the language of the dead person's soul when reality is the opposite. It seems that by creating this analogy, the author seeks to express that the media does not act only as a neutral medium.
5. In other words, humans live in a surreal world where media signs and codes have cut off the connection with reality and have become a substitute for reality. The exaggerated statement of this reality is proposed by Jean Bourdier about the Persian Gulf War as follows: "The Persian Gulf War happened only on television screens, or in other words, the Persian Gulf War did not happen at all (Merrin, 1994, 447).
6. In other words, as a result of the presence of the media, with the mediaization of human interactions and the virtualization of social institutions, which were previously dependent on specific places, virtual realms have been created where people can participate in many different social institutions regardless of their physical location and in them to share (Hjarvard, 2021, 69), and beyond that, the media presents a new narrative of the environment; it is not a final matter to change its meaning (Hemmati, 2024, 34).
7. Baudrillard, explains the concept of pseudo-event as such: "Borstein's meaning is that the world of events, history, culture, and ideas is not created from real and contradictory and changing experience but is made as human artifacts from the elements of the secret and technical deception of the media. It is these elements of mystery and deception (and nothing else) that define any

signification as consumable. This generality is the replacement of the code instead of the referential dimension that determines the consumption of mass media” (Baudrillard, 2001, 118–117).

8. The concept of a smart city, which has been repeated a lot in the literature on urban planning in the last decade, is simply a city that can provide efficient urban management through receivers, information collection systems, and computer processing (Lai et al., 2020, 293).

9. Shahcheraghi and Bandarabad say: “The truth of today’s life is the mixing of reality and permission.” If we consider the invention of perspective in the optical renaissance as a revolution in architecture, then simulation technology in the 1980s and virtual reality in the 1990s can be considered a leap that is at least as important as the invention of the telephone, television, and the automobile. Virtual reality was introduced in the mid-1980s. The space that the viewer understands and thinks is real, while it is a space that was created by the computer and does not have a real existence, and it is a virtual thing that is thought to be real” (Shahcheraghi & Bandarabad, 2021, 510).

10. For example, in this field, recent research shows that only five minutes of playing the role of a hero or a villain in virtual

environments can easily affect a person’s social behavior. According to researchers, virtual environments give people the opportunity to experience identity and conditions that they cannot have in real life. These results show that playing the role of a powerful symbol causes a person to behave heroically in the real world. While playing the role of a criminal, one’s behavior leads to the harassment of others (ibid., 511).

11. One of the other examples that can be mentioned in another medium of cinema is the computer game “Grand Theft Auto,” which is known as GTA for short. This first-person game, in which the user interacts through a human avatar, is based on crime and theft in the 3D space of a large city called Los Santos, which can be considered a pretend Los Angeles. Although the events of this game are unreal and even take place in a city that does not exactly correspond to reality, the audience can apply the memories in the virtual space to the reality space due to the similar symbols they receive from it compared to the real city. The result is that, according to the research conducted, this game and similar games show that what happens in “location-based” computer games affects the reality of the audience’s life and their view of the reality of the city (Delgrange et al., 2020; Cicchirillo, 2020; Shi et al., 2020).

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