

Intersection of Digital and Physical: Phygital Urban Public Spaces

Berna Gürkan¹, Fatih Terzi²

¹ Department of Urban Planning, Faculty of Architecture, Istanbul Technical University, Istanbul, Türkiye

² Department of Urban and Regional Planning, Faculty of Architecture, Istanbul Technical University, Istanbul, Türkiye

gurkan22@itu.edu.tr , terzifati@itu.edu.tr

Abstract

Public space is in a constant state of evolution, continuously reshaped by its sociocultural context, technological advancements, and the shifting needs of urban life. This research aims to investigate the role of phygital spaces in transforming public space by transcending physical limitations. It intends to help rethink public space and phygital public spaces' potential to revitalise underutilised urban spaces. Using expert interviews and thematic and framework analysis, the research identifies key themes such as social interaction, space activation, governance and design. The research argues for a reconceptualisation of public space that embraces digital integration, offering an alternative framework relevant to urban planners, designers, and policymakers addressing contemporary spatial challenges.

Keywords: Phygital Space, Public Space, Underutilised Spaces, Spatial Digitalisation

Introduction

Space is a dynamic product of social relations (Lefebvre, 1991). These social relations are especially prominent in public space since it is the stage of communal life (Carr et al., 1992). With digital technologies improving and being incorporated into our daily lives every day, there is also a transition in social life in the context of urban public space with this change in contemporary society's needs, demands and perception towards space (Castells, 2004). People use public space relatively less than they did in the past for various reasons (Cybriwsky 1999; de Freitas, 2010; Bazzanella et al., 2014; Akkar Ercan, 2016; Lee, 2020; Badel & López Baeza, 2021; Del Vecchio et al., 2023).

Reconceptualising public space in this sense can be an alternative design approach towards new placemaking to encourage people to use public space more. Phygital spaces can be exemplified as an alternative due to their emphasis on user experience and flexibility in terms of physical limitations. This approach can be used in underutilised urban spaces to activate these spaces, and this way reintegrate them into the urban fabric. To further investigate the potential of phygital spaces especially as a way to transform underutilised urban spaces, the following research questions are posed:

- What is the potential for phygital space to transform public space socially and spatially?
- How can they be used to enhance the value and functionality of underutilised public areas?
- How do individuals perceive public spaces that integrate physical and digital elements?

Phygital Space

Phygital spaces represent the intersection and interweave of digital and physical realms where the boundaries of these two realms are blurred (Mele et al., 2022). The term "phygital" was first introduced by a marketing company that created it as a conceptual idea of branding that contained "immersive real-world experience" (Nofal et al., 2017, p. 220). In terms of urban planning, digital tools are used to enhance the physical space and thus user's experience enriching the way they interact with their environment and sometimes with each other (Bazzanella et al., 2014; Brusaporic&Maiezza, 2021).

The idea is simply capturing each realms' best features and eliminating bad ones, strengthening both (Nofal et al., 2017; Mele, 2022; Sui & Shaw, 2022). They are immersive and mostly interactive. They have a promising potential for both storytelling since they are a great and mostly fun way to transfer information, and for engagement

and co-design with the potential of gathering opinions from citizens and actually analyse and evaluate their behaviour in these spaces. Through both of these potentials the crucial part is they can be conversation starters, social interaction points, collaborative and collective experiences because they can be attractive and interesting for many people (Bazzanella et al. 2014; Andrade & Dias, 2020; Cevallos Andrade & Del Blanco García, 2025). As Del Vecchio et al. (2023) underlines, people are both passive users and creators of the meaning of new public places in urban phygital environments, which serve as a foundation for new intentional or unintentional community sharing.

Additionally, they are placeless and adaptive, meaning they can be inside/outside, a façade/ big open space/ small room, in the urban periphery/centre. They are independent of many laws because they are not fixed, changeable, removable, flexible.

Space Activation through a Phygital Approach for Reclaiming Underutilised Spaces

Space activation can be achieved through daily use or attachment to the place, so feeling a sense of belonging, identity. To be able to attach a place -and since it is a public space in the first place-, it needs to be accessible and inclusive. All these elements are tied to people's perceptions of space and that is in the hands of urban planners and designers that "make place". The concept of placemaking is creating shared memories through different social groups and improving quality of life (Chen et al., 2022; Pavlaki, 2021). Digital placemaking is augmenting physical places with digital services to improve the quality of these spaces thus attracting people and enhancing social, cultural, environmental and economic value of places (Morrison, 2018). Therefore, if these spaces can be made places through digital interventions (phygital approach), they can be used as a technique to revitalise and reclaim underutilised spaces by activating them the same way as well.

Underutilised urban spaces are a byproduct of growth in every city mostly as a cause of losing or reducing value (i.e. the meaning and use) due to lack of planning or one that didn't anticipate some certain consequences leading to areas that are unwanted (Lynch, 1960; Trancik, 1986; Di Giovanni, 2018; Hwang & Lee, 2019). They create disconnectivity and discontinuities in urban fabric and become something in between with no clear purpose especially in heavily populated cities (Trancik, 1986; Sameeh et al., 2019; Azhar et al., 2020). Beyond only being empty or vacant, there are other types of underutilised spaces such as mono functional spaces which are limited to a part of the day or only some events. Reusing and revitalising these spaces are a great way to create cohesive and interconnected urban fabric spatially and socially (Di Giovanni, 2018; Sameeh et al., 2019).

There are many possibilities and potentials on how to achieve this activation such as creating safer environments, more greenery, better accessibility. Along with these approaches, the research proposes another opportunity that is focused on digital interventions. By taking advantage of digital tools and technologies, these spaces that are often neglected and/or overlooked can be integrated into the broader urban and functional system in a novel way.

Case Studies

A wide spectrum of case studies from around the world are explained for a more concrete and better understanding of phygital spaces varying in temporality (temporary vs. permanent), interactivity (interactive vs. non-interactive), thematic orientation (heritage and culture-focused vs. entertainment- or infrastructure-driven) and public accessibility (open public spaces vs. controlled environments) (Table 1).

Table 1: Comparison of case studies.

Case Study	Urban Context	Technological Approach	Cultural Dimension	Financial Accessibility	Location
Basel Cathedral	Enhancing cultural heritage	Projection mapping	Cultural heritage preservation and narrative	Free	Indoor exhibition in public space
Rel:attiva Presenza	Narrating local neighbourhood history	Projection mapping	Explanation of the identity of a neighbourhood	Free	Indoor exhibition in public space
Luminous Pathway	Promoting social interaction	Interactive Lighting	Everyday urbanism with artistic approaches	Free	Square
Hagia-Sophia H&E Museum	Enhancing cultural heritage	3D animations immersive environment	Cultural heritage preservation and narrative	Paid entrance	Indoor museum
The Sphere	Transforming the silhouette	High-res LED immersive environment	Futuristic entertainment	Paid entrance	Indoors venue

Krypta unter der Vierung in Basel Cathedral is a permanent and immersive installation in the basement of Basel Switzerland's main cathedral. The cathedral is crucial to the city and its image since it is over 1000 years old and has had many different phases. There is a narrative explaining the history of Basel through these phases with animations, lights and projections over the oldest Roman ruins in the cathedral (Figure 1). It exemplifies how digital technological interfaces can mediate between the past and present, enabling cities to reinterpret underused or hidden spatial layers through cultural heritage (Bernasconi et al., 2019).

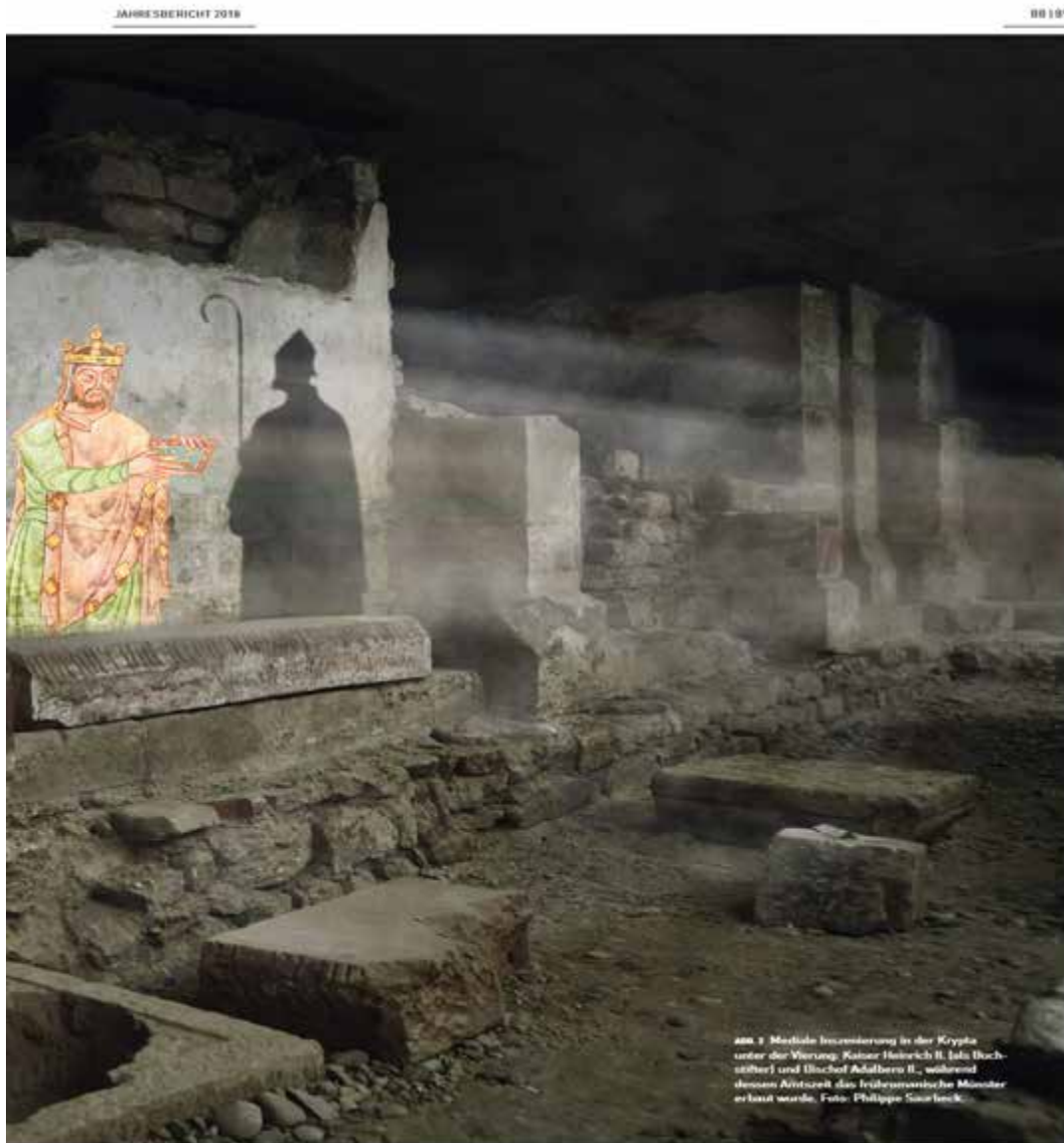


Figure 1: A part of the exhibition (Bernasconi et al., 2019, p88-89).

Rel:attiva Presenza was a temporary and immersive installation made in 2008 with projection mapping and sound environment in Mexico. The purpose was to describe the mutation of Coyoacán neighbourhood through time to create a narrative of the culture which is a historical and very important neighbourhood in Mexico City (Figure 2). The designated users were also the residents that had lived through these different forms of the neighbourhood, and this acted as the archive of perceptions, experiences and narrative of those people enabling them to reinterpret their environment with heritage (Iaconesi & Persico, 2013).



Figure 2: A part of the exhibition (AOS, 2008).

Luminous Pathway is a visionary media architecture and urban design project in Montréal, Canada in Quartier des Spectacles (QDS) which is the city's vibrant cultural district. The whole space covers 8 public spaces and 80 venues that change content and context (Figure 3). It is permanent as urban projection sites and temporary as luminous installations. The aim of the design is to attract people's interest, motivate them to engage, amaze, entertain, and provoke thought. It serves as a benchmark for experimental urbanism and media architecture where light acts as a spatial setting to change the perception and use of public space creating a sense of belonging. (Quartier des Spectacles, 2015; Quartier des Spectacles, n.d.)



Figure 3: Quartier des spectacles in 2023 (Quartier des spectacles, n.d.).

Hagia Sophia History and Experience Museum in İstanbul, Türkiye is an immersive and interactive museum with a historical narrative that blends digital technologies and cultural heritage again through a very crucial and iconic

building. Visitors are guided through a chronological journey from a pagan temple to a Byzantine cathedral and to an Ottoman Mosque including the stories of all 3 versions of rebuilding Hagia Sophia and with it İstanbul in different time spans (Figure 4). It has an urban memory and an urban perception in it that comes with such an important structure that shapes people's perception of the area after the visit of this phygital space adding another layer of importance and emotion on the visitor's eyes (Çelik & Kahraman, 2024).



Figure 4: The collapse of the dome of Hagia Sophia in past remodeled (Dem Museums, 2024, 7:19)

The Sphere is an immersive entertainment venue in Las Vegas, USA that is quite unique in terms of immersive architecture and experimental design (Figure 5). Very high technological equipment is used to achieve that level of immersive experience for many people which also brings high costs and sustainability issues (Nisa, 2023).



Figure 5: The inner design of The Sphere (Florian, 2023).

Methodology & Data Collection

The research used a qualitative method mixing thematic and framework analysis based on **in-depth interviews** with experts selected through purposive sampling. 10 experts participated in the research and experts were chosen based on their experience on intersecting themes of public space and digital transformation. There were urban planners, architects, interior and landscape architects and digital technology experts that have contributed to the research. While the sample size may appear limited from a quantitative standpoint, the aim was not statistical generalization but rather the extraction of rich, contextual insights.

The data of expert opinions was collected via semi-structured interviews based on 10 questions prepared with the light of research questions, objectives, literature review and case studies. There were 4 main themes in the questionnaire; general definitions and conceptual framework of phygital spaces, transformation of public spaces and digitalisation, transforming unused spaces and reconceptualising public space, future trends and recommendations (please see Appendices for the full interview form). The reason for the semi-structured design was to allow flexibility to the experts to engage in further conversation related to their expertise or newer topics that might be related to the topic.

Questionnaire for the interviews are presented below:

1. How do you evaluate the impact of merging physical and digital environments on public spaces?
2. What are the main advantages and disadvantages of phygital public spaces compared to traditional public spaces? Tip: Consider aspects such as accessibility, user engagement, privacy, economic opportunities, and over-reliance on technology.
3. Which urban challenges can be addressed through digitalization in public spaces? Tip: Some key challenges include overcrowding, rigid spatial configurations, lack of engagement in planning, inefficient land use, and public safety concerns.
4. What are the key drivers accelerating digitalization in cities? Tips: Factors may include urbanization, technological advancements, smart service demands, digital governance, sustainability goals, and citizen engagement.
5. What aspects of digitalization contribute most to user experience and satisfaction in public spaces? Tip: Think about factors like education, entertainment, personalization, and engagement.
6. Do you think phygital public spaces are effective in enhancing social interaction? Under what conditions are they more effective? Tip: Social engagement could be influenced by factors like design, ease of use, or cultural acceptance of technology.
7. What are your thoughts on transforming unused or underutilized urban spaces through phygital approaches considering limitations of size, capacity, and location? Tip: Examples include turning abandoned lots into interactive parks or using projection mapping to revitalize historical sites.
8. In your opinion, can the integration of digital technologies provide a sustainable solution for revitalizing underutilized spaces? Tip: Consider environmental, economic, and social sustainability in your response.
9. Do you think phygital public spaces can help create more attractive, functional, and sustainable urban environments? If so, how? What are the biggest barriers to implementation, and how can they be addressed?
10. Do you have any additional insights or perspectives on phygital public spaces?

The answers of the expert's insights were analysed through a combination of thematic analysis; identifying and analysing themes within qualitative data and framework analysis; systematically organising and interpreting this data through a structured matrix of themes and subthemes to identify patterns, relationships, and meaning. (Braun & Clarke, 2006; Ritchie & Spencer, 1994). Themes were created from the interviews based on the frequency and relevancy of the answers and later matrixes were created from summarised answers of interviews to have a holistic understanding of all experts' contributions for the topic.

Results

From the combination of literature, case studies and experts' answers and insights, a thematic and framework analysis has been conducted (Figure 6). Firstly, all interviews were transcribed and familiarised. Then, 6 themes have been created from codes in consideration with literature and case studies. Then the interviews were in-

dexed with the determined themes and matrixes were created with the summarised data from the indexing to be able to compare experts' opinions on the themes and interpret.



Figure 6: Word cloud from expert answers for each question.

The first theme is Blending of Digital and Physical Experiences in Public Spaces with 2 sub-themes: their evaluation of phygital spaces and the comparison to traditional public space (Table 2). Generally positive comments predominate in terms of the basics of phygital spaces.

Table 2: Blending of Digital and Physical Experiences in Public Spaces

Experts	Their evaluation	Comparison to traditional space	Keyword
A	Integration of these is quite seamless nowadays but digital is an augmentation that always reflects the precise moment where it is used in physical space.	Traditional public space is the inevitable goal and digital is an addition to it.	Integrated, Layer
B	It is more of a digital infrastructure, sensors and service in public space	People don't see traditional and enhanced space the same so they don't try to act like it but to immerse themselves in the digital parts more individually.	Amenity

C	There are many aspects to it like sensors, the environment and an interface level with people.	Digital enhancements create an alternative to a permanent physical infrastructure, maybe creating simpler solutions.	Diverse, Alternative
D	-	Users of merged digital and physical spaces can only compare the two with answering what value it brings	Layer
E	They could be both a bad experience that disconnects people from space with personal devices and also good one with a design that utilises digital tools well.	As the experience enriches the space, it might be a way of getting people's attention more.	Potential
F	There is a new type of physicality created through digitality which is a new cross-section.	It changes the perception of public space maybe by creating awareness for the existing space.	Enhanced
G	The integration depends on the users and their interest and background.	-	Dependent
H	As of now, such a discourse of integration or blending of digital and physical spaces is too bold.	-	Unrealistic
I	The boundaries of such a distinction of digital and physical space no longer exist.	-	Integrated
J	The integration of these spaces is positive because of an information layer that doesn't need effort.	With new layers like visuals, narratives and information, our experience in space changes than the traditional space (which is a different and still valuable experience as is)	Innovative

The second theme is Social Dynamics with 3 sub-themes: interaction, participation and engagement/co-design (Table 3). While some experts argue that social issues should be dealt with mostly basic design principles and several think that digital additions have a positive effect.

Table 3: Social Dynamics

Experts	Interaction	Participation	Engagement/ Co-design	Keyword
A	Digital enhancements don't necessarily improve social interaction.	Allows to have more ideas of the residents	-	Irrelevant
B	It generates different types of interactions but that might not be the result of digital technology.	Might create better outcomes because it is used to get data	-	Diverse interaction
C	Pointing at things together is the core of interaction and digital enhancements could create many things to point at with people.	Adding a digital layer makes it possible for a lot of people to participate in the imagination of what a public space can be.	They can be used to show a preview of space while being designed to make decisions on it with the people.	Convenient
D	A digital layer must be designed in a way that would enhance interaction than diminishing it.	Personal devices must not be the approach to create a suitable environment for participation.	-	Dependent on design
E	They help the creation of an arbitrary collective formed by users	The interactive nature makes participation and engagement to space easier and more effective maybe.		Easier
F	People are attracted to space through digital tools and meet in physical spaces enhancing interaction that makes them spend more time there than usual.		Adding digital layers to design processes is much more meaningful than seeing it as a billboard.	Communication
G	Social interaction is crucial in phygital spaces which is what is aimed.	Working with different types of people is beneficial for participation such as age	-	Goal
H	Interaction is encounters of people and aesthetic experience is individual not social.	Community engagement and participation cannot be discussed through these digital enhancements because there is very little material to talk about.		Irrelevant
I	It can increase interaction.	It could be used to get data about the demand.	There is not yet a bottom-up approach on these spaces.	Method for design

J	It is an effective way to increase interaction.	-	Gamification of spaces can be a great way to co-design and engage people.	Effective
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The third theme is Governance, Ethics and Regulation of Phygital Spaces with 3 sub-themes: ownership, accessibility and inclusivity (Table 4). All experts gave great importance to the issue and highlighted the importance of these to create an equitable public space for all.

Table 4: Governance, Ethics and Regulation of Phygital Spaces

Experts	Ownership	Accessibility	Inclusivity	Keyword
A	Digital enhancement of any kind requires a budget, even through a public entity it will have a profit-driven or controlling approach that needs a digital conduct to be developed.	-	People who are disadvantaged such as homeless people might not be welcomed in these spaces.	Controlling
B	They create a controlled space either by a private or government. There should be implications and more research on the effects.	-	Might create inclusivity issues	Controlling
C	Ethical barriers like privacy or publicness of space are difficult problems.	It must be made sure that public space is still truly public and available and free for everyone. Digital additions might only serve privileged groups if not community oriented.		Inclusivity
D	A digital layer means controlled and regulated which can be both good and bad so there must be a balance of openness and security.	Space can be more accessible through a digital layer in terms of time of the use.	-	Reachable
E	-	Accessibility and inclusivity are about the basic design principles so the physical part not the digital one.		Irrelevant
F	The borders and level of digitality must be determined to decide on what should be regulated and controlled.	-	-	Prepared
G	-	Public space must be accessible and inclusive in any case, here the difference can be to determine who demands the digital additions.		Irrelevant

H	The digital space is controlled and limits the publicness of space.	Digitalisation is a tool of inequality now, there is a serious difference between societies that can access digital technology and those that cannot.	Because of the high possibility that these spaces are private and for a fee, it is semi-public so not entirely inclusive.	Controlling
I	-	The accessibility of digital technology might be limited because of infrastructure but will be overcome with time.	-	Promising
J	-	-	-	-

The fourth theme is Revitalisation and Sustainability of Underutilised Spaces (Table 5). Some experts thought that phygital spaces would be an excellent match for the goal whereas others state that for a full transformation there must be something permanent that can fit into a daily routine, and they don't see digital interventions as such. Almost all experts underlined that physical basic design principles must be a part of the transformation and most thought that it is spatially, socially and economically sustainable as it is refunctioning a space.

Table 5: Revitalisation and Sustainability of Underutilised Spaces

Experts		Keyword
A	The biggest advantage of digital advancements is an opportunity to gain attention for certain underused and unrecognised spaces. It is sustainable socially and spatially.	Intriguing
B	Integration of digital technologies can provide a sustainable solution for revitalising underutilised spaces under circumstances, they can support the process, but they aren't transforming space by themselves.	Secondary
C	Digital could be few steps ahead of physical but ultimately physical investment must happen to really revitalise the space, it could be used as a drive to engagement and investment that would result with the aimed physical redevelopment.	Temporal
D	It is a good way to activate space in a flexible and temporary way without physical investment needed. But, there needs to be supporting reasons to use a particular underutilised space, digital things aren't enough by itself. The reason behind why this space isn't used must be investigated and connected to a supply demand approach.	Temporal
E	A well-designed physical space is needed for revitalisation, digital technology or digital tools are an addition of support.	Secondary

F	It is a great opportunity to revitalise the underutilised spaces from big parks to facades which would be very sustainable spatially.	Potential
G	There is a potential of revitalisation that would direct people into these areas providing economic, social and spatial sustainability but it is important to decide the reasoning behind it. If it is profit-driven, it might as well stay as it is.	Potential
H	There is a temporary possibility of transformation of underutilised spaces but just because there aren't many examples yet, it is not likely that a low-quality space is transformed with increased user experience. And sustainability shouldn't be searched with digitalisation.	Temporal
I	It has a great potential for especially monofunctional spaces with an existing infrastructure to integrate them into the urban fabric.	Potential
J	Underutilised spaces must be transformed without digitalisation first and be in a routine, after that it can be an addition.	Secondary

The fifth theme is Space Activation with Digital Tools with sub-themes; Enhancement of Sensation/Perception, Emotion, Memory, Experience and Urban narrative (Table 6). Many experts agreed that sensation, perception and experience would be enhanced through digital additions and several experts thought that this would add to the memory and emotions felt in this space creating room for sense of belonging and identity. Additionally, some experts pointed out that urban narrative would change in a way that people are more aware of their surroundings and open to information. However, some experts thought that this would be an unnatural way of experiencing space thus wouldn't be successful enough to activate space.

Table 6: Space Activation with Digital Tools

Experts	Enhancement of...HN					Keyword
	Sensation/ Perception	Emotion	Memory	Experience	Urban Narrative	
A	Digitalisation has a chance to synchronise the perceived space with inhabitants in public space.	-	-	It might bring a collective experience for people in an existing physical public space	-	Collective
B	They affect how we perceive space	-	-	-	They affect how we navigate space.	Minor difference
C	-	Telling the story of a space that includes curiosity, and playfulness adds emotion and memory to everyday spaces		-	Digital storytelling tools enhance attachment to places through layered historical or cultural narratives.	Identity

D	The triggers of space are the basics like senses to make a place.	-	-	Adds an experience to traditional space which makes it multifunctional and interactive.	Sensations could be integrated with the digital and physical application that is projected onto urban space	Novel experience
E	They stimulate the senses and load information triggering perception and thus emotion and changing the meaning of space.		Has an impact on collective memory, its construction and the creation of a culture.	Creates a new type of reality within physical space, changing the experience of the space and activate sensory ones.	Gives the possibility of space design even on a blank canvas that can be changed constantly	Adaptable, Identity
F	It changes the whole perception of public space.	-	-	Additions of experiences and playful interactivity can boost a sense of belonging.	People can participate more in the physical public space with digital additions, which makes it used more actively, effectively, for longer, activating the physical space.	Activating
G	-	-	-	The experience should be mild enough to blend in with the physical environment.	When the identity of cities and their physical reality don't create a need for interaction, digital technology may not be necessary.	Irrelevant
H	This can give a different form to the processes of sensing, feeling and mutual learning.		It wouldn't create memory because it is not organic.	It has the potential to transform the organic experience, into another form that is created with predefined content. We cannot anticipate the outcomes yet.	-	Cautious

I	It gives a new perspective and perception of the space at the same location and time especially when supported with senses.	-	-	It multiplies the experience by inverting the relationship of the user and space with being impressive and immersive.	It provides new ways of urban historical narrative that could be very informative.	Impressive
J	The spatial perception can be enhanced with digital tools.	-	The aim should be to create a memorable environment	It would create a new type of learning experience.	It can increase the awareness of an urban space with seamless information	Expansion of understanding

The sixth and final theme is Context Specific Design and Local Adaptation (Table 7). All experts highlighted the importance of context by content, culture, scale, location, existing situation of the physical environment, users and many more. They all agreed that without a context of specific space the evaluation of the phygital space is impossible since the context might vary vastly especially in different cultures but also in the same city or even the same neighbourhood. They stated that it depends on the people's existing perception of that space to be able to assess the change.

Table 7: Context Specific Design and Local Adaptation

Experts		Keyword
A	A context-oriented design approach is needed to have a certain observation and outcome with an emphasis on where the digital enhancement is done, by whom and how it could impact the public space.	Consequence
B	Technologies aren't the fast and easy solution; purposeful implementation is needed depending on the context. Social innovation, political will and change in public administration processes are needed.	Dependent on policy
C	Digital technologies are tools, not solutions. A sustainable integration must be adapted to local social, cultural and political contexts and must match people's needs rather than just being aesthetic or entertainment functions.	Need-driven
D	The design can never be disconnected from the context and the people.	Dependent on design
E	It depends on the place, scale, need and context. It might not be possible in every culture or urban environment.	Conditional

F	Design has an important role here. Digital additions can be integrated according to its scale, context, need, demand, user profile and usage patterns.	Dependent on design
G	The concept of phygital depends on the design, location and situation such as ease of use or cultural acceptance.	Acceptance
H	It is necessary to create a discourse of meta-digitalisation formed by associating the typologies of different types and contexts with how the experts evaluate them through a feedback mechanism.	Open to correction
I	The most important aspect is to integrate culture and locality into these spaces that would spark the interaction and participation.	Integration
J	The local adaptation and harmony of the space is very important for people to accept it.	Acceptance

Overall, it can be said that majority of the experts see phygital spaces as an opportunity for promising space activation and enhancement but without forgetting the essentials for proper design and planning structures and principles. They see it is an added value to a space, and that public space should already be of high-quality, accessible for all, inviting and welcoming both physically and by digital content including as an approach for revitalising an underutilised space. But most experts state that space can be activated through digital tools, and it is most of the time more effective or easier than physical investments.

There is a tie in terms of if social interaction could be achieved in phygital spaces mostly because of digital technologies' way of personalisation and individualism depending on who initiates this space which is why there should be regulations to make this space more accessible and simply available.

Finally, all the experts stated that phygital spaces depend on the context and can be successful only if it matches the physical, cultural, social and political sphere of the designated space.

Findings & Discussion

The general results of the expert interviews revealed that there is a consensus on change of user's perception and experience of space with the integration of digital technologies into public spaces. All experts investigated WH- questions for almost every question and have expended the questions and their insights mostly depending on their own expertise.

Integration of physical and digital spaces: Majority of experts agreed that the blending of digital and physical spaces is already underway. They emphasized that that digital layers should complement rather than replace physical space. According to them improvements in spatial conditions must first adhere to effective and well-established physical design principles, which should then be enhanced through thoughtful digital augmentation.

Sensory experience and memory: Most of the experts viewed phygital spaces as a challenge to traditional public space. They stressed the importance of existing public environments and the sensory experiences they offer in daily life—such as sounds of people and animals, or the smell of coffee. After establishing this, about half of the experts acknowledged that in certain contexts, phygital enhancements could enrich these experiences by making them more interactive and immersive, potentially encouraging the creation of new memories. Many

emphasized that the information that phygital interfaces provide is much more memorable and integrated than traditional space resulting in more awareness of surroundings. Because of this they can be a great way to create a collective memory and reinforce participation and local identity with urban narratives, digital storytelling, gamification through spaces that have historical and cultural value.

Practical benefits and data utilization: Majority of experts agreed that digitalisation can create innovative solutions for practical issues like communication between users and stakeholders especially due to the responsiveness potential of it. Several experts added that these spaces can be as platforms for collecting data from users—such as through speech input, surveys, co-design activities, or urban analytics—which can inform future design processes.

Temporality, flexibility and revitalization: Almost half of the experts thought that digital approaches are a great way to overcome rigid spatial configurations or investment hardships in congested urban areas due to phygital space's temporality opportunity and flexibility in terms of space and context. Especially in this sense, it was seen as a good opportunity for revitalising underutilised spaces without physical limits like size, capacity and location. Yet almost all experts emphasized that for this revitalisation to last basic design principles must be prioritised.

Critical perspective, ethics and governance: Nevertheless, several experts also pointed out that they are mostly controlled environments and thus there is an immense importance of content and context. All experts have underlined the importance and need of thoughtful design, ethical frameworks and governance models that pay attention to equity and long-term spatial justice.

With the light of these insights and previous literature and case studies, it can be said that phygital spaces are an alternative of space activation, and they can be used to reintegrate underutilised spaces to the broader city scape.

Expert opinions were a great match to the fragmented insights from different researchs in the literature review, even though the term phygital was new to many experts which is why there aren't many relevant comparisons to its definition in their eyes and the literature. Key themes from literature such as digital placemaking and space activation through digital interventions, adaptability, interactivity, immersivity were mentioned by almost all experts in a positive way complying with each other. Especially the cultural values and leisure time activities in public spaces that were very visible in many of the case studies were mentioned by the experts as enhanced experience, perception, sensation, emotion, and thus identity.

As also the patterns and inconsistencies of consensuses and conflicts show the nature of the topic to be polarising, and that individual experiences or perspectives might play a bigger part. This is why while experts' backgrounds were influential in terms of the results, all occupation groups' ideas were quite sharply divided in all questions. For each of the ten questions, responses were typically split, with around five experts expressing a positive view on phygital approaches and five a critical one, though the individuals in each group varied across questions. Nevertheless, there were many aspects that experts brought themselves up and agreed upon due to the general approach and favour of basic design principles. These aspects were a result of the cautiousness on the potential power that the designer institution holds in these spaces to the context and content.

In general, phygital spaces seem to bring more awareness and knowledge with them that could create an individual or collective identity. Nonetheless, this doesn't mean that urban challenges can be fixed entirely with digital additions. For permanent and just solutions to them, basic design principles that care about human centred, high-quality spaces that prioritise citizens' well-being are critical. Phygital space that centre users experience as their nature are a notable alternative when issues such as governance, ethics, context and content are secured.

Conclusion

The research explored the evolving nature of public spaces in the digital era through phygital spaces and their potential of revitalising underutilised spaces through space activation and engagement. It tried to explain the remarks for these spaces as a way to reconceptualise public space overcoming conventional limitations.

The findings and inferences from literature review, case studies and analyses showed that phygital space can be an alternative design approach for future public spaces. This is because it adds value to the existing space in a unique way that allows for freer applications than traditional implications. This freedom brings flexibility and adaptation possibilities to space which makes it applicable to many scopes taking the local context into consideration while doing so as exemplified with the case studies. Lifting the burden of conventional limitations like size, capacity and location physically and rigid construction codes legally enables this freedom which creates new opportunities for underutilised spaces that range from abandoned and neglected to monofunctional spaces.

Additionally, the change of perception and experience of space triggers a series of events that would make people see space differently, as a place. Cultural, locational and content specific examples can be great ways to revitalise any urban space, adding new experiences especially for leisure time in public spaces. This should be supported by basic design principles to create a holistic design approach for the space to be attractive and inviting and to be able to reintegrate into the urban fabric successfully and permanently. Through this process, regulations are vital to ensure an equal and ethical public space that fosters a responsive, adaptive and interesting nature.

Limitations of this research were reliance on limited sources and case studies due to the novelty of the topic, limited sample size of experts, no direct user comments or public data and subjective judgements about the topic due to the researchers' urban planning background.

Future research can further fill the gaps through large scale surveys, sensor-based research that really examines behavioural shifts of users; context-based research that focuses on the differences of culture and content in phygital spaces; focus on different types of digital technologies and their effect; political aspect of phygital spaces in terms of content and inclusivity.

References

- Akkar Ercan, Müge (2016) 'Evolving' or 'lost' identity of a historic public space? The tale of Gençlik Park in Ankara. *Journal of Urban Design*, 22 (4), pp.520–543. <https://doi.org/10.1080/13574809.2016.1256192>
- Andrade, José Gabriel and Dias, Patrícia (2020) A phygital approach to cultural heritage: Augmented reality at Regaleira. *Virtual Archaeology Review*, 11, pp.15–25. [Online] Available at: <https://doi.org/10.4995/var.2020.11663>
- Art is Open Source (AOS) (2008) Relattiva presenza. Art is Open Source. [Online] Available at: <https://www.artisopen-source.net/2008/11/08/relattiva-presenza/>
- Azhar, Jasim, Gjerde, Morten and Vale, Brenda (2020) Re-imagining urban leftover spaces. In: *Smart and sustainable cities and buildings*. Cham: Springer. [Online] Available at: https://doi.org/10.1007/978-3-030-37635-2_21
- Badel, Fatemeh and López Baeza, Jesús (2021) Digital public space for a digital society: A review of public spaces in the digital age. *ArtGRID – Journal of Architecture, Engineering & Fine Arts*, 3 (2), pp.127–137.
- Bazzanella, Liliana, Roccasalva, Giuseppe and Valenti, Simona (2014) Phygital public space approach: A case study in Volpiano. *Interaction Design and Architecture(s) Journal - IxD&A*, 20, pp.23–32.
- Bernasconi, Marco, Hagendorn, Andrea, Lassau, Guido and von Harten, Beate (2019) Krypta unter der Vierung des Basler Münsters: Eine neue Informationsstelle. *Jahresberichte der Archäologischen Bodenforschung Basel-Stadt*, 2018, pp.85–129. [Online] Available at: <https://doi.org/10.12685/jbab.2018.85-129>

Braun, Virginia and Clarke, Victoria (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3 (2), pp.77-101.

Brusaporci, Stefano and Maiezza, Pamela (2021) Smart architectural and urban heritage: An applied reflection. *Heritage*, 4 (3), pp.2044-2053. [Online] Available at: <https://doi.org/10.3390/heritage4030116>

Carr, Stephen, Francis, Mark, Rivlin, Leanne G. and Stone, Andrew M. (1992) *Public space*. Cambridge: Cambridge University Press.

Castells, Manuel (2004) The space of flows and the space of places. In Castells, Manuel (ed.) *The network society: A cross-cultural perspective*. Cheltenham: Edward Elgar.

Cevallos Andrade, Daniel and Del Blanco García, Federico Luis (2025) Designing a phygital prosthesis for urban spaces: Merging digital and physical realities. *Street Art & Urban Creativity*, 11 (1), pp.163-178. [Online] Available at: <https://doi.org/10.62161/sauc.v11.5684>

Chen, Kuangfan, Guaralda, Mirko, Kerr, Jeremy and Turkay, Selen (2022) Digital intervention in the city: A conceptual framework for digital placemaking. *Urban Design International*, 29, pp.26-38. [Online] Available at: [Cybriwsky, Roman \(1999\) Changing patterns of urban public space: Observations and assessments from the Tokyo and New York metropolitan areas. Cities, 16 \(4\), pp.223-231. doi:10.1016/S0264-2751\(99\)00021-9.](https://doi.org/10.1016/S0264-2751(99)00021-9)

Çelik, Feyzanur and Kahraman, Mehmet Emin (2024) Müzelerde deneyim odaklı sergileme teknikleri: Ayasofya Tarih ve Deneyim Müzesi örneği. *Sosyal Bilimler Dergisi / The Journal of Social Science*, 11 (69), pp.244-258.

De Freitas, C. Alex (2010) Changing spaces: Locating public space at the intersection of the physical and digital. *Geography Compass*, 4 (6), pp.630-643.

Del Vecchio, Pasquale, Secundo, Giustina and Garzoni, Andrea (2023) Phygital technologies and environments for breakthrough innovation in customers' and citizens' journey: A critical literature review and future agenda. *Technological Forecasting and Social Change*, 189. <https://doi.org/10.1016/j.techfore.2023.122342>

DEM Museums (2024) Deneyim müzeciliği hikayeleri - Bölüm 1: Tarihte hikaye anlatıcılığı [Online] Available at: <https://www.youtube.com/watch?v=73bdS0vedfk>

Di Giovanni, Andrea (2018) Urban voids as a resource for the design of contemporary public spaces. *Planum. The Journal of Urbanism*, 37 (II), pp.1-28.

Florian, Maria-Cristina (2023) The Sphere at the Venetian Resort opens to the public in Las Vegas. *ArchDaily*. [Online] Available at: <https://www.archdaily.com/1007658/the-sphere-at-the-venetian-resort-opens-to-the-public-in-las-vegas>

Hwang, Soe Won and Lee, Seog Jeong (2019) Unused, underused, and misused: An examination of theories on urban void spaces. *Urban Research & Practice*, 13 (5), pp.540-556. [Online] Available at: <https://doi.org/10.1080/17535069.2019.1634140>

Iaconesi, Salvatore and Persico, Oriana (2013) ConnectiCity, augmented perception of the city. *Leonardo Electronic Almanac*, 19 (1), pp.80-81. [Online] Available at: <https://www.artisopensource.net/network/artisopensource/wp-content/uploads/2020/03/LEAVol19No1-IaconesiPersico.pdf>

Lee, Dahae (2020) Whose space is privately owned public space? Exclusion, underuse and the lack of knowledge

and awareness. *Urban Research & Practice*, 15 (3), pp.366–380. doi: 10.1080/17535069.2020.1815828.

Lefebvre, Henri (1991) *The production of space*. Oxford: Blackwell.

Lynch, Kevin (1960) *The image of the city*. Cambridge, MA: MIT Press.

Mele, Christina and Russo-Spena, Tiziana (2022) The architecture of the phygital customer journey: A dynamic interplay between systems of insights and systems of engagement. *European Journal of Marketing*, 56 (1), pp.72–91.

Morrison, Jo (2018) A definition of digital placemaking for urban regeneration. Calvium. [Online] Available at: <https://calvium.com/a-definition-of-digital-placemaking-for-urban-regeneration>

Nisa, An Nuur Khairune (2023) Las Vegas Sphere: Technological innovations that bring unforgettable travel experiences in the city of neon lights. *Journal of Tourism Sciences*, 1 (3), pp.133–142.

Nofal, Eslam, Reffat, M. Rabee and Vande Moere, Andrew (2017) Phygital heritage: An approach for heritage communication. *Proceedings of the Third Immersive Learning Research Network Conference*, Coimbra, Portugal.

Pavlaki, Evangelia (2021) *Media interventions in public space: A place-based approach for the assessment of human experience in digitally augmented urban environments*. PhD thesis, University of Nottingham.

Quartier des Spectacles (2015) *Lumino Thérapie: 2015 edition—Multidisciplinary competition for enhancing and animating public spaces* [Programme brochure]. Montréal: Quartier des Spectacles.

Quartier des Spectacles (n.d.) *The Quartier*. [Online] Retrieved 12 April 2025. Available at: <https://www.quartierdespectacles.com/en/the-quartier/>

Ritchie, Jane and Spencer, Liz (1994) Qualitative data analysis for applied policy research. In Bryman, Alan and Burgess, Robert (eds.) *Analyzing qualitative data*. London: Routledge, pp.305–329.

Sameeh, Rana, Gabr, Mostafa and Aly, Sherine (2019) Reusing lost urban space. In: *New cities and community extensions in Egypt and the Middle East: Visions and challenges*. Cham: Springer. [Online] Available at: <https://doi.org/10.1007/978-3-319-77875-4>

Sui, Daniel and Shaw, Shih-Lung (2022) New human dynamics in the emerging metaverse: Towards a quantum phygital approach by integrating space and place (vision paper). In: *15th International Conference on Spatial Information Theory (COSIT 2022)*. Leibniz International Proceedings in Informatics (LIPIcs), 240, pp.11:1–11:13.

Trancik, Roger (1986) *Finding lost space: Theories of urban design*. New York: Wiley.

Appendices

EXPERT INTERVIEW FORM

Research Title: Digitalization and Phygital Public Spaces: Transforming Unused Urban Spaces

Researchers: Berna Gürkan & Prof. Dr. Fatih Terzi

Research Subject: This research explores the concept of Phygital Public Spaces, examining how the perception and function of public space evolve when integrating a spatial perspective of digitalization. The study aims to understand the implications of phygital environments on urban spaces and their potential benefits, particularly in activating underutilized areas.

Individual Consent for Participation: Your participation in this study is entirely voluntary. You have the right to withdraw at any stage without providing a reason. By agreeing to participate, you confirm that you have been informed about the study and consent to your responses being used for research purposes.

Estimated Duration of Participation: The interview is expected to last approximately one hour.

Publication of Information: The information you provide with the personal information you've given below will be included in the research findings and published as part of the master's thesis. The study adheres to academic and ethical guidelines, ensuring responsible use of all collected data.

Data Recording Consent: Audio and video recording will be conducted during the interview process.

Researcher:

Interview Date:

Expert's Name:

Profession/Field of Expertise:

Institution:

Years of Experience in the Field:

SECTION 1: GENERAL DEFINITIONS AND CONCEPTUAL FRAMEWORK

Guidance: The term phygital public spaces refer to the blending of physical and digital elements in urban environments. This integration can take various forms, such as smart infrastructure, augmented reality, or interactive digital features in public spaces. In this section, we aim to understand how experts define this concept and their perspectives on its role in urban transformation.

1. How do you evaluate the impact of merging physical and digital environments on public spaces?
2. What are the main advantages and disadvantages of phygital public spaces compared to traditional public spaces?

Tip: Consider aspects such as accessibility, user engagement, privacy, economic opportunities, and overreliance on technology.

SECTION 2: TRANSFORMATION OF PUBLIC SPACES AND DIGITALIZATION

Guidance: Digitalization is changing the way people interact with public spaces and each other. Smart cities, interactive installations, and digital governance tools are reshaping how these spaces function. This section explores the evolving role of public spaces in the digital era and benefits, and challenges of integrating digital technologies into public spaces.

3. Which urban challenges can be addressed through digitalization in public spaces?

Tip: Some key challenges include overcrowding, rigid spatial configurations, lack of engagement in planning, inefficient land use, and public safety concerns.

4. What are the key drivers accelerating digitalization in cities?

Tips: Factors may include urbanization, technological advancements, smart service demands, digital governance, sustainability goals, and citizen engagement.

5. What aspects of digitalization contribute most to user experience and satisfaction in public spaces?

Tip: Think about factors like education, entertainment, personalization, and engagement.

6. Do you think phygital public spaces are effective in enhancing social interaction? Under what conditions are they more effective?

Tip: Social engagement could be influenced by factors like design, ease of use, or cultural acceptance of technology.

SECTION 3: TRANSFORMING UNUSED SPACES

Guidance: Many urban areas contain underutilized or abandoned spaces that could be revitalized through digital technologies. Phygital approaches may provide opportunities to reimagine these spaces for cultural, social, or economic purposes.

7. What are your thoughts on transforming unused or underutilized urban spaces through phygital approaches considering limitations of size, capacity, and location?

Tip: Examples include turning abandoned lots into interactive parks or using projection mapping to revitalize historical sites.

8. In your opinion, can the integration of digital technologies provide a sustainable solution for revitalizing underutilized spaces?

Tip: Consider environmental, economic, and social sustainability in your response.

SECTION 4: RECONCEPTUALIZING PUBLIC SPACE & FUTURE TRENDS AND RECOMMENDATIONS

Guidance: As technology evolves, so do our expectations of public spaces. This section explores future trends and emerging technologies that may shape public spaces in the coming decades and aims to collect additional expert insights, potential research gaps, and practical challenges for future implementation.

9. Do you think phygital public spaces can help create more attractive, functional, and sustainable urban environments? If so, how? What are the biggest barriers to implementation, and how can they be addressed?

10. Do you have any additional insights or perspectives on phygital public spaces?

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