

Smart Heritage as a Design Tool

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Abstract

Smart Heritage enables urban designers and planners to reimagine historical narratives within cities through the untethered perspectives of smart technology. Smart Heritage is the convergence between the smart city and heritage disciplines that intertwines the autonomous and automatic capabilities and innovation of smart technologies with the contextual and subjective interpretation of the past. It is an emergent and distinct discourse in the academic literature that positions technology as the lead-curator of historical narratives. It is comparable with similar smart discourses, such as Smart Mobility and Smart Infrastructure, and contrasts with the human-led and archival focused Digital Heritage discourse. Through Smart Heritage, urban designers and planners are not physically, intellectually, and locationally limited in retelling and deploying culturally and socially powerful historical narratives. Instead, experts can draw online and personal data to produce powerful and novel experiences in cities. This article introduces Smart Heritage as a tool for urban designers and planners. It discusses how Smart Heritage can reimagine historical narratives within cities.





Mar et al. (2018) deploy Smart Heritage in tourism and historic site management mobile applications in Avila, Spain (pictured)

Introduction

Urban designers and planners are embracing smart technologies as tools to respond to global urbanisation. Smart technologies are automated and autonomous software and hardware, operating independently from constant human direction or oversight. Cities and their respective professions are deploying these technologies because traditional tools, such as human-led decision making and operations, fail to maintain pace with urbanisation demands. Many notable cities have adopted smart technologies in coordinated programs, such as Smart London Together (Greater London Authority, 2018),

Amsterdam Smart City (Amsterdam Economic Board, 2020), and the Quayside project in Toronto (Waterfront Toronto, 2020). The UN-Habitat (2020) and Organisation for Economic Co-operation and Development (Matsumoto et al., 2019) also encourage governments to deploy smart technologies to address rapid urbanisation challenges. As a result, urban designers and planners now seek innovative new technological capabilities to survey, manage, and reimagine cities, including heritage.

The adoption of smart technologies began at the start of the 21st century. Growing out of proto-smart city disciplines like the 'wired

city' and the 'digital city', urban designers and planners envisioned cities that automatically and autonomously served people (Dutton, 1987; Ishido, 2002). Early researchers highlighted how technology operates daily administrative duties. For example, Partridge (2004) discussed how 'information communication technology' provides access to public information and services. Bowerman et al. (2000) describe "a city that monitors and integrates conditions of all of its critical infrastructures". However, the advancement of technology drove urban designers and planners to remove people further, seek additional technological applications, and enable technology's ascension as the primary civic arbiter rather than the server. Instead of delivering rudimentary tasks, cities became distinct entities that actively engaged with society, made decisions, and held agendas through automated and autonomous technologies. In short, cities were 'smart'. The most recent prominent understanding of the 'smart city' is a self-regulating technologically-driven civic system that delivers productivity, sustainability, accessibility, well-being, liveability, and governance outcomes (Yigitcanlar et al., 2018; Shamsuzzoha et al., 2021; Mozuriunaite & Sabaityte, 2021).

Stemming from the adoption of smart technologies are innovative smart discourses, such as Smart Mobility and Smart Infrastructure and others. These discourses converge traditional disciplines, like mobility and infrastructure, with smart technologies into frameworks where commentators can dually engage them (Streitz, 2019; Nikitas et al., 2020). Therefore, these

discourses are applying smart technologies to resolve issues in the traditional discipline's focus. For example, Smart Mobility includes using sensors in road corridors to monitor congestion so an intelligent system can augment traffic signal phrasing and road speeds to improve vehicle flow and safety (Flugge, 2017). Smart Infrastructure includes a technological system that monitors power, water, or data networks for outages and schedules repairs automatically (Mehmood et al., 2019). Many other examples of both discourses exist in the literature and practical instances. An important distinction between the smart discourse and its traditional counterpart is the smart discourse's ability to automate and autonomously manage processes free from the humans' physical, intellectual, and locational limitations through its access to online information and capabilities. This unique ability unlocks innovative conceptualisations of issues and solutions. For urban designers and planners, Smart Mobility and Smart Infrastructure are commonplace. They often hold dedicated sections in local government strategic documents and specific staff and financial resourcing. There are also specialised professional and research forums, such as the *Smart Infrastructure Conference 2021* hosted at the Hong Kong University of Science and Technology.

Building on the success of these smart discourses and the ongoing advancement of technology, urban designers and planners seek new disciplines to converge with smart technologies that address urbanisation pressures further. An emergent smart discourse in the academic

literature is *Smart Heritage*. Smart Heritage is the convergence between the smart city and heritage disciplines that intertwines the autonomous and automatic capabilities and innovation of smart technologies with the contextual and subjective interpretation of the past. It converges the heritage discipline with smart technologies to deliver solutions regarding social and cultural narratives in cities. With further development, urban designers and planners can deploy Smart Heritage alongside existing smart discourses to enhance cities. This article introduces Smart Heritage as a tool for urban designers and planners. It discusses how these experts can utilise Smart Heritage to reimagine historical narratives within cities.

Smart Heritage as a Design Tool

The academic literature depicts Smart Heritage as a tool for urban designers and planners to innovatively deliver historical narratives. Since Smart Heritage's inception a decade ago, researchers theoretically and practically explored its design applications in museums then later expanded to cities. Its development illuminates how smart technology can disrupt and innovate historical perspectives, opening opportunities for designers to reimagine narratives. This section introduces Smart Heritage as a tool for urban designers and planners by detailing its development over the past decade.

The first reference to Smart Heritage in the academic literature was made by Thwaites

(2013). Thwaites described Smart Heritage as “hybrid virtual-real worlds rich in detail, interpretation, and aesthetic impact” that delivers immersive experiences based on historical and personal data. These experiences pivoted on technology blending authorised historical and personalised data, delivering fictional ‘fantasy’ narratives in some cases. In 2013, Thwaites recognised the immediate design opportunities for such blending, for example, providing access to remote or closed heritage sites and enabling interaction with international, lost or archived spaces through virtual or augmented technologies. However, Thwaites also identified that future technologies would more comprehensively blend new narratives into daily experiences and realise greater immersion. As a result, future technologies would dissolve the clear boundaries between technologically-generated narratives and authorised historical narratives. Thwaites understood that it would produce misrepresentations, contested and fake histories, and privacy and data sharing concerns. As a solution, Thwaites pointed to establishing institutional practices for deploying public historical data and building awareness of the cultural responsibilities in online contexts. While nascent and mainly hypothetical at the time, Thwaites illuminated a theoretical path for how researchers can deploy Smart Heritage to deliver innovative narratives.

The next prominent advancement of Smart Heritage as a design tool was by Chianese and Piccialli (2014). They conceptualised then tested the discourse in a museum context.

They conceptualised a “museum of smart objects” where intelligent technological sensors communicated with each other, the visitor, and an online data source to design and deliver historical yet personalised experiences. The technology was based on the *Internet of Things* architecture consisting: a sensing layer that transfers and acquires data, including hardware nodes on short-range and local networks; a system layer that transfers data across different local networks; and an application layer that converge the multiple networks onto a unified *Internet of Things* network with middleware functionalities and access to an online data source. They term the visitor the “end-user”, and their enjoyment was a paramount outcome, demarcating the user’s consumption role in contrast with the smart system’s curatorial role. In the test phase, Chianese and Piccialli installed the technologies in a sculptural exhibition within the Maschio Angioino castle in Naples, Italy. The researchers provided end-users with a mobile phone that collected their data and engaged with the Smart Heritage network. The test’s purpose was to verify the ‘smartness’ underlying the design of the technological architecture. Chianese and Piccialli concluded that Smart Heritage is “a powerful tool to address the design of the complex connection between new technologies, knowledge to be transmitted and visitors of Cultural Heritage environments”. They identified that smart technology bridges between the physical world and the information-dense online world. When combined as Smart Heritage, it amplifies the end-users enjoyment through pairing them with engaging narratives based on authorised and

online data. For designers, the blending of these data theoretically enables limitless narratives to exist in an exhibition. Designers can also simultaneously deploy different or competing narratives through curating personal experiences with minimal physical changes to an exhibition. The conceptualisation of Smart Heritage’s technological architecture by Chianese and Piccialli substantially advanced Smart Heritage as a design tool, and the testing initiated its practical application.

Chianese and Piccialli later added another notable contribution to Smart Heritage through editing a journal section titled ‘The Internet of Cultural Things: Towards a Smart Cultural Heritage’ in the *Future Generation Computer Systems* (Piccialli & Chianese, 2018). They stated that Smart Heritage “is a novel concept integrating intelligent objects, sensors, services and applications within static cultural places such as museums, monuments, exhibitions and so on”. The special section contained numerous contributions to the discourse, which theoretically developed Smart Heritage’s technological architecture and applied it to additional museum contexts.

Notably, Vassilakis et al. (2018) presented theoretical and practical insights into its design application in the journal. Vassilakis et al. stated that museum visitors rarely experience all the curator’s intended narratives in an exhibition, and exhibitions often contain various primary, secondary, and unintended narratives. Traditional audio guides and printed interpretative materials

nudge users towards the intended storylines, but their effectiveness relies on the user and can be poorly adopted. Also, the reduction of exhibits to singular narratives to improve their clarity narrows the exhibition's audience base and can be historically misleading or incomplete. As a theoretical solution, Smart Heritage reframes the museum as an open data source where a multiplicity of narratives co-exist, stem from, and evolve within, instead of the curator nudging users and suppressing alternative interpretations. In their practical application, Vassilakis et al. detailed the *exhiSTORY* system where smart technology automatically curates novel heritage exhibitions from an expansive cultural collection database and the users' personal data. The system involves geolocation sensors, exhibit trackers, the semantics and media engines, a story finder and a story maker. It forms a user profile for each visitor by connecting to their Facebook account or collecting preferences through a short game. The system exploits the data inside the museum to pair each user with the stories that resonate with their profile. Therefore, the system considers the user's style, social preferences, background, online history and real-time data to present tailor-made experiences. Vassilakis et al. found that Smart Heritage enables richer storytellings that exploit the full extent of the exhibit's semantic information. They identified that further research into the most efficient profiling tools would improve their system and detect which narrative designs maximise information retainment and trigger deeper user reflection for greater narrative resonance. Their article explicitly highlighted smart technology as the sole lead curator in

Smart Heritage experiences and added significant theoretical and practical design advances.

Mar et al. (2018) provided the most comprehensive design application to date of Smart Heritage through their *Smart Heritage City* project in Avila, Spain; see Figure One. The project featured a system called 'SHCity-Manager' that diagnosed heritage assets and attractions' issues for site managers and tourism operators. The project also featured a mobile application called 'SHCity-Tourist', which designed personalised tours of the city based on a short questionnaire of personal preferences, such as accessibility restraints and interest. It then compared wait times at attractions across the city, the user's location, and the distance to the attraction. Its purpose was to maximise the time spent at the attractions and the user's enjoyment. This contribution offered the first comprehensive practical deployment of Smart Heritage on a city scale. In addition, the mobile application showed consideration of the technologies' user interface through attractive designs and scalability, which are relevant for large urban areas and multi-city deployment, and an economic benefit through its application for tourism. For urban designers and planners, the *Smart Heritage City* project is the foundational case on how Smart Heritage can deliver historical narratives within cities.

Smart Heritage Reimagining Cities

The academic literature discusses how Smart Heritage reimagines historical narratives in cities by challenging dominant historical accounts and introducing dynamic storylines. Urban designers and planners should consider incorporating Smart Heritage in their initiatives to deliver cultural and social change and innovation in their designs. This section discusses how Smart Heritage reimagines historical narratives within cities.

Brusaporci (2020) identified that Smart Heritage challenges the dominant historical narratives in cities by removing human limitations. Brusaporci stated that Smart Heritage is “a useful tool for a critical knowledge of reality, and for model analysis, design and validation” as the technology disregards authorised heritage narratives and personal and cultural reluctances. Instead, the technology can view all the data equally, if programmed, including where the “contrast between physical reality and digital reality ceases to exist”. As such, Brusaporci indicates that Smart Heritage can be a tool to reimagine revised, ignored, or non-dominant historical narratives, delivering cultural and social change in urban communities. Brusaporci specifically noted that Smart Heritage presents a significant challenge to the Built Heritage, museum, and government sectors, as these sectors are active purveyors of authorised heritage narratives and human-led curatorships. The desire to challenge dominant narratives aligns with the prominent criticism concerning the socio-cultural structures in the heritage discipline by Smith (2006). Smith

argues that western organisations often dictate dominant historical narratives and gatekeep revised, ignored, and non-dominant histories from accessing social and cultural capital. These organisations and their followers place less value on intangible heritage forms, such as spirituality and cultural practice, central to these histories. They instead favour physicality, aesthetics, and age. The organisations and dominant narratives resultingly discriminate against non-western histories as they do not meet western standards of heritage value. Therefore, Smart Heritage offers a pathway for urban designers and planners to reimagine historical narratives in cities by uplifting revised, ignored, and non-dominant histories through smart technologies and serve their communities.

Batchelor and Schnabel (2021) recognised that Smart Heritage introduces dynamic historical narratives in cities through its unique ability to engage online information continuously. In their research of Smart Heritage in Australian local governments, they described Smart Heritage is planned to deliver a ‘mediatised environment’ in the City of Newcastle, Australia, where public cultural and heritage sites across the city communicate in real-time to improve the user experience. Similar to the exhiSTORY system by Vassilakis et al. (2018), this environment would utilise and analyse personal and big data but on a city-wide scale and inform the local government’s design of public historical spaces and sites. The outcome of such an installation would be the ability for historical narratives to continuously evolve and reflect on trends,

audiences, and remembrance occasions. History would, therefore, not be static but be a fluctuating narrative that more accurately serves those who engage with it. The dynamic historical narrative outcome aligns with heritage researchers who stress the heritage discipline's ongoing interpretative and valuing processes. Winter (2012) argues that "heritage is both enmeshed in, and constituted by, complex, entangled and contradictory processes", including social, political, governance, individual, collective, and economic processes. Janssen et al. (2017) state that heritage is "constantly in flux and whose substance and meaning are continuously being redefined by society". The dynamic narratives in Smart Heritage compete with the authorised perspective that heritage is fixed, complete, and true (Harrison, 2009). Smart Heritage, therefore, presents an opportunity for urban designers and planners to adopt heritage narratives as moving and reflective to tell the stories of the cities' inhabitants continuously.

Urban designers and planners can leverage Smart Heritage to reimagine historical narratives in the city by firstly being aware that smart technology can challenge dominant discourses and introduce dynamic narratives, and secondly incorporating Smart Heritage into their initiatives. For challenging dominant discourses, it requires a conscious effort to realise the political privilege of western historical narratives and the resulting cultural and social impact in cities on marginalised communities, and their ability to consider new, revised, or non-dominant histories that may fall outside authorised narratives.

Therefore, urban designers and planners should engage ignored or less dominant communities and not rely solely on authorised organisations for sourcing historical narratives. A Smart Heritage initiative that delivers this outcome is a lighting or visualisation installation that depicts local and recent histories not officially classified as 'historic'. Or deploying publically-projected mixed reality that reimagines lost indigenous characters on a colonial streetscape who protest or mourn the present-day activities, highlighting the cultural loss and dichotomy. For introducing dynamic narratives in cities, urban designers and planners should capture, engage with, and deploy public data feeds. It also requires engaging the smart city sector to understand the possibilities and the technological architectures and incorporate them into their designs. Urban designers and planners could, for example, adopt the aforementioned 'mediatised environment' in public space initiatives.

Conclusion

Smart Heritage is an emergent smart discourse that enables urban designers and planners to reimagine historical narratives within cities through the untethered perspectives of smart technology. Its development over the past decade highlights its ability to design historical narratives through automated and autonomous technologies for museums and city-scale applications. These technologically curated historical narratives introduce innovative design

opportunities for urban designers and planners. They challenge dominant historical narratives and introduce dynamism into cities, improving overall livability through adding heritage value. Importantly, through Smart Heritage, the past becomes less beholden to authorising heritage organisations as technology enables divergent and underrepresented narratives. The constant data stream in a smart city also enables freeform narratives rather than static histories such as interpretative plaques and passive audio guides. Smart Heritage, therefore, offers an array of new possibilities for urban designers and planners to incorporate the past into their initiatives innovatively.

Smart Heritage requires further efforts to install it alongside Smart Mobility and Smart Infrastructure in professionals' minds and find its way onto regulatory processes. Smart Heritage currently lacks the professional conferences and research centres that benefit these earlier discourses. However, its development indicates a trajectory to become the new vanguard discourse at the intersection of technology and the past. The researchers of this article predict it will surpass Digital Heritage as the prominent discourse in this area. The bulwarks of professionalism and academia will materialise as it rises in eminence. These researchers recommend that future-focused urban designers and planners become aware of Smart Heritage and consider its ability to influence their designs and incorporate it into their initiatives.

Biography

David Batchelor is a PhD Candidate in the Wellington School of Architecture at Victoria University of Wellington. His research produces Smart Heritage Principles that converge smart technologies with heritage within local government strategic documents and operations.

Professor Marc Aurel Schnabel is the Dean of the Wellington Faculty of Architecture and Design Innovation, Victoria University of Wellington, New Zealand. Trained as an Architect, he is leading research in architectural technology. He has taught and worked in Germany, Australia, and Hong Kong for thirty years. He is recognised for his research in computational design, virtual reality, digital heritage, parametric design learning and intelligent cities. He has been the President of both ANZAScA and CAADRIA, and established the 'Digital Architecture Research Alliance' – www.DARA.digital – and the social network 'Urban Digitalics' connecting professionals and researchers in innovative digital spatial design.

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