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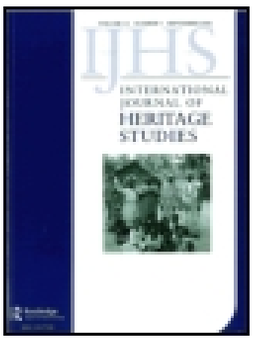

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Digitalising endangered cultural heritage in Southeast Asian cities: preserving or replacing?

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ABSTRACT

In the last decade, the dramatic developments in digitalisation have reached cultural heritage. Digital archiving and reconstruction, virtual reality, and 3D laser scanning, modelling and printing, are influencing the way we consume, manage, and preserve it. As part of the latter, detailed virtual records of endangered urban cultural heritage, through digital archiving, capturing, and reconstruction techniques, can help preserve its memories and lengthen its life; particularly, once decision-makers resolve to end its tangibility. However, the application of digitalisation to cultural heritage is not always easy, faced with issues such as cost, lack of sources and skills, sustainability, and intellectual property limitations. This paper illustrates the challenges encountered by land-deprived and fast-growing Southeast Asian cities in amalgamating urban cultural heritage preservation with pressing development needs. Ultimately, it discusses the introduction of digitalisation in this debate by examining the broader consequences of the association.

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Preserving cultural heritage

On the evening of April 15 2019, the eyes of millions of people all over the world were fixated on a fire that partially devastated *Notre-Dame de Paris*. By the time it was extinguished, the cathedral's spire and most of its 13th-century wooden roof had been destroyed. The timing of this cultural heritage calamity (Nossiter 2019; Malik 2019), coincided with an art history exam I conducted in Singapore. At the end of the exam, several students approached to reflect on the *Notre-Dame* fire, commenting with sadness on the event. Where I usually would have encountered questions related to the exam, the students only had concerns about a piece of cultural heritage they had never visited. What drove their concern? Why were my students worried about the preservation of a building that most of them would never experience first-hand?[1]

A cultural heritage item is defined today by its historical relevance and artistic attributes, but also by its cultural values, its identity associations, and its capacity to trigger memories[2] (Vecco 2010), in a comprehensive approach that incorporates the heritage's context[3] (Greffe 2004). My students in Singapore seemed genuinely touched by the destruction of *Notre-Dame de Paris*. Most had not had, however, any direct personal knowledge or physical contact with the cathedral; they were not members of its local or national community; most of them were not Christian or were even familiar with Christian practices. However, they were able to empathise with those experiencing sorrow for its damage. *Notre-Dame de Paris* had transcended its locality to belong 'to the universe as a whole' (de Quincy, as quoted in Gamboni 2001), acquiring a heritage dimension for the whole of humanity (Malraux 1957). The cathedral had become a true icon of identity (Lowenthal 1998) and attained

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a symbolic value that transcended its daily use (Gamboni 2001). The Parisian cathedral's inclusion as a world heritage site in 1991 in UNESCO's *World Heritage List* as part of 'Paris, Banks of the Seine', helped to underscore its global significance. The real-time fire grief showcase by the international media did the rest, bestowing globality to the monument's particular 'heritage crusade', using the expression coined by Lowenthal (1998),[4] and helping the world to submerge in what Hafstein calls the 'rising tide of heritage' (2012).

The *Notre-Dame de Paris* fire sparked several debates regarding the value of cultural heritage and its preservation.[5] One particularly relevant in the context of this paper is that of the depth of the reconstruction. *Notre-Dame de Paris* belongs to what Laurajane Smith (2006) defines as *Authorised Heritage Discourse* (AHD), a dominant collective and universal narrative that most people acknowledge as valid as it is sanctioned by 'heritage experts' (Josefsson and Aronsson 2016), and by national and international organisations such as UNESCO and ICOMOS. In the aftermath of the fire, French President Emmanuel Macron vowed for a 5-year express reconstruction, for a *Notre-Dame* 'more beautiful than before' (as quoted in Lyons 2019), in time to welcome visitors for the 2024 Summer Olympic Games. Within a few days, nearly one billion dollars was pledged for the restoration (Bostock 2020). The majority of the contributions came from tens of thousands of small anonymous donors from all over the world, underscoring the monument's popularity and global status. Some of the larger contributions were controversial, particularly when France's most prominent fortunes stole the limelight with promises of donations that took months to arrive and led to self-promotion and competition polemics (Cerullo 2019; Chakrabortty 2019).

Cultural heritage comprises today a multitude of items such as cemeteries, gardens, landscapes, industrial and rural heritage, and urban ensembles. These inclusions constitute a substantial expansion from the initial associations of the term which, until the second half of the 20th century, primarily referred to monuments, historical buildings, and archaeological sites (Vecco 2010). However, this all-embracing notion of cultural heritage does not necessarily translate on widespread support towards the preservation of cultural heritage items. The vast majority of heritage sites in need of preservation do not enjoy the popularity of *Notre-Dame de Paris*, certainly not its global attention. They do not have novels, movies, games, animations, and extensive documentation produced in their honour. Often, there are scarce detailed records and documentation that can help to understand them better and to preserve their relevance. In addition, rapid urbanisation subjects cultural patrimony to tensions that pose a threat to its preservation (Groizard and Santana-Gallego 2018). This is especially true in fast-evolving Asian environments, where the handling and preservation of urban heritage assets can pose dilemmas to policy and decision-makers, and choices are rarely conflict-free or straightforward. Lack of resources, shortage of time, and financial constraints add extra challenges to the conundrum.

This investigation focuses on at-risk and non-protected cultural heritage sites that struggle to survive in some of today's large and densely populated Southeast Asian cities. In a short period, a 'VIP cultural heritage' such as *Notre Dame*, managed to mobile funds that could contribute to the reconstruction or preservation of hundreds of heritage sites and artefacts. In contrast, valuable cultural heritage assets in fast-paced Southeast Asian cities, especially those non-gazetted and non-protected, struggle to attract attention and financial support for preservation. In this context, this paper examines the suitability of preventive heritage preservation in Southeast Asia, and explores the use of digitalisation as a prospective alternative to traditional preservation, or oblivion.

When it is gone, it is gone

Throughout history, there are uncountable examples of remarkable cultural heritage vanished. Perhaps one of the most known is that of ancient *Library of Alexandria* in Egypt, created in 283 BC by Macedonian general Ptolemy I Soter. The Library was one of the largest and most significant libraries of the ancient world, visited by the great thinkers of the age to study and exchange ideas (Serageldin 2013). At one or several points, it was totally or partially obliterated,[6] which provoked

the loss of a significant amount of ancient history, literature and learning. Its vanishing has become a symbol of the irretrievable disappearance of cultural knowledge and heritage (Rico 2017).

Destruction and the irremediable loss of valuable cultural heritage continues today. In Afghanistan, the iconic 5th-century AD *Buddhas of Bamiyan* were destroyed by the Taliban in 2001. These monumental standing Buddha statues were carved into the side of a cliff in the Bamiyan valley at an elevation of 2,500 metres. They were among the most famous cultural landmarks of the region and listed as a *World Heritage Site* along with the surrounding cultural landscape and archaeological remains. The Taliban defended the destruction as an act of protest against the Western countries' double standard. For them, spending resources in protecting the images but ignoring the suffering of the Afghan people was morally criminal (Bernard 2001; Centlivres 2008). What the Western-led narrative considered morally criminal was, however, the destruction of the Buddhas itself, with the United Nations (2001) labelling it as 'an act of intolerance that struck at the very basis of civilized coexistence', and UNESCO (2001) a 'crime against the common heritage of humanity' (UNESCO 2001). Afghanistan's post-Taliban leader Hamid Karzai, called it called a 'national tragedy' (as quoted in CNN 2002).

In 2015 in Iraq, the *Islamic State of Iraq and the Levant* (ISIL) destroyed the ruins of the ancient Mesopotamian cities of Hatra and Nimrud, and obliterated artefacts from the Mosul Museum. Besides, during the Syrian Civil War, ISIL destroyed large parts of the 4,000-year-old oasis city of Palmyra, located in present-day Homs.[7] Palmyra, with its grand stone collonaded streets, Roman amphitheatre, ornate tombs, and myriad temples was one of the world's significant historical landmarks, a site often known as the *Venice of the Sands* (Butcher 2015; Boissoneault 2015). The damage inflicted to some of the cultural heritage was in many cases, irreparable, described by UNESCO as 'war crimes' (Shaheen 2015).

In Nepal, an earthquake in 2015 reduced to piles of rubble many of Kathmandu valley's most historically significant buildings, including several iconic UNESCO World Heritage sites, some dating more than 1,700 years. Among the well-known landmarks devastated was the lighthouse-like *Dharahara Tower*, initially built for the queen of Nepal in 1832. Apart from renowned monuments, a lot of housing dating to medieval times was also destroyed in the earthquake, 'living monuments [...], directly linked with a very vibrant, cultural, intangible heritage' (Ekin 2015).

In Rio de Janeiro, a fire devastated Brazil's *National Museum* in 2018. 92.5% of the museum's 20 million artefacts were destroyed in the blaze (Newcomb 2018), including indigenous artefacts, dinosaur remains, and 'Luzia', the oldest human skeleton ever discovered in the Americas. Marina Silva, a former environment minister, described the fire as 'a lobotomy of the Brazilian memory' (as quoted in Phillips 2018).

Digitalisation and cultural heritage: benefits and risks

In the last decade, the dramatic developments in digitalisation have reached cultural heritage. Techniques such as digital documentation, archiving and reconstruction, 360-degree capturing, virtual reality, 3D laser scanning, modelling and printing, are impacting the way cultural heritage is consumed by visitors and audiences, but also the way it is maintained, managed and preserved. Online platforms such as Google's *Art and Culture* (including the project *Open Heritage* that provides digital heritage preservation to dozens of sites), Khan Academy's *Smarthistory*, Wikipedia's *GLAM*, and *Europeana*, amongst others, are now offering visitors high-resolution images and background of artworks located in museums or cultural heritage sites around the world. Countries and individual institutions are also making active use of digitalisation in the advancement of their cultural heritage. As an example, *Virtual Museum of Canada* (VMC) contains a directory of over 3,000 Canadian heritage institutions, a database of over 600 virtual exhibits, and over 900,000 images. Many public and private museums now run parallel virtual collections of their exhibits or include *ad hoc* born-digital content such as 3D environments, digital art, net art, and virtual reality. Some institutions even exhibit collections that exist solely in cyberspace. Some of the

world's famous cultural heritage has been digitalised or is currently being digitalised. For instance, Istanbul's iconic *Suleymaniye Külliye* (Mosque and Complex) was fully digitalised in 2019, including outputs such as 3D modelling and Virtual Reality (Kan et al. 2019).

There are a number of benefits associated with the synergy between the new technologies and cultural heritage: Accelerating the documentation methods (Kan et al. 2019); Improving and diversifying the way cultural heritage is accessed by complementing and enhancing the experiences offered (Gaitatzes, Christopoulos, and Roussou 2002; Kersten, Tschirschwitz, and Deggim 2017); Bringing the cultural visitor very close to the essence of the cultural works, providing details challenging to see in a gallery or a heritage site (Styliani et al. 2009); Supporting with promotion, audience development, and attracting new visitors (Missikoff 2006; Hill et al. 2018); Offering greater accessibility to cultural heritage (Deggim et al. 2017; Tschirschwitz et al. 2019), particularly for people with limited financial means or mobility, and providing alternative environments of display and engagement with to the confines of traditional museums (King, Stark, and Cooke 2016); And, providing educational tools to enhance both teaching and learning experiences, for instance through so-called 'serious games' designed for educational objectives (edutainment), which allow for a new kind of knowledge dissemination (Anderson et al. 2010; Mortara et al. 2014; Liarokapis et al. 2017).

The advent of digital technologies can also contribute to equity of access and democratisation of culture (Besser 1997; Frau-Meigs 2013), by providing access to everyone, and removing traditional barriers such as money, location and opening hours, and making heritage less dependent on 'experts' (Witcomb 2007). This aspect is particularly relevant in extraordinary circumstances such as the Covid-19 pandemic, which dramatically limited physical access to many heritage sites.

Digitalisation can also provide a sort of memory' insurance policy' for cultural heritage, in the event of a total or partial destruction, or substantial degradation. For instance, in Afghanistan's *Bamiyan Valley*, the iconic Buddhas rose again for a few hours in 2015 in the form of holographic statues thanks to 3D laser light projection technology provided by a Chinese team of heritage enthusiasts. In Iraq, *Project Mosul* aims to preserve artefacts and monuments destroyed using 3D modelling, based on crowd-sourced photographs, which could later be reproduced using 3D printers. In Nepal, a technology-driven salvage started days after the earthquake shook the Kathmandu valley, and included smartphone apps where documentation and photographs of the damaged heritage could be shared. In Rio de Janeiro, Google had worked with the *National Museum of Brazil* before the fire devastated the museum, in order to help bring its 20 million artefacts online. Thanks to advances in technology, such as high-resolution photography, photogrammetry, 3D laser scanning, and virtual and augmented reality, the museum's lost collections can now still be experienced through a *Street View* virtual exhibition.

However, there are also difficulties associated to the use of digitalisation to preserve cultural heritage: for instance, the lack of available data and sources, or misalignments between contextual information and the digital content (Chowdhury 2010); it can be time-consuming and expensive (European Commission 2015); it can encounter an absence of proper coordination, support, long-term sustainable planning, and adequate professional, technical skills or knowledge (Cignoni and Scopigno 2008; Bruno et al. 2010); its excessive usage has also raised questions regarding ethical and political-economic implications (Lor and Britz 2012), environmental sustainability (Ruthven and Chowdhury 2015), and intellectual property ownership (Borissova 2018).

The allegedly pivotal role of digitalisation in the democratisation of cultural heritage also needs to be further examined as it has been subjected to little critical analysis (Waterton 2010; Richardson 2014). In fact, some authors have cautioned that in their interaction with heritage, digitalisation activities 'can subtly reinforce non-democratic structures' and 'top-down approaches' (Taylor and Gibson 2017), replicate 'centralized' attitudes (Hogsden and Poulter 2012), and should not automatically be seen as neutral (Pickover 2014). In this regard, some authors have stressed the risks associated with universal accessibility, such as in the heritage of indigenous communities (Ngata, Ngata-Gibson, and Salmon 2012). A longer-term concern is the use of successful digital preservation projects by decision-makers to justify demolishing tangible cultural heritage.

Much can be done to improve the use of digitalisation responsibly in the preservation of endangered cultural heritage, particularly in the context of today's busy, land-deprived and fast-growing Southeast Asian urban spaces.[8] The handling and preservation of heritage assets often pose dilemmas to decision-makers and governments, and choices are frequently complex. When heritage preservation implies delays and halts to commercial gains, progress or growth, or the betterment of infrastructure, accessibility and connectivity, decision-making is not straightforward (Ocón 2018), and amalgamating the preservation of cultural heritage with pressing development needs not an easy task.

Digitalisation can provide alternatives in easing these challenges. Digital archiving of existing documents such as technical data, blueprints and old pictures, together with digital capturing techniques that include full coverage photography and videography (for instance, with the help of 360-degree technology and drones), 3D laser scanning, and reconstruction techniques such as digital drawing and 3D modelling, can be used for virtual reality purposes. The drop in prices (Tschirschwitz et al. 2019) and the gains in accuracy in 3D printing technologies (Balletti, Ballarin, and Guerra 2017), today offer new possibilities of display and analysis of heritage assets. This new 'digital cultural heritage', also known as 'cultural heritage information resource' (Lor and Britz 2012), can lengthen the heritage's life and expand its reach.

Digitalising endangered Southeast Asian cultural heritage

Joint institutional preservation of tangible cultural heritage is not as rooted in Southeast Asia as in other parts of the world. While the *Association of Southeast Asian Nations* (ASEAN) includes the protection and preservation of the region's cultural heritage among its various focuses (see for instance the 2000 *ASEAN Declaration on Cultural Heritage*), little is done or coordinated from ASEAN's Secretariat in this respect. Most of the tangible heritage preservation executed in the region in the last decades was done thanks to the admirable work of the region's governments and international organisations such as UNESCO. Also, thanks to the support from affluent countries such as Japan, which over the years contributed to the preservation of ancient temples such as Borobudur (Indonesia), Angkor Wat (Cambodia), and Wat Phu (Laos), the restoration of the ancient city of *Hue* and its Royal Palace (Vietnam), and old pagodas and buildings in Bagan (Burma).[9] At the beginning of 2018, ASEAN revealed the launching of the *ASEAN Cultural Heritage Digital Archive* (ACHDA) project, to present and raise awareness of ASEAN's rich cultural heritage on one website, including artefacts, old documents and paintings (ASEAN 2018; ACHDA 2021). The ASEAN Secretariat implements ACHDA through the *Japan-ASEAN Integration Fund* (JAIF). Three years down the road, the digital archive still has a long way to go, with only a modest number of resources on display (163 as of the beginning of 2021), from three of the ten ASEAN countries (Thailand, Malaysia, and Indonesia), and uncertainty in its future development plans. These limitations illustrate the gaps between the rhetoric and realities of conservation policy at the regional level.

This paper looks at case studies from two of Southeast Asian's most significant and fastest-growing cities, Singapore and Kuala Lumpur. Both have established and long-running heritage protection and preservation institutions. In Malaysia, the *Department of National Heritage* (Jabatan Wasari Negara), under the *Ministry of Information, Communication and Culture*, has responsibility for preserving and managing the national heritage. A *National Heritage Act 2005* (Act 645), came into effect in 2006 to provide for the preservation, conservation, and management of national heritage. This includes conserving dozens of buildings and monuments of historical, architectural, and cultural significance. (A Ghafar Bin Ahmad n.d.). In Singapore, the *National Heritage Board* (NHB) is the custodian of Singapore's heritage. Formed in 1993, NHB reports to the *Ministry of Culture, Community and Youth*, and among others, it sets policies relating to heritage sites (NHB 2020). The NHB works with the *Urban Redevelopment Authority* (URA) under the *Ministry of National Development*, which in 1989 became the national conservation authority in charge of preserving culturally, architecturally and historically significant buildings, and sets out guidelines and processes for restoration of buildings. Partnerships

between the two are common to preserve daily-life urban heritage. To date, conservation status has been given to over 7,000 buildings in more than 100 areas (URA 2020).

Despite the abundance of opportunities for support, in the complex and rapidly-evolving urban realities of Singapore and Kuala Lumpur, there are still numerous 'cultural heritage blind-spots' concerning preservation and conservation. These are typically non-protected, non-gazetted, less popular or easy to handle cultural heritage sites, at times located in prime or strategic urban locations. They include a variety of sites, from old estates and *kampongs* (traditional villages now engulfed by the growth of the cities) to historical landmarks and iconic buildings (e.g. bunkers from the country's involvement in the Second World War). The following cases present examples of notorious, yet largely vulnerable, cultural heritage in these two Southeast Asian urban spaces. In both cases, the cultural heritage was at risk of disappearance, whether due to commercial needs or to developmental pressures derived from the shortage of land and population pressures. In both cases, the preservation undertaking encountered the technologies provided by digitalisation with different results.

Case from Southeast Asia 1: *Bukit Brown Cemetery* in Singapore

In Singapore, graves are frequently exhumed to give way to development. In the last two decades, the total or partial dismantlement of several old public cemeteries has been in the spotlight, leading to controversies that criss-cross issues such as development, progress, urban planning, history, memory-shaping, identity-building, or the right to rest in peace. *Bukit Brown Cemetery* is one of the largest and most prominent of those public cemeteries. It ceased operation in 1973 but still contains tens of thousands of tombs and is believed to have been the largest Chinese cemetery outside China (Banyan 2013). Some of its graves dating back to the 1830s, including some from the country's pioneers that belonged to all paths of life: businessmen, manual labourers, industrialists and revolutionaries (Sun Yat Sen Nanyang Memorial Hall 2013).

In 2011, the Singapore government announced that a new eight-lane road would be built over parts of the cemetery to cater to increased traffic (Singapore Government 2011). Five thousand graves were initially affected by the construction, and the remaining parts of the cemetery and its surrounding land are slated for future redevelopment into new housing. The government's decision met fierce resistance from several civil society groups that urged the government to rethink its plans, underscoring the cemetery's rich heritage worthy of preservation.[10] Eventually, the Singapore government agreed to discuss the cemetery's future with non-governmental groups, in a shared effort to retain and celebrate the heritage of Bukit Brown (Lim 2012).

Ultimately, the government pursued its plan of building the highway, which was completed at the end of 2018. However, this case unleashed a sort of 'heritage fever' in Singapore. Building up from previous cases where tangible heritage had been lost forever (e.g. Bidadari Cemetery, the National Library at Stamford Road, the National Theatre, the Van Kleef Aquarium), civil society groups in the country set out on a quest to save the cemetery. For years, *Bukit Brown Cemetery* was in the popular discourse, and its impending slow-motion disappearance triggered a reaction from ordinary citizens and the flourishing of grassroots initiatives rarely seen in Singapore (Chong 2015).

The cemetery activated this new heritage consciousness in Singapore's citizenry. Indeed the debate, which touched on national history and identity, went beyond the cemetery itself until then a stranger to many Singaporeans. Arguably, many of the preservation initiatives that followed would not have happened without this seminal incident. The outpouring of interest included: several books supported by Heritage boards and societies; Policy institutes and Memorial halls; chapters in academic books; articles and reports in international media; documentary films; exhibitions; theatre plays and performances; and dedicated websites by heritage groups.

From the point of view of digitalisation, a unique initiative emerged: *The Bukit Brown Cemetery Documentation Project* (Figure 2). The project, sponsored by the government, was a collaboration between several universities, polytechnics, researchers, heritage societies and institutes, and adopted a holistic approach, treating the cemetery as an organic socio-cultural space. It documented and virtually archived 3,901 graves, including (where available) Chinese and English names, and close and wide-angle photographs of the graves (Figure 1). It also collected and virtually captured the social history, memories and rituals associated with the cemetery, as well as the exhumation process.

Figure 1. Oon Chim Neo's tomb site in 2012 (The Bukit Brown Documentation Project 2020).

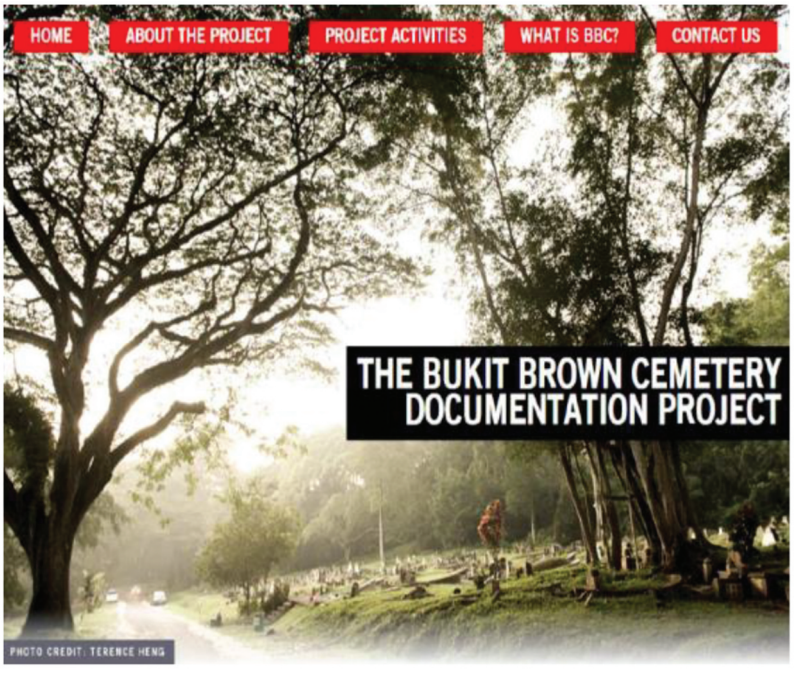

Figure 2. The Bukit Brown Cemetery documentation project's website.

When the tangibility of those graves was gone, the online resource developed served as a virtual platform to disseminate findings, educate the public on the heritage value of the Bukit Brown Cemetery, and to some extent, to keep it 'alive'. This criss-cross collaboration between a diverse range of stakeholders set new boundaries for future cultural heritage challenges like this in Singapore. For instance, in *Bukit Brown*, there are still close to 100,000 graves, and dozens of burial

grounds, from different confessions, lay scattered across the island in better or poorer-maintained facilities. These sacred places, despite their historical relevance, are not deemed architecturally significant, and therefore are not gazetted and protected.

Digitalisation can assist, not only with archiving, but also with digital mapping and virtual replication, and most importantly, with the preservation of memories and stories associated with them. In a rapidly changing country with a constantly evolving society, heritage can be a delicate matter interweaving notions such as culture, history, identity, memory, and the sense of belonging. In the case of *Bukit Brown*, while development won the battle, digitalisation provided a reasonable opportunity for government and civil society groups to partner for common ground. It also helped to preserve memories of a piece of meaningful cultural heritage, much esteemed by many Singaporeans, and offers alternatives in future cultural heritage debates.

Case from Southeast Asia 2: *Pekeliling Flats* and *A&W Petaling Jaya*

The second case takes us to Malaysia and presents two examples of virtual preservation of architectural heritage shortly before their disappearance, in the absence of sanctioned protection. Both cases used digital archiving, capture and 3D modelling and printing to record urban-located structures that had architectural or historical merit but were not gazetted as national heritage and therefore, were left without protection against demolition.

As in Singapore, many urban areas in Malaysia are rapidly reshaped through development. The *Pekeliling Flats*, also known as 'Tunku Abdul Rahman Flats', were built in the 1960s in Kuala Lumpur. They were the first pilot project that introduced *Industralised Building System* (using precast concrete) to Malaysia, aiming at affordable-housing for the low-income group. In total, seven blocks of 17-storey low-cost flats and 4-storey shop-houses were built (Figure 3). These flats were the second high-rise residential buildings in Kuala Lumpur after the *Suleiman Courts*, which, despite their historical significance as the first high-rise residential buildings in Kuala Lumpur, were demolished in 1986 leaving behind no records such as technical data or plans (Esmaeili, Woods, and Thwaites 2015).

The second example in Malaysia is the *A&W Petaling Jaya*, the first drive-in restaurant in the country (Figure 5). The restaurant, built in the 1960s, was slated for demolition in 2014, despite

Figure 3. The Pekeliling Flats opened in the 1960s in Kuala Lumpur (The Star 2013).

The *Pekeliling Flats* were demolished between 2014 and 2015. However, before that, a group of researchers from Malaysia's *University of Malaya, Multimedia University, and Sunway University*, virtually reconstructed these flats to preserve them for the future.

The process of digital preservation included several phases: digital archiving through digital capture, 3D modelling for virtual reality purposes, and collecting existing materials (including old photos, newspaper articles and old videos) to be digitalised and archived. The researchers performed full 3D reconstruction including full coverage videography (using drones) and photography (throughout two field visits, they captured more than 1,000 images and videos). Although the original *Pekeliling Flats* have now disappeared, their digital restoration can be used by historians, architecture schools, researchers, and many others (Figure 4). The 3D model created can be printed using 3D printing for exhibition and educational purposes, as well as be converted for use in virtual reality contexts for virtual visitors.

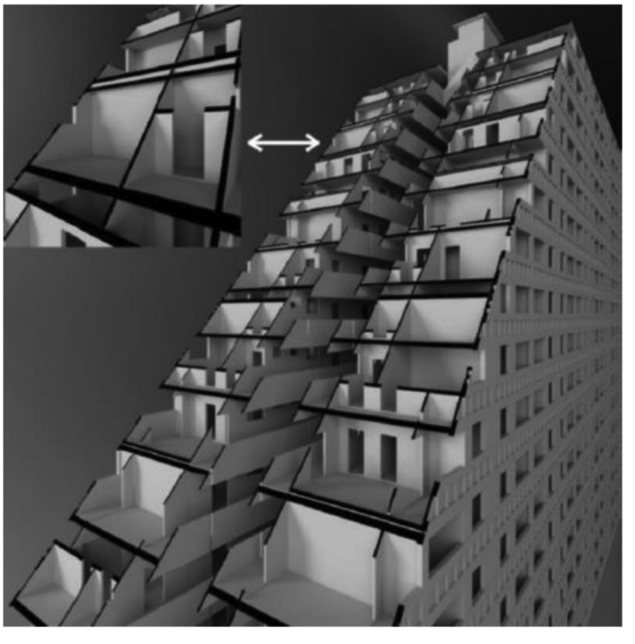

Figure 4. One of the Pekeliling towers sliced (Esmaeili, Woods, and Thwaites 2014).

Figure 5. The *A&W* restaurant in Petaling Jaya in the late 1960s (The Star 2014).

Figure 6. The 3D model of the *A&W* PJ's original state (Esmaeili, Woods, and Thwaites 2015).

local objections, to make way for new developments, as it is located in a prime area, near a well-known mall and the Taman Jaya light rail transit (LRT) station. The 24/7 drive-in restaurant was a well-known landmark of the city and held special meaning to thousands of Malaysians who 'fondly remember it for the birthday parties, high school first dates, and late-night *makan* [food/eating] sessions with waffles and root beers served in ice-cold mugs' (Ng 2018). Despite several delays in the demolition, at the beginning of 2018, it was officially announced that the A&W drive-in would be pulled down (Ch'ng 2018).

Anticipating the demolition, the team of researchers embarked on a digital reconstruction of the *A&W PJ* drive-in with the primary objective of virtually saving it (Esmaeili, Woods, and Thwaites 2015). The team created 3D modelling for two versions of the building. The first one replicated the original building from the 1960s (Figure 6). This structure was designed in a way that customers could drive in and be served by roller-skating waitresses without leaving their cars. For that virtual reconstruction, there were hardly any records or data, and the team had to base it on an old, low quality, black and white grainy photo. The 3D model of the *A&W* PJ drive-in can now be used for virtual reality purposes such as virtual/online museums or serious games, providing a sort of 'time travelling' experience. The second 3D model focused on reproducing the way the drive-in restaurant looked in 2014 when it was tagged for demolition. In this contemporary version, an interior extension had been added by the owners, equipped with air conditioners. The team, based their model on observations and work done during field visits, focusing on achieving a full digital rendering. Full photography, videography, measuring, and generation of a draft plan were used to produce a 3D model that can now be downloaded and printed using 3D printers.

Technology enables us today to virtualise almost anything. A cultural heritage item can be fully reconstructed in a virtual environment if enough visual reference materials are available for visualisation artists, or if they have full access to it. 3D modelling cannot save a building from its demolition, and can be a time consuming and costly process.[11] However, 3D reconstruction can prevent the complete disappearance of a heritage asset by virtually preserving its 'soul', which includes its external appearance, but also the memories and stories associated with it.

Conclusion

In the aftermath of the *Notre-Dame de Paris* fire, French videogame maker *Ubisoft* pledged half a million euros to the reconstruction cause (McNicoll 2019; Wales 2019). The contribution was highly symbolic.

Assassin Creed Unity, a popular videogame that unfolds in Paris during the 1789 French Revolution has sold millions of copies across the world and is Ubisoft's most popular game. It includes a highly precise digital reproduction of *Notre-Dame de Paris*, the result of years of work for artists, designers, and historians (Webster 2019). The glorious cultural landmark that inspired the video game, now in times of trouble, receives back from its digital nemesis, both in terms of funds for its reconstruction and as an essential piece of historical documentation (Sitzes 2019). This 'cultural heritage reciprocity' reminds us of the multifaceted and multi-layered potential partnerships enabled by digitalisation.

When valuable cultural heritage is destroyed or vanishes, whether due to natural disasters or human-made actions, little can be done to bring its tangibility back. The destruction of heritage sites, artefacts, and museum collections, much of them irreversible, remind us of the diverse threats that exist to the world's cultural heritage. It also spurs us to protect and preserve them. Here, digitalisation can assist with reconstruction, and with the preservation of the memories and stories associated with it. Admittedly, the digitalisation of tangible cultural heritage is not a new phenomenon. Since the early 20th-century, local history groups photographed and documented endangered heritage buildings and structures. Furthermore, from the second half of the century, some architecture schools encouraged the documentation of threatened buildings as part of their curriculum. To some extent, the new wave of contemporary digitalisation, with tools such as Virtual Reality, 3D laser scanning and printing, and 360-degree capturing technologies, represents the 'next level' of a trend that started long ago. Despite this continuity, as observed in the case studies from Southeast Asian cities, often still today, preservation is only set in motion when the heritage is in danger, for instance, once demolition is slated. This paper argues that today's widely available and accessible digital technologies can help to spur more preventive preservation, particularly of endangered and non-protected cultural heritage.

The digitalisation of cultural heritage is not always an easy task. It can suffer from the absence of proper planning and support, and a lack of available data and sources. It can also be time-consuming and expensive. The notion of universal accessibility requires further examination concerning its implications on the democratisation of information. Decision-makers should not use advances in new technologies as an idle justification to demolish cultural heritage. However, for the most part, as demonstrated by this paper, digitalisation of cultural heritage can be a practical preservation resource, with ample potential for expansion. Digital archiving of existing documents together with digital capturing methods, and reconstruction techniques, can be used for virtual reality purposes. These new technologies can help to increase the cultural heritage's reach. In some cases, they can lengthen and expand the cultural heritage's life once its original physical manifestation is gone.

In Southeast Asia, where, with exceptions, regional funding for cultural heritage preservation is not readily or widely available, partnerships are a must. Collaborations between educational institutions and researchers, national governments and heritage bodies, technological companies, and local communities, among others, are fundamental in the effort to preserve disappearing or at risk of disappearance urban cultural heritage sites. Arrangements where the cultural heritage is approached from a multi-stakeholder and interdisciplinary perspective, appear crucial to ensure a meaningful and productive work of preservation. As discussed in this paper, in the context of Southeast Asian's complex urban environments, digitalisation can, and probably should be, an integral part of those partnerships.

This study has paved the way for further investigations in this field. More analyses on the application of new digital technologies in the preservation of endangered cultural heritage are needed. This is particularly urgent in urban spaces in Southeast Asia, where cities such as Singapore, Manila, Jakarta, Kuala Lumpur, and Bangkok, are expanding rapidly, often engulfing their cultural heritage with that growth.

Notes

1. Noting the subtle differences between close terms like 'digitisation', 'digitalisation' and 'digital transformation', for the purpose of simplicity this paper will use the term 'digitalisation' throughout to encompass all the digital actions discussed.

2. In the *Krakow Charter on the Principles of the Conservation and Restoration of Built Heritage* (ICOMOS 2000), a monument is defined as 'a clearly determined entity, the bearer of values, which represent a support to memory. In it, memory recognises the aspects that are pertinent to human deeds and thoughts, associated with the historic time-line'. It is generally accepted in heritage studies that cultural heritage can evoke memories in a way that can be used to build or strengthen identity (Lowenthal 1998; Greffe 2004). However, not all authors agree with this affirmation. For instance, Josefsson and Aronsson (2016), affirm that heritage is not collective in the sense of producing common values and, as such, not always a definitive generator of collective identity.
3. In the 2000s, partly due to its integration into UNESCO frameworks and Conventions (2003 *Convention for the Safeguarding of the Intangible Cultural Heritage*, 2005 *Convention on the Protection and Promotion of the Diversity of Cultural Expressions*), the notion of cultural heritage expanded to include notions of immateriality and orality, such as customs, folklore, oral and performing traditions, religious or profane manifestations (Barrio et al. 2012).
4. 'Only in our time has heritage become a self-conscious creed, whose shrines and icons daily multiply and whose praise suffuses public discourse' (Lowenthal 1998, 1).
5. Another interesting debate sparked by the *Notre-Dame* fire is the 'dissonant heritage' disagreements (Ashworth and Tunbridge 2006) that affects the type of reconstruction. Many, included the cathedral's chief architect Philippe Villeneuve, advocated for a faithful reconstruction of the cathedral (Kennicott 2020), as with the *Stari Most* bridge in Bosnia. Others, amongst them French President Emmanuel Macron, favoured innovative 21st-century solutions, in the manner other historical buildings such as Berlin's *Reichstag* (Laurent 2019; AFP 2019). A few, following John Ruskin's precepts (1849), who regarded restoration as the worst form of destruction because it meant 'a destruction accompanied with false descriptions of the things destroyed', prefer to leave the cathedral without rebuilding (Viennot 2019), as in the case of the *Hiroshima Peace Memorial* in Japan. Ultimately, over a year after the fire, the decision was to restore the cathedral to its last 'complete, coherent and known' state (Breeden 2020).
6. Plutarch points to Julius Caesar's troops, which accidentally might have burned it down during or after the *Siege of Alexandria* in 48 BC (100). Gibbon marks the destruction during the outlaw of pagan practices by Coptic Pope Theophilus of Alexandria in 391 AD (1781), while De Sacy points to the Muslim conquest of Egypt around 642 AD (1810). For more about the different theories regarding the destruction of the Library of Alexandria see El-Abbadi, Mostafa, and Fathallah, Omnia Mounir (2008).
7. Apart from the heritage loss inherent in the damage caused by ISIL and war airstrikes, and the widespread looting, a number of heritage items, such as Greco-Roman busts, jewellery, and other artefacts were lost during the transportation from the Palmyra museum to Damascus for safekeeping. Some of them were even found later on the international art market (McGirk 2015).
8. The percentage of urban population in the Southeast Asian region has increased from 15% in 1950 to close to 50% in 2018, with Singapore (100%), Malaysia (77%), Indonesia (57%), and Thailand (52%), above the average. The estimation is that by 2050 this percentage will rise to 66% (United Nations 2018).
9. For the latter, for instance, the cultural division of the *Japanese Ministry of Foreign Affairs* donated 33 million dollars to UNESCO (Houtman 1999).
10. Among the groups were the *Singapore Heritage Society* (SHS), the *Singapore Nature Society* (SNS), the *SOS Bukit Brown* group, and *All Things Bukit Brown*. The first two produced position papers arguing why the road project should be halted, underscoring Bukit Brown's several levels of heritage worthy of preservation, and its ecological value and biodiversity.
11. Especially polygon modelling -a method for modelling objects by representing or approximating their surfaces using polygons-, and non-automated or device-based methods.

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