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Merging Smart and Healthy Cities to Support Community Wellbeing and Social Connection

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Definition: Urban planning has long pursued the improvement of health and wellbeing through the rapidly evolving scholarship and practice of health-supportive environments, underpinned by the seminal World Health Organization's Healthy Cities Framework. Although a much more recent development, technology has been informing urban planning, as well as advancing healthcare and personal wellbeing monitoring and assessment. Known as the Smart City movement, it has much to offer regarding life in towns and cities, as well as how they are managed, maintained, and developed. There is also a growing appreciation of the potential for smart city technology to enhance human and environmental health in the context of urban planning and public place making. This has been reinforced by the COVID-19 pandemic with its reawakening of community interest in health and wellbeing, including mental illness, a greater awareness of the importance of local environments, and an explosion of technological knowhow in the embrace of remote working, online shopping, and education. Using the example of the authors' "Smart Social Spaces" project, this entry discusses the potential benefits of an evolving integrative concept called "Smart Healthy Social Spaces". The aim is to support community wellbeing as part of everyday living, especially associated with social connection, in densely populated and culturally diverse urban environments, where locally situated public spaces are increasingly important for all citizens.

Keywords: COVID-19; environmental sustainability; healthy cities; smart cities; loneliness; public spaces; social connection; wellbeing

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1. Introduction

The global COVID-19 pandemic (variously referred to here as "COVID-19", "COVID", and the "pandemic") reawakened community interest in health and wellbeing and the importance of local environments. It is no exaggeration to say that patterns of daily life and regular routines were upended as governments responded to public health advice in a desperate effort to reduce the incidence of the epidemic. The threat of an easily transmissible and deadly virus shifted our long-held health and wellness attention away from the risks of noncommunicable chronic diseases such as obesity, cancer, cardiovascular conditions, and mental illnesses. While the fear of catching COVID-19 and becoming seriously ill has now diminished globally, the need to engage in health-supportive behaviours has never been more pressing. So too has the provision of a sustainable built environment that makes it easy to engage in activities that keep us, and our planet, healthy and well.

Being based at home during the pandemic resulted in a renaissance of locally situated pursuits, as well as gigantic leaps in and reliance on technological skills. Communities

sought solace and respite in their local parks and public spaces—sitting under a tree, walking the dog, strolling along the street, going for a run, peddling down a cycle path, or just kicking a ball around. Local environments have never been more critical to the health of residents irrespective of cultural background, age, or ability level. Working from home also strengthened the importance of local environments in daily life for many. During the height of the pandemic and its consequent lockdowns and work-from-home orders, we saw people tapping on laptops, taking business calls and zooming clients and customers while sitting in, or walking around, an outdoor setting, including parks, plazas, paths, and streets.

As we emerge from the pandemic, there is greater appreciation for the home environment and less of a separation between leisure activities and work. The importance of health-supportive behaviours has been reinforced, along with the need to provide environments where this is facilitated. We have an enhanced respect for those viruses caught from each other, while also appreciating that the chronic diseases that have plagued global populations for decades are still rampant and must be addressed. Being separated socially, experiencing deep feelings of loneliness, and struggling with anxiety and depression have also been very much a part of pandemic life. This has resulted in a newfound appreciation of the importance of supporting mental health across the life course.

This is the context for this entry. The central aim is to contribute to the growing recognition of the value of integrating smart city technology and health-supportive cities research and practice to enhance human and environmental health. It is somewhat ironic that despite the widespread use of technology in society and everyday life, especially since COVID-19 appeared, the potential of technology to reinforce the supportive role of the built environment to reduce the major risk factors for chronic disease remains underdeveloped [1]. A connected, networked, and data-driven society enables citizens to better self-manage their own health and wellbeing [2,3]. As we have witnessed during the pandemic, and now in transitioning to urban life post COVID-19, the use of smart technology is more important than ever. Not only can technology maximise the potential of urban and recreational spaces in our communities, but it can also facilitate a better work–life balance for many residents. Through the example of our "Smart Social Spaces" project, we illustrate how smart public street furniture can provide equitable access to technology and infrastructure, in addition to traditional functions such as offering a comfortable place to rest, relax, and find relief from an overstimulating urban environment. The activation of the project's two examples of smart street furniture provides insights into how these installations can support healthy behaviours for community connection, social interaction, and general wellbeing in densely populated urban locations where public spaces are increasingly important. The entry makes suggestions for creating health-supportive smart spaces while discussing their health benefits in local communities to improve social, environmental, and economic conditions. The theoretical foundations of health-supportive environments and smart cities are the starting point for this entry, and from there, consideration is given to the emerging common ground between these theoretical positions. This entry then presents the "Smart Social Spaces" project. The final section is a synthesis of the theory and practice as a contribution to the evolution of an integrative concept called "Smart Healthy Social Spaces".

2. Theoretical Foundations

2.1. Health-Supportive Environments

The notion of a health-supportive environment can be traced back to the earliest human settlements [4] with an evolving understanding of how built environments affect people's health. Contemporary town planning, as practised in Australia and other western democracies, has its origins in the Industrial Revolution and associated 19th century urbanisation processes. The resultant rapidly growing, crowded, and unsanitary cities were targeted by the fledgling planning profession in its efforts to improve the health of urban residents [5]. This goal was closely aligned with that of the evolving discipline of public

health, which soon realised that the attainment of good health depended on many factors outside the individual, and well beyond the remit of medical and surgical interventions. The World Health Organization's (WHO) holistic definition embraces this understanding of health as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" [6]. Achieving this state was, and remains, a basic human right irrespective of "race, religion, political belief, economic or social condition" [6]. Planners, designers, developers, and builders have long been accorded responsibilities for promoting healthy cities. Significant advancements in building design, housing quality, neighbourhood layout, and city planning have resulted from efforts to prevent and treat disease. This is well illustrated in an illuminating historical analysis of the management and treatment of tuberculosis in South Australia. Collins and Lekkas [7] reveal how influential this quest for health was in promoting the development of town planning in that Australian state jurisdiction.

Formative linkages between planning and public health gradually shifted, and it was not until the latter part of the 20th century that concerns for health were once again linked with urban form. Suburban sprawl, with its accompanying low residential densities, car dependency, and long physical distances between people's homes and places of employment, was collectively identified as the major culprits in undermining good health (see for example [8–10]). These defining characteristics of contemporary urbanised, post-industrial cities make it difficult to be physically active on a regular basis. Resulting sedentary lifestyles are associated with many of the risk factors for chronic diseases that continue to plague modern communities—including a range of cancers, heart conditions, diabetes, depression, and dementia.

Underpinning the global focus on health-supportive environments is the seminal work of the WHO, creating and developing the "Healthy Cities" movement over the past three decades [11]. Healthy cities have been appositely defined as follows:

"A healthy city is one that puts health, social wellbeing, equity and sustainable development at the centre of local policies, strategies and programmes based on core values of the right to health and well-being, peace, social justice, gender equality, solidarity, social inclusion and sustainable development and guided by the principles of health for all, universal health coverage, intersectoral governance for health, health-in-all-policies, community participation, social cohesion and innovation" [11] (p. 4).

Many cities, especially in Europe and the Americas, have adopted the Healthy Cities "action domains", which form a framework of practical principles and strategies. These are summarised in Table 1.

Table 1. WHO Healthy Cities Strategic Framework.

Action Domains	Key Example Strategies
Improve city governance to address health and wellbeing	Establish local partnerships; promote accountability; undertake city health profiles and integrated city health development plans
Reduce/minimise health inequalities	Education about implications of health inequalities for all in society; measure inequalities; develop detailed actions
Promote health in all policies	Develop processes to integrate health and equity in local policies; ensure policy benefits embrace health; education to undertake health impact assessment
Promote community development and empowerment; create social environments to support health	Promote health literacy, community resilience, social participation and inclusion; encourage physical activity across the life course; facilitate healthy food access; address mental health issues

Table 1. *Cont.*

Action Domains	Key Example Strategies
Create built environments that support health and healthy choices	Create neighbourhoods that are safe, clean, and sustainable; address poor sanitation, noise, and air pollution; invest in healthy urban planning and design (e.g., cycling and walking infrastructure, access to quality green space)
Improve the quality of and access to local health and social services	Universal health coverage; culturally appropriate services meeting diverse community demand; well-coordinated primary healthcare with public health services
Plan for all people, prioritising the most needy	Ensure children have a healthy start to life; provide access to education for all; address ageism and healthy ageing; map the social landscape focusing on needs of vulnerable and disadvantaged communities
Strengthen local public health services and capacity to deal with health-related emergencies	Invest in health promotion and disease prevention programmes; address obesity; enhance capacity to respond to climate-change-related emergencies (e.g., natural disasters, epidemics)
Plan for urban preparedness, readiness, and response to public health emergencies	Work to strengthen an inclusive, evidence-based community emergency response that accounts for vulnerabilities; develop inclusive surveillance practices

Source: Developed from WHO [11] (p. 11).

The COVID-19 pandemic has served to strengthen the relevance of health-supportive environments, shifting long-held concerns about chronic non-communicable diseases to apprehensions about highly transmissible illnesses. This reawakening of community interest in health and wellbeing sits alongside changes in daily behaviours in work patterns, shopping habits, and modes of travel [12–16]. Even the design and layout of cities has been questioned, including the pursuit of higher residential densities under the banner of urban consolidation. This is very much associated with concerns about humans living in close proximity in the face of an extremely transmissible virus [17,18]. City residents able to work remotely during the pandemic initially abandoned urban centres for rural and regional towns. Added attractions included more affordable housing and the perception of higher environmental quality [18,19]. Nevertheless, the extent and longevity of these movement patterns and health-related apprehensions remain uncertain [17,20]. As the panic subsides about the voracity of COVID, especially given the availability of vaccines and effective medications, there is a realisation that the chronic diseases that have plagued global populations for decades are still present and must be addressed. COVID has provided an opportunity to focus attention on the social determinants of health, inequities across the population, and the importance of quality of life as central to wellness and happiness [21].

Nevertheless, the essential qualities of a health-supportive environment remain unchanged. These are places that make it easy for all people, no matter where they live or their economic position, to be physically active every day in their transportation and recreational activities. Access to fresh, nutritious food, which is culturally appropriate and affordable, is facilitated. Opportunities for social connection are prioritised, especially to combat loneliness and isolation, with an appreciation of caution when one is ill or particularly vulnerable to transmissible disease. Underpinning health-supportive environments is a healthy planet, which must be protected from the threat of catastrophic climate change and associated environmental degradation [22]. Put simply and starkly, all life is dependent on the health of the planet. Action to address a warming climate has direct benefits for

the wellbeing of animals, plants, and humans. Rising temperatures are affecting people's health, making it harder for many citizens to undertake health-supportive behaviours in excessively hot weather, such as being physically active in outdoor spaces or connecting with each other in natural settings.

The emergence of COVID is a salient reminder of the central role that the built environment continues to play in the maintenance of good health and the prevention of disease. Technological innovations and medical discoveries are crucial, but they are only a part of our response to keeping communities healthy and well. Understanding how the environment impacts human health—both positively and negatively—is now an established interdisciplinary area of scholarship and practice [23,24], which brings public health [25], town planning [26], and urban design [27] together, alongside the legacy framework of the WHO Healthy Cities. Post COVID health-supportive environments will continue to progress in response to readjustments in work patterns, commuter travel behaviour, and the extent to which communities inhabit local environments. A further part of this evolution will be the embrace of technologies as central to another developing movement—that of the smart city.

2.2. Smart Cities

While the notion of a smart city is relatively new, first identified in the US by corporate digital giant IBM in 2008 [28], it has had a rapid trajectory from a singular focus on technology to a more holistic and systems-based conceptualisation. An early and useful definition provides a clear understanding of the basic tenets: "a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create a sustainable, greener city, competitive and innovative commerce, and an increased life quality" [29] (p. 135). This has evolved so that smart cities embrace systems thinking, sustainable practices, and community engagement with technology and policy [28]. In Australia, there has been a focus on smart city activation across a range of scales (from local public space to precinct and neighbourhood levels), types of services (from waste management to communications, water and green infrastructure provision), ways of managing urban systems (timeliness and efficiency), community engagement (from service delivery to accessibility of data), and sustainable resilient governance [30].

Since its inception, the urban planning profession, along with policy and decision makers, have been taking great interest in smart cities and the application of technologies to address a range of challenges. Of particular concern is increasing pressure on basic city infrastructure due to rapid urbanisation and growing population density. Tapping into technology and data, the smart cities movement is developing digital services and tools to operate the city more efficiently, enabling evidence-based decision making to bring about tangible and responsive outcomes for the community. The concept of a smart city can embrace a wide range of infrastructure—both "hard" and "soft". The latter generally takes in governance and policy, cultural diversity and social inclusion, and education. Hard infrastructure relates to the buildings of a town or city, its natural resources, waste management, and transportation networks and modalities [31].

Some of the key technological trends that enable smart cities to deliver new solutions are networking and communication infrastructure, Internet of Things (IoT) and sensor technologies, cloud computing, and big data and data analytics [32]. Further, many smart city deployments focus on specific infrastructure, and there is a need to connect individual systems (silos) to provide aggregate efficiencies and support new services [32]. Nevertheless, smart city initiatives are not just about the technology; rather, they involve human intervention on many levels. We have argued previously [33] that to be successful, the complexity of smart cities project demands multidisciplinary expertise. Not only does this mean collaboration across various disciplines from urban planning, landscape architecture, and industrial design to software and hardware engineering, but also diversity of scale. This can range from furniture pieces to a public space, and then beyond to the street and suburb.

Therefore, in conceiving the smart city as much more than technological enablement, we now consider how it can specifically address health in terms of humans and the environment. Initially, we look at the current state of play and then move to detail our project, which brings healthy city and smart city principles together.

3. Health-Supportive Environments and Smart Cities: Emerging Common Ground

In recent years, there has been growing recognition of the value of integrating smart cities and healthy cities research and practice to address contemporary urban and health challenges. Two major trends can be distinguished in the application of smart city ideas to health:

1. The improvement of healthcare and health services.
2. The improvement of population health and wellbeing by reducing risk factors for chronic disease.

In the following sections, each trend is discussed in relation to the literature and some pertinent applications.

3.1. Smart Cities and Health Services

The adoption of technologies to rethink healthcare within the networking and sensing infrastructure of smart cities originated with the introduction of smart health to complement mobile health services [34]. Examples include providing real-time information via an interactive pole about pollution levels and amounts of pollen and dust. Applying advanced analytics to turn these data into insights by smart cities service providers could help people with allergies determine the safety of urban activities that affect their health. Another opportunity provided by smart city infrastructure is traffic management to help navigate an ambulance efficiently to an accident. The quickest route can be identified, and traffic lights dynamically adjusted to reduce the time to reach the emergency site [34].

Further, the application of big data and data analytics can support the pursuit of healthy behaviours in urban environments. For example, Boulos and Al-Shorbaji [3] highlight the importance of intelligent geospatial analytics systems to process and make sense of geo-located data in real time. This enables the identification of spatial health trends to monitor and improve health at both the population and individual levels. In addition, open data can be leveraged to improve governance of the healthy city. One such example is the City Health Dashboard (cityhealthdashboard.com, accessed on 30 June 2023). This provides area-specific data across the US on health status, health determinants, and equity at a range of geographic levels. The aim of the dashboard is to make resources widely available and easily accessible to encourage effective city and community-level action to improve health and wellbeing [35].

3.2. Smart Cities and Reducing Risk Factors for Disease

Smart cities can play an important role in achieving healthy city objectives. It has been argued that smart cities have better chances of becoming healthier cities by harnessing IoT technologies for the benefit of local populations [3]. Transparent digital and information infrastructure can enable citizens to be more informed, engaged, and empowered about the decisions that are made regarding their city. Further, such a digital platform enables urban dwellers to better self-manage their own health and wellbeing within the metropolitan setting [3].

Smart cities can promote health-supportive behaviours. An example here is the analysis of traffic data and pedestrian metrics to improve pedestrian safety and enhance walkability, thereby increasing physical activity as part of daily routines. Schneider [36] proposes using data from a social networking application for runners and cyclists, counting and mapping their activities to understand patterns of behaviour. This assists in identifying popular places most in need of better cycling and pedestrian infrastructure, as well as the provision of adequate shade, seating, bike repair stations, public toilets, and water fountains. Smart city traffic management can reduce time sitting in long lines of slow-

moving vehicles, thereby increasing wellbeing as stress is reduced [37]. Moreover, less traffic means reductions in air and noise pollution, which is associated with positive health outcomes for both people and their environment.

Mirroring our interests in smart cities and the enhancement of social life, previous studies have explored the potential positive health impacts of smart cities to improve social connection. According to Holt-Lunstad [38], "social connection has a protective effect on health and longevity", and research is needed to better understand how technology can bring people together. The importance of this for older people cannot be overstated, although it is essential to note that vulnerabilities to experiencing loneliness are not age specific [39]. In Australia and elsewhere, COVID has further exacerbated social separation and serious health implications of loneliness and isolation [16,40]. Chen and Schulz [41] provide evidence that Information and Communication Technologies (ICT) alleviate older persons' social isolation by connecting them to the outside world, assisting with social support, facilitating participation in valued activities, and helping to improve self-confidence. Levels of physical activity for older people have been enhanced through the use of digital technologies in the context of the WHO's Age Friendly City Framework [2]. Through this lens, further insights are offered about the importance of place and social connection in supporting older people's health. Apart from these studies, there is a general lack of research that investigates the social aspects of smart cities, which is where the research is positioned.

4. Smart Healthy Social Spaces: An Evolving Integrative Research and Practice Agenda

Local-scale projects directed at specific human-centred problems are often overlooked in bringing smart cities and health-supportive environments, including the WHO Healthy Cities, together. Innovative research and projects are needed to support people–place relationships and healthy urban living through the application of smart technologies in local public spaces. As cities become more compact and higher-density living is increasingly the norm, there is greater pressure for councils to provide and maintain public space amenities, making the neighbourhood liveable (this descriptor is frequently used as a proxy for health-supportive environment), productive, and socially sustainable for its citizens.

As noted by Vasilevska [42], open spaces—both "hard" spaces such as plazas, malls, and courtyards, and "soft" spaces such as parks, gardens, and nature reserves—provide settings for public gatherings, recreation, and visual relief from the urban landscape. As well as offering opportunities for exercise such as walking, running, and cycling, public spaces provide the chance to meet, helping citizens develop and maintain social ties, which subsequently builds social capital [43,44]. These spaces also assist in mitigating stressful urban lifestyles, especially associated with high-density residential accommodations [45].

During the pandemic, the importance of public spaces, especially local parks, increased as many individuals and communities sought regular respite in fresh air for both physical and mental wellbeing [16,40,46–48]. This was a pattern repeated worldwide [49]. In Australia's most populous state, it was found that "use of public spaces increased significantly during COVID-19 and remained high even as restrictions eased" [40] (p. 11). Having access to public spaces was further reinforced as "lockdowns" were maintained, travelling was significantly curtailed, orders to work from home were ongoing, and limitations on visiting 3rd spaces continued [50]. These are the spaces frequented between work and home such as cafes, restaurants, gyms, malls, and public libraries—the places that greatly shape our social life and create community ties and connections between individuals. Being lonely and isolated was acutely experienced by many individuals, and in turn, our collective awareness of the adverse health consequences of loneliness and isolation grew—and continues to do so [39,51].

As restrictions eased and urban life reemerged from the pandemic, city officials sought opportunities to reactivate abandoned public spaces and town centres. The "Streets as Shared Spaces Program" (https://www.dpie.nsw.gov.au/premiers-priorities/great-

public-spaces/streets/grants-for-councils, accessed on 8 July 2020), initiated by the NSW Government in June 2020, is an example of one such response. This program aimed to help local councils quickly install demonstration and strategic pilot projects to improve the attractiveness and safety of streets, paths, and plazas. A strong priority was the encouragement of economic activity back to urban centres while allowing users to keep a distance from each other by widening footpaths, converting carparks to parklets, and creating pop-up (that is, temporary) bike lanes. The legacy of the pandemic means that such spaces will only increase in importance as people work more from home for at least some of the week to continue to reap the benefits experienced during the pandemic [14,15]. The advantages of remote working include productivity gains for the economy as more goods and services are produced with the same resources. For the individual, improvements in wellbeing resulted from reduced hours spent commuting, leaving more time to care for family and to enjoy healthy recreation in local parks and gardens [14,15].

Given the changing role of public spaces and their contribution to supporting healthy living, the move to smart cities and the increasing use of smart technology more broadly can play a vital role in encouraging physical activities and social connections, which in turn reduce common risk factors for chronic disease. This opens new opportunities to provide well-designed, easy-to-access, and culturally appropriate public spaces that support urban dwellers engaging in healthy behaviours. Care must be taken to design these with known people–place relationship principles underpinning their planning, implementation, and maintenance; otherwise, the result may well be inappropriate public spaces.

In the next section, the Smart Social Spaces project is introduced as an example of how smart city technology can supplement the health-supportive nature of places.

5. Smart Social Spaces in Action

The Smart Social Spaces project was an interdisciplinary collaboration between academic researchers, practitioners, and local government officers [33]. Representing the Faculty of Built Environment at the University of New South Wales Sydney (UNSW), the University of Sydney, Street Furniture Australia (SFA), and the Georges River Council, the team was made up of industrial designers, city planners, a healthy built environment expert, a landscape architect, an environmental psychologist, and an architect. This was in addition to the industry and local government partners from similar disciplines but also including engineers, graphic designers, an infrastructure manager, tradespeople, parks maintenance crews, and a communications coordinator. The complexity of the project demanded the broad expertise in the multidisciplinary teams from across the partners, which is further elaborated in the authors' previous work [33].

The project provided an opportunity to develop, test, and prototype unique street infrastructure in the public domain. There were two over-arching objectives: first, to establish how technology can support the creation of more sociable, health supportive, and equitable public spaces, while also enhancing the quality and character of the public domain; second, to explore how technology, such as digital wireless sensors, can facilitate efficient and informed management and monitoring by local councils of their public space infrastructure.

A detailed discussion of the second objective is beyond the scope of this entry but can be accessed in Steinmetz et al. [52]. The focus here is the health and wellbeing benefits of the smart street furniture installations. Specifically, the aim of these new smart facilities was to increase the range of activities offered within the local council's urban parks and plazas, promoting health-supportive physical activities and social connection to address isolation and loneliness. There were two phases of the project involving specific smart street furniture installations. These are discussed below.

5.1. Phase One: Healthy Living Hardware Pole

The Healthy Living Hardware (HLH) Pole is a freestanding, multi-functional human-scale smart pole that aims to improve amenity and digital infrastructure in public spaces

(see Figure 1). The HLH Pole was originally designed by research team member Tietz and trialled in remote Indigenous communities of Australia to improve community health [53]. The newly configured urban iteration of the prototype provides access to electrical power, a water tap, lighting, a space for preparing and cooking food and making hot beverages, a place to charge a phone, and internet access—all contained within a space-saving vertical column. The Pole is also wired with sensors to transmit data to a Smart Asset Management Dashboard. Data comprise information about the Pole's utility use, the local micro-climate, and human movement. The Pole has a flexible architecture to accommodate additional technologies such as solar panels, digital community boards, CCTV, speakers, emergency button, and interactive maps. Modular design provides the capacity of each configuration to be responsive to the surrounding context and particular needs of the immediate community.

Figure 1. HLH Pole in an urban plaza and an urban park. Source: Authors, partly adapted from [52].

The HLH Pole was installed and tested in Georges River Council in November 2018 in different types of public spaces—one an urban plaza (Memorial Square, Hurstville, Sydney, Australia) and the other, a large green open space (Olds Park, Penshurst, Sydney, Australia). Both sites are busy, socially successful public spaces, well utilised by the community. Detailed behaviour mapping was conducted to investigate whether and how the HLH Poles provided opportunities to support social life and healthy living. Behaviour mapping is a systematic method to observe people using and interacting with their environments. It enables the real-time recording of patterns of use, revealing what people do in places, how users' activities relate to each other spatially, and how the space supports or hinders activities. These methods and results are fully detailed elsewhere for the reader [54,55].

The Pole introduced new activities, such as charging a mobile phone outdoors, and supported more traditional pursuits including food and drink preparation. Not having to pay for use meant that everyone was included. Social activities were facilitated and ranged from plugging in a speaker to play music together, to using the tabletop to support coffee

cups while standing around and chatting with friends. This was particularly evident in the Square, which is centrally located in a busy shopping centre, close to public transport, and frequented by many young people and workers. Given the novelty of the Pole, exploration by children and adults was observed as groups gathered, taking photos and enjoying each other's company.

In summary, the HLH Pole facilitated a range of freely available activities including eating, learning, working, collaborating, or playing with friends and associates—all of which support social connections in the outdoor environment. Activating the Pole in a town square and a parkland location illustrates the Pole's capacity to bring communities together in a range of settings including different types of parks, town centres, streetscapes, campuses, and retail or business precincts. Further discussion of this potential, especially considering the fundamental role of social connection for health and wellbeing, is presented in the last section of the entry.

5.2. Phase Two: ChillOUT Hubs

The second phase of the Smart Social Spaces project involved the development of an outdoor community space called the "ChillOUT Hub" (see Figure 2). Fully IT-enabled, the Hub accommodates smart furniture, solar power, and electrical charging points. Environmental sensors measure and monitor the Hub's microclimate, utility useage, and people frequenting the space. The Hubs aim to increase community sociability and connectivity, enable knowledge exchange, and provide flexible spaces for work and recreation. The ChillOUT Hubs were installed in February 2020 in three different locations, offering opportunities to understand how they perform in varying urban situations:

Figure 2. ChillOUT Hub in Kogarah. Source: Photos by Jackie Chan, with permission from Street Furniture Australia, industry research partner, 2020.

Belgrave Street, Kogarah: a pedestrian thoroughfare and public plaza in a busy medical precinct adjoining the town centre.

Macquarie Place, Mortdale: a footpath extension adjoining a shopping strip in a neighbourhood street.

Timothy Reserve, Hurstville: a park adjacent to a regional sports oval in a residential area.

It was hoped that a range of uses across the three sites would be supported—professional network building, social connections, incidental interactions in the public realm, enhancing safety with more people out and about, and providing access to restful green space, sunshine, and fresh air, especially for apartment residents with large households.

A comprehensive survey was developed to obtain feedback from users about their experiences using the differently located Hubs and their evaluation of the facilities—the survey and results are detailed elsewhere for interested readers [56]. We were particularly interested in understanding how the technology enabled healthy living by facilitating community connection (through known companions and incidental interactions with strangers), to immersion in a restful natural and green open space.

Incorporating smart features into traditional street furniture functions increased the range of activities undertaken by users across the three sites. Visiting the Hub to sit and take a rest, enjoy food or a coffee, and meet others were mentioned frequently. The most utilised features were seats and tables, with the provided shade also a significant attraction, although it needed to be improved to offer optimum protection from the harsh Australian sun. Interestingly, the available smart technologies were less important, with phone charging the most used feature. While the ChillOUT Hub encouraged people to stay longer at all three types of public space, the park setting was the most popular, with users staying for the longest times. Nevertheless, length of stay was related to different uses. Short stays were associated with workers eating lunch on their own or charging a phone, whereas longer engagement with the Hubs occurred when accessing Wi-Fi, and for caregivers, watching children playing nearby. The ChillOUT Hub encouraged people to come back, with just under half reporting frequent use. Older community members visited the Hubs more often than younger users. The older, more frequent users reported greater feelings of community connection as a result of being at the Hub. However, suggestions were made that safety and comfort needed to be improved.

In summary, the ChillOUT Hubs enhanced the quality of urban plazas and parks for users. They supported people's health by providing a place for social interaction and community engagement. The Hubs responded to a range of user needs from the provision of smart technologies to physical comforts that bring people together into natural areas supporting their health in different ways.

6. Smart Healthy Social Spaces: Integrating Technology and Place for Smarter Health-Supportive Cities

In this final section, we discuss how technology and place might evolve in an integrated way to advance the provision of health-supportive places in the form of "Smart Healthy Social Spaces". Using the example of the Smart Social Spaces project, the aim is to synthesise the theory and practice of smart cities and health-supportive environments (both the legacy of the WHO Healthy Cities and the broader healthy built environments research and practice) to progress this agenda across a variety of spatial contexts and with an appreciation for living with and beyond COVID. The departure point is the integration of healthy and smart infrastructure as activated in the Smart Social Spaces project described above, with full details for interested readers in the authors' other work [52,54–56].

The Smart Social Spaces project provides innovative and freely accessible amenities that enable all community members, from youngsters to older folk, across a range of cultural backgrounds and of varying abilities and economic circumstances, to regularly enjoy open air public spaces in natural settings close to home and work. Being with others supports mental health and physical wellbeing—just knowing there is a place to take shelter and rest (the Hubs) or a facility to enable checking one's phone if on a break from the office or home study, but still needing to be in touch with colleagues

(the HLH Pole), encourages more citizens to be out and about in green spaces, taking in the fresh air and sunlight. Opportunities for social and professional exchange have the potential to enhance community connectivity and reduce physical and social isolation, especially for older retirees, particularly if they spend most of their day at home. Free and equitable access to Wi-Fi and IT-enabled infrastructure promotes digital inclusion across the population, reduces the digital divide, and facilitates social connectivity from professional networking to casual "street corner conversations". The infrastructure provides a safe place for people across the life course to engage with the built environment and each other, thereby promoting broader civic engagement.

The Smart Social Spaces project also addresses many ongoing and post COVID concerns with the activation of different precincts, bringing to life public open spaces and facilitating work and study from home and changing commuting patterns, which are becoming entrenched as part of the (possibly unanticipated) legacy of COVID [13–15]. Local businesses will particularly benefit from increased public space and street activation in commercial precincts during the day and at night. Smart Social Spaces promote a culture of a dynamic, mobile, and networked workforce and local student population. Further, the design and amenities of Smart Social Spaces can support people experiencing financial challenges with limited access to home internet or adequate domestic space, particularly associated with high-density housing, to study or work effectively. With access to economic, educational, and social opportunities, the project provides a space for local business meetings, student interactions, and other networking opportunities. For those on a short break from work, at-home caregivers, or retirees living alone, the installations in parks, streets, and plazas invite and incentivise participation in health-supportive activities with others in a well-managed and safe environment. There are also possible uses for business promotions, advertising, and recruitment. These spaces can be substantially self-supporting through solar power, with backup support from the grid.

7. Smart Healthy Social Spaces: An Evolving Integration

Located at the intersection of the theory and practice of smart cities and health-supportive environments, the activation of the Smart Social Spaces project offers insights about supporting healthy urban living for all citizens. Through the provision of freely accessible user-friendly smart technologies in outdoor urban public space, community activities, social connection, and other health-enhancing behaviours are enabled, supported, and promoted (see Figure 3). Smart Healthy Social Spaces respond to reducing risk factors for chronic, non-communicable diseases and accommodating new work, study, and social behaviours in locally based environments that have emerged as a result of COVID.

Taking into account the theory and practice presented earlier in this paper, we now discuss the qualities of smart healthy social spaces and consider how the integration of technology and place might evolve to better support health and wellbeing in local urban neighbourhoods.

First, Smart Healthy Social Spaces can facilitate, encourage, and support social interactions and community connections. This is critical to address the high rates of loneliness and isolation increasingly reported in our communities, and which for many were acutely experienced during the pandemic. There are serious adverse health implications associated with social isolation: "social connection is a significant predictor of longevity and better physical, cognitive, and mental health, while social isolation and loneliness are significant predictors of premature death and poor health" [51] (p. 23).

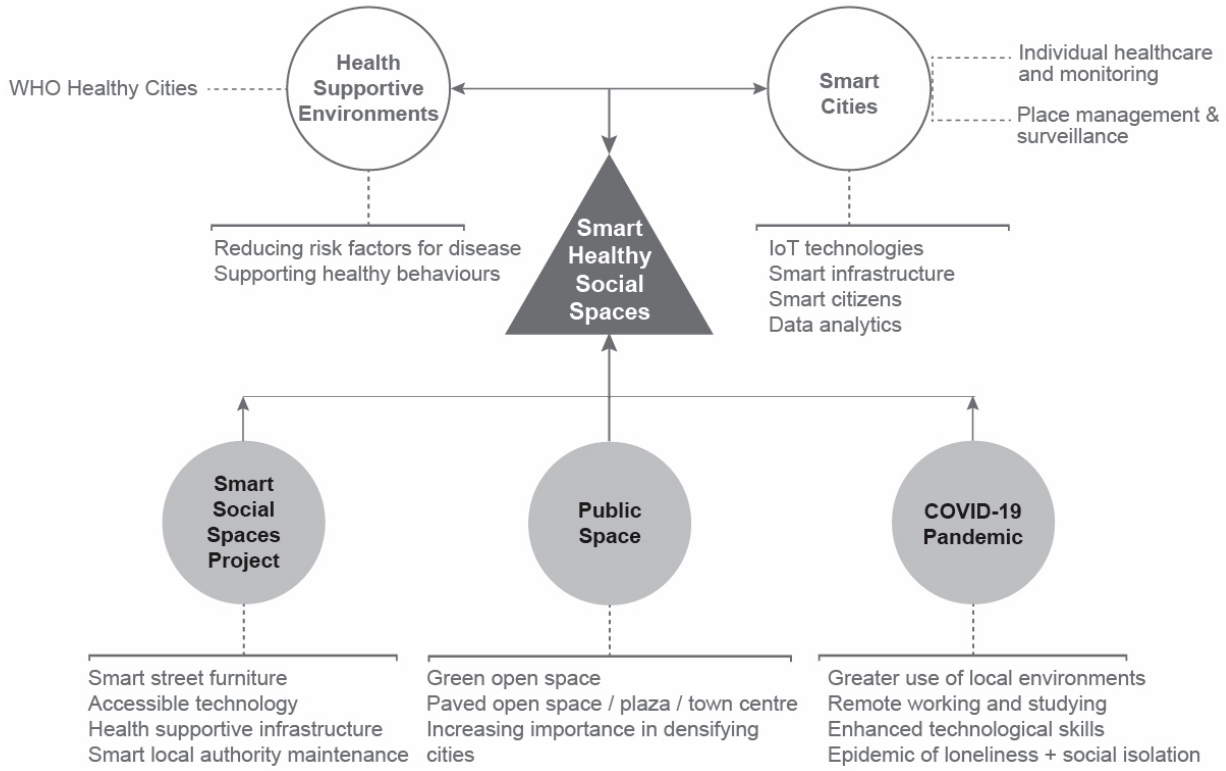

Figure 3. Smart Healthy Social Spaces—bringing health-supportive environments and smart cities together to advance health and wellbeing in public spaces. Source: Authors.

Previous studies have also demonstrated the impact of environmental factors on the level of social interaction [45]. Providing streets and public spaces that are safe, clean, and attractive are essential to support community connection [40,46]. One of the influential determinants of good mental and physical health is social connection and a sense of community supported by the built environment. Accessible, digitally enabled amenities have the potential to enhance opportunities for social interactions in a range of public spaces. Activation of the Smart Social Spaces project encouraged older people from diverse cultural groups to spend time together. In addition, workers and younger people focused on activities associated with the busy shopping and commercial area, close to public transport, where the smart street furniture was installed. Depending on the context, both geographical and demographic, health-supportive social connection can be enhanced in different situations via well-placed smart amenities. This has considerable significance for those living in apartments, especially if small and crowded, and working from home several days a week, which is likely for many professionals in a post COVID world [14].

Second, Smart Healthy Social Spaces increase opportunities for physical activity. This is one of the most important health-supportive behaviours as it reduces many of the risk factors associated with chronic disease. Interestingly, it was also found that consistently meeting physical activity guidelines offered protection from severe illness, hospitalisation, and death if COVID was contracted [57]. The built environment plays a major role in providing opportunities for physical activity—and connecting people together is frequently an added motivation to participate. Parks and gardens are essential for recreational activity [58], and when freely accessible and in convenient locations, opportunities for physical activity as part of daily routines are greatly enhanced. We found that the Smart Social Spaces project encouraged more frequent and longer visits in public spaces for those who already practise physical activities, and as an enticement to others to engage in this critically important health-supportive behaviour.

Third, Smart Healthy Social Spaces promote connection to nature. There are significant public health benefits from immersion in natural features and settings such as streets lined

with trees, green roof tops, community gardens, parks, and open spaces [59]. Extensive connective pathways for walking and biking further enhance the health benefits, particularly reducing mental stress and lack of physical activity associated with sedentary urban lifestyles. There is a need to better integrate natural processes and ecosystem functions with built environment and urban infrastructure in public spaces [59]. Installations such as the HLH Pole and the ChillOUT Hubs facilitate nature experience by promoting the use of parks and connection to green space through the provision of technology infrastructure such as Wi-Fi and electrical charging facilities. These public amenities, as Brkljačić et al. [60] (p. 151) claim, can "widen the range of possible 'outdoor' activities and attract more (young) people to parks". COVID has reinforced the importance of easy access for everyone to nearby natural green open spaces [40,46], and with more remote working post pandemic [14], this will endure as workers seek restful recreational opportunities in the hours gained back from commuting, as well as having the choice to vary their work environment from indoors to an outdoor setting.

Fourth, Smart Healthy Social Spaces enhance environmental sustainability and responsiveness to climate change. One of the most important elements here is the provision of heat-sensitive places that facilitate outdoor activities in hot climates. Public spaces have a significant role to play in providing cool, comfortable, social places—essential to vibrant city life, enabling residents to be active and socially connected in the outdoors as temperatures climb. The use of heat-sensitive approaches to public space and street furniture design, which incorporate smart technologies to create public spaces that provide thermally comfortable conditions, is essential.

WHO Healthy Cities embrace the four core qualities of an integrated healthy social space without specifically mentioning the term "smart city". Going back to the definition of "Healthy Cities" presented earlier, providing a place that promotes wellbeing for mental and physical health, that connects all community members equitably, and that champions environmental sustainability are central tenets of the WHO model. So too is the commitment to adapting to "transformative changes in the way cities, understand and deal with health, equity and well-being. . . continuously adapting to emerging priorities, knowledge, needs and sociopolitical contexts" [11] (p. 13).

Practitioners are also recognising the benefits of integration in contemporary placemaking and the need to respond to change. Late in 2021, the NSW Department of Planning, Industry and Environment published a guide focusing on public space and the embrace of technology [61]. A comprehensive range of spaces is included: outdoor places—parks, gardens, playgrounds, leisure areas, and beaches; public facilities—libraries, museums, galleries, and community centres; streets and their associated spaces. The principal benefits of smart public spaces are clearly and succinctly summarised (see Table 2), along with the presentation of local case studies, one of which is our Smart Social Spaces project (page 11). Social connection, safety, equitable access, and health are highlighted for people using the space within the broader benefits for space providers, managers, and local businesses.

Table 2. Benefits of Smart Spaces.

Who/What Benefits?	The Benefits
People Users of the space All ages, abilities, culturally diverse	Connects people to the space—creating a sense of belonging
	Connects people to each other
	Equity—enhances inclusivity
	Access—enhances accessibility
	Supports health and wellbeing
	Contributes to safety
	Engages users to talk about their experiences

Table 2. *Cont.*

Who/What Benefits?	The Benefits
The public space Outdoor Indoor	Increases resilience and efficiency
	Supports management
	Informs space activation and planning
	Supports maintenance—equipment, street furniture, infrastructure
	Contributes to safety
The local economy	Supports economic activity
	Supports local businesses

Source: Adapted from NSW DPIE [61] (p. 6).

8. Conclusions

This entry is part of the evolution of integrating health-supportive environments with smart cities [1,2]. The Smart Social Spaces project contributes to advancing this agenda, together with current theorisation and practice, and the opportunities that have emerged from the COVID-19 pandemic—the reawakening of community interest in health and wellbeing; a greater focus on local environments for work, study, and leisure; and the leap in technological familiarity and skills across the community. In a similar positive vein, Jasiński [17] argues that we can use the momentum for change to create "the post-pandemic city as a sustainable, friendly, green, smart and safe organism, responding also to other contemporary challenges such as environmental pollution and climate change" (p. 4). The activation of the Smart Social Spaces project demonstrates how innovative and collaborative research and practice can effectively advance this agenda. The ChillOUT Hub and the HLH Pole activated different public spaces, encouraging community members to connect and enjoy outdoor health-supportive activities together. There are cautions, and we need to be mindful of citizens' privacy concerns and local government authorities substituting data collection for on-the-ground staff with their in-depth local knowledge and specialist expertise. This, however, does not detract from the possibilities that smart cities offer health—both for individuals and the planet as a whole, especially as we navigate increasing temperatures and the urgency of cooling urban environments. Smart cities and healthy cities can work together for everyone's benefit, heralding new and creative opportunities into the 21st century. Ultimately, both are seeking "...sustainability, quality of life and well-being from interventions in the environment and valorization of social capital in an urban and globalized society... the materialization of this search depend on the efforts of various sectors, institutions and intersectoral policies" [62] (p. 1). It is the recognition of what different approaches can bring, and the willingness of all to work in collaborative ways, to realise the best health and wellbeing outcomes for the community in the places they love and use every day.

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Informed Consent Statement: The research presented here comprises a range of different research methods. Only one part of the research involved surveys with respondents. Questionnaires were filled in anonymously and participants were not asked any identifying information such as their name or address. There are no signed informed consent forms from subjects.

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