Technological implications for planning and designing human-centred cities

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Abstract

The 4th Industrial Revolution characterized by the merging of info-tech and bio-tech will overturn existing modes of living and production, creating new spatial opportunities. The recent movement of counter-urbanization can be understood as urbanites taking advantage of info-tech and flexible working to explore new and more comfortable life. The 4th Industrial Revolution characterized by Artificial Intelligence (AI) and Internet of Things (IoT) can offer technical supports for making urban life more human-centred. To explore the connection between technology and urban planning and design practice, a more humble and inclusive understanding of the term "human-centred" is provided, stressing humans' deep connections with other species in the web of life. Meanwhile, three fundamental trends of the 4th Industrial Revolution are discussed; they are: job automation, new economy and industry, and flexible working. Following these trends and the new conception of "human-centred", three principles are proposed for the planning and design of future cities: 1) Interwoven nature, which emphasizes a tight integration and harmonious co-existence of the built and natural environment; 2) Attraction-driven, which stresses the value of natural and cultural sites at non-central locations; 3) Dispersion, which encourages a decentralization and more equitable allocation of urban resources.

Keywords

the 4th Industrial Revolution, human-centred city, future city, urban planning/design

Introduction

Cities of the 21st century are facing unprecedented challenges. Environmental degradation and sustainability are perhaps the most urgent agendas of human societies. And cities, or the built environment in a broader sense, will play a significant part in tackling these issues. Adding to the challenges is the impact of new technologies. Humanity is at the doorstep of the 4th Industrial Revolution, which will bring more radical changes than previous revolutions with steam engine, electricity, and Internet (Bonciu, 2017). Historian Yuval Harari (2016) characterizes this revolution as the merging of info-tech, especially AI, and bio-tech, which will shift technological impacts from disrupting large-scale ecological systems to disrupting micro-scale biological systems inside the bodies of organic life. He further predicts that a potential ideological transition from "humanism" to "dataism" would change on how we lead our lives and do our work.

On the surface, the 4th Industrial Revolution will be an all-round transformation of production and daily life by AI. But on a deeper level, it will be a process in which humanity reinvents its own value in the face of highly intelligent machines. Humans must learn how to survive and coexist with AI as it begins to surpass human capabilities in more areas. In this process, Information and Communication Technologies (ICT) may enable humans to leave central cities and explore new livelihoods. They can also be used for more refined understanding, renewal, and preservation of cities and natural environments.

The recent movement of counter-urbanization in which some urbanites leave central cities in pursuit of a simpler lifestyle can be understood as people taking advantage of information technology and flexible working arrangements to explore a new and more comfortable life.

At the moment, most cities in the world are still products of modernist planning approaches. Yet, the long-practised modernist concept of urban planning and design, proposed a century ago (Corbusier, 1929), is unable to cope with challenges of the 21st century. Modern cities are planned and designed based on the principle of maximum economic efficiency (Ratti & Claudel, 2016, 19). Under such a paradigm, urban spaces have been divided into areas of housing, working, production, consumption, leisure and so on (Mitchell, 1996, 164). Buildings of the agricultural age which were more human-scale have mostly been replaced by skyscrapers to maximize economic return of a lot. And to connect and accommodate these giant structures, roads that are not designed for low-speed pedestrians but for high-speed vehicles were built, determining the structure of cities. Despite huge efficiency gains, modern cities have brought about non-negligible social and environmental problems, such as the deprivation of street vibrancy and community trust (Jacobs, 1962), traffic congestions (Arnott & Small, 1994; Falcocchio & Levinson, 2015), and air pollution (Cohen et al., 2004). With the old problems persisting while new technological revolutions arriving, modern cities will face more complex challenges.

What can cities and the makers of cities do today? Apart from making good use of the 4th Industrial Revolution to tackle existing urban issues, urban planners and designers need to understand the trends of the 4th Industrial Revolution and, through strategies of spatial and environmental design, guide this process towards a more sustainable and human-centred scenario of production and daily life. The history of human settlements shows that the means of communication and transportation determine the form of a city (Batty, 2018, 71). Meanwhile, cities have been built according to different narratives with a basic format of "what a city is and how it works" (Lynch, 1981, 71). For instance, cities of ancient times were built as ceremonial centres while those of the industrial age were built to work like machines (Corbusier, 1929) or organisms (Geddes, 1915; Howard, 1946). With the imminent 4th Industrial Revolution, a proper narrative is that cities should be more human-centred, promoting the comprehensive development of individuals as well as the harmonious co-existence of the built and natural environments.

To write up such a narrative, this paper first offers a new understanding for the term "human-centred". Then, three far-reaching trends of the 4th Industrial Revolution pertaining to urban life and urban space will be discussed. Finally, the paper proposes three planning and design principles for the creating more human-centred built environments. Just as Le Corbusier proposed the Radiant City to address issues of the old Parisian towns being unable to accommodate a modern and healthy urban life, the three principles offer planners and designers possible strategies to embrace and respond to the challenges in a new era that are tightly linked to the mentality of dataism.

A new understanding of "human-centred"

For a long time, human-centred discussions in the field of urban planning and design have focussed on how spaces in cities should meet the various needs of human beings. Theorists like Gehl (2011) and Jacobs (1962) have criticized modernist planning's doctrines that prioritize a city's economic and mechanistic efficiency rather than the well-beings of its inhabitants. Relevant studies have looked at different aspects of meeting "human-centred" needs, including health and safety of citizens (Corburn,2009; Dumbaugh&Rae,2009), urban dimensions perceived by human beings (Long & Ye, 2016), or the responsiveness of urban infrastructures meeting citizens dynamic demand(Andreani et al.,2019). This topic has also been expounded by the general field of design focusing on human dignity and human rights (Buchanan, 2001).

By space and scale, cities in the agricultural era were arguably more human-centred. According to urban theorist Camillo Sitte (1965), many medieval towns are in accordance with human scale, namely what individuals can comfortably experience and appreciate. They represent an integration of art and practicability, as they were adapted to local conditions and planned from the artistic and pragmatic preferences of the residents (rather than from the viewpoint of "God" overlooking a city). The "human-centred-

ness" of these old towns can be attributed to the low productivity of the agricultural times, when all urban functions and activities had to be performed by biological labour. Thus, the scale of cities was consistent with the walking capabilities of humans or livestock, and the experience of cities fitted humans' natural perceptions.

Entering modern age, cities created by the Industrial Revolution are much less human-centred. Density and efficiency are the hallmarks of modern cities, which were designed to be sophisticated machines for the smooth processes of value creation. Urban roads became vehicle-centred (Gehl, 2010, 3 – 8) while high-rise buildings for efficient collective working and living replaced moderate buildings that were closer to human scale, causing a feeling of alienation to individual citizens (Gifford, 2007). It can be said that the industrial civilization centres more around the collective boon of human beings rather than the well-being of individual residents.

However, whether it be the individual-scale towns in agricultural age or the collective-scale cities of the industrial age, the explorations in space making seem to separate human beings from other species and from the entire network of life. Such a human-only perspective is unsustainable. A new and more enriched meaning of "human-centred" is needed. In the age of the 4th Industrial Revolution, the conceptualization of "human-centred" should not only be in the pursuit of more diverse and customized human needs, but also unify these needs into the network of life. Here we can resort to Fritjof Capra's discourse of "Deep Ecology" (1997, 3 – 13) to establish such a more inclusive conceptualization.

According to Capra, our old methods of governing the planet are insufficient and unsustainable and we need to re-identify our positions in the ecological system. He points out that "Shallow Ecology" views humans as "above or outside of nature, as the source of all value", but "Deep ecology" does not separate humans from the natural environment. It sees the world not as a collection of isolated objects, but as a network of phenomena that are fundamentally interconnected and interdependent. "Deep ecology" recognizes the "intrinsic value of all living beings and views humans as just one particular strand in the web of life". It is grounded in eco-centric (earth-centred) values, calling for a radically new system of deep ecological ethics. Capra's thesis sets up a more humble understanding of being "human-centred", which considers not only the fine and complex individual needs but also humans' intricate association with the web of life. Fortunately, trends of the 4th Industrial Revolution can offer opportunities to meet Capra's high standard of being "human-centred".

Technological trends relevant to city making

As modernist planners (e.g. Le Corbusier) adopted achievements of the Industrial Revolutions to create their "future cities", planners and designers of the 21st century need to take advantage of the 4th Industrial Revolution to give life to the next generation of cities.

The built environment is inert, hard to be transformed physically (Batty, 2018, 91) compared to industrial products like Apps, furniture, or automobiles, which can quickly adapt to people's shifting preferences. Hence, amongst the kaleidoscope of technological trends, planners and designers need to pinpoint and grasp those long-term and fundamental trends relevant to spatial use and spatial design. For instance, in the case of Autonomous Vehicle (AV), compared with the evolution of vehicle form or its operating system, a more game-changing trend may be the scenario that AV could one day completely replace conventional cars as we know today, just as cars replaced carriages a century ago.

There are three long-term technological trends that are significant enough to alter urban form and design paradigm, they are: job automation, new economy and industry, and flexible working.

Job Automation

Job automation will be an inevitable result of AI's impact on the workforce. For a job, when machine does it better and cheaper than human, it becomes economically logical that machine should take the job. There has been such a wave of job automation during previous Industrial Revolutions, when machines replaced humans to perform most agricultural and some manufacturing work. In the era of AI, more advanced machines could replace humans to perform more physical and intellectual work (McKinsey Global Institute, 2017). The job automation during previous Industrial Revolutions led to human's migration from farmland to cities. With a new round of job automation, we shall ask: will citizens as we know today move to somewhere else or become a different type of people based on the work they do or places they live?

The association between job automation and how urban spaces get transformed accordingly can be elaborated in the case of AV. If AV performs much better than human drivers, then the automation of driving will be inevitable. In addition, AV, together with the idea of shared mobility, will redefine car industry because of a changed mindset of car ownership (Duarte & Ratti, 2018). A car equipped with AI in a network of smart infrastructures will be able to take care of itself when not used. They can find a cheap and compact place to park and come pick up their users when called upon. The linkage between owners and cars in the form of having a car sitting on a close-by parking spot will be substantially loosened. Thus, the maturity and full adoption of AV will render many parking spaces obsolete - one compact autonomous garage may fulfil the parking demand of an entire neighbourhood, which creates opportunities to transform the freed-up urban spaces that are originally for parking for more meaningful purposes, such as housing, park, libraries, community centres and so on.

The same logic can be applied to other professions. When job automation in a certain industry, such as retail, manufacturing, or those that are being or will be impacted by large language models (e.g. ChatGPT), starts to invalid certain types of space or architecture, it becomes an

opportunity to re-purpose these newly available spaces.

New economy and industry

What comes along with job automation is the emergence of new economy and new industry. Job automation and new industry are two sides of the AI revolution, presenting both opportunities and challenges for governments and companies. On the one hand, new economies and industries will create new jobs and professions. A myriad of new products and services that are heavily dependent on data will be created when IoT matures (Rao & Prasad, 2018). In essence, ubiquitous sensing and various algorithms will reveal previously hidden layers of the physical world, generating massive amount of new data. And, with the help of different AI applications, new values will be created with these data. For instance, Microsoft is developing AI for Earth[1], a portfolio of AI-infused "Earth applications", which will help monitor, model, and ultimately manage Earth's natural systems.

On the other hand, governments may have to take care of those whose jobs are automated by machines with either re-employment training or basic provision of social security. As mentioned earlier, we have seen such a workforce shift when human societies transitioned from an agricultural civilization to an industrial one a century ago. Farmers became workers in factories and offices, and modern cities were the result of such a transition. In our time, a key question becomes: will there be enough new jobs created for the potentially displaced workers? Or more fundamentally, will human beings still be valuable in future economies? The Mckinsey Global Institute (2017) holds a rather optimistic view that as new industries emerge, enough new jobs will be created.

Human beings used to devote their labour or intelligence in exchange for living materials and monetary reward. When people can no longer sell their effort for these rewards through existing jobs, how will they keep themselves valuable in future economies? Perhaps in new economies, the value of people will no longer be limited to driving a vehicle, cleaning an apartment, conducting ordinary diagnosis, or providing basic professional consultancies; their value will be manifested in undertakings of more real social and environmental benefit, such as spending more time knowing better about themselves, learning about bio-diversity, educating kids, conducting creative works, or exploring outer spaces. The 4th Industrial Revolution requires human beings to reinvent their values that cannot be matched by machines. In confronting the ever-intelligent machines, going into professions that involve human interaction, unpredictability, and creativity seems to be a viable option for human beings (Tegmark, 2017, 118 – 129).

Compared with job automation's indirect space creation through the invalidation of existing spaces, new economy and industry may generate new spaces in more direct ways. These new spaces should be well understood and designed to become new anchor points for future urban settlements.

Flexible Working

In the meantime, another important long-term trend that will be relevant to urban space is flexible working. Flexible working can be defined as: a work practice that involves members of an organization substituting a portion of their typical work hours (ranging from a few hours per week to nearly full-time) to work away from a central workplace - typically principally from home - using technology to interact with others as needed to conduct work tasks (Allen et al., 2015). This emerging mode of work has gained huge momentum after COVID-19 (Aksoy et al., 2022). Apart from Work-From-Home (WFH), third places such as coworking space, coffee shops, and libraries can also accommodate flexible work activities (Di Marino&Lapintie, 2017).

Currently there are different forms of flexible working. An extreme case is Work-From-Anywhere, in which employees work completely remotely and thus become able to live far away from their firms (Choudhury et al., 2021). A more common practice is the hybrid model in which workers can remote work for one or two days a week (Bloom et al., 2024). Recently, the U. K. government has also started a compressed four-day week model, which in some cases is reported to outperform the hybrid model (Hogg, 2024).

It is believed that flexible working will give rise to new patterns of urban space. This has been discussed back in the 1990s when the Internet first emerged. William Mitchell, an influential urban theorist, argued that remote working could reduce the reliance on urban centres for both individuals and organizations, giving them more location choices to settle (Mitchell, 1996, 1999). In his case, WFH becomes the norm, workplace is also dwelling place, and various pedestrian-friendly live-work communities emerge at suburban, exurban, and remote areas, particularly at 'unique natural environments, culturally resonant urban settings, and local communities that hold special social meaning' (1996, 104). Such urban forms imply zero or very short commutes and a more equitable distribution of resources.

During COVID-19, economist Matthew Kahn gathered past findings about flexible working and wrote about possible scenarios of how workspace will be transformed by the shifting activities of workers and firms (Kahn, 2022). At the individual level, Kahn believes that WFH-eligible workers can move to many possible destinations, a prediction not dissimilar to the thesis of Mitchell. But Kahn goes further to imagine that such a dispersion of talent will create local demand for services provided by non-WFH workers, such as house cleaning, garden care, baby-sitting, and so on. This will facilitate the development of local communities. At the firm level, Kahn presents the competition between the traditional power of agglomeration economy and the increasing force of decentralizing work activities. Firms will have to decide where to settle down and how much office space to rent or buy. To the extreme, Kahn imagines that some firms may experiment arrangements similar to the WeWork model - renting out a hotel suite to hold brainstorming sessions or client presentations. Consequently, these companies

become nomadic as they temporarily arrange face-to-face meetings of different subsets of workers during particular time slots.

Scenarios of these influential scholars have not fully materialized, but in real life there are already traces of their prophecies, such as emerging workspaces that are created not by building brand-new office towers in CBD but by renewing abandoned industrial sites that hold unique social or cultural memories at non-central locations. Recognizing these trends, urban planners and designers can be more proactive in space making and achieve the more equitable resource distribution envisioned by Mitchell.

Planning and design principles

Job automation, new economies, and flexible working will call for appropriate spatial responses on the part of urban planners and designers: how to create built environments that promote both the realization of human value and sustainability objectives? Does it simply mean adding more plants in the built environment or designing public spaces that encourage more social integration? Despite inevitable challenges, the three trends also bring opportunities, as a data-driven society is possible to take care of diverse individual needs and the restoration of ecological systems. It is how to translate these non-spatial trends into planning and design strategies that matter.

There have been some explorations for this matter. Mitchell's thesis on "Recombinant Architecture" (1996, 47–107) provides initial answers that different types of architecture will be transformed by the interference of digital technologies for respective social and economic activities. A bit later his e-topia (1999, 147 - 154) proposes five points of design and planning strategy: Dematerialization, Demobilization, Mass Customization, Intelligent Operation, and Soft Transformation, which summarize fundamental characteristics of urban transformation in the age of information. Entering the 21st century, relevant views were more careful, such as Michael Batty's prudent contention that the form of future cities is unpredictable and may no longer follow the complex and ever-changing functions (Batty, 2018, 70 – 91), or Carlo Ratti's idea of invoking public debate about new spatial possibilities based on current technologies, which acts as a natural selection that steers technological development toward the most desirable future (Ratti & Claudel, 2016, 3 – 13).

The early bold exploration of Mitchell and the later careful arguments of contemporary scholars are undoubtedly valuable. However, planners and designers will further benefit from more actionable strategies. The three trends discussed above imply that new urban spaces can emerge in three ways: 1) invalidation of old space, making room for new space; 2) direct creation of new space; 3) revitalization of existing space through technologies. Following these mechanisms, three planning and design principles are proposed here for the creation of more human-centred built environments. In fact, some of the principles have been suggested by academia or adopted by the industry. Expounding them together establishes a comprehensive package for planning and design professionals.

Interwoven Nature

The principle of interwoven nature means a more organic integration and more inclusive co-existence of human habitat space and natural ecological systems. It stresses the harmony of bio-diversity in designing the built environment, achieving urban liveability through the interweaving of building ecology and natural ecology.

The fine management of urban spaces supported by AI and IoT technologies can potentially release a great amount of space, making room for the interwoven co-existence of different ecological systems in an urban environment. Public spaces not only open to humans, but also to plants and animals, so that plazas, streets, and courtyards become a series of connected parks and gardens while building facades also become homes to different species instead of lifeless vertical surfaces. A built environment interwoven with ecological systems will generate more urban greenery, reducing the heat in cities (Bowler et al., 2010) and augmenting cities' ability of air cleaning (Popek et al., 2013) and water retention (Monteiro & Castro, 2019). This strategy is directly consistent with Capra's idea of "Deep Ecology" that the web of life and the network of phenomena are fundamentally interconnected and interdependent. In addition, proximity to nature adds to the psychological and physiological well-being of humans, such



Figure 1. Singapore, a garden city (source: https://www.smartcitylab.com/blog/urban-environment/singapore-transformation-garden-city/)

as alleviating stress and anxiety, reducing aggressive behaviours and crime levels, accelerate healing for hospital patients, and promoting physical and social activities (Beatley & Newman, 2013; Demuzere et al., 2014; Soderlund & Newman, 2015).

Singapore has been at the forefront of implementing the idea of Interwoven Nature. In the new generation of buildings in Singapore (such as the Changi Airport in Figure 1), we often see designers carefully integrating vegetation into building facades or vertical spaces. With more urban spaces to be freed up by the 4th Industrial Revolution, such design strategies can be more extensively exercised.

Meanwhile, feasibility and practical issues should not be overlooked. One square foot more land for trees means one less for humans; plants not only occupy ground footage, but also demand underground space of greater width and depth. This is a conflict between the short-term economic benefit and long-term environmental gain. It requires planners and city governors to reasonably orchestrate the natural elements. Also, landscape work should adapt to local geographical conditions, such as climate and topography. Specifically, the selection of plants must follow professional knowledge to prioritize the security and health of human residents. After all, human beings are the main inhabitants of cities.

The implementation of interwoven nature could produce a balance between planned and unplanned landscape, meaning that nature is "invited" to participate in the planning and design of urban landscape, just as William Kent's landscape design at Stourhead in the 18th century. In this way, the combined force of human and nature will complete a dynamic picture that reveals local characteristics. According to Kevin Lynch's standard, a good city should allow its residents to directly perceive various natural processes, including the shifts of weather, season, and life stages of living things (1981, 138–139). In an environment intertwined with nature, citizens will be able to experience these processes and develop a mindset of being an integral part of ecological systems.

Attraction-driven

The principle of attraction-driven suggests that city planning and design take advantage of cultural and natural heritages when locating new towns or renewing old ones. This idea derives from Mitchell's judgement about local attractions which he believed will regain popularity thanks to tele-communication (1999, 76).

The idea of attraction-driven will gradually change the planning paradigm of prioritizing central cities or city centres. An important goal of future cities of the 21st century is to support human's comprehensive development and the restoration of ecological systems, rather than 20th century's pure pursuit of efficiency and scale economy. The making of modernistic cities led to extensive developments, which not only worsened urban living environments but also destroyed many cultural and natural resources (Hough, 2004). In addition, the concentration of resources in big cities, such as job opportunities, healthcare service, education, and other

amenities, has left the humanistic or ecological resources in remote areas under-utilized or declined (Li et al., 2019).

New economies and flexible working will potentially allow more non-central locations to prosper. AI and IoT may gradually invalidate the old planning ideal of achieving efficiencies through proximity and agglomeration, freeing a city's site selection and program arrangement from the old mindset of prioritizing the convenience of commodity production, exchange, and transportation. The idea of attraction-driven is in line with various possible future economies, where service sector and knowledge work will be the main economic actors. Urban agriculture (Pearson et al., 2010) and personal fabrication (Niaros et al., 2017) can distribute some farming and manufacturing activities into communities; AV and high-speed trains will turn many remote areas into easily accessible places. All these changes will provide new ur-



Figure 2. The Baiyangdian Lake in the Xiong'an New Area (source: http://www.xinhuanet.com/english/2019-01/02/c_137715153_14.htm)

ban location choices. New settlements can go after comfortable climate and agreeable sceneries or areas rich in cultural or historic heritage.

The site selection of the Xiong'an New Area, a flagship future city planned near Beijing, is a good example, in which the entire planning centres around the Baiyangdian Lake (Figure 2), the largest freshwater lake in the North China Plain (Zou & Zhao, 2018). Some may argue that the Xiong'an New Area, planned and built around Baiyangdian Lake, is simply a traditional satellite city of Beijing, aiming to alleviate the population pressure on Beijing. However, this is not the case. Similar to the Quayside project in Toronto's waterfront and Toyota's Woven City experiment in Tohoku, Xiong'an New Area is an exploration of future cities in terms of planning, construction, and operation. The main characteristic of Xiong'an New Area is that it uses the natural resources of Baiyangdian Lake as an anchor, leveraging advanced urban technologies to alleviate Beijing's population pressure while exploring an urban form that harmoniously integrates the built and natural environments. It aims to provide a model for future cities in China and around the world.

Not only should extant high-quality cultural and natural heritage be utilized, but new attractions can be actively created by revitalizing existing sites. For instance, the transformation of obsolete industrial facilities into creative and recreational areas creates new attractions for post-industrial cities. Successful cases include the Beijing's 798 district [2] and the high line park of New York [3].

Dispersion

Dispersion refers to the decentralization of economic activities and all associated spaces, including workspace, housing, healthcare, and recreational spaces. This is not only a spatial trend that will become more possible under the momentum of flexible working and the thriving of digital platforms, but also a strategy that planners and designers can actively adopt in making urban spaces. The idea of dispersion is borrowed from one of Mitchell's core arguments in his theses of "Recombinant Architecture" and e-topia. There is evidence that many physical transaction spaces such as small shops or big trading centres have started to shrink or even disappear (Zhang et al., 2016).

Development in ICT and transportation will provide the infrastructure that help realize the vision of dispersion. Transportation of information, people, and goods will be more convenient, creating more possibilities to pull resources (e.g. healthcare, education, housing, investment, and employment) out from existing urban centres. Similar to the relation between "job automation" and "new economy and industry", "attraction-driven" and "dispersion" can be seen as two related spatial ramifications of the new economic logics. What is more exciting to speculate is that these newly created urban areas from dispersion may become sites where new occupations emerge, alleviating the issue of job automation.

Since the revolution of ICT will create new economic opportunities that are more reliant on tele-communication instead of physical loca-

tion (Hjorthol & Gripsrud, 2009; Vargas-Llave et al., 2020), dense and highly concentrated urban agglomerations may be relaxed. In other words, one can expect more poly-centric metropolitan regions characterized by dispersed local agglomerations. Poly-centric can become typial of future cities, which is more preferable for its equitable resource distribution. Specifically, small-scale clusters may scatter around major metropolitan centres. Each cluster may be confined to a small radius (e.g. 15min walking) and offers sufficient and diverse amenities for health and recreation. Efficient and clean self-driving transportation systems connect different clusters while walking and cycling are the dominant means of transportation within the cluster. Live/work housing unit is the main building type that accommodates various forms of flexible working.

The example of the Xiong'an New Area can again illustrate the principle of dispersion. The promotion and planning of the new area is an inevitable choice to relieve the spatial and environmental stress of Beijing as a mega-city. The plan takes advantage of the ecological resources of the Baiyangdian Lake to accommodate Beijing's non-capital functions (Figure 3). Such a dispersion would not only make Beijing more liveable by optimizing its urban functions, but



Figure 3. A proposed bird observatory and eco-museum in the Xiong'an New Area (source: https://tlslandarch.com/portfolio_page/xiongan-new-area/)

would also help achieve a more coordinated development of the region by rationally harnessing the surrounding natural resources (Zou & Zhao, 2018).

The idea of dispersion can not only create new settlements around natural or cultural attractions, but also improve the space quality of existing urban environment. Dispersion is not meant to go against the law of urban agglomeration, but to encourage more agglomerations around unique local environments.

Challenges

However, one should anticipate challenges that might defy planners and designers' visions, challenges like the counter-urbanization movement in which suburban or rural areas are selected over urban centres. Counter-urbanization will have different effects on different cities. In addressing the phenomenon of counter-urbanization, urban planners and designers should collaborate more closely with economists and sociologists to analyse the gains and costs based on specific characteristics of each city. It can be treated similarly as the trends extrapolated from technological development earlier in this article – the phenomenon should first be well understood by urban professionals and then be utilized as opportunities to promote more equitable urban development. In addition, more scientific or engineering methods, such as machine learning, statistical modelling, or agent-based modelling, should be incorporated into urban planning and design practices.

Perhaps the biggest challenge does not lie with urban planners or designers, but with society as a whole. This challenge tests if society, particularly tech giants and governments, has the ability and wisdom to fully harness the potential of the 4th Industrial Revolution on one hand, and properly accommodate those being displaced on the other. Therefore, it requires not only the knowledge and capabilities of scientists and engineers but also constant reflections and debates among economists, legal scholars, philosophers, and ethicists on the risks and opportunities arising from the interactions between humans and machines as well as humans and nature.

Planners and designers shall actively embrace the potential of new technologies, while remaining keenly aware of phenomena like counter-urbanization and respecting any changing circumstances. Many technological trends and their corresponding spatial outcomes are already predictable, and planners and designers will face experiments similar to those undertaken by the modernist pioneers a century ago. For example, when traditional parking lots are no longer needed, what should be done with the vast freed-up spaces? When autonomous driving becomes the norm, how can street and public spaces transform? When remote working takes up half of our work time, how should residential units be planned and designed? When low-altitude transportation and the low-altitude economy arrive, how can the new transportation networks be designed? This time, we hope that in our planning and design, a more human-centred outcome can be achieved.

Conclusion

Industrial Revolutions more than a century ago brought us enormous power to alter natural environments and build cities that support life of billions. The revolution of the Internet and digital technology added another layer of virtual existence to the physical environment. However, urban life turned out to be neither human-centred nor sustainable. An eco-centric mentality emphasizing the deep connections in the web of life can help construct a new understanding of human-centred development, which is more compatible with today's urgent agendas of sustainability.

Meanwhile, three long-term trends under the imminent 4th Industrial Revolution will bring about opportunities and challenges for creating more human-centred cities. These trends include job automation, new economy and industry, and flexible working. The respective changes in production, economic operation, and urban life will have spatial consequences that need to be properly harnessed by urban planners and designers.

Embracing and responding to these foreseeable trends, three urban planning and design principles are proposed, namely Interwoven Nature, Attraction-drive, and Dispersion. They promote the co-existence of the built and natural environment, equitable allocation of urban resources, and more balance and diverse integration of work and life. These principles demand innovative ways to conceive how urban functions should be arranged, how the built and natural environment should coexist, and how new types of urban life can be created.

Discussions about human-centred urban spaces become more relevant and urgent in the context of the 4th Industrial Revolution, because ideas of "human centred" or "humanism" that have developed for centuries since the Renaissance and have infiltrated into all aspects of life are about to be shaken by the ideal of "dataism". Machines have started challenging humans in capabilities, ethics, and value judgement in unimaginable ways. Therefore, topics about human-centred city, humanistic society, and the impacts of data paramountcy on urban space and planning practice demand more serious and comprehensive conversations. Urban planners and designers can and should take an active part in utilizing influential technologies and creating more human-centred built environments.

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Notes

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