The influence of modern technologies on spatial structures

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Abstract: Inventions and innovations have accompanied mankind since our very beginning contributing to the cultural heritage of societies. Nowadays people are faced with the implementation of modern technologies every day. It happens in highly developed societies which in order not to be excluded from the market or social life, should keep up with the latest implementations. This is due to the rate of change and the multiplicity of issues to which it relates. The following text tries to reflect on the problem of unforeseen consequences of the implementation of the inventions and innovations resulting from the pressure of time – ranging from portable electronics, to solutions designed to improve travel comfort and safety, to the implementation of the electronic communication systems, management and planning. Meeting the special interests of some social groups, inventions and innovations could have different effects on the life of groups which are not interested, and could have side effects in their lives. Considering that the public space is a common good, and that it is unique, one should be able to forecast not only positive but also controversial consequences of the implementation of modern technologies.

1. Technology & Innovation

In common language the term 'modern technologies' is less frequently used than 'innovation' and, contrary to popular belief, their meaning is not the same. Technology is a „processing natural resources into usable goods (products) deliberately and cost-effectively [and] knowledge about this process" (Ambrodziak-Więckowska et al., 1998), while innovation is „the introduction of something new; the newly introduced thing; novelty (...)" (Ambrodziak-Więckowska et al., 1998). In The National Chamber of Commerce brochures it is written that innovation (from Latin: *innovare* – renew) is „practical application of a new invention which alters the reality and habits" (Adamczak and Gędłek, 2010) and „deliberately introduced change in

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technique, organization, business, or in any other sphere of human life" (Gędłek and Adamczak, 2009). „Innovation can also refer to the transformation of the present invention into a product or process which can be put on the market" (Gędłek and Adamczak, 2009). An invention is „what was invented, imagined; also, inventing" (Ambrodziak-Więckowska et al., 1998) of a new product or method that solves the problem (Adamczak and Gędłek, 2010), having a purely technical nature (Gędłek and Adamczak, 2009).

Most of the objects surrounding humans are obvious to them – but it was not always like this. Man lives in a built environment filled with physical structures which originated as inventions and then became popular – this process operates since the beginning of mankind. Often „to gain knowledge of something previously unexplored" (Ambrodziak-Więckowska et al., 1998) is to discover something which already existed in nature, which results in making an invention; and vice versa: inventions are used as a tools for making further discoveries.

2. (Non-)modernism

Are new technologies – in this context – inventions? Modern is „new times competent, contemporary, present; taking into account the latest developments in a particular area; progressive, not-underdeveloped" (Ambrodziak-Więckowska et al., 1998). An invention is considered in the context of its first description or its first appearance in a given moment in history of the particular place. It can be assumed that modern technologies are only these inventions that are currently being implemented for the first time in a given area. This leads to some further questions: may technology be modern in one place on Earth and old-fashioned in another or it should be described as a modern solution using existing technologies? As it was mentioned earlier, technology is the processing of natural resources into a product, while the introduction of something new is called an innovation. Therefore, for a better understanding, it is proposed to distinguish modern technologies from modern methods and solutions of technology use – which are understood as innovation.

3. Form & function of the public space

The quality of the public space results from the overall spiritual and material achievements inherited from the past generations, and worked out today. Cultural heritage includes, for example: works of art, material goods and methods of their manufacturing. The public spaces are unbreakably linked to the technological legacy and achievements of communities that inhabit them. Public space has evolved over the centuries (with its positive and negative sides) depending on the development and collapse of many cultures: Ancient times developed, among others, technologies affecting hygiene, and in consequence the health of urban residents (aqueducts carrying fresh water for the public watering places, public baths, public toilets with discharge of sewage from the city). In this regard, the Middle Ages was a setback (but thanks to the advanced craftsmanship contractors created great public structures like Gothic churches and cathedrals, where people prayed for cures for diseases and an end to epidemics harassing human kind); In the nineteenth century diseases have been associated with the generally prevailing stench in the cities, and so the construction of

modern sewage systems began. It was as late as 1854 in Soho, London when doctor John Snow proved that diseases may be transmitted by water, and sewage pouring near water intakes is the cause of contamination[1] (Johnson, 2006). After a thousand years the great return to investing in technologies that provide clean water and dispose of waste water began. The problem was moved outside of the city – to the riversides.

Contemporary public spaces in the cities of the so-called Western civilization are also not without faults. Although the risk of water-borne diseases is limited to a minimum, new risks appeared, including atmospheric emissions of toxins, heavy metals, and dusts. The only way out of this situation seems to be the production of things, their use and further processing completely without emissions – according to the upcycle theory (McDonough and Braungart, 2013). The great difference between the old and the new public space is the way in which modern humans (do not) interact with one another, and how and where they move. Before the invention of the clock[2] time did not rule people, they worked on one task, then moved to another. The transition from the natural time (seasons, days, work rhythm) to artificial time (days of the week, hours) is one of the reasons why we do not live today in a sustainable manner (Thackara, 2010). Already in 1881 George Beard introduced the concept of *neurasthenia* – describing psychological problems caused by the increasing pace of life attributed to, among others, the telegraph, the railway, and the invention of steam power (Beard, 1881; Thackara, 2010). The above examples indicate that the inventions designed to 'make life easier' may complicate it.

Another reason is the fact that nowadays life in the public space is ruled by money. Lorens writes that „the free market economy, globalization, and connected to that neo-liberal capitalism, mobility and individualization of the social life destroyed traditional public space" (Lorens, 2010). The walls of the public space, which are facades of buildings, fences and temporary structures, belong to the owners of plots adjacent to this space. Smith believed that man „by pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it" [*sic!*] (Smith, 1776). Adam Smith's innovative thought that people should manage their wealth without limits because by nature they have a rational approach seems to be controversial[3]. What he called the *invisible hand of the market* (Smith, 1776) had taken away a sense of community in the public space.

Nevertheless, it cannot be said that a better alternative to the capitalist system was the totalitarian system, which arbitrarily coerced social attitudes [*sic!*] and centrally controlled the market. It follows that decisions on investments in and around public space should not be left entirely in the hands of either: the private capital or the top-down control. Therefore, spatial development needs strong governance at the

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[1]So far sewage was poured into cesspits, sometimes on the streets and into the basements of houses. Doctor John Snow suspected that the reason of every 4 − 5 year epidemic in London may be water contamination. He convinced authorities after mapping the deaths during cholera epidemic and investigating where water was taken from. The study revealed that the disease cause was a contamination of the popular (recognized previously as clean) water pump. The water intake was contaminated as a result of illegal sewage tank leak into the groundwater (Johnson, 2006).

[2]Tower clocks were already known in the fifteenth century (Podwapiński, 1952).

[3]„It is obvious that every person in a particular situation can better assess in which branch of the national economy can put their money, and in which branch the product reaches the highest value, than would be able to do for him a statesman or legislator" (Smith, 1776).

municipal level, as it is written in The Constitution of Poland (Zgromadzenie, 1997).

4. Innovative methods of spatial planning

Urban design is multidisciplinary and its results typically become visible after decades; but conditions are changing on a regular basis, therefore, digital modeling and planning of spatial structures may be quite helpful. Rozwadowski writes that „the use of models is especially important in areas where controlled testing of the new theories in the real world is very expensive and difficult, if not impossible" (Rozwadowski, 2005). Modern cities develop too quickly to use only conventional methods for their planning. In order to speed up work and adapt it to the constant changes it should be supported by the processing power of computers. The role of the designer is to enter input data for the calculations and select one of many generated output possibilities. Helenowska-Peschke writes that „evolutionary models based on simulation of artificial life (...) are a denial of the modernist practice of arbitrary control and management" (Helenowska-Peschke, 2010). With computers, you can change plans not only during the design process, but also in real time, with the changing conditions. It does not radically speed up the process of urban development – the real effects of modern urban planning and evaluation emerge after long time (Helenowska-Peschke, 2010). However, today you can test modern planning methods for limited areas, including: renovation, restoration, modernization or just construction.

5. Side effects of inventions

History shows that implementing inventions and innovations one should be wary of the side effects. The desire to obtain benefits (resulting from the particular or social interest in introducing new technologies and solutions) may entail negative consequences for the uninterested. The introduction of rail transport led to mass migration of the population, making it easier to transit from poor provinces to industrial cities. Railway has also made transport of bulky goods independent of the access to navigable rivers, which resulted in the development of industry in new places. The negative effects of this invention were, among others: the cities become overcrowded, city space is torn by the railroad tracks, there is increased danger of accidents, the quality of air decreases, and noise pollution rises. Already in 1854 in *Walden; or, Life in the Woods* Henry David Thoreau wrote his famous statement, „We do not ride on the railroad; it rides upon us" (Thoreau, 1854). Nowadays, the main problem with this mode of transport is the division of the spatial structures of cities by the impassable barrier of the tracks – other problems have been eliminated or reduced to a minimum (e.g. the noise barriers screen settlements along the railway lines, electrification reduces air pollution; safe passages and crossings are built).

Just like railway, individual transport has brought many positive and negative changes. Society is satisfied with seeming independence given by owning a car. However, users (drivers) must bear not only the purchase cost of a vehicle, but also its use and maintenance (fuel, insurance, repairs, tolls, downgrading). Other users of public space (including drivers out of the car) must adapt to the road infrastructure accepting discomfort and danger such as: longer walking route and longer time at pedestrian crossings, accidents (in which almost only pedestrians and cyclists are killed), noise

pollution and exhaust fumes, cars running over and grabbing the public space even during their non-use time.

It is estimated that a personal car is used only two hours per day – in other words, for twenty-two hours it is useless! According to the Lynn Sloman's 'Rule 40:40:20', (the author of the book *Car Sick: Solutions for Our Car-addicted Culture*), about 80 % of travels by car can be replaced with pedestrian walks, cycling and public transport – 40 % without changes in the infrastructure and the other 40 % by making small changes. „People usually think that the journey by public transport takes about 70 % longer time than it is in reality, and the driving time is estimated to be 26 % shorter than the actual" (Sloman, 2006; Thackara, 2010).

There is also the problem of transport emissions of too much CO_2 into the atmosphere. One can say that it depends of engine efficiency but such attitude runs counter to sustainable development. „Until Watt's steam engine came along, roughly half the coal that was dug from an underground mine had to be used to power the earlier type of engine that pumped water from underground and made it possible to mine the coal in the first place. Watt's engine drastically reduced the amount of coal that had to be used to allow mining. But because steam power became so widespread, the aggregate demand for coal rose dramatically" (Heck and Rogers, 2014).

But CO_2 emissions could be reduced, among others, by persuading drivers to use public transport. Comparing to individual car travelling, „for the slightest evil should be considered long-distance journeys made by bus and coach. Calculated per passenger this mode of transport emits 29 grams of CO_2 per journey kilometer, while the train the value is 52 grams, and for the car – 170 grams" (Thackara, 2010). In addition, of the fewer cars the more attractive the public space, and this will affect a more frequent choice of walking/cycling and improving interpersonal contacts (which from the inside of the car is limited to complaining at others, or worse, offending others by the opened window). Jan Gehl, a popular 'star-urban planner' writes in this context that „the value (...) is the trend for parking cars 100 to 200 meters from the apartments. Streets of such areas are more populous, being on them and looking at them is more engaging, and the chances of frequent, informal neighbors meetings grow" (Gehl, 2009). Thanks to Gehl's publications and activity, the voices of integrating local traffic on the terms dictated by pedestrians using the street design called Woonerf zones[4] become popular (Gehl, 2009). Although, following the Netherlands, this solution was applied in many countries, in Poland it is considered an innovation in the public space, and one which contradicts the use of modern technology – car driving.

The first street lamp was constructed and installed in 1853 by Ignacy Łukasiewicz in Gorlice, Poland (Kula, 2002). The invention immediately became popular around the world. Street lighting after nightfall helped to avoid poorly visible obstacles and collisions with other traffic participants. It is also said that better illumination of public space improves safety in the context of assaults and robberies. Meanwhile,

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[4] „This principle was first introduced in the country-regionplaceNetherlands, where many neighbourhoods have been designed or renovated in view of slow movement of vehicles. In these Woonerf type places vehicles are allowed to enter under the houses doors, but the streets are evidently designed as walking areas where cars are forced to move at slow speeds between fixed places where people stay or play. Cars are guests in the domain of pedestrians. The concept of the integration of car traffic on pedestrian conditions offers significant advantages over other methods of segregating traffic" (Gehl, 2009, p. 111).

Martyniuk-Pęczek writes: „New York city authorities decided to intensively illuminate all streets with increased crime and drug trafficking. It turned out the problem did not disappear, because criminals moved to other areas of the city, and intense lights did not stop hooligans from fighting" (Martyniuk-Pęczek, 2009). Thus, street lights do not always affect 'safety improvement', but the 'feeling of being in a safer place' compared to where it is darker. Meanwhile, from the bright space one cannot see the danger lurking in the dark, and vice versa – hiding in the shadows is much better for seeing the light-exposed victim. This effect is best seen in a photo, which objectively reflects the contrast between light and dark spots. The above examples show that certain innovations and inventions do not affect the implementation of the selected targets, but they can even cause the opposite effect. But is not the darkest place under the candlestick?

6. Modern innovations

Modern technological development tends to combine reality and the virtual world. A recently popular term the 'smart city' is related to the implementation of the information and communication technologies (ICT) and to managing with their use. A Smart City is supposed to be flexible and accessible and thereby convenient for individuals. Everything has to be available at your fingertips (and even without the gesture[5]), such as through the smart phone (Ylipulli et al., 2013). One should answer the question, what effects, including side effects, will the smart technologies bring? „Linking ICT with the space of the city is most evident in the so-called media spaces – places where traditional architectural elements are enriched with digital displays, interactive installations, and where are heavily used wireless communication devices" (Mitchell, 1995; Stangel, 2009). Some of them may harm traditional spaces and even monuments.

In the meantime, further innovations are coming under the premise to help people with everyday life and to improve the environment. For example, there will be electric cars that require multiple charging stations. Will this entail further unforeseen conflicts in the public space? Until recently, the market of the individual transport of persons (compared to the public/mass transit) in the cities was dominated by taxi corporations and not affiliated taxi drivers. Currently, in dozens of cities around the world, you can hire a car easier than a taxi (Malec, 2014). It is possible that this will affect the greater use of the car, rather than the previously mentioned two hours a day. On the other hand, it may result in more people giving up walking, cycling and using public transport. The effect may be isolation of the people moving inside rented cars and a traffic increase.

No-manned flying objects, the so-called drones, may become the next means of urban transport. They will be able to send and receive mails (see the announcement of Amazon corporate or China's delivery companies), explore the museums at night (when they are empty), and the physically disabled will be able to move remotely – for example going shopping (and meeting neighbors) without leaving home. However, it can be expected that part of the population will use this opportunity to spend more

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[5]It can be expected that the hand-held phone will disappear as quickly as it had appeared in our life. The next devices will not have to be controlled by the touch of a finger but, for example by thoughts.

time at home, away from the public space. Is it possible that the world will look like a computer game implemented into the reality, and humanity will move even more into virtual space?

7. Future in augmented reality

A significant change in how modern man functions on a daily basis was the replacement of stationary phones by mobiles that use cellular networks – transmitters and receivers placed around the world. This made it easier to communicate with other people virtually anytime and anywhere. But with the common use of this tool, new problems have arisen, ranging from lack of coverage or network failure to discharge of batteries, which are then transferred to undesirable situations in personal and professional life. Another important problem was the inappropriate use of phones in public places. Examples abound: leaving meetings in order to answer the call; interrupting presentations (by a presenter who has not turned off the ringer); speaking so loud on public transport or in the cinema that others hear one's private conversation ; disturbing acoustic concerts or theatrical performances. These negative effects of new technologies, although caused by a minority, unwittingly touch the majority in public and semi-public spaces. To quote the words of Saddie Plant, „the mobile phone is more than a communications technology – it's a remote control which can operate the environment" (Plant, 1998; Stangel, 2009).

The launch of the so-called 'smart-phone' improved access and exchange of information via the Internet. In addition, the screen of this device has become an overlay applied to the world around us, giving additional unprecedented opportunities (Rozwadowski, 2012). Augmented reality (AR) is a combination of elements of the virtual world with the real one (Stangel, 2009). According to an online publication dealing with this issue in 2014 there would be a breakthrough in the appearance of a number of devices that provide the consumer with an enhanced reality (KZero, 2014).

In recent years, we have seen how street protesters communicate with the world. This was possible thanks to the use of ubiquitous access to the Internet. Municipal WiFi is also used to promote attractions, for tourist information, navigation and many others. Can be shared wirelessly or via a network of hot-spots, such as pylons with touch screens (Baranowski, 2008; Ylipulli et al., 2013). Authorities in a number of countries have recently turned off Internet access in order to hinder the protesters in a public space from contacting the world. Paradoxically, this confirms the conclusion that when for one group modern technologies are a useful tool, for other groups the same technologies can be a problem.

8. Summary

This paper attempts to identify the broadly understood impact of modern technologies on public space. Past and current implementations of inventions and innovations are taken into account and exemplified to show their impact on both spatial and social structure. The objectives persuading the introduction of modern technologies are presented with their intended and unexpected side effects. It should be emphasized that these effects tend to be positive, negative or inducing controversy and conflicts

between different social groups. It is also noted that the rush of the modern world is conducive to the implementation of new inventions and innovations without reflection. This results in a risk of infirmity and loss of control over the development of public space, and consequently limited possibility to pass it to future generations in a better condition than the one inherited from our ancestors.

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