

ABSTRACT

This article discusses the use of population monitoring within urban spaces by designers. It considers its use to define design strategies aiming at mitigating the impacts of the Covid-19 pandemic. Some governments have made use of identified citizens' data as well as stored population data collected through telephone companies. In search of new strategies to mitigate the impacts of the pandemic, data such as statistical surveys of the population have been collected and used for communication. As a result, new services are offering digital applications which can help contain the pandemic. Designers are amongst the categories of professionals involved in this new development. When monitoring a community, aspects such as data privacy and surveillance capitalism need to be considered. What will happen to the data collected once the pandemic is over is also a matter of concern. In this context, how and what aspects designers should consider in this scenario are questions that need to be addressed. This study attempts to answer these questions based upon the results of a systematic literature review on the topic. This literature review-based research has confirmed the importance of design strategies in the development of new applications.

Keywords: design strategy; design ethics; crowdsourcing, urban space; COVID-19

INTRODUCTION

This article focuses on the actions towards data monitoring to contain the Covid-19 pandemic. It considers that communication between the government and the population is extremely important to contain a pandemic. "Quantitative analyses would provide updated estimates of the burden of disease, assist in the design of locally appropriate control programs, estimate the effectiveness of current interventions, and support 'real-time' updates to local operations" (HOLLINGSWORTH et al., 2015, p.2).

In particular, it will be argued that when designing for urban spaces and their users, the participation of citizens in decisions related to both the planning and the development of products and services is key. Codesigning with citizens has a positive effect on the development of urban products and services. One of the many benefits being that citizens' involvement triggers mechanisms that can reinforce the sense of belonging and citizenship (KEIL; KISTMANN, 2016).

As the threat of the Covid-19 pandemic continues, citizens' participation has been used by different communities, so that contamination can be mapped. Through monitoring, it is possible to identify outbreaks and reach the population of infected areas, as well as to plan new health actions.

An example of a monitoring action is SwissCovid, which is an application developed by the Swiss government in collaboration with other European researchers and scientists. SwissCovid is a contact tracing app which, among other features, can find out when an individual has been near other app users infected by the virus. Its main design characteristic is its guidelines to protection of privacy. Such guidelines make the population feel safe when adding data and contributing to mitigate the impacts of the pandemic. This project was funded by the Swiss federal government, and uses Bluetooth technology (SWISSINFO, 2020).

Another example of a monitoring action is the website created by the New York City government, COVID19.NYC. The website is an information platform where both experts and the general public can provide information about Covid-19. This information makes it possible to create scenarios, predict new outbreaks, and implement social distance measures in different neighbourhoods (QUAINTANCE, 2020).

To prevent and control the Covid-19 pandemic, data gathering has also been used in China to trace individuals infected with the virus. The data collected are inserted into platforms for information crossing. In Shanghai, a platform named “one-net management” has been developed to provide and cross-check data (CAI et al, 2020).

In addition, in the Chinese city of Wuhan, sensors to obtain information which will help contain the circulation of the virus, increase safety, and improve air quality have been installed. Other types of data have also been collected and shared between the cities in the region for control over a larger area. This has been done in a partnership between a technology company and the city government (CAI et al, 2020).

Similarly, in Brazil, cell phones have been used for data collection and to provide advice and support to citizens. In the city of Curitiba, calls received through the number 33509000 are monitored. Attendants offer advice and general information about coronavirus to citizens. This strategy helps to control people’s displacement to health units, thus helping control the spread of the virus. It also allows health professionals to map regions with the highest number of cases of the virus (BREMBATTI, 2020).

All these approaches were developed rapidly, from emerging demands. Tonetto et al. (2020) highlight the role of a pragmatic Strategic Design (PSD). PSD is concerned with real-life applications of design in organizations. It favours practice-based actions over mere technical approaches, favouring the design of product-service-systems. PSD is considered a multidisciplinary intuition *metadesign* process concerned with user experience, which represents a strategic concern in many organizations. PSD focuses on preferred outcomes (TONETTO et al.,2020).

The potential of new technologies, however, presents some concerns as regards the transference of data between companies and governments, as some may use the data for reasons not related with the pandemic, including gaining profit. This highlights the challenges faced by designers when developing a PSD and the importance of ethical elements in design.

Considering the emergence of this theme in the current scenario, and in situations that might arise with the expansion of Information Technology Communication (ITC), this article aims to examine the ethical aspects involved in such situations. To do this, it uses a literature review to highlight the role of designers in this process and the aspects they should consider.

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This study is based upon a previous qualitative investigation carried out through both a systematic and an unsystematic bibliographic review in 3 defined stages. The investigation considered primary sources in the databases of the journals Capes, Scopus, and Science Direct, and used filters (FONSECA & KISTMANN, 2020).

The results of the study are discussed in this article which is structured as follows. Section 1 looks at cyberspace design ethics. Section 2 considers the urban space and monitoring. Section 3 reviews the actions and tools for pandemic control. Section 4 examines some of the consequences of monitoring during a pandemic. Finally, in section 5, some final considerations are presented.

1. CYBERSPACE DESIGN ETHICS

Ethics in design, specially ethics related to the digital context, was discussed by Tomás Maldonado in the 90's. At that time, Maldonado discussed in various ways how ethical questions can be applied to cyberspace and design. He questioned whether the cyberspace assures democracy, since economic forces and democratic forces do not always work together. Cyberspace helps governments to practice normative and censor control over networks, becoming a threat to the potential emancipatory mechanisms of information technologies (MALDONADO, 2012).

The topic of cyberspace and design ethics has been further explored and discussed since the 90's and specially in the 2000's. Hamington (2019), for instance, states that notions of care ethics and design thinking should be reformulated and applied within this context. Hamington reports that although design thinking is receiving significant attention and application in business practices, ethics has only achieved limited traction among business ethicists in academia.

Considering the peculiarities of digital research, such as the absence of a researcher; exposure of confidential data; confidentiality and anonymity; the security of data transmission; the security of data storage; and the tracking of participants over time, it can be assumed that further challenges may present themselves. The loss of experimental control in the Internet laboratory, for instance, can lead to participant misbehaviour, intentional or not (NOSEK; GREEWALD, 2002).

Also considering the ethical challenges created by these new technologies and the issues related to design, Shilton (2020) highlights the characteristics of platforms available to users. Shilton emphasises the type of informal information that is produced and how the practices of design affect the social values materialized in emerging technologies. Shilton also shows how design practices can encourage ethical reflection and action. To demonstrate this, she gives the example of a laboratory that engineers software for mobile phones to track users' locations, habits, and behaviours.

Similarly, Cummings (2002) highlights that in the field of engineering, professionals and students, when involved in the development process of digital applications, do not question the ethics of designing these products.

Clearly, ethics in design concerns methods, algorithms and the capability to reason about the ethical aspects of the designer's decisions. Together these elements configure a complex system, in which decisions taken by administrators directly affect the design approach and the development of new products and services (DIGNUM et al., 2018).

These aspects show the importance of investigating the impact of this new technology on the new digital services offered to citizens that are based upon monitoring of urban space.

2. URBAN SPACE AND MONITORING

As the Covid-19 pandemic continues, more research that links urban space and its data, and which considers this connection a determinant factor in the mitigation actions to slow the spread of the virus, is conducted. Cities and their continuous flow of citizens provide large volumes of data. These data have been used to identify possible contamination points, infected citizens and those they have been in contact with, and their activities. These data have also been used to better understand future scenarios.

In this sense, You et al. (2020) argue that one of the objectives of urban planning must be to improve human health, for instance, by helping to prevent epidemics. According to them, this should be done by consciously reflecting about the situation and its propagation characteristics. For example, morbidity resulting from quarantine can leverage the risk of contracting viruses, a problem which could be solved if cities offered better-planned spaces.

In addition, the use of data for mitigation and containment of viruses and other diseases can become a trend. Infectious disease surveillance systems are expanding to include digital data from applications and media used by the population (ALLAM; JONES, 2020). Public health agencies are gaining access to deeper data on population behaviours and on individuals (HERRERA et al, 2016).

Cities with sensors and digital technologies that allow for data to be collected have become libraries, and the information gathered should be used to enhance the urban environment and improve the well-being of the population (SIMEONE, 2020). However, although there are many benefits in using these technologies, it is necessary to consider the communication between government and private power so that these benefits are put into practice. Also, the popularization of gadgets has led to a softer view of problems that, in some cases, were not externalized (PARN; EDWARDS, 2018).

HAN et al. (2020) show that information beyond big data, such as reports and public opinion expressed through social media, can also help to understand and monitor the spread of the coronavirus. Their study analysed social media data in the early stages of COVID-19 in China and show that at the time 13 sub-topics related to COVID-19 were being discussed by the public. Their research also shows that some of the comments provided could lead to conclusions which could interfere with prevention measures.

Although Big data, reports and public opinion are collected by actions and tools developed mainly by engineers, these are also transformed into digital services by designers.

3. ACTIONS AND TOOLS FOR PANDEMIC CONTROL

Advances in monitoring Big Data, in Artificial Intelligence, in Informational Modelling as well as in other monitoring tools and methods to contain the Covid-19 pandemic are observed in this new scenario.

For example, the number of technological innovations for the detection of viruses are increasing. Health problems in the population can be identified rapidly and specialists alerted to investigate the flow and contact tracing of individuals. Examples of these new

technologies are biosensing applications, cell phones, and non-descriptive devices that are capable of diagnosing and sending data to specialists and platforms, using artificial intelligence, machine learning and remote contact with health professionals (BRAGAZZI ET AL.; 2020; QUESADA-GONZALEZ AND MERKOÇI, 2017).

Although information from monitoring and crowdsourcing at city level is an important factor, there are flaws in the application of technical data (LAI et al., 2020; YIGITCANLAR; DESOUZAA, 2020).

With regard to citizens' participation, crowdsourcing is a generic approach for formulating and thereby solving distributed problems by the direct, indirect, or event-based participation of users. Through crowdsourcing it is possible to identify behavioural tendencies, which can help to avoid future problems (AHMAD et al., 2018).

An example of this is how platforms such as Twitter and other social networks have explored the innumerable possibilities for data collection during the pandemic, going beyond street research, to identify mobility patterns and spread of the virus (MCNEIL et al., 2016).

The use of crowdsourcing tools has also helped to reduce the number of Covid-19 cases in Wuhan, China, as noted by Leung and Leunf (2020).

When designing new applications, the collaboration between different fields of knowledge is paramount. According to LAI et al. (2020), five components provide the basis for a successful collaboration in the context of a pandemic: movement, facilities, people, information, and engagement.

As regards the use of data, Lemos (2020) suggests the following should be considered: a) the flow of people who use locative media; b) personal data monitoring; c) activity and exposure on social media by individuals infected with the virus. With this data, heat maps of cities, neighbourhoods, and even of streets can be generated to identify the mobility of the virus. Ethical issues regarding privacy and the use of data should also be taken into consideration, since data monitoring and data exposure can be considered an invasion of privacy.

A common application of AI is in the monitoring of vehicles by satellite images to identify traffic patterns. The information gathered can be used for development, planning of future scenarios, and for suggesting different routes in mobility applications. (TANVEER et al, 2020).

The use of Artificial Intelligence (AI), particularly in the health sector, is a new challenge. "In broad terms, AI is defined as machines or computers that mimic cognitive functions that humans associate with the human mind, such as learning and problem solving" (YIGITCANLAR; DESOUZAA, 2020, p. 3).

However, according to Santosh (2020), since not all data added to platforms are analysed, mistakes can occur. In relation to the Covid-19 pandemic, Simsek and Kantarci (2020) show that the need to use AI in healthcare has revealed how unprepared the healthcare systems were to cope with the pandemic.

Similarly to AI, Big Data also shows enormous potential for helping in the management of Covid-19, and its role is anticipated to increase in the future. Both AI and Big Data can be used to monitor the spread of the virus in real time, and to plan and increase public health interventions accordingly. They can also monitor the effectiveness of these interventions, repurpose old compounds and discover new drugs, as well as identify potential vaccine

candidates and enhance the response of communities and territories to the ongoing pandemic (BRAGAZZI et al, 2020).

In this sense, the management of design together with mathematical modelling is a powerful tool for planning policies that aim to contain the pandemic. In the current scenario, the combination of different areas of knowledge is vital if more effective results are to be achieved in a shorter period of time. Such an approach reinforces the importance of interdisciplinarity (MAYORGA et al, 2020; ELAVARASAN; PUGAZHENGHI, 2020).

All these actions and tools are extremely important when considering the consequences of monitoring citizens' data in urban spaces.

4. CONSEQUENCES OF MONITORING DURING A PANDEMIC

The urbanization of the world tends to increase, which as a result, will increase the speed at which infectious diseases are spread. Migration and mobility around the world also have led governments to monitor the activities of individuals with a view to preventing epidemics, as these also contribute to the transmission of infectious diseases and as such have an impact on global health (ALIROL et al, 2011; KICKBUSCH; SKELLARIDES, 2006).

Today's economy is information-based, and this information is urban-based. Thus, with the evolution of the pandemic, the economy has suffered a serious setback which will have grave repercussions (NIJIMAN; WEI, 2020).

Urbanization and population growth have contributed to the increase in the number of cases of Covid-19, and cities have become hubs for the rapid transmission of the pandemic. However, technology, AI and machine learning have made cities more resilient (WESTROPE, 2020; KUMMITHA, 2020).

A further adverse impact of monitoring during a pandemic can be seen if extreme users are also taken into consideration. Since security measures have changed the space and its rules, people with disabilities may be faced with additional difficulties, such as the lack of safe alternatives for access to essential businesses, which can make them more vulnerable to crimes (SANTIAGO; JANSON, 2020; PINEDA; CORBUN, 2020).

Pandemics do not only have an impact on users' behaviour. Other types of data are also of interest to health programs. For example, it is also important to monitor data on waste collection, basic sanitation and water treatment, as these are very susceptible infrastructures for the spread of viruses (SPENCER et al, 2020)

5. FINAL CONSIDERATIONS

The Covid-19 pandemic has shown that there is a wide set of economic possibilities mediated by Information and Communication Technology (ICT). This creates a number of new opportunities for the design practice and research. However, it is important to be aware that governments can use the data to exercise control and enforce censorship on their citizens, and in so doing they threaten democracy. Designers must be aware of how their work is affected by such constraints and reflect about their position in relation to them.

Research has also shown that we have turned to technology when searching for alternatives to stop the pandemic, with evidence of this seen in the tools used to predict new waves and areas of contamination. It has also been shown that Artificial Intelligence (AI) can help in

controlling a pandemic. Some AI applications constitute the foundation of cities which aim to offer a better life for their citizens, and which have been affected by the increase in urbanization. However, the literature review shows that none of the works referred to here discusses aspects related to the democratic content related to data monitoring and use.

The increase in the use of ICT has reinforced its importance for designers. This can be seen specially in the USA, Switzerland and Britain. The trend can also be seen in Brazil with the increase in cell phone communication. A growing interest in the use of ICT in relation to Covid-19 and other related issues is also evident. The possibility of a future Covid-19 reinfection scenario and potential consequences could be the focus of future research.

Moreover, it has also been shown here that today's information-based economy impacts urban life. Products, services and systems based upon artificial technology, the use of big data and bio-sensing applications will continue to be used by governments in their efforts to control the spread of pandemics and tackle other related problems. Improving the efficiency of data collection and data processing, which is essential for these new technologies, requires a closer interaction between designers and citizens, to ensure an immediate and effective response to problems that might arise.

The development of new products and services can present challenges to designers and a pragmatic strategic design (PSD) seems to be the way forward. An interdisciplinary approach in which designers and other professionals, such as engineers, anthropologists, lawyers, statistician, communicators, and economists will collaborate, is also key.

The use of public data, as cities struggle to combat a pandemic, is considered one of the components of urban intelligence along with data science. Both public data and data science have shown that the impacts of Covid-19 have been significant not only on the health of individuals, but also on the economy and society, and on cities as a whole. Thus, urban management and governance are key in the search for a solution to the crisis. In this scenario, the importance of design management and the role that it plays in helping to tackle the current Covid-19 crisis have been highlighted. With its methodological tools, dimensions of application of technology at both government public policies level and private initiative level, design management is essential.

In terms of future research, this can be established by governments aiming at developing new competences. Designers, in particular, should be involved in such studies, as they can help with their intuitive thinking, together with the analytical tools that the crowdsourcing tools offer.

Designers have a crucial role in the development of these applications, and the services related to them, particularly with regard to users' behaviour. However, it is also important to consider the measures which focus on the end-users and their level of confidence with the monitoring style offered.

All these aspects are linked to the service planning process. Visual elements and structure of information can help in assuring confidence and better communication of the ethical aspects of data collection. The use of other designed elements, such as publicity, announcements, web communication, is also important.

In particular, this study has shown that ethical aspects need to be considered at all levels of design solutions when designing applications using data monitoring. The absence of a researcher, use of confidential data, issues of confidentiality and anonymity can all affect the

design thinking methodology. Trust is another important aspect, as machines cannot distinguish between false and true information.

This study has also shown that the singularities between the different groups of users must also be considered when designing new applications. The results obtained show that attention should be paid to population growth in order to understand population behaviours which can contribute to the spread of the virus, such as migration, which results in a population consisting of individuals from several countries. This brings an important cultural element to the design of applications which aim at enabling communication between city governments and citizens.

Finally, this study has shown that the topic of population monitoring within urban spaces by designers should be further explored, for example, with a field research, considering the methodology and design intervention results. Investigations into methods of gathering information, the design process of applications, and how the design field can benefit from field research should also be conducted. Such investigations should explore elements such as cultural aspects, usability, user-experience tools, and sense of belonging.

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