The Smart City as Time-Space Cartographer in COVID-19 Control: The South Korean Strategy and Democratic Control of Surveillance Technology

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ABSTRACT

While the US, UK, France, Italy, and many other liberal democracies ended up implementing complete lockdown after tens of thousands of deaths from COVID-19, South Korea kept factories and offices running, flattened the curve, and maintained a low mortality rate. Extensive media coverage has focused on South Korea's testing capacity as the primary reason, but little discussion of the vital role of the smart city has occurred. In this short paper, we will 1) describe how smart city technologies form a crucial part of disease control in South Korea, 2) explain the social conditions for the extensive use of smart city technology, and 3) offer critical insights into contemporary discussions on the issue of smart cities and surveillance.

Keywords: covid-19, smart city, patient tracing, data protection, surveillance technology

Why South Korea, Why Smart City?

East Asian countries have extremely low COVID-19 related deaths per one million population (Table 1). There are differences among East Asian countries, though. The number of confirmed cases in Japan and Singapore continues to increase, and the ratios of confirmation to test are high. Hence, the death tolls in these two countries are very likely to rise over the next few weeks. China, after initial confusion, controlled the disease well but achieved it through an extremely strict lockdown, a measure that was necessary in that situation but not desirable politically and economically. The remaining two are Taiwan and South Korea—the truly successful cases in East Asia.

Taiwan has been near-perfect. The number of patients is low, and local transmission has been almost completely prevented. At the time this paper was written (7 May 2020), all businesses in Taiwan ran as usual. Taiwan achieved this success partly because it took a head-start approach to the pandemic. The World Health Organization (WHO) was still sending Twitter messages like 'Preliminary investigations conducted by the Chinese authorities have found no clear evidence of human-to-human transmission of the novel #coronavirus' on 14 January, but Taiwan started monitoring passengers on flights from Wuhan a week before, on 7 January. By 6 February, Taiwan banned flights from China, Hong Kong, and Macao. Such action was feasible for the Taiwanese government partly because Taiwan could gather

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enough anecdotal evidence from their civilians and civil servants in Wuhan, and its government relies upon its China-bashing stand for its domestic support.

Let us look at South Korea now. The death per one million population in South Korea is 5, which is only 1/111 to 1/43 of US., Italy, UK, France and Spain. Even Germany, the best of Western Europe, has 17 times as high mortality as South Korea. Although it is not as low as that of Taiwan (0.3), South Korea appeared to offer a more useful model for the rest of the world for three reasons. First, South Korea was in a similar situation to the rest of the world in terms of difficulty with the head-start approach. Unlike Taiwan, South Korea and the rest of the world could not collect enough local information on Wuhan from unofficial sources. More importantly, unlike Taiwanese government, other governments could not take the political risk of damaging their economies when neither WHO nor the Chinese government has confirmed the need for pandemic control. Second, South Korea showed that an initial large outbreak can be overcome. It had a huge outbreak in mid-February in the Sinchonji Jesus Church but overcame it by continuing extensive testing. Finally, the restriction that the South Korean government imposed on its citizens' mobility was extremely low. Schools and universities moved to online teaching, and large-scale gatherings were banned. Most businesses, however, were running as usual without interruption, a factor which led the International Monetary Fund (2020) to forecast that the South Korean economy will be the least affected among high-income economies.

The primary weapon was extensive testing, as widely reported in the media. South Korea can produce 100,000 test kits and conduct 20,000 tests per day, while most Western European countries are lagging far behind these numbers (Parodi, Jewkes, Cha & Park, 2020). However, who is to be tested? Not all patients walk in for testing. Many patients, primarily those in their twenties and thirties, continue to live normal lives, spreading the virus without realizing that they are infected because their symptoms are mild or non-existent. That is where the smart city comes in—as a space-time cartographer.

Table 1. Reported Cases, Deaths and Tests

Country	Total Cases	Total Deaths	Total Cases /1M pop	Deaths / 1M pop	Total Tests	Cases / Test (%)
USA	1,238,083	72,285	3,740	218	7,727,938	16.02
Spain	253,682	25,857	5,426	553	1,932,455	13.12
Italy	213,013	29,315	3,523	485	2,246,666	9.48
UK	194,990	29,427	2,872	433	1,383,842	14.09
France	170,551	25,531	2,613	391	1,100,228	15.50
Germany	167,007	6,993	1,993	83	2,547,052	6.55
China	82,883	4,633	58	3		
Japan	15,253	556	121	4	186,343	8.18
Singapore	20,198	18	3,452	3	175,604	11.50
S. Korea	10,806	255	211	5	643,095	1.68
Taiwan	439	6	18	0.3	65,589	0.66

Source: Coronavirus Update, *Worldometer* URL: https://www.worldometers.info/coronavirus/ (Accessed on 7 May, 2020)

Note: Countries that were mentioned in the text are shown in the table.

The Smart City as Time-Space Cartographers in Contact Tracing

Smart technologies can trace the past mobility of patients and draw a time-space map similar to what geographers know from Hägerstrand (Hägerstrand, 1970; Ellegård & Svedin, 2012). Using such mapping, the nodes of interactions are identified, and people who were 'bundled' in those nodes are identified and tested.

The three smart technologies that play a major role are credit and debit cards, mobile phones, and CCTV. Credit card transaction records show where purchases were made. According to one estimate, 96.4% of all transactions in South Korea are cashless (Ministry of Economy, Trade and Industry, 2016), so tracking those transactions offers excellent coverage of people's mobility. Mobile phones can be used for the same purpose because mobile network providers keep records of the phone locations. There are more phones than people in South Korea, so nearly everyone can be traced by their phone location. Additionally, in 2014, South Korean cities had 9.5 million CCTV cameras or one camera per 5.4 persons (Statistics Korea, 2014). Each individual is captured 83.1 times per day and every nine seconds during trips, according to 2014 statistics. This figure is likely to be substantially surpassed today (National Human Right Comission of Korea, 2010). Further, these numbers do not include numerous CCTV cameras installed in the hallways of residential buildings with the residents' consent but without report to the government. In addition to CCTV, more than 80% of automobiles have black boxes (Kim, 2017). This percentage equates to 19 million cars (Ministry of Land, Infrastructure and Transport, 2020). Considering the physical size of the country, South Korea appears to have one of the highest densities of surveillance technology. South Korean law stipulates that, when the Minister of Health and Welfare declare pandemic, the Korea Centers for Disease Control and Prevention can request these data via the police. The request, approval, and visualization of data were sought manually, but the COVID-19 Data Support System that was introduced on 26 March automised the process (Sonn, Kang, & Choi, 2020).

These data are used to crosscheck and fill the gaps in the epidemiological investigator's record from interviews with confirmed patients. Interviews do not offer fully reliable data because human memory is never perfect. Further, patients sometimes try to hide part of their whereabouts. A patient's name is not made public but a patient might still want to hide his or her whereabouts because 1) those who were in the same place with a patient might be able to identify who that patient is and blame him or her for putting them in danger of infection; 2) a patient does not want his or her family and friends to know he or she visited socially stigmatised places; or 3) the potential online humiliation is still painful even if such humiliation is directed toward someone identified by a patient number that only the patient knows belongs to him or her.

As such, the spatio-temporal mapping is based on a merging of data from patient interviews and data from surveillance technology. This accomplishes two aims. First, health authorities can determine with whom the infected person has had close contact after infection. Although there are a few dead spots such as bathrooms and other places where CCTV is not present, nearly all potential patients can be identified. Second, a new patient's movements can be compared to those of earlier patients. This comparison reveals exactly where, when, and from whom the new patient was infected. If there is no overlap with an earlier patient, it implies that an unknown patient exists. The frequency of unknown infection transmission is a good indicator of whether the situation is under control and whether fast diffusion will occur in the subsequent days.

Once the spatio-temporal mapping is complete, the outcome is published on government websites and mobile apps. Further, local governments send text messages to all residents. Those who visited such places can learn that they may have been exposed and can visit a district health office for testing.

There is criticism that the release of such information constitutes an overexposure of private data, which is true in some cases. Although the names of the patients are never revealed, information is sometimes specific enough to identify the patients, not to the general public, but to people who know the patients personally. Nonetheless, this overexposure is an effective way to give citizens peace of mind. Visualization in the form of a map is particularly effective in part because by converting the invisible viruses' to visible locations on maps, citizens can overcome the fear of the invisible. In addition, offering as much information as possible to the citizens can prevent rumours and fake news that can damage people's trust in the health authorities. A good indicator of the success in gaining public trust is the fact that South Korea is one of the few countries where the COVID-19 outbreak has not caused panic buying. Panic buying itself is bad enough, but it can also escalate to more chaotic situations, such as rioting. Therefore, preventing it is extremely important. Another indicator of the country's success is the near absence of COVID-19-related fake news in South Korea. Fake news was rampant in many countries, as exemplified by the 5G theory in the UK, causing arson (Adams, 2020). In South Korea, there was no major fake news to which the government or major legacy media had to respond.

Social and Political Context of Smart City Technology and Success in Pandemic Control

It should be noted that none of the technologies described above are uniquely available in South Korea. South Korean cities have a higher density of infrastructure, but no country does not have mobile phones, CCTVs, or credit cards that they could use for patient tracing. However, not all countries intensively mobilised these technologies, as South Korea did. A stark contrast is evident in the UK that does not even show the number of patients in smaller localities like the City of London within Greater London. The reason is that, with a population of 9,000, patients might be easily named.

As such, socio-political differences, rather than technological ones, determine whether smart city technologies can be used in pandemic control. Figuring out why South Korea could do it requires more systematic research, but we can list four factors that social scientists of South Korea are likely to agree on, without a major debate.

1) Experience from the 2015 Middle East Respiratory Syndrome (MERS) outbreak: As Taiwan and Singapore learned lessons from severe acute respiratory syndrome (SARS) outbreaks in 2003, South Korea, too, underwent similar experiences from being the only place where major MERS outbreak outside the Middle East. One of the primary causes of failure in controlling MERS in 2015 was non-transparency. Park Keun-hye Administration held information within the circle of health professionals and civil servants to avoid public panic. Unless required by the government to inform the government and the public, hospitals that have tested a positive patient have incentive to conceal the fact from the public because having such cases become public knowledge will reduce the number of customers. When the hospitals try to make infection prevention measures less visible to the public, it is not

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surprising that one of those hospitals failed to implement all necessary measures and became a hotspot of infection. Despite the administration's and hospital's efforts, individuals with insider knowledge, including health professionals, were leaking information. When mixed with fake news on the internet, this information caused public panic, exactly the situation that the government tried to prevent. Pressed by this "infodemic," Park Won-soon, the mayor of Seoul, decided to go against the central government's guidelines and exposed the list of hospitals where outbreaks had occurred and places the confirmed patients had visited. Such specifics proved extremely helpful in stopping the spread of the pandemic (Kim, 2015b). The central government eventually accepted that its guidelines were wrong (Kim, 2015a). This experience convinced the government, health professionals, and the general public that a high level of transparency is essential in pandemic control, which led to the revision of related laws to specify what type of information can be used in what situations (Ahn, 2016).

2) Change of administrations: Non-transparency was not limited to pandemic policies but to other areas of government action in Park Geun-hye Administration. The most obvious example is the administration's handling of the Sewol Ferry disaster, where 304 people, including 250 high school students on their school trip, lost their lives. Many Koreans feel that the administration tried to cover up various facts to avoid taking responsibility for substandard regulation of marine transportation and the near-complete absence of coordination in rescue missions after the accident (Shin, 2016), all of which contributed to the impeachment of the president in 2017. After the impeachment, the current president, Moon Jae-in, as the candidate from the main opposition party, won the election. Thus, he and his staff had a strong motivation to handle major issues differently from the impeached president.

3) Tradition of interventionist state: South Koreans have a higher expectation of state intervention. This expectation is likely to be an outcome of the interventionist state itself (Sonn 2007; Sonn & Lee, 2015). As is widely known, in the 1970s, the South Korean state actively implemented protective policies for strategically important sectors and eventually made some of those sectors internationally competitive. Researchers of South Korean economic policy termed the outcome of this implementation the "developmental state" (Amsden, 1992). The developmental state, in its original form, has since been overwhelmed by the free market but the state continues to aggressively find a new niche in the economy and society to intervene. (Sonn & Kang, 2017; Wade, 2018). South Koreans are familiar with the state's omnipresence and often request it. Therefore, the state's mobilization of surveillance data collected by private businesses does not look unfamiliar to South Koreans. When people's expectation of state intervention is combined with the recent history of protests on the state's errors that we explained in the previous paragraph, the state is under strong pressure to intervene and handle the situation properly.

4) Smart city policy: South Korea has an extremely aggressive smart city policy (Kim, Gwak & Koh, 2019). The development of the smart city is one of the new niches that the state has discovered in recent years. All local governments put smart city elements in their comprehensive plans. Further, there are two pilot smart new town projects (Eco Delta City and District 5-1 of Sejong City). In these two greenfield sites, state-owned corporations are building small new towns as portals for smart city technological developments. Unlike the majority of smart city projects where IT is introduced to improve existing infrastructure, these two smart new towns will have infrastructure that are designed and built to work with the IT that are predicted to exist in the next decade, such as fully functional autopiloting vehicles. The aim is to integrate South Korea's new town development experiences with

advanced IT and create a brand for urban development businesses overseas as well as job creation within the domestic economy. The heavy use of smart city technology within urban spaces has been promoted by the state; therefore, Koreans are not surprised at all in the use of smart city technology in pandemic control. The smart city data hub that is partly related to the COVID-19 Data Support System that we mentioned earlier is a good example.

Instead of these obvious factors, some journalists have proposed cultural and historical explanations. For example, Traub (2020) argues that the Asian value is the reason why South Korea and other East Asian countries were good at dealing with pandemics. This theory is easily falsified once the spatio-temporal differences in political systems and pandemic control methods are considered. South Korea's response seems similar to that of Taiwan and Singapore, but very different from that of China and Japan. Unlike the first three, China swiftly enforced lockdown measures at three scales: banning most international flights; blocking Wuhan and Hubei; and banning movement of people in cities. Japan's response was closer to that of Sweden than to that of other East Asian nations in denying the need for mass testing. In addition, while Asian values did not change, all these countries adopted strategies different from those in the previous pandemics—SARS and MERS. As noted in one of the earliest debates on Asian value (Kim, 1994), a traditional value can be interpreted and mutated to various forms depending upon context, so the traditional value alone cannot determine the action of the state and people.

Related to 'Asian value' theory is collectivism theory (Mirzafarjouyan, 2020). As Asians are less concerned about privacy and more willing to sacrifice their individual rights for the good of the collective, South Koreans are willing to accept the use of surveillance technology. First, South Korean handling of MERS that we explained earlier completely contradicts this hypothesis. Privacy was well-protected at that time. Second, this theory cannot explain why Western Europeans did not resist much to a lockdown, that is, some might think, a bigger violation of human rights. Despite cultural differences, people seem to be willing to sacrifice their rights when the need and cause of sacrifice is obvious, so the collectivism theory has marginal value in explaining the success of South Korea's strategy.

Some writers argue that people's obedience to state policy that comes from the experience of authoritarianism explains why East Asian countries are doing well in pandemic control (Wintour, 2020). This theory, too, is easily falsified in the face of simple historical facts: Taiwan and South Korea have overthrown authoritarian governments multiple times and there are multiple major parties competing to win elections. On the other hand, Japan and Singapore, where the same party has been ruling the country for the most part of modern history and rarely had incidence of civil disobedience. If obedience is the key, Japan and Singapore should do better than South Korea and Taiwan but the reality is the opposite.

Some authors even argue that the Asian discipline is the key (Annuar, 2020). However, no objective proof validates that East Asians are more disciplined than Germans, English, and other ethnic groups. Different groups of people are disciplined in different ways, so it is difficult to compare the level of discipline across ethnic groups. In addition, Asians often think Japanese are most disciplined of all Asians, but Japan is not handling COVID-19 well.

Implications for smart cities and data protection

Surveillance lies at the core of disease control. 'Test. Treat. Track' is a principle the World Health Organization (WHO) commonly uses in pandemic control (World Health Organization, 2012). The South Korean CDC tends to call it 'trace, test, and treat', but the meaning is the same. Among the three elements, track or trace is based on the surveillance of people. WHO euphemistically calls it 'surveillance of the disease' (World Health Organization, 2020), but it means surveillance of patients and potential patients because pathogens cannot be surveyed without monitoring the people who carry the pathogens. The South Korean strategy has magnified the inherent surveillance by utilizing smart city technologies.

This action obviously raises a familiar question of security versus privacy. People often use as analogies George Orwell's Big Brother, but what exists today is not the same as what this concept represents. On the brighter side, a big brother as a single entity does not exist. Businesses and government agencies can cover only certain aspects of an individual's life. On the other hand, contemporary surveillance is ceaseless. The Big Brother could not monitor a subject continuously, so they had to rely upon the fear of being watched. The absence of surveillance is covered by not letting the subjects know whether they are being watched or not. Today's surveillance technology, especially in cities in advanced economies, extends far beyond that. Google knows what users are reading and watching as long as they use a Chrome web browser. Facebook monitors which ad individuals click and offers more of the same kind. Mobile network providers have been experimenting and will soon launch in large-scale systems connections between location data and advertisements.

Under these circumstances, the fear of surveillance is understandable. Simple fear and complete dismissal of surveillance, however, do not take the discussion far enough. First, the data are already available. Big data firms such as Facebook and Google create huge profits. Thatcher, O'Sullivan, and Mahmoudi (2016) argue that such a business model is a type of accumulation by dispossession (See also Harvey, 2003; 2006; Sonn & Shin, 2020), since the public, who are the producers of these data, have almost no say about its compilation and do not profit from it at all. As the smart city evolves, the city is being converted into a data collection lab, and the big data industry will continue to grow. When big data firms collect data with or without an individual's approval and use that data for their profit, it is difficult to argue that the state should not use the same data for security and safety of people.

Second, we should also consider the changing perception of privacy. In the age of social media where people volunteer to reveal their privacy on Instagram, Facebook, Twitter, and many other online platforms, younger generations are less offended by surveillance.

Finally, and most importantly, the choice in front of us is not between patient tracing through surveillance technologies and perfect protection of individuals' rights. At least on this occasion, the pandemic has forced nations to choose between two evils: 1) extensive use of surveillance technology on a small proportion of the population early on to protect lives and the freedom of mobility or 2) lockdown for everyone, which is practically a weaker form of house arrest and which damages the economy, which in turn, further impoverishes the poorest of society. It is difficult to say which of these two is the better option from a political philosophy point of view, but it is not difficult from an effectiveness point of view. When the public has a better understanding of the effectiveness of surveillance and realises privacy does not have to be fully violated for patient tracing, it would be people who would want

surveillance, not a deep state that exists outside democratic control. A historical evidence is that the majority of Americans did not oppose to security measures in the airport after September 11 (Ross, 2020).

On such occasions, intellectuals' usual warning of a big brother is not likely to change much.

Given all these facts, it is better to accept that surveillance is already in place. Denying these facts makes democratic control of data, surveillance, and the smart city weaker, not stronger. It is better to accept its existence as a reality and contemplate how to control it. One of the critical topics to discuss is the creation of a surveillance system that merges data from different sources. The merging is extremely powerful as shown in South Korea's tracing of COVID-19 patients, so it is useful and dangerous at the same time. When such merging is allowed, how citizen can democratically control this merging, and how and when any merging should be dismantled are some of the important questions that arise.

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