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Changing Mobility Lifestyle:
A Case Study on the Impact of COVID-19 Using Personal Google Locations Data

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ABSTRACT

The article is focused on a detailed micro-study describing changes in the behaviour of the authors in three months before and during the COVID-19 pandemic. The study is based on data from Google Location Service. Despite the fact it evaluates only three people and the study cannot be sufficiently representative, it is a unique example of possible data processing at such a level of accuracy. The most significant changes in the behaviour of authors before and during the COVID-19 quarantine are described and interpreted in detail. Another purpose of the article is to point out the possibilities of analytical processing of Google Location while being aware of personal data protection issues. The authors recognize that by visualizing the real motion data, one partially discloses their privacy, but one considers it very valuable to show how detailed data Google collects about the population and how such data can be used effectively.

KEYWORDS

Behavior Changes, COVID-19, Czechia, GIS, Google Locations, Mobility, Spatial Analyses

1. INTRODUCTION

After the sudden approach of COVID-19 pandemic to our lives, people have had to adjust daily routines according to nation-wide restrictions and anti-epidemic measures. Besides the general availability of data about COVID-19 disease, it is possible also explore and analyse personal data generated via mobile applications with a shared location. An important area of data analysis that is currently being worked on in connection to COVID-19 pandemic is the processing of data from mobile operators. In Czechia, such data are used in the so-called "smart quarantine" (a term used by regional hygiene administrations), which is based on the visualization of individual mobile phone data to for detect the movement of infected people. Based on the infected person's consent, the data is supplied to the specialists, who create so-called commemorative maps. Such maps serve as a graphical visualization of the individual's movement for the past five days. It then helps the infected individual to recall places of his movement and subsequently people he has met.

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The current position of the population can be detected based on a variety of large datasets (often called „big data"), whose importance is growing in recent years in all areas of human activity. Although the topic of big data has been intensively discussed in the last few years, the term originally appeared in connection with visualization more than 20 years ago (Cox & Ellsworth, 1997). Batty (2016) states that determining the boundary of what is and what is not big data is very relative because almost always in the last 60 years there were data sets that could not be processed by the then hardware and software. As a reason why the topic is widely exploited today, Batty mentions a significantly higher number of sensors and online data sources that can be processed. According to Batty, the key aspect of big data is the existence of mobile phones and the large amount of potential data associated with them. In a number of his publications (e.g. Batty, 2013; Batty, 2016), Batty mainly describes two main areas of big data that are used for urban studies, namely data from mobile operators and data from social networks. It is important to note that multinational private corporations such as Microsoft, Facebook, Google, Apple or even mobile operators, collect large amounts of data (which can be called big data due to its heterogeneity) on their users, which in the case of the COVID-19 pandemic appears to provide an opportunity to stop the uncontrolled spread of the disease.

In case of social networks, the analysis of big data is often performed on data from Twitter or Foursquare networks (Hawelka et al., 2014; Kocich, 2018), and such data is used to determine land-use (Frias-Martinez & Frias-Martinez, 2014; Roberts, 2017), defining the boundaries of spatial structures (e.g. Yin, Soliman, Yin, & Wang, 2017) or monitoring the mobility of people (Noulas, Scellato, Lambiotte, Pontil & Mascolo, 2012; Long, Jin, & Joshi, 2012; Noulas, Scellato, Mascolo & Pontil, 2011). Similarly, data from many other social networks are analyzed (Frothingham, 2014; Haworth, 2016; Selala & Musakwa, 2016), which also include networks focused on recording sports activities (e.g. Strava, Endomondo, Garmin, etc.). Based on the analysis of data showing the movement of sports activities, it is possible to identify the most frequently used cycle paths, problematic intersections, recreational areas, traffic behavior of mobility participants (Sun, 2017).

In the developed world, ownership of a mobile phone is taken for granted and therefore mobile operator data can serve as the best source for identifying the true location of the population over time. The problem with these data, however, is their unavailability, whether due to price, incompleteness, or other objective criteria. The issue of personal data protection also plays an important role, as data from mobile phones contain sensitive information. Nevertheless, the frequency of use of this data is increasing, especially because it brings valuable insights of real mobility patterns (Calabrese, Diao, Di Lorenzo, Ferreira & Ratti, 2013; Kahrik, Novák, Temelová, Kadarik & Tammaru, 2015; Novák & Temelová, 2012; Sevtsuk & Ratti, 2010; Monsivais, Ghosh, Bhattacharya, Dunbar & Kaski, 2017).

In addition to mobile operators' data, data from Google Location (location tracking) is also valuable. Google collects this data under specific terms of conditions and only if a Google Maps user agrees to share their location. Compared to the data of mobile operators, data from Google Location is usually more accurate, because the location of the device (most often a mobile phone) is determined not only by the proximity of nearby BTSs (base transceiver station) but also by connection to WiFi networks and especially by GPS (if this option is enabled on the device). Thanks to this, it is possible to evaluate in which vehicle the person was moving, whether he was static in one location and what was the accuracy of the targeted position. Google mainly uses the data for its internal analyses, however, each user has the opportunity to download their data in JSON format and further process and visualize it. Based on such data, it is possible to identify the user's location much more accurately, which is crucial for subsequent analyzes. The data can be used, for example, to identify the most common routes (Löchtefeld, 2019), to analyze population movements (Ruktanonchai, Ruktanonchai, Floyd & Tatem 2018), to evaluate spatial patterns of movement, or to analyze visit rates of various places (Romero, 2019). Also, on 3 April 2020, Google released a new service, COVID-19 Community Mobility Reports (Google LLC, 2020), in response to requests from official