

# Purpose of mobility data usage and risk assessment: POSMO ethical data market case

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**Abstract**— This paper scrutinizes the complex risks associated with the utilization of mobility data, highlighting the ethical considerations and potential harm to individuals whose information is collected. It stresses the imperative of adhering to ethical standards in data usage, particularly the importance of alerting to and averting the risk of re-identification and other misuse forms. Further, the paper explores the ethical challenges and responsibilities tied to data usage, centering on POSMO, a data market platform committed to ethical practices. It underscores the decision-making process within the ethics committee as a vital, non-automatable element of ethical data usage, highlighting the significance of human empathy, an understanding of sociocultural contexts, and the evolving nature of moral standards. The paper presents a case against automating ethical decision-making, given the complexity, high dimensionality, and context-sensitive nature of mobility data that necessitates meticulous integration with current systems and infrastructure. Moreover, the paper details the objectives behind POSMO's use of mobility data, from enhancing transportation systems to ensuring public safety, and stresses the importance of limiting purposes to protect the privacy and autonomy of data subjects. This conscientious data usage approach is crucial for upholding accountability, reducing data collection, and avoiding misuse, thereby leading to more transparent, reliable, and ethically oriented data management practices.

**Keywords**— *mobility data, data ethics, location tracking, re-identification, “data colonialism”, automatization*

## I. INTRODUCTION

“Mōtus vīta est”, the ancient Romans said. The substantive aspects of movement are quite informative in the context of studying its subjects. Just as ancient hunters tracked prey by the patterns of tracks on the ground, so in the modern world, mobility patterns contain information about key aspects of individuals' life activities. 'Traces' in real space are recorded as data, collected by various collectors for a wide range of different purposes. Animals always leave traces during their life; it is a necessary condition for survival and continuation of the species. Humans possess the freedom of choice, rationality, and the ability to predict, and therefore can independently determine which of their 'traces', when, by whom, and for what purposes may be used. Or, continuing the logic of the above metaphor, control the availability of digital 'traces', or data about their movements, to increase their well-being and avoid the risks of becoming 'prey', that is, a victim of manipulation, exploitation, or other harm.

Unlike nature, culture is a place of relative safety for human life. The basis of this safety is the moral norms and traditions of behavior and interaction accepted in society,

which have been formed over centuries and millennia. The rapid development of digital technologies and the ubiquitous use of data do not provide sufficient time for the spontaneous, gradual, and progressive establishment of ethical regulations for qualitatively new formats of social interactions. The need to accelerate this process and solidarize efforts to ensure overall safety and productivity in the context of using mobility data is evident.

What is mobility data? “Mobility data records how people and technologies exist and interact with their surroundings and includes footfall, catchment regions, dwell-time analysis, and customer journey mapping, and more.”<sup>1</sup> Based on these data it is possible “to conclude, solve problems, anticipate trends, predict the course of action, answer questions, unlock decision-making, and identify opportunities”<sup>2</sup>. That is, to move from reactive to proactive solutions, that is, to a qualitatively more productive and effective forecasting, planning, and control over changes, that is, to another level of authority. How to find a balance between the efficiency and safety of using mobility data? The high informativeness of the data contains potentially high risks of privacy loss; a high level of privacy protection significantly reduces the potential for data use (Pellungrini R. et al, 2018). However, researchers note “...the paradoxical situation we are facing today is that we are fully running the risks, without fully catching the opportunities of big data: on the one hand, we feel that our private space vanishing the digital world, and that our personal data can be used without feedback and control; on the other hand, the same data are seized in the databases of companies (telecom companies, insurance companies, ...), which use legal constraints on privacy as areas for not sharing it with science and society at large, keeping this precious source of knowledge locked to data analysts or service developers.” (Pratesi F., 2018) The assertion that the analysis of potential risks is exhaustive is unfoundedly optimistic, as the main risks of privacy loss, or re-identification of data subjects, are related to the use of “background knowledge,” which is quite problematic to structure and verify in full. However, at the same time, the argument about the enormous potential of data use, which is currently being realized very limitedly, is valid (Kapp A., 2022) and with a “enormous” attention to possible risks (Pellungrini R., 2017).

So, to find a balance between the informativeness and privacy protection of mobility data, or in other words, a balance between the efficiency and safety of data use, verification of potential data use goals considering forecasting and preventing/minimizing potential risks is

<sup>1</sup> What is mobility data, and why is it important? UNICAST, 2022. <https://www.unacast.com/post/mobility-data>

<sup>2</sup> Wahl M., 2021. Motion-S. <https://motion-s.com/mobility-data-analytics-for-whom-when-and-why/>

necessary. This approach is implemented by the ethical data market POSMO<sup>3</sup>, located in Zurich, Switzerland. Currently, the POSMO (“Positive Mobility”) cooperative specializes in collecting data on the mobility of Swiss residents and using anonymized data for various socially beneficial purposes. Let’s consider the full spectrum of possible applications of mobility data in this specific example.

## POSMO’S PERSPECTIVES OF USING MOBILITY DATA

### A. Transport Mode

Mobility data of individuals are very informative for urban planning and the development of city infrastructure. Therefore, POSMO in view of the global trend towards urbanization (Haraguchi M., 2022) assess the possibility of data donations regarding tracking data and to look to use data for multiple purposes (dashboard in regard to cycling, and questions in regard to public transport. Zurich’s population is expected to increase to 520,000 people by 2040. Accordingly, the city authorities are very interested in using mobility data to ensure the normal functioning of the city. For effective urban development planning, high-quality and accurate data are essential (Chevallier T., 2022), representing different segments of the demographics and not biased by the interests of private companies. As a foundational value of its activities, the ethical data market POSMO defines inclusivity and diversity, meaning equal terms and rights of participation in the cooperative for everyone in case data subject would be motivated by membership. As an independent organization, POSMO provides high-quality and accurate data without intentions to lobby private interests of any companies or communities. It should be noted that technical means of collecting mobility data, such as GPS, are often not sufficiently accurate (Huang H., 2019). Therefore, POSMO in data analytics utilizes data verification procedures to ensure their accuracy and informativeness, particularly in the focus of transport mode or type.

The use of mobility data is necessary for effective traffic management in cities, improving the efficiency and cost-effectiveness of urban transportation, reducing congestion, and enhancing road safety. But these kinds of models do not take into consideration walking and cycling, they are heavily biased towards cars and to a lesser degree towards public transportation. However, using data for these purposes is the most problematic (Huth, D., 2017) from a privacy protection perspective, since with a 98% probability data subjects can be re-identified (Xu, F. et al. 2017), using background knowledge. In addition, not only the privacy of data subjects, but also of certain government entities should be considered in the interests of national security. Famous example of using the Strava fitness tracker in 2017. This led to the disclosure of the locations of military bases in the USA. To mitigate such risks, POSMO explores the possibilities of generating and using synthetic data. Moreover, for city authorities, it is more advantageous, safe, and productive to collaborate with a local data collector rather than digital giants like Google or Apple Maps. In this format, city authorities receive more accurate and precise data without being dependent on foreign corporations.

### B. Environmental protection

Mobility data is necessary for finding and implementing environmental protection solutions. This is widely discussed in academic circles, but in practice, the potential of mobility data is sparingly used (Liu, X., & Dijk, M., 2022). This concerns monitoring the current situation, modelling, and verifying optimal solutions in a specific region, rather than on a global scale. The use of accurate and high-quality local data is a necessary condition for the success of these initiatives. For example, despite the high level of environmental awareness among residents of Switzerland, initiatives such as car- and ridesharing are not popular (Hoerler, R. et al, 2017). Apparently, the implementation of global initiatives to protect the environment requires considering the specifics of the local context for its practical implementation (Oke, J. B., 2019) and the application of various methods and solutions. As sustainability is declared as one of POSMO’s main ethical values, the cooperative’s management is highly motivated to participate in such projects, provided there is informed and voluntary consent from the data subjects.

### C. Business strategies

Mobility data is highly informative for use in the field of sales and formation of business strategies (D’Silva, K. Et al, 2018). Data sharing in this context can also be mutually beneficial for both companies offering goods and services and potential customers, i.e., data subjects, but only if legal and ethical requirements for data transfer are met. This is a fundamental position of POSMO: protecting privacy (real data does not leave the cooperative’s server), and each data request project undergoes a thorough review by an ethical committee and is accompanied by a data curator responsible for the technical aspects of data security.

### D. Societal impact

The use of mobility data is critically necessary for quality management of critical situations, accidents, and disasters. It has been proven that in critical situations people prefer to use familiar travel routes (Harms, I. M., Burdett, B. R., & Charlton, S. G., 2021). Therefore, using such data to forecast, design and manage disaster response strategies is vital. And in this context, the problem of data accuracy and information content becomes crucial, since not all data providers have the spatial or temporal coverage necessary for specific tasks, and they overlook information about the representativeness of the data sample (Haraguchi, M. et al, 2022). Global initiatives to address humanitarian crises as The Humanitarian Data Exchange (HDX), managed by the United Nations Office, do not currently have a sufficient arsenal of data to prevent and respond to emergency situations in Switzerland. Accordingly, it makes sense to develop similar initiatives on a local scale (Yabe, T. et al, 2022), and this requires not only financial investments (Balsari, S., Buckee, C., Chan, J., & Schroeder, A., 2022), but also effective communication and safe cooperation. There is reason to believe that the format of an ethical data market in solving such problems is optimal.

Mobility data has become a vital tool in enabling effective public health and epidemiology, especially for tracking diseases and understanding how people’s movement patterns contribute to the spread of disease (Kishore, N., 2021). Perhaps it is in this context that the ethical dilemma between public good and privacy protection is most sharply presented.

<sup>3</sup> POSMO. <https://posmo.coop/>

Vital interests and public health/well-being take precedence over privacy according to GDPR and FADP. However, the implementation of these principles is fraught with human rights violations, meaning it is associated with extremely high risks, which complicates the decision-making process, the criteria for evaluating justified and reasonable intervention, and their validity in specific situations (Savi, M. K. et al, 2023). In other words, the use of mobility data should be assessed as a useful tool (Oliver, N. et al, 2020) in healthcare protection, its application does not diminish the value of traditional medical practices such as manual contact tracing or patient interviews. If traditional medical practices are insufficient for solving certain tasks, it makes sense to use data from reliable providers, for whom solving ethical dilemmas is not a technical problem, but moral regulations for data use are integrated into the architecture of their activities.

Population mobility is not limited to performing routine activities or survival practices in critical situations. Mobility data is increasingly used in tourism (Xu, Y., Xue, J., Park, S., & Yue, Y., 2021) and event planning, to optimize visitor experiences, manage their flows, and improve services. Achieving a positive outcome requires considering a variety of factors, such as information from local communities and businesses and integrating it into tourist and event content, accounting for mass pedestrian and passenger flows of city residents, preventing unauthorized data disclosure to third parties, etc. Collaboration with an ethical data market can also be beneficial to avoid the described risks and damages.

The use of mobility data of residents can significantly impact real estate development in the context of optimizing location selection (Hurtubia, R., Gallay, O., & Bierlaire, M., 2010), qualitative accounting of demographic trends (Pagani, A., Baur, I., & Binder, C. R., 2021) and improvements to investment assessment models (Zhang, J. et al, 2023). Accurate and ethically and legally secure data is a necessary component for the successful implementation of such strategies. Therefore, the outlined perspective of using mobility data is one of the priority tasks for expanding the functionality of POSMO's activities.

## II. PRIVACY AND SOLIDARITY: NEW PERSPECTIVES ON DISCOURSE ETHICS

Mobility data serves as an asset for researching not only patterns of human movement and demographics (Gibbs, H. et al, 2023), economic (Kohli, N., Aiken, E., & Blumenstock, J., 2023), political (Allen, W. L., 2020) and other indicators, but above all, these data reveal patterns of behaviour (Recchi, E., & Tittel, K., 2023) various segments of the population. It has been proven that the characteristics of individual mobility reveal the main characteristics of a person (Wang, A. et al, 2020), their interests, habits, memory. Using these patterns is the key to gaining control over the situation ('the art of reading traces'), and the range of applications of power, as is well known, is extremely broad from positive to negative and even tragic consequences. The greatest concern in the use of mobility data is the threat of loss of privacy for data subjects. At the heart of this problem, A. Calnan (Calnan A., 2009) identifies two main aspects: the loss of control over information (the content of what is prescribed to an individual as a predicate of their identity or behaviour) and unauthorized secondary use of data (without the consent and awareness of the subject). It is worth noting that data ethics at the current stage is focused not so much on defining privacy as on privacy-related harms and ways of mitigating them. This fact

is explained by the requirement for the safe use of data at present to solve current problems and tasks (Kisselburgh, L., & Beever, J., 2022).

The decision to share your data is based on three beliefs: "(1) valence (emotional attitude towards a particular outcome and the allure of receiving a reward); (2) expectancy (self-confidence to do s.th.); and (3) instrumentality (perception of the probability of gaining reward)" (Barth, S., & De Jong, M. D., 2017). However, researchers (Rohunen, A., & Markkula, J., 2019) note a paradoxical trend: the monetary compensation offered by data collectors tends to increase the level of concern among data subjects and raises doubts about the motives of their activities. POSMO's ethical data market offers its data subjects social status not as users of the service, but as members of a community, a cooperative. Thus, individuals retain the agency in decision-making regarding the entire spectrum of data operations. Moreover, belonging to a group based on common goals, values, and benefits is a significant factor in solidifying the intentions and expectations of all collaboration subjects, fostering trust, transparency in decision-making, and accountability in its implementation. In such a format for organizing relationships in the use of data, confidentiality is represented multidimensionally: individual privacy, population privacy, and proprietary privacy (Xie, C., et al, 2022). Such an integrated approach allows us to differentiate the assessment of potential risks and provide the necessary measures to prevent them.

### *Mobility data as an indicator of vulnerability*

Interaction in the POSMO cooperative is based on the ethical principles of inclusivity and diversity, conducted with zero tolerance for discrimination. Therefore, making decisions about the purposes and methods of using data absolutely cannot be automated (Silva, S., & Kenney, M., 2018), and project evaluation for data use is critical (Jakobi, T. et al, 2022). In addition to traditional arguments in favour of ethical principles of inclusion, diversity, and non-discrimination, the rapid development and implementation of digital technologies bring about a qualitatively new one: changing the essence of the concept of vulnerability. Traditionally, certain segments of the population are considered vulnerable: children, the elderly, women, the unemployed, immigrants. However, the accessibility/possibility of using technologies transforms the concept of vulnerability not so much as a definition of a person's status, but as a state of being (Witzleb, A. N., 2020). In certain conditions, which can be adjusted, any individual becomes vulnerable (such as in cases of privacy violations or unlawful data use, like the well-known Cambridge Analytica scandal or the Facebook emotion contagion study). The use of mobility data can serve as an indicator of vulnerability and a means of organizing social support (Xia, C., Hu, Y., Chi, G., & Chen, J., 2023) (Steiner T., 2024).

In addition to organizational measures to protect the rights of data subjects (Steiner T., 2024), technical solutions are crucial, such as data anonymization, time distortion (Primault, V. et al, 2015), built-in additive noise (Calderoni, L., Bandini, S., & Maio, D., 2020) and others, as well as preventing various attacks (Pellungrini, R. et al, 2017).

### *A. The organizational structure on mobility data usage*

The organizational structure of the data market as a cooperative has significant advantage. While the dynamics of digital giants such as Facebook and Google provide reasons

(Crisanto, J. et al, 2022) to define it as a strategy of “data colonialism” (Sadowski, J., 2019), a local cooperative implies a different format of collaboration, in which data subjects are not deprived of self-determination and are not objects of manipulative influence. The preservation of individuals' subjectivity in POSMO is ensured through a transparent and inclusive decision-making process with the control of ethics committee, and accountability for data operations at all stages of the data lifecycle. Since the use of data is essentially an innovative process, the consequences, and outcomes of which are difficult to predict and define, then such a dialogue of all interested parties has reason to believe that it is a successful example of the implementation of the arguments of discursive ethics for situational communities (Markovic J., 2009). In such communities, shared goals and values serve as the foundation for cooperation and solidarity, but group members maintain a focus on their own subjectivity.

### B. Why ethical decision making can not be automated

Making ethical decisions requires the use of human compassion, understanding of the sociocultural context, and grounds for moral choice. Moreover, mobility data includes confidential information, handling of which can lead to various consequences. Therefore, decisions must be made with consideration for responsibility and accountability, which cannot be fully automated. In each case, prioritizing ethical standards and social values over economic benefit may seem illogical or mistaken. The dynamic nature of moral norms changes over time, making ethical issues controversial and complex, often turning them into dilemmas. Transparency in making and implementing such decisions is necessary, as it contributes to the formation of public trust and stable development in data usage.

From a technical standpoint, automating the decision-making process appears unlikely. Mobility data is typically multifaceted, variable, and context-dependent, reflecting human behaviour. The use of automated methods could negatively impact the quality and utility of this data. Moreover, mobility data often requires integration with various systems and infrastructures, adding to the complexity. Overcoming these technical challenges, if possible, would require substantial resources. Therefore, the most optimal format for resolving ethical dilemmas is discursive ethics, an open and accountable dialogue involving all participants in the data use process, prioritizing common goals and values and adhering to the principle of self-determination. The optimal organizational structure for implementing this interaction format is an ethical data market cooperative as a situational local-level community. It is in such a context that achieving a balance between ethical principles and the expected benefits of using mobility data, protecting the rights of data subjects, and ensuring data informativeness, personal interests, and the common good appears possible.

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