The Unreliability Paradox:

What Kind of Data Science and AI Do We Need in Transportation?

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The core goals of transportation planning have always been the enhancement of accessibility and mobility of goods and individuals. “Accessibility” is broadly defined as the *potential* to travel and "mobility" as the *realised* travel. Better accessibility is associated with a larger choice set of destinations to be reached with the same effort. Better mobility is associated with improved qualities of the transportation system, in particular speed, reliability and comfort.

Through data science and artificial intelligence, transportation planning has been subject to major developments: New sources of large data have brought a much deeper understanding regarding movement patterns and motivations for travel. Prediction of delays, real-time response and optimization of schedules have all been subject to significant developments. The profitable operation of new forms of transportation, such as vehicle-sharing is not thinkable without intelligent data science. Further, and arguably, the biggest game changer for accessibility and mobility, is the introduction of autonomous vehicles.

At the same time, a development that might be considered as partially contrary to these advances is taking place and also gaining in significance: It is by now well-established that “local accessibility” and “slow mobility” are key aspects for well-being and quality of life. For example, the “15-min-city” and ideas related to “machizukuri” are important concepts where it starts to be acknowledged that it is important to encourage persons to stay within a neighbourhood. Environmental reasons are one argument but “well-being” is at least as important.

The underlying reasons why “well-being” may improve through such measures deserve further examination. Reduced stress from spending less time traveling and greater opportunities to build social connections—once the need for lengthy commutes is eliminated—appear to be key factors. However, opponents might argue that achieving “ultimate accessibility and mobility,” where individuals could hypothetically “beam

themselves anywhere," would yield similar benefits. This suggests the need for a deeper analysis. In this context, important considerations include the potential mental stress associated with excessively large choice sets and the significance of effort in achieving one's goals. This has, for example, triggered the development of research on "benefits of inconvenience" (see e.g. https://fuben-eki.jp/en/). Closely related to this is further the theory of "resonance" by Hartmut Rosa. Rosa proposes that a "resonating" life is desired by all and that there are four key aspects that encourage resonance. In particular, the role of "surprise" and "unavailability" (in his book the fourth aspect of resonance) which, in a transport context, is closely related to "unreliability", appears to be important in our context. Ultimate accessibility and mobility appear a dream come true but would minimize this aspect and potentially lead to large negative "side effects".

Based on these arguments we aim to discuss what the role of data science and AI is and if we need to rethink what defines a "better" transportation system. Questions we aim to address in this workshop are hence related to where the role of data science to "improve" transportation systems needs to be critically rethought. More specifically, we are thinking about the following three questions:

- What is the best mathematical framework for rigorous data analyses of unreliability? What mathematical guarantees can and cannot be expected?

- How can data science help distinguish "good" from "bad" unreliability, quantify the long- and short-term impacts, and communicate the results?

- Can the "benefits of inconvenience", positive (side-)effects of "surprise" and "unavailability" be quantified and if yes, should these aspects even be considered in cost-benefit analysis?

- How can approaches like gamification and fuzzy information create more robust, safer, and smarter traveller experiences? In the longer term, can such approaches support well-being? If yes, what methods and pipelines from contemporary machine learning and AI might lead to new tools for travellers? Are new tools even necessary?