



Aalto University
School of Engineering

Decision-Support for Human-Centered Planning of Mobility Systems

Milos N. Mladenovic
Assistant Professor
Spatial Planning and Transportation Engineering
Department of Built Environment

03.05.2018

Outline

- Three starting premises
- Planning for existing mobility elements
- Planning for emerging mobility elements
- Reflections for action

Starting Premise 1

- Decision-support → Supporting “better” decisions through the use of criteria and societal values
- Decisions should be socially-just

Starting Premise 2

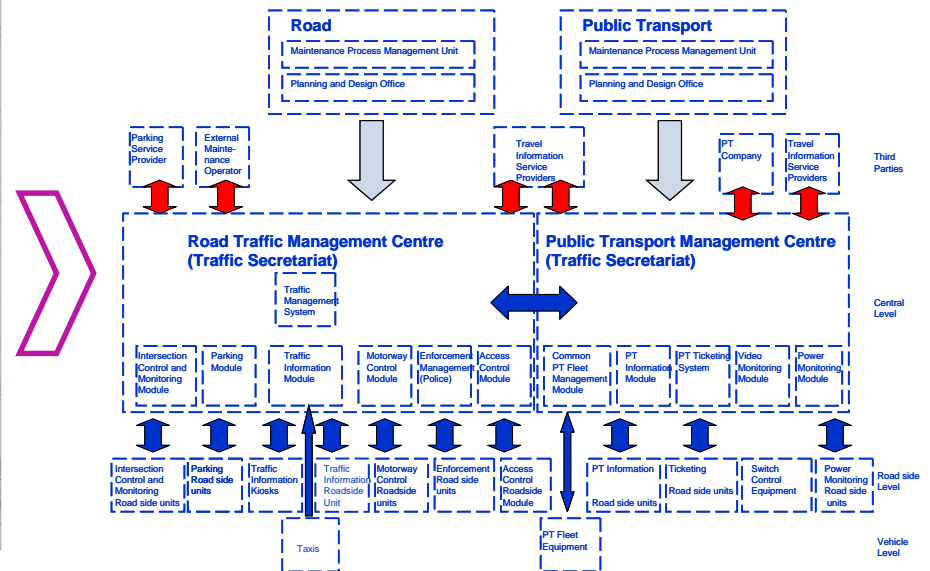
- Human-centered → Understanding the complexity of human behavior
- People are not solely utility seeking, rational beings

Starting Premise 3

- Planning of mobility systems → Methods for envisioning alternative futures with mobility technology and services
- Beyond conventional planning which predominantly focused on the material infrastructure

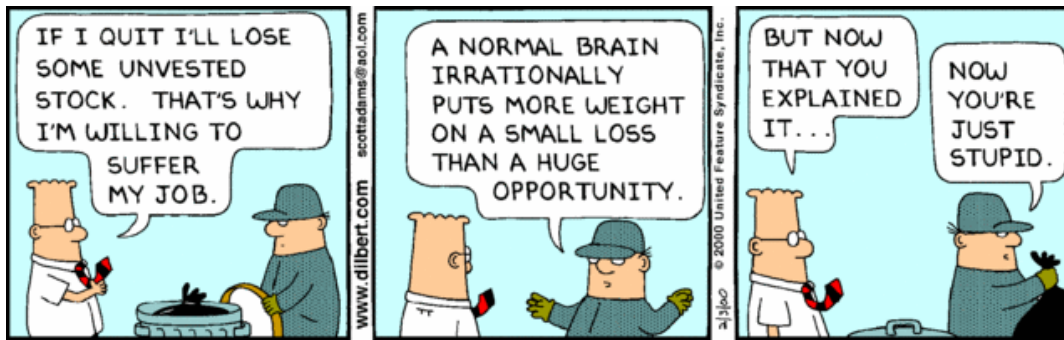
Mobility Systems Planning

- Conventional planning involved decisions about large infrastructure
- 21st century planning will be facing more and more decisions about technological systems and services



Irreducible Human Complexity

- We do not (always) rationally calculate costs and benefits of multiple choices
- We use habitual, mental, shortcuts as heuristics with biases (e.g., willingness-to-pay vs. willingness-to-accept, loss aversion)
- We are also seeking variety (e.g., new alternative as desire for unfamiliar, alteration among familiar alternatives)



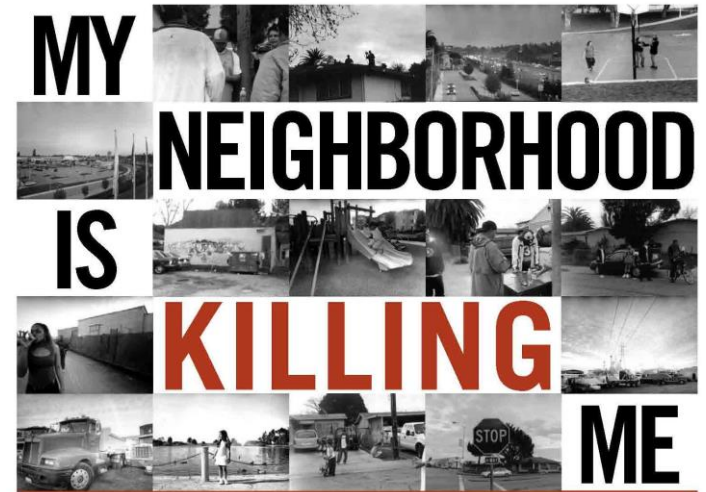
Irreducible Human Complexity

- It is not just about the amount of time, but also about travel experience during this time
- Cultural and social processes affect habit formation (e.g., identification with the appropriate/significant other, tendency towards cooperation in groups through altruism, reciprocity, reputation building, etc.)



Challenge of Socially-just Decisions

- Several theories of social justice in planning (e.g., environmental justice)
- Legal justice vs. social justice
→ not everything that is legal is moral and not everything that is moral is legal
- Balancing equality (of access to opportunities for everyone) and liberty



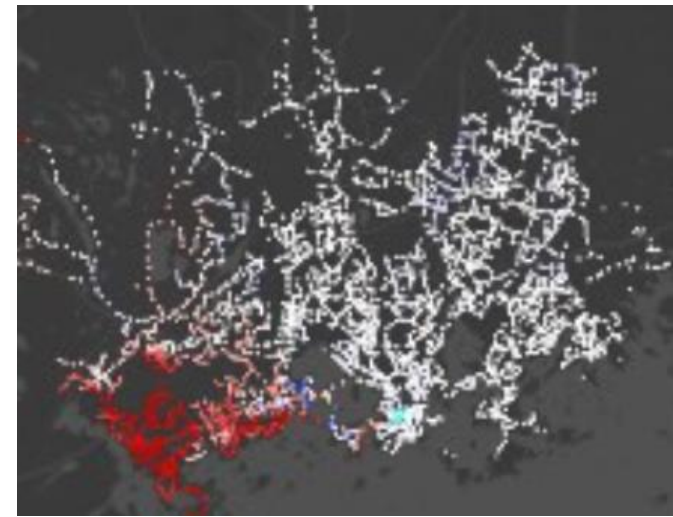
Social Justice Standpoints: Examples

Option 1: Classical utilitarianism

- Maximize the total amount of good minus total amount of bad (minimize total amount of CO₂ emissions)

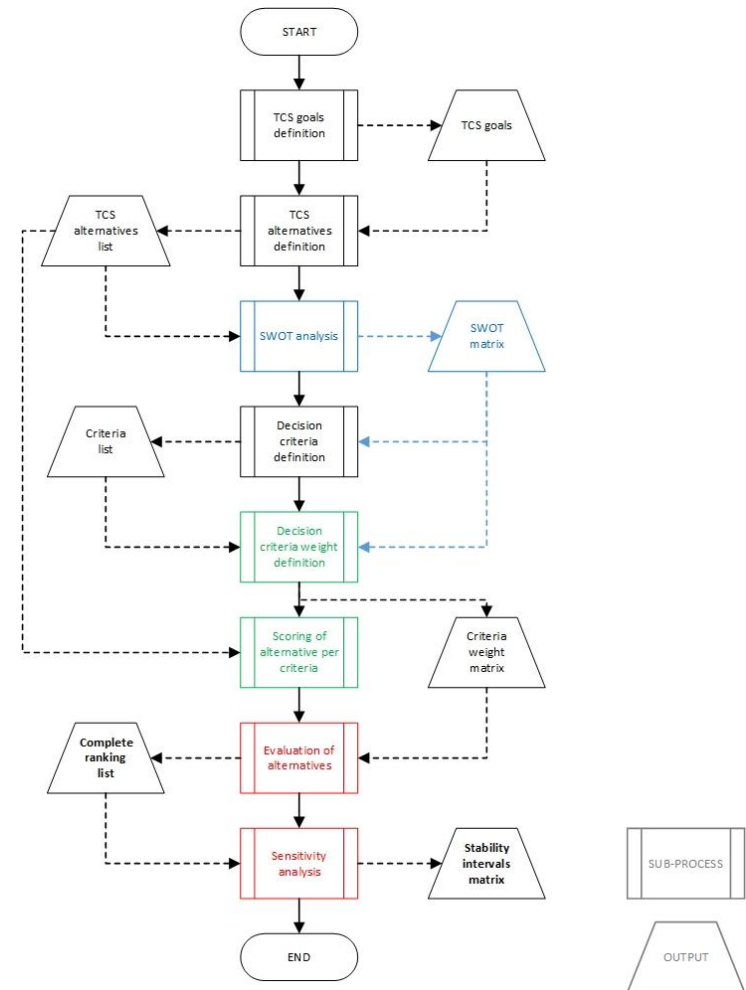
Option 2: Distributive contractarianism

- Understand the distribution of good/bad and maximize the benefit for the least-advantaged (West Metro accessibility to south-west Espoo)



Case 1: Existing Technologies

- E.g., Road pricing technology
- Well-defined technological features
- A range of multi-criteria and modeling decision-support methods
- Well-established deliberative procedures
- Criteria can include: fairness of pricing, user friendliness, privacy, user cost, etc.



Case 2: Emerging Technologies?

- Connected vehicles



Case 2: Emerging Technologies?

- Urban demand-responsive mobility services



Case 2: Emerging Technologies

1. **Uncertainty:** known unknowns and unknown unknowns
2. **Struggle of visions:** images of alternative “problems” or “challenges” and “solutions”
3. **Engineer’s blind spot:** focusing on the object of the design by narrowing the down the range of possible and desirable futures
4. **Systemic effects:** expecting mostly positive and discounting undesired
5. **Value-based decisions:** we can decide about these technologies by explicitly accounting for complexity and social justice

Case Study: Priority System in Mobility

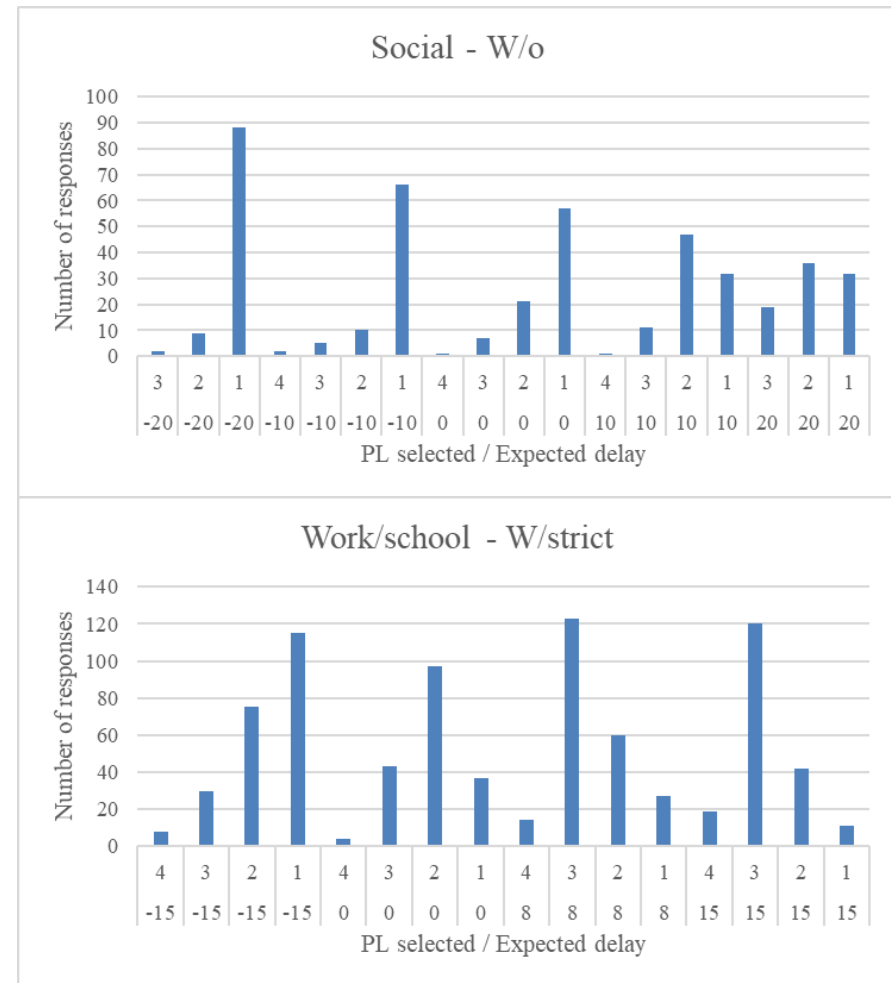
- User can select Priority Level (PL) for each trip
- 4 PLs, ordinal scale, from least important to most important
- PLs are used to determine the right-of-way
- Starting with 20 Non-monetary Mobility Credits (\mathbb{C})
- Each PL relates to \mathbb{C} gain or loss

PL	1	2	3	4
\mathbb{C}	2	0	-2	-10

- Emergency Credits (\mathbb{C}) and Dynamic \mathbb{C} Ceiling
- Web-based experiments in the United States

Results in Brief: PL Selection

- People tend to select lower PL for shopping, social, entertainment, vs. holiday, personal business, work/school, and medical trip purpose
- Users tend to select lower PLs when there is no (strict) time obligation, as opposed to trips with time obligation



Conclusions for Action

- Some old challenges will remain (e.g., simultaneous demand and dynamically-limited network capacity)
- Shaping people's behavior requires an expanded understanding of humans, individually and collectively
- Making socially-just decisions requires seeking of balance between sums and distributions of effects
- Provide opportunities for truly participatory development of mobility systems, with all its messiness
- Learning to plan for technology will require inter-organizational collaboration

Selected References

- Pangbourne, K., Stead, D., Mladenovic, M., & Milakis, D. (2018). **The case of mobility as a service: A critical reflection on challenges for urban transport and mobility governance.** In Governance of the smart mobility transition (pp. 33-48). Emerald.
- Jokinen, J. P., Sihvola, T., & Mladenovic, M. (2017). **Policy lessons from the flexible transport service pilot Kutsuplus in the Helsinki Capital Region.** Transport Policy.
- Mladenovic, M., Mangaroska, K., & Abbas, M. M. (2017). **Decision support system for planning traffic operations assets.** Journal of Infrastructure Systems, 23(3).
- Glavic, D., Mladenovic, M., Luttinen, T., Cicevic, S., & Trifunovic, A. (2017). **Road to price: User perspectives on road pricing in transition country.** Transportation Research Part A: Policy and Practice, 105, 79-94.
- Mladenovic, M. (2017). **Transport justice: designing fair transportation systems.** Transport Reviews, 37(2), 245-246.
- Blyth, P. L., Mladenovic, M., Nardi, B. A., Ekbia, H. R., & Su, N. M. (2016). **Expanding the design horizon for self-driving vehicles: Distributing benefits and burdens.** IEEE Technology and Society, 35(3), 44-49.
- Mladenovic, M., & McPherson, T. (2016). **Engineering social justice into traffic control for self-driving vehicles?.** Science and engineering ethics, 22(4), 1131-1149.

Kiitos!