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Designing Storytelling Maps for Cross-Regional Transport Network Planning

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Abstract:

Transport networks in neighboring regions are interconnected, meaning that for inter-regional trips, the utilization of transport services is influenced by each region's network. However, the lack of coordination can result in sub-optimal outcomes for the overall system. In this context, it is essential to account for the *strategic interactions* among sub-network designers. Medeiros (2019) concluded cross-border railway services tend to be overlooked in investments of countries, leading to a potential loss of travel demand and undermining the competitiveness of rail transport. He et al. (2024) proposed a game-theoretic framework for the multi-region network design problem by leveraging both non-cooperative and cooperative game theory. The goal of the framework is to facilitate the modeling of multi-region network design problems, proposing mechanisms to align the interests of decision-makers, foster cooperation, and improve performance from the perspectives of sustainability, efficiency, and social welfare. Applying the results in the real world is challenging, as it often involves stakeholders such as transportation policymakers, transport operators, and various customers.

We identified that storytelling maps can effectively organize spatial information and make the trade-offs in cross-regional transport network plans more accessible. Storytelling maps often use maps, graphics, imagery, and videos to illustrate specific events and people with a spatial focus (Roth, 2021). Storytelling maps embed visualizations and textual descriptions in narration (providing context and structure), making the message more relatable and memorable to readers (Thöny et al., 2018). For example, Bartalesi et al. (2023) designed storytelling maps to explain the Organic Olive Oil Value Chain. Laura Tateosian and Shukunobe (2020) designed storytelling maps to explain the key events and strategies of two teams in a video game, such as positions, movements, and attacks.

In this project, we are planning to design and develop an interactive story map that can help explain the impact of cooperation on environmental sustainability, transport affordability, and public transport profitability. The storytelling map will explain the background, visualize the different transportation network plans, and further show the impact on transportation operators and passengers. To demonstrate the design of storytelling maps for transport network planning, we proposed three Research Questions (RQs):

RQ 1: How does a storytelling map inform a spatially meaningful understanding of the network design plan?
RQ 2: In what ways does a storytelling map illustrate stakeholder values and experiences of cross-regional network investment?
RQ 3: What are the benefits of storytelling maps for network design generally?

In this case study, we will design storytelling maps to demonstrate network planning solutions with the networks of Zurich and Winterthur as a case study. The storytelling maps should explain the spatial information of different planning solutions, their impacts, and the co-involvements conditions. As shown in Figure 1(a), these two networks are operated relatively separately, but connected by a rail line operated by SBB. In addition, the customer demand is simulated by MATSim based on population data provided by the Swiss Bureau of Statistics. Figure 1(b) compares network design game solutions with 50% allocated via 1) inter-regional investment mechanism and 2) co-investment and payoff-sharing mechanism.

We proposed three next steps to answer the research questions. 1) Proposing a three-act storytelling structure (Redmond-Sanogo et al., 2018) for each network solution; 2) Visualizing spatial-related information according to the proposed three-act structure in a meaningful way; 3) Evaluating and improving the visualization design to ensure understandability. The storytelling map will be implemented as an interactive web map for stakeholders to communicate the cross-region network plans. The results of this study will contribute to the design recommendations for storytelling maps.

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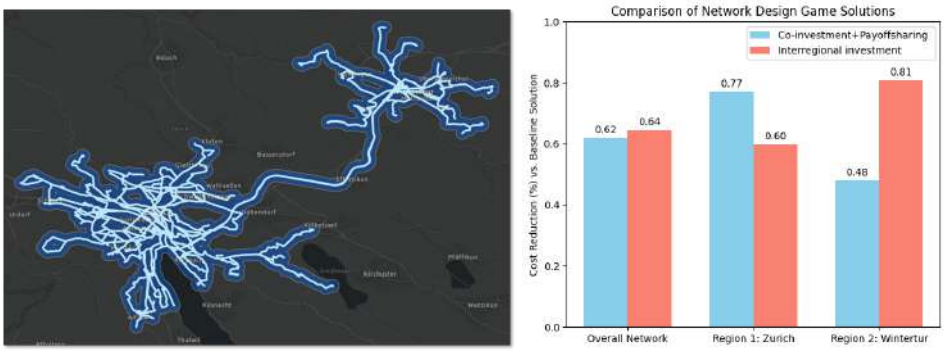

(a) Zurich and Winterthur transport networks (b) Network design solutions

Figure 1. Study area and network design solutions

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