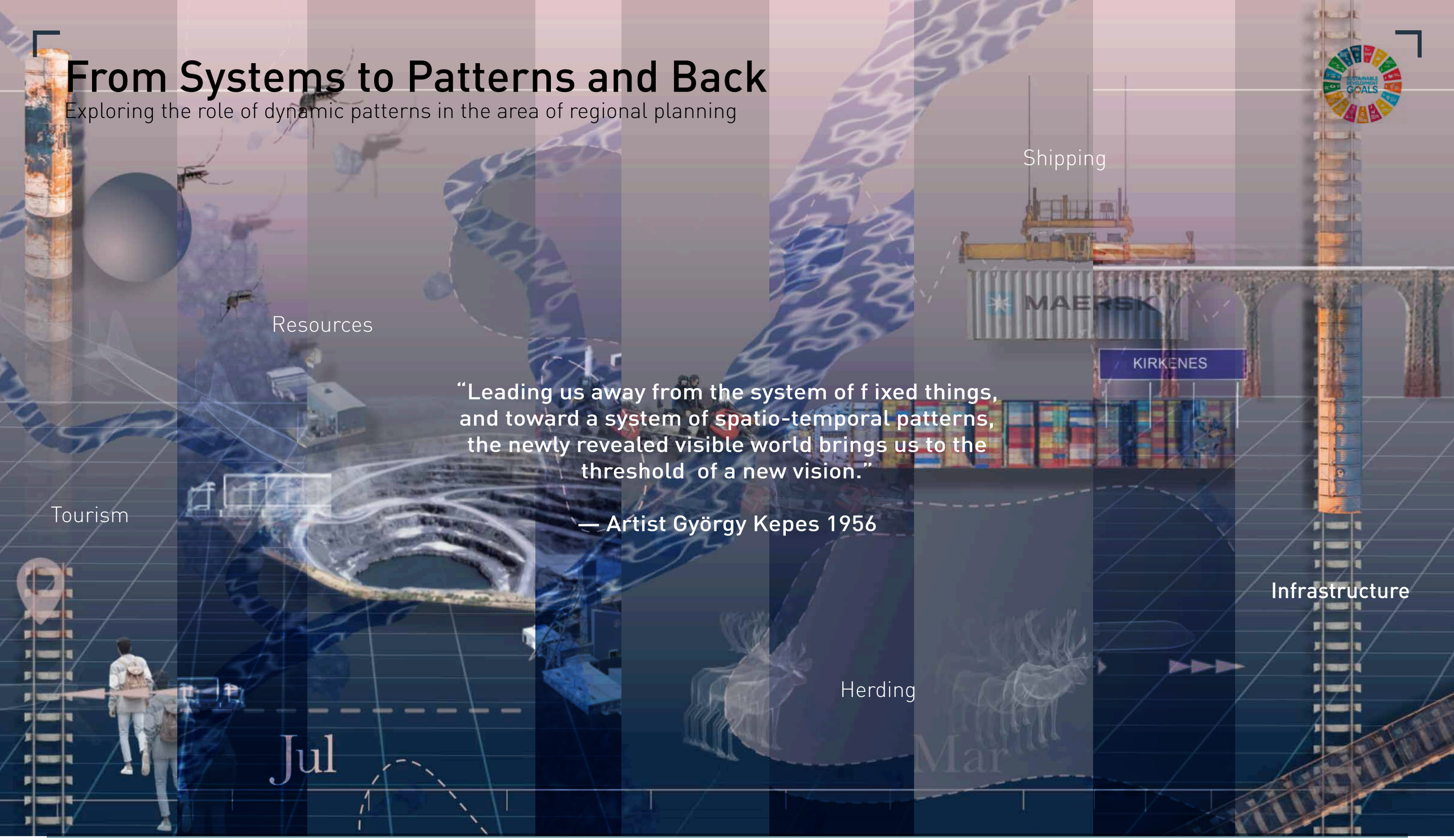
From Systems to Patterns and Back

Exploring the role of dynamic patterns in the area of regional planning



“Leading us away from the system of f ixed things, and toward a system of spatio-temporal patterns, the newly revealed visible world brings us to the threshold of a new vision.”

— Artist György Kepes 1956

Country / City	Finland, Helsinki
University / School	Aalto University - School of Arts, Design and Architecture
Academic year	2019/2020
Title of the project	From Systems to Patterns and Back: Exploring the role of dynamic patterns in the area of regional planning
Authors	Ayda Grisiute

TECHNICAL DOSSIER

Title of the project	From Systems to Patterns and Back: Exploring the role of dynamic patterns in the area of regional planning
Authors	Ayda Grisiute
Title of the course	Master Thesis
Academic year	2019/2020
Teaching Staff	Prof. Pia Fricker
Department/Section/Program of belonging	Department of Architecture, Master's Programme in Architecture and Landscape Architecture
University/School	Aalto University - School of Arts, Design and Architecture

Written statement, short description of the project in English, no more than 250 words

The master thesis presents a data-driven framework to explore the role of dynamic time and direction patterns in the area of Finnish Lapland and Arctic Ocean railway in order to improve decision-making in complex urban and landscape planning and design tasks. In an era marked by dramatic environmental, political and societal changes, the Arctic region becomes more global and complex. In order to cope with the increasing complexity in regional challenges, Systems Thinking, dynamic patterns, modelling and use of simulation are researched to open up anovel ways for complex regional planning methods.

The project presents a dynamic, evidence-based planning and decision support tool called CityScope Lapland. The main goal of CityScope Lapland is to use digital technologies to incorporate dynamic variables in urban and landscape spatial analysis and methodology; secondly, to improve the accessibility of the decision-making process for non-experts through a tangible user interface, and third, to help users evaluate their decisions by creating a feedback through real-time visualization of urban simulation results.

This is achieved by designing an agent-based model and using different representation and abstraction features for different dynamic data packages. The project is integrated within the GAMA simulation platform and embedded in the MIT CityScope framework - a medium for both, analyzing agent's behavioral patterns and displaying them to the stakeholders.

For further information

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CLIMATE CHANGE AGAIN

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SCHOOL PRIZE

The Arctic Ocean Railway

Arctic Status Quo

1. Arctic legal boundaries, Arctic States and Arctic Council Permanent Observers.

2. Arctic infrastructure network

3. Arctic Indnigenous populations, preserved nature territories

4. Northern Sea Route, Arctic Ice

5. Arctic Resoure distribution

Spatial Nararatives

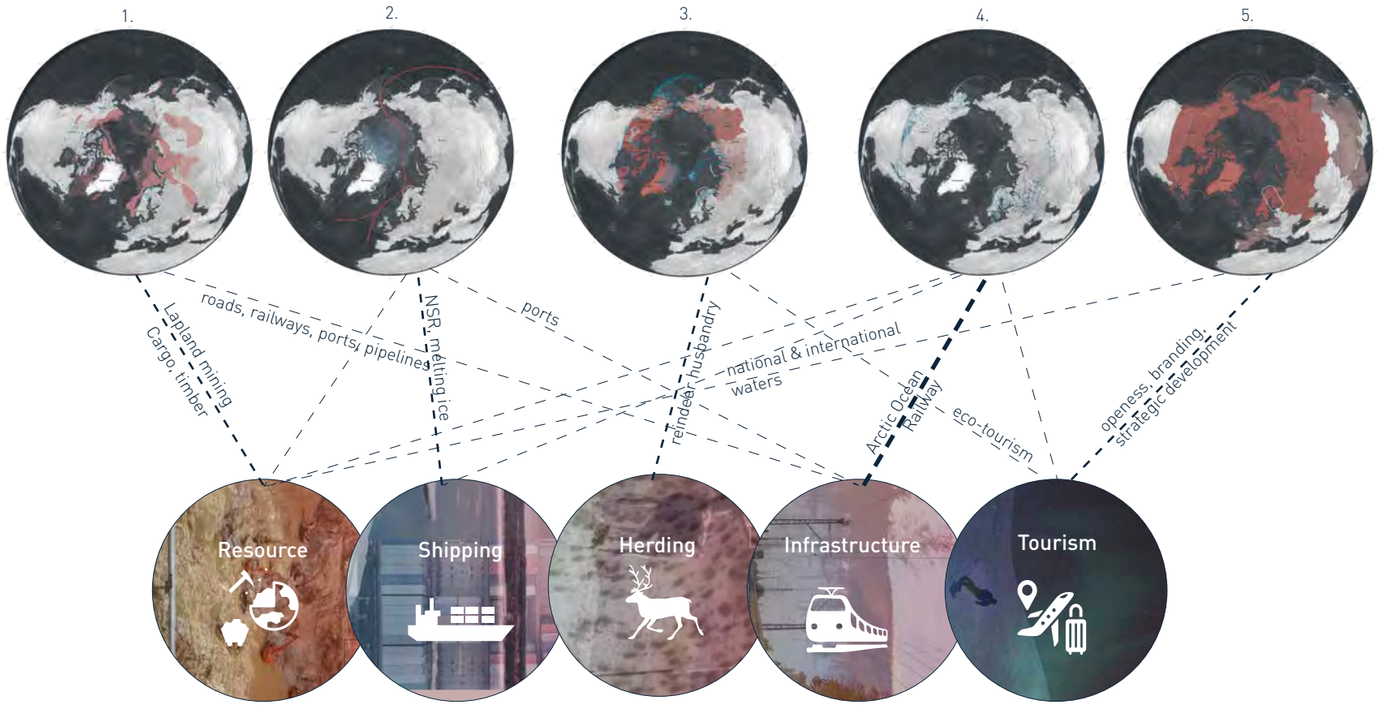
The selected spatial narratives on the left become more and more connected, while in common imagination and often discrete fields, they still stay apart. This causes number of challenges for collaboration and dabate.

The work attempts to blur the traditionally imposed boundaries and emphasize interconnectedness in order to have better informed large-scale decisions.

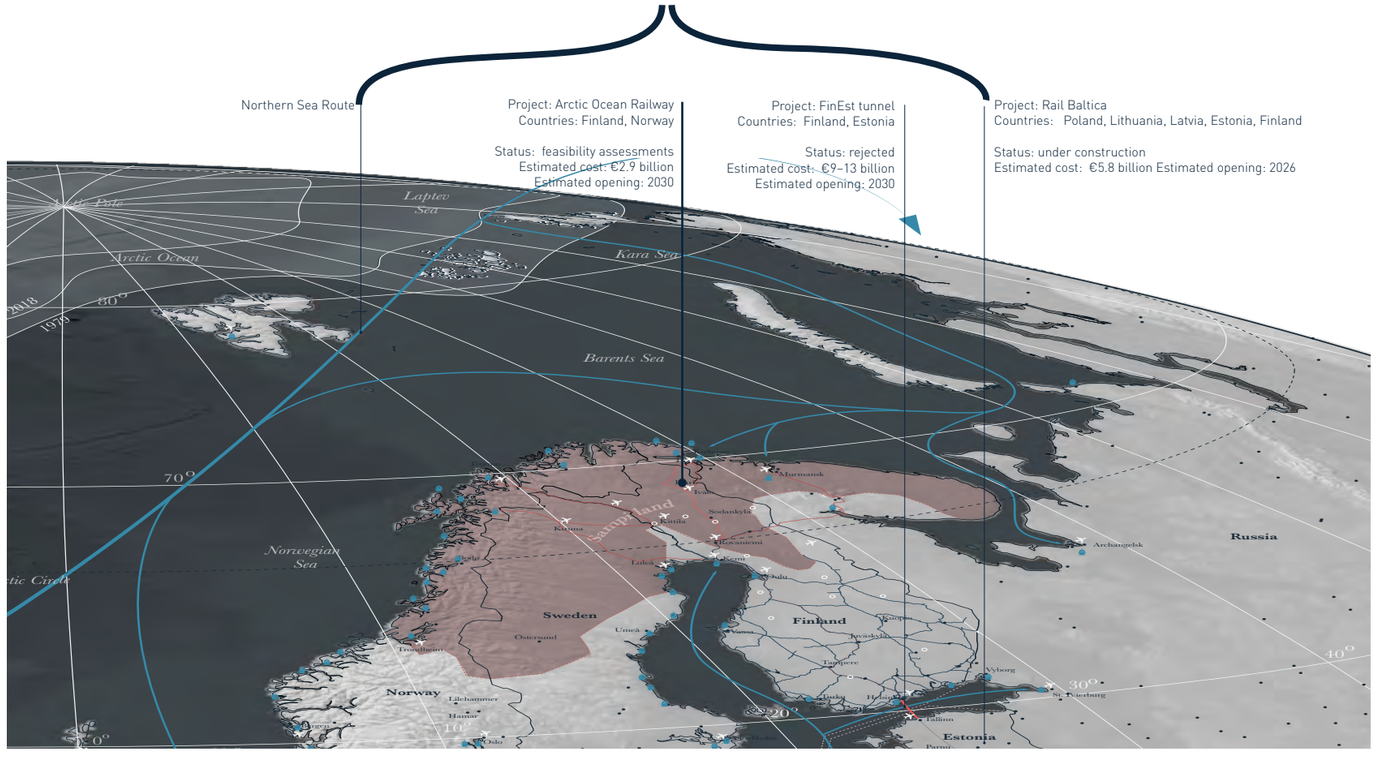
A part of global network

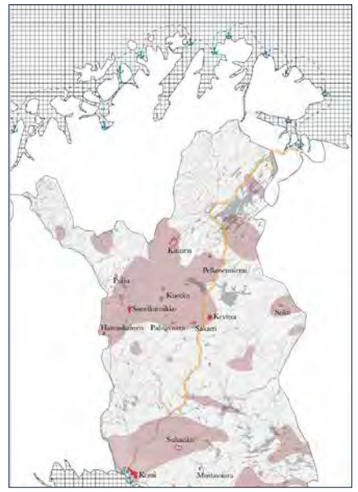
The Arctic Ocean Railway is a complex spatial construct, both environmentally, ethically, technically and economically. On the one hand, the project sounds like a natural expansion of the global mobility network, creating a connection between the Arctic Ocean and mainland Europe. On the other hand, the impact on local environment and the project's complex nature makes it difficult to assess, halting and questioning its development process altogether.

Clear challenges are visible in the project implementation: collaboration among different stakeholders, estimating the environmental implications and economic feasibility.



The Arctic Corridor

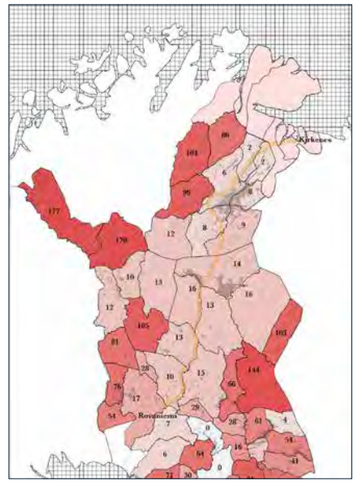




Resource potential

Map portraying the resource potential in Lapland (light red), mines (dark red), supporting infrastructure and the Arctic Ocean Railway.

Shipping · Tourism · Infrastructure



Herding Districts

Map portraying herding cooperative boundaries, reindeer distribution (represented by color intensity of the reindeer cooperative and a number of herders) in Lapland and the Arctic Ocean Railway.

Herding · Infrastructure

Tourism destinations

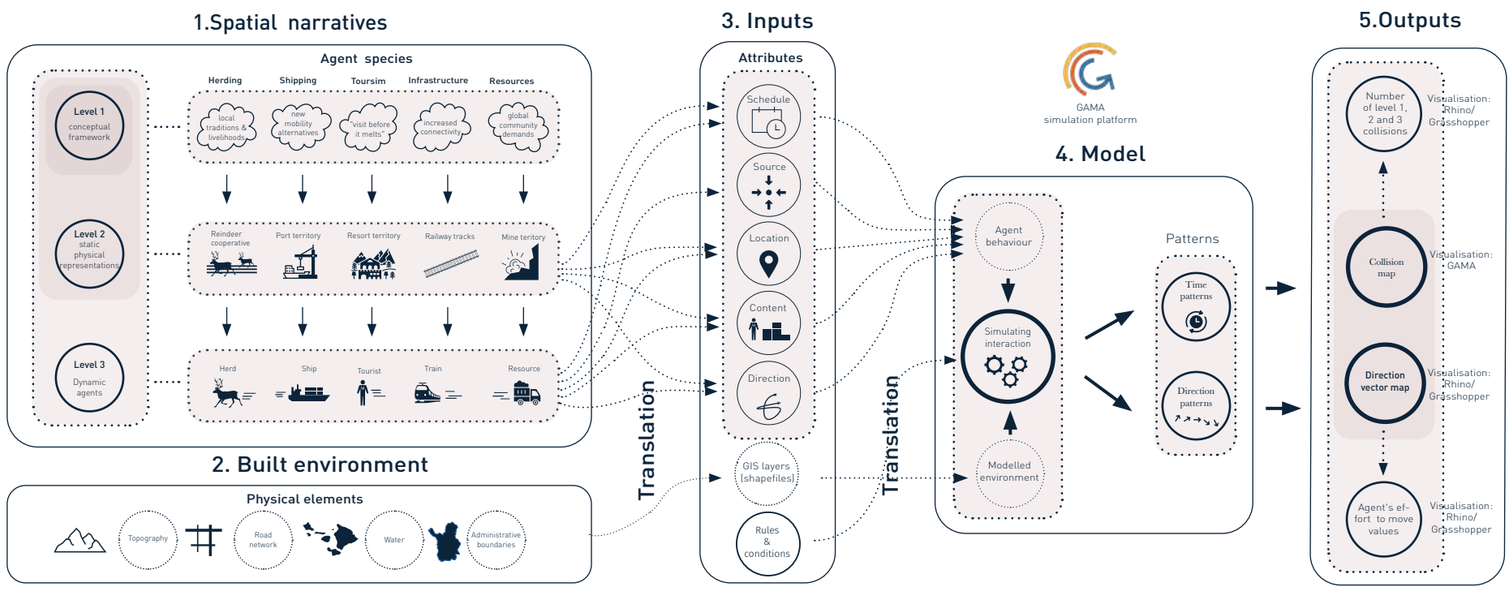
Map portraying tourism destinations in Lapland (resorts and preserved nature areas) colored in yellow and brown respectively, supporting infrastructure and the Arctic Ocean Railway.

Resources · Shipping · Infrastructure

Simulation Model Design

Model structure:

1) Agent species of selected narratives on three different levels.
2) Built environment elements.
3) Input: agent attributes, built environment datasets, def ined rules and conditions for inter-action.
4) Implemented inner model processes that simulate agent behaviour and interaction.
5) Output layers: collision map, direction vector map, support-ing displays - collision counter and movement effort counter.



dynamic representation available:
https://vimeo.com/388881825

Model Outputs

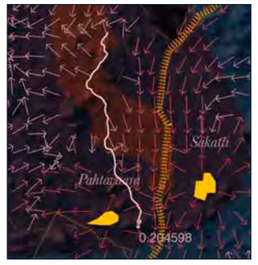
Direction vector map.

Static agents have a direction as one of its attributes. When combined with direction vec-tors of topographic elements they can form a vector field. The generated vector field dis-plays the underlying path-like directional structure.

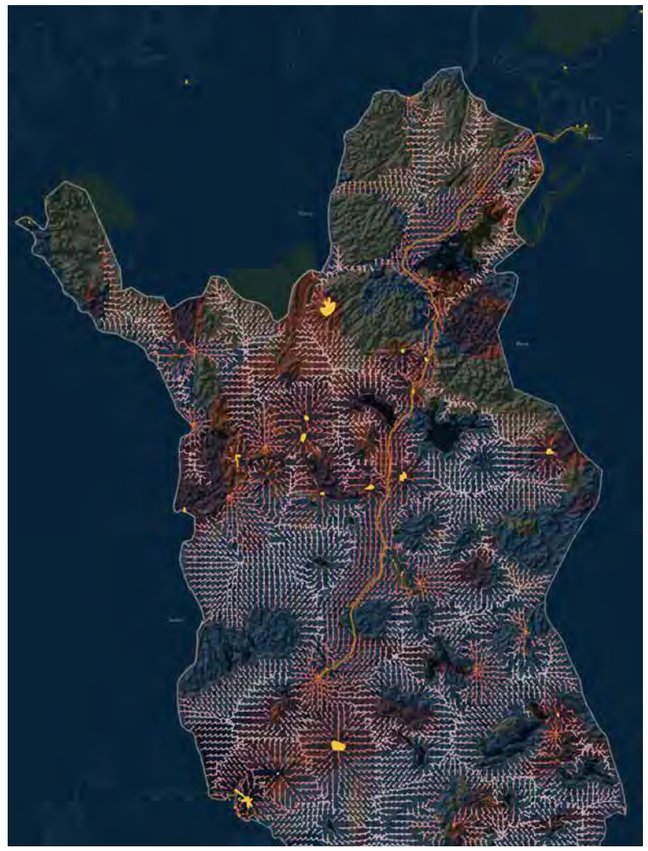
Movement effort counter.

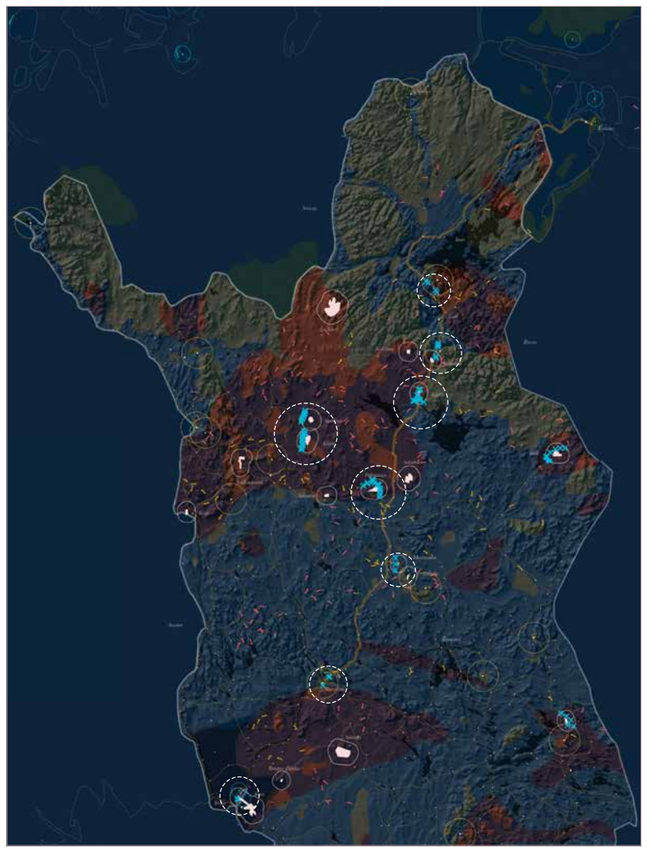
This supporting display visua-lises the effort required from dynamic agents when mov-ing across the vector field. It shows the agent's path and its movement effort along it. The effort value is calculated by comparing vector field values and dynamic agent's direction vector values.

Herd agent path

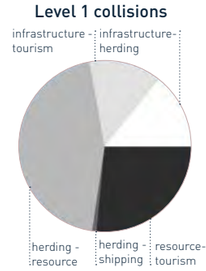


Train passenger agent path

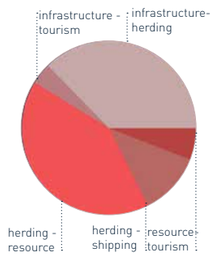




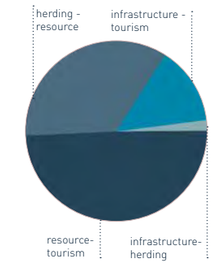
Level 1 collisions



Level 2 collisions



Level 3 collisions



Collision map.

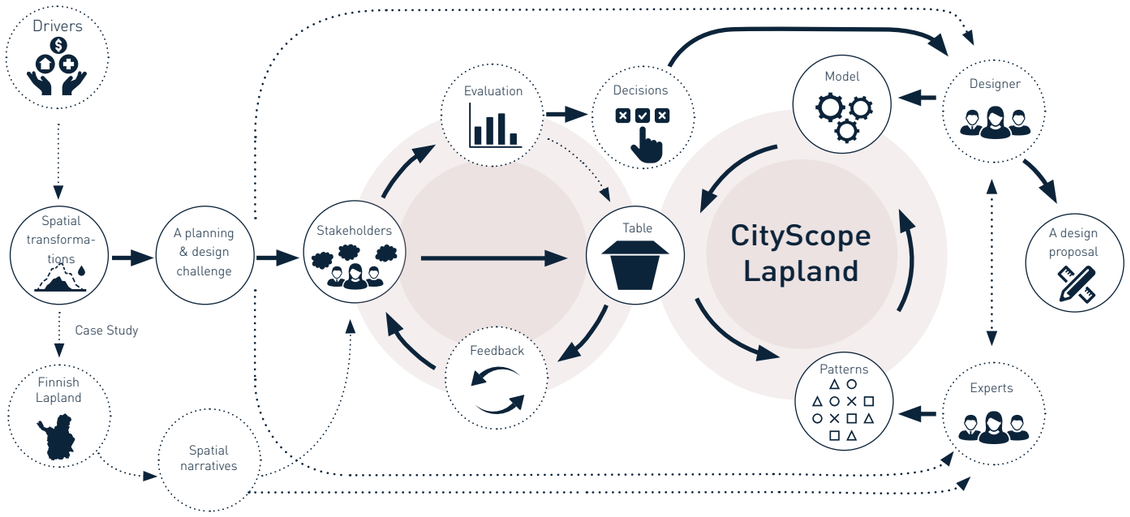
This allows the possibility to distinguish moments where and when different agents col-lide (blue crosses), based on a set of predef ined rules for in-teraction. This output displays occurring collision distribution over time in the modelled en-vironment.

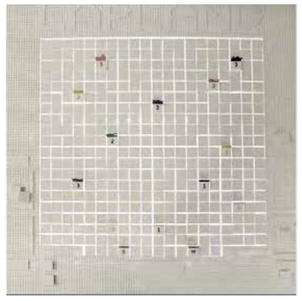
Collision counter.

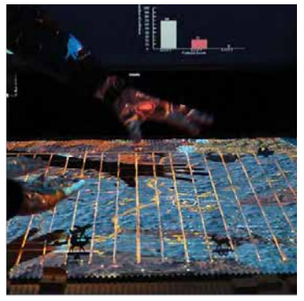
This supporting display visua-lises collisions between differ-ent agent pairs on three levels - conceptual, static and dynamic. It potentially informs about the impact of different agent spe-cies on each other.

CityScope Lapland

Potential workflow of CityScope Lapland







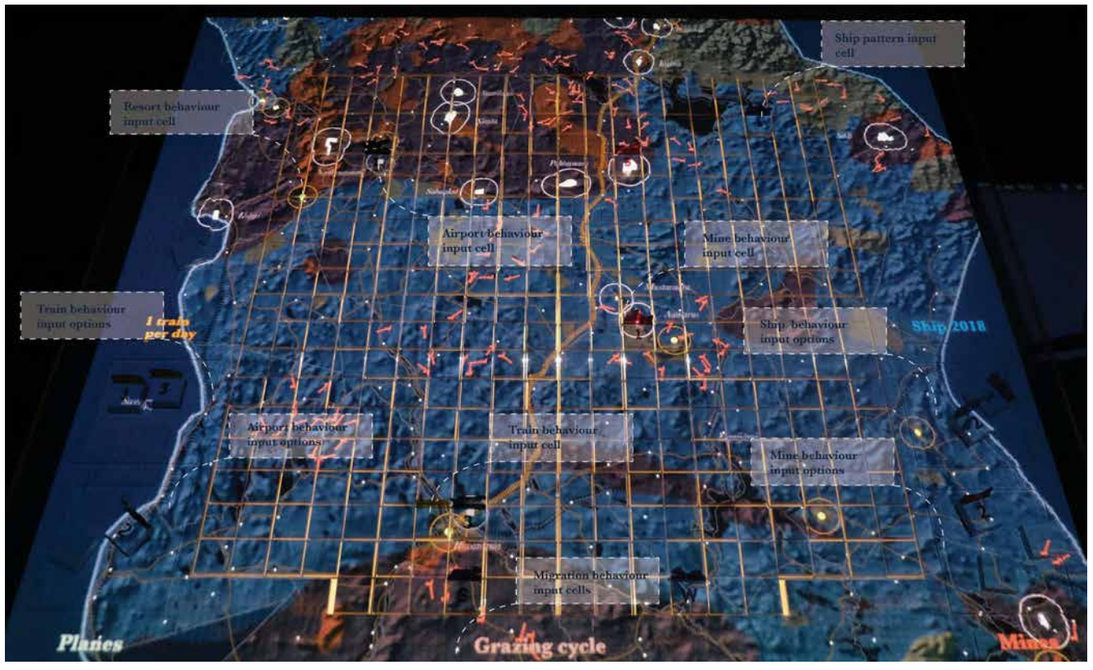
CityScope Lapland table interface

The facilitated CityScope setup for this project is ~1m x 1m with size with 400 interactive LEGO cells.

Apart from displaying the running simulation, additional information is also displayed to create more imersive interactive display.

dynamic representation available: https://vimeo.com/389396106

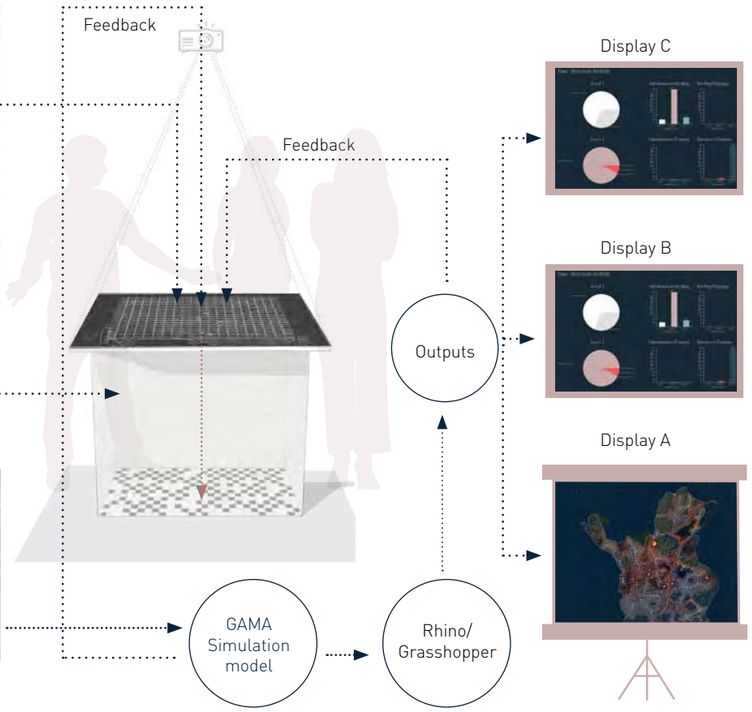
Tangible User Interface



Barcoded Lego modules

In-built scanner

Simulation model



CityScope Lapland hardware - software system

The CityScope setup consists of three layers. The computational layer is the simulation model, the physical table with LEGO works as a tangible layer, and the communication between the former two via in-built scanner is the interactive layer.