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Creating Input Data for an Agent-based Micro-simulation using GIS

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Tasks of Transport Planning

- Optimal design of transport systems
  - Respect global utility and, as far as possible, individual preferences
  - Strategic planning of network development
  - Design (e.g. shape of a road) and configuration (e.g. green time fractions of traffic lights) of infrastructure
  - Determine impacts of changes in infrastructure
  - Design infrastructure to reach a desired impact

Traditional Approach: 4-Step-Process

- Models are created on a zonal level (e.g. a zone is a municipality or a district of a city)
  - Aggregated data can be used

- Aggregated Model
  - No individual preferences of single travelers
  - Only single trips, no trip chains

- Static, average flows for a selected hour, e.g. peak hour

Introduction to Agent-based Transport Micro-simulations

- Every person in a model is represented by an agent with specific attributes and preferences, which allows a high level of detail.
- Detailed behavioral model can be implemented, e.g. based on agents' socio-demography.
- Every agent has a planned daily schedule containing trips and activities, which it tries to optimize.
- Agent-based models allow high resolution analyzes of agents' behavior.

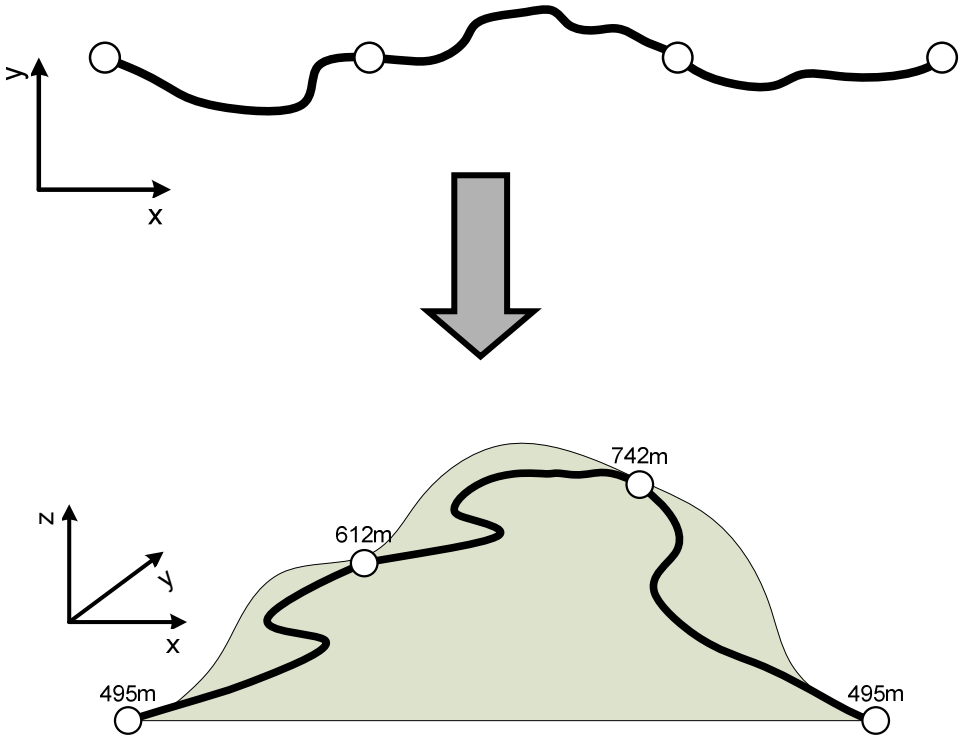
Creating an Agent-based Model

- Problem: Data is often not available on a microscopic level.
  - Aggregated data has to be disaggregated!

- Several typical use-cases for GIS tools, e.g. ...
  - adding height information to a road network
  - assigning buildings and count stations to a road network
  - assigning people to buildings
  - merging datasets

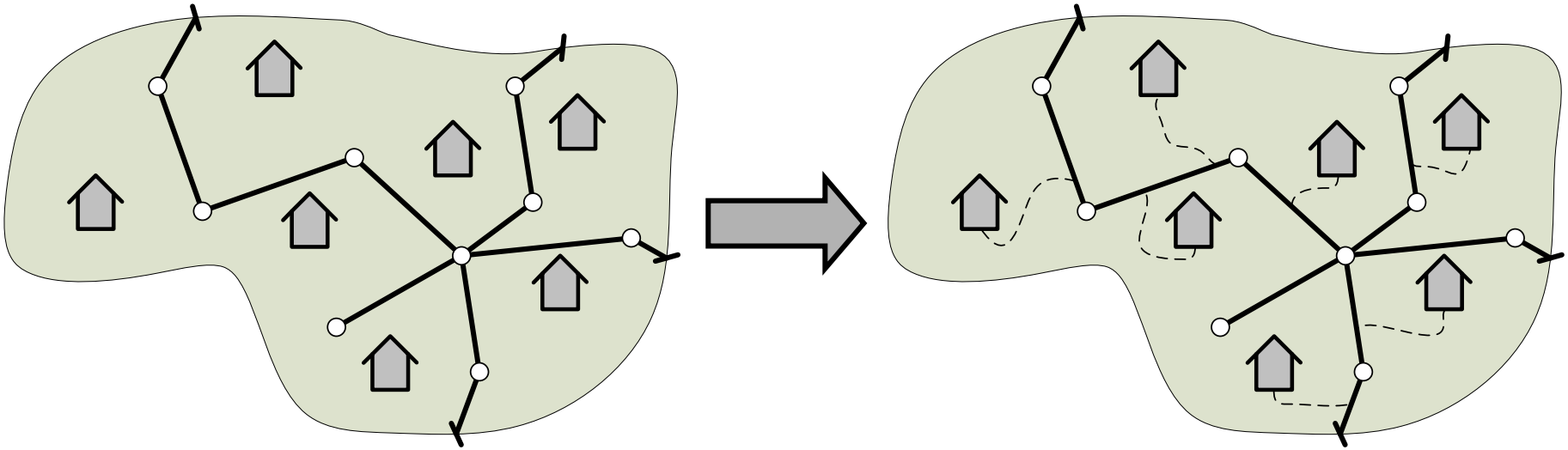
Adding Height Information to a Road Network

- Assigning height information to each node
- Add shape information to each link



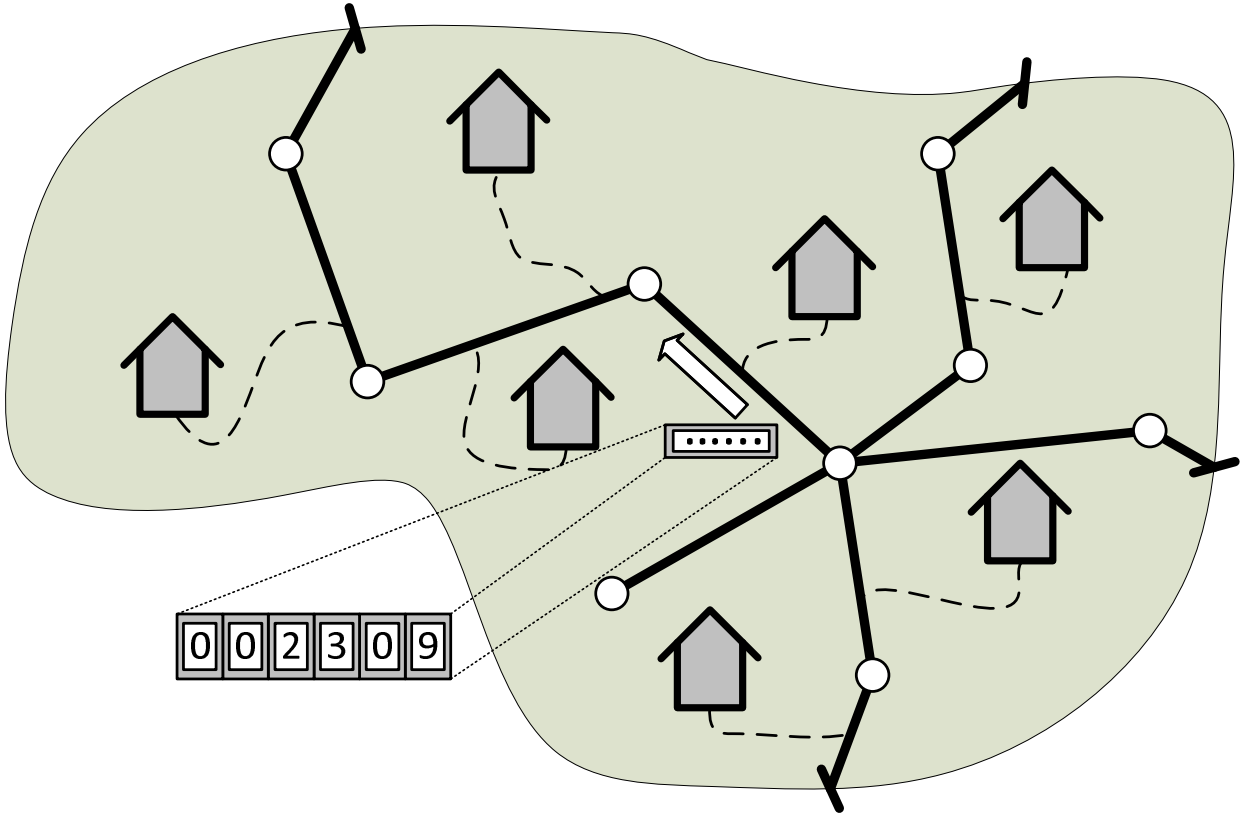
Assigning Buildings to a Road Network

- Assign each building to a road
  - Take road attributes into account (e.g. ignore highways)
  - Use address information (if available) or select nearest link



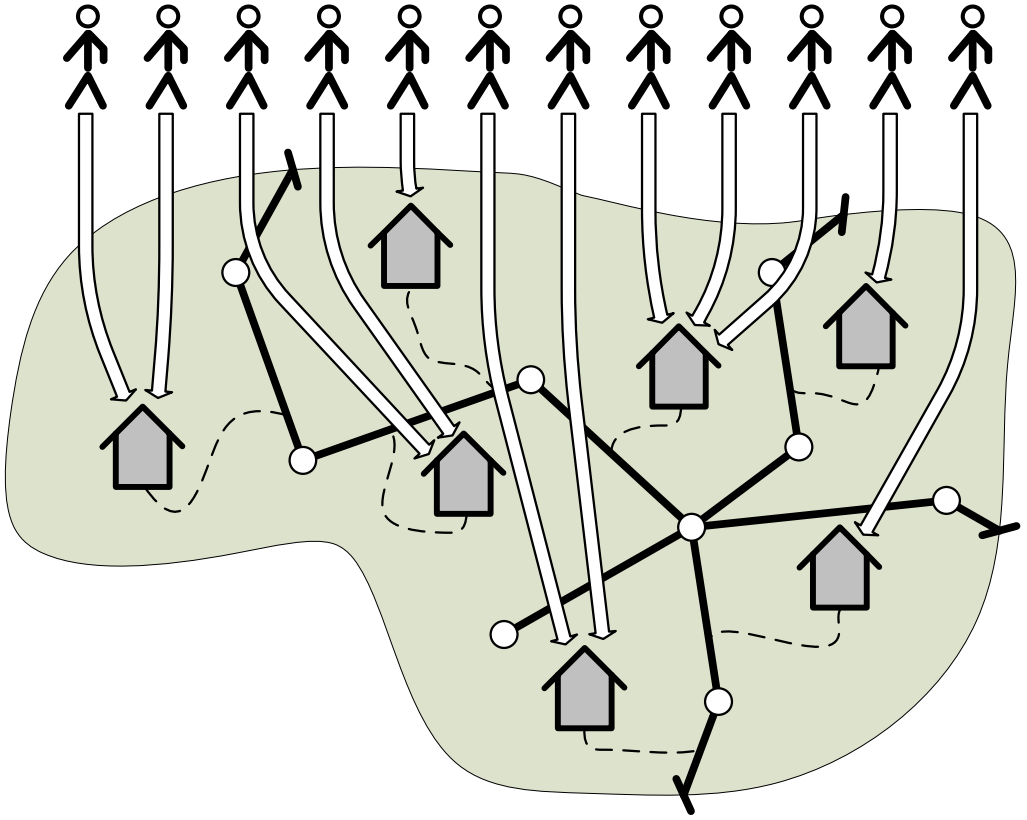
Assigning Counting Stations to a Network

- Assign each counting station to a road.
- Define the direction of focus.



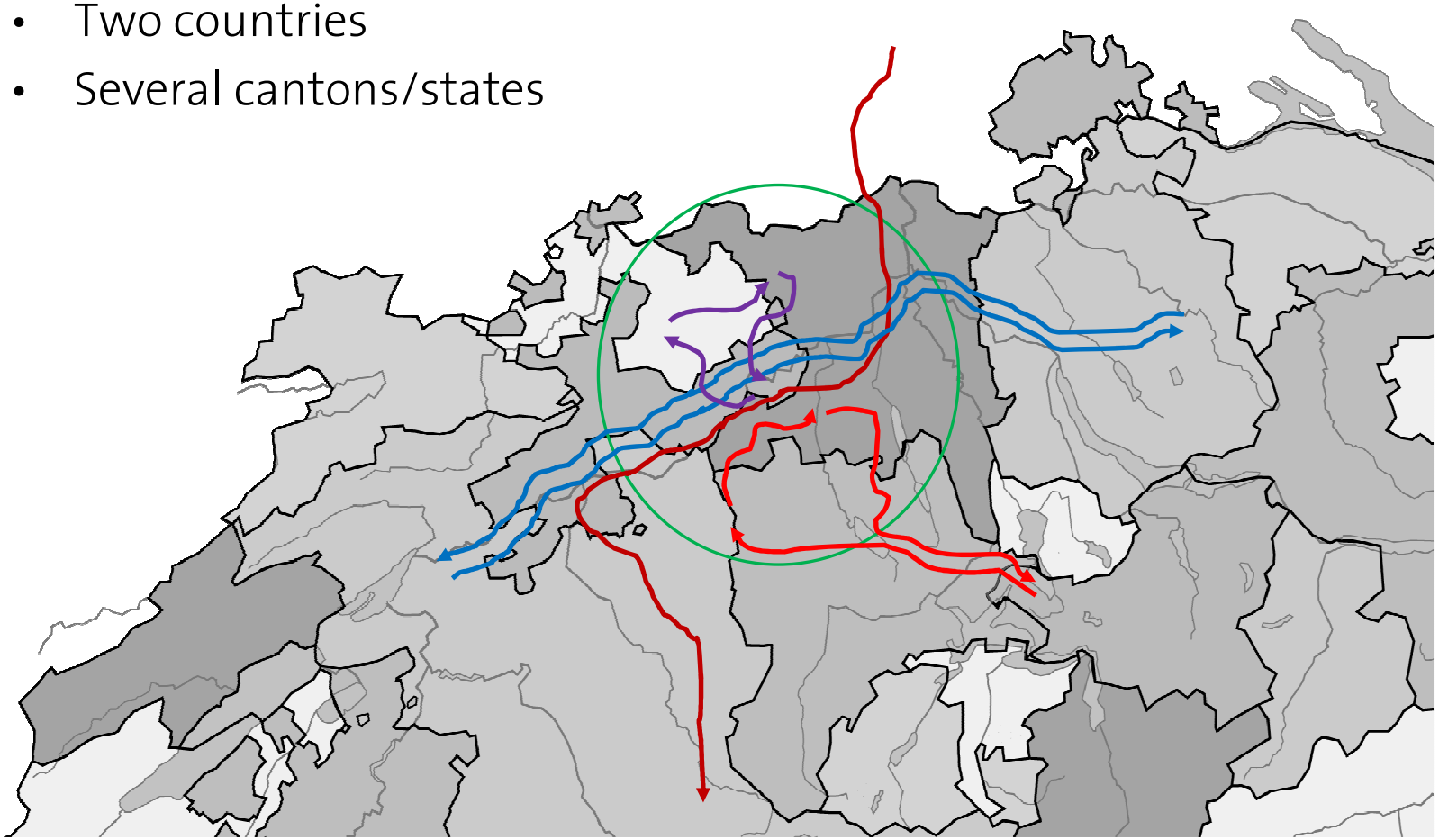
Assigning Population to Buildings

- Typically, population data is given on municipality level.
- Disaggregate population by assigning people to buildings.



Merging Datasets – A typical Scenario

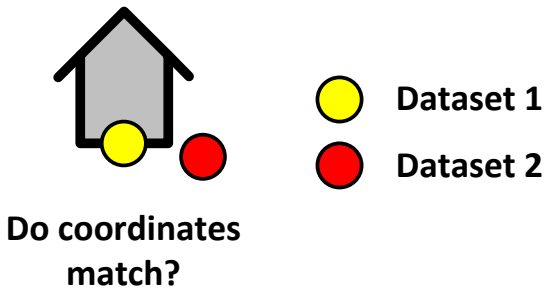
- Two countries
- Several cantons/states



Merging Datasets

- Often, multiple dataset have to be merged and duplicates have to be removed.

- For example:
  - match building datasets from cantons and cities
  - map enterprises to buildings

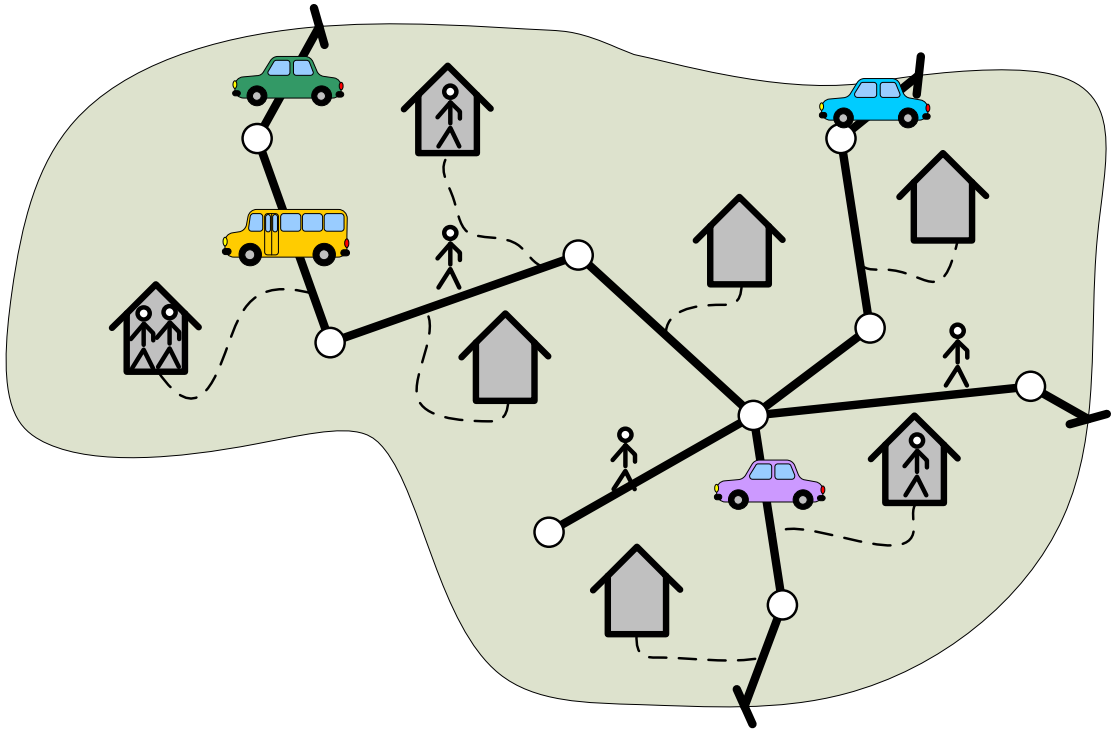


Analyze Results from an Agent-based Micro-simulation

- After running an agent-based micro-simulation, its results have to be analyzed, e.g.
  - distribution of population in a certain area
  - mean travel time between two municipalities
  - ...

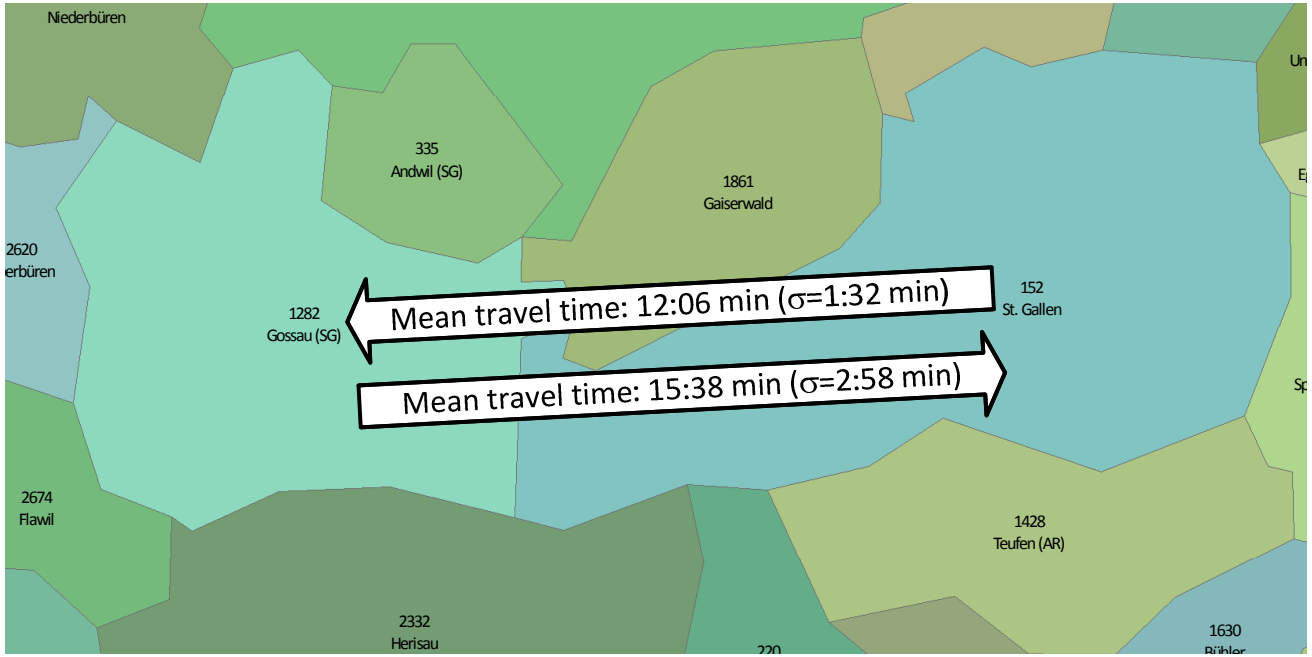
Population Distribution

- For example:
  - Total number of people: 28
  - People at home/traveling: 12/16
  - Car drivers/passengers: 3/2
  - Bus drivers/passengers: 1/12
  - …



Mean Travel Times

- Mean travel time from one zone to another one, depending on
  - time of day
  - day of week
  - transport mode



Conclusions

- We have seen that, GIS Tools are very helpful when...
  - creating agent-based and
  - analyzing results from agents-based micro-simulations.

- Creating input data highly depends on the available datasets and varies from model to model.

- Analyzes based on simulation results can be automated since models produce comparable output data.

Questions?