# Coordinated Views for Informed Spatial Decision Making

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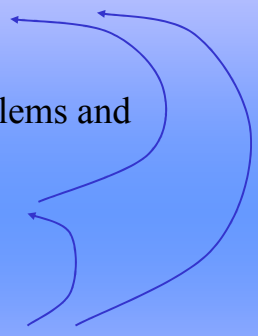
## Decision-making Process

- Intelligence:
  - collect and integrate data;
  - explore the data, identify problems and opportunities
- Design
  - find possible solutions
- Choice
  - analyse and evaluate the options;
  - select the most suitable option or subset



H.A. Simon, *The New Science of Management Decision*

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# Decision Support Tools

- Intelligence
  - Exploratory Data Analysis (EDA) techniques
- Design
  - Modelling tools
- Choice
  - Computational MCDM methods (multi-criteria decision making)

J. Malczewski, *GIS and Multicriteria Decision Analysis*

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# Exploratory Data Analysis

- Goal: detect relationships, patterns, and trends; generate plausible hypotheses
- Based on data visualisation
- Current standard: high user interactivity
- Multiple complementary displays represent various aspects of the data
  - Need to be linked to enable integration of information into a coherent picture of the data as a whole

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# Numerical MCDM Methods

- Criteria: numeric or ordinal attributes
- Types of criteria:
  - **benefit**: higher values are more suitable
  - **cost**: lower values are more suitable
- Different importance of criteria
  - direct specification: weights or ordering
  - indirect specification: aspiration levels, tolerance intervals, etc.
- Outcome variants
  - evaluation scores or ranking
  - subset of options close to the specified goal

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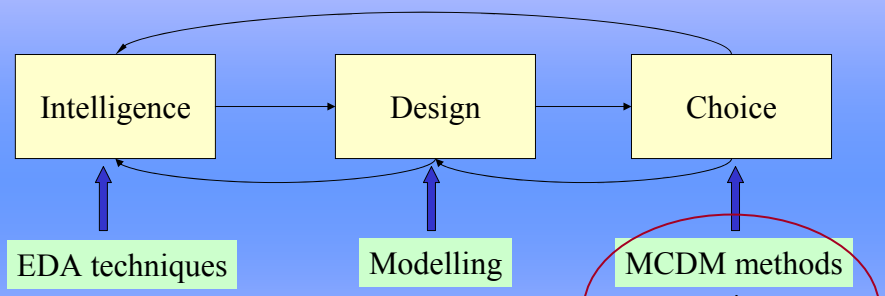
# Decision Support Tools (Our Proposal)




- should be properly linked

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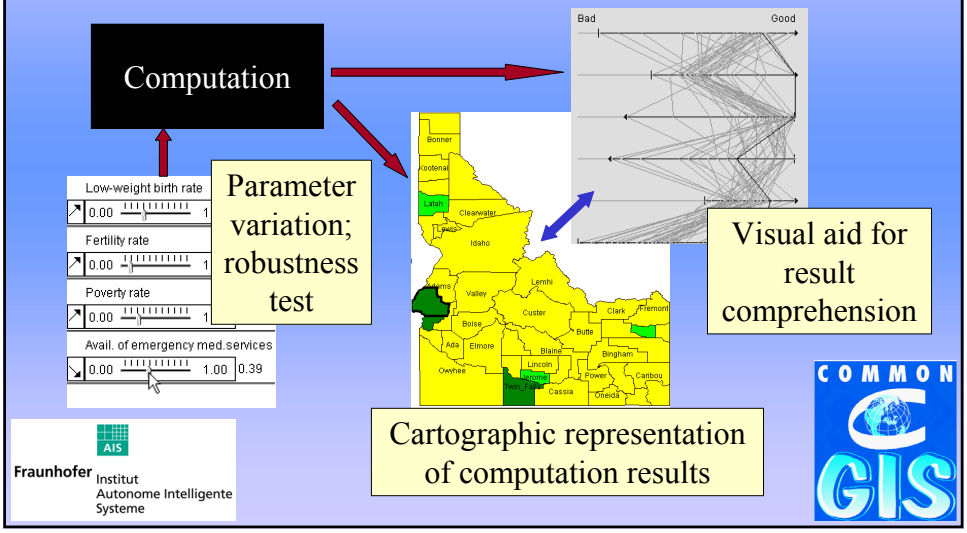
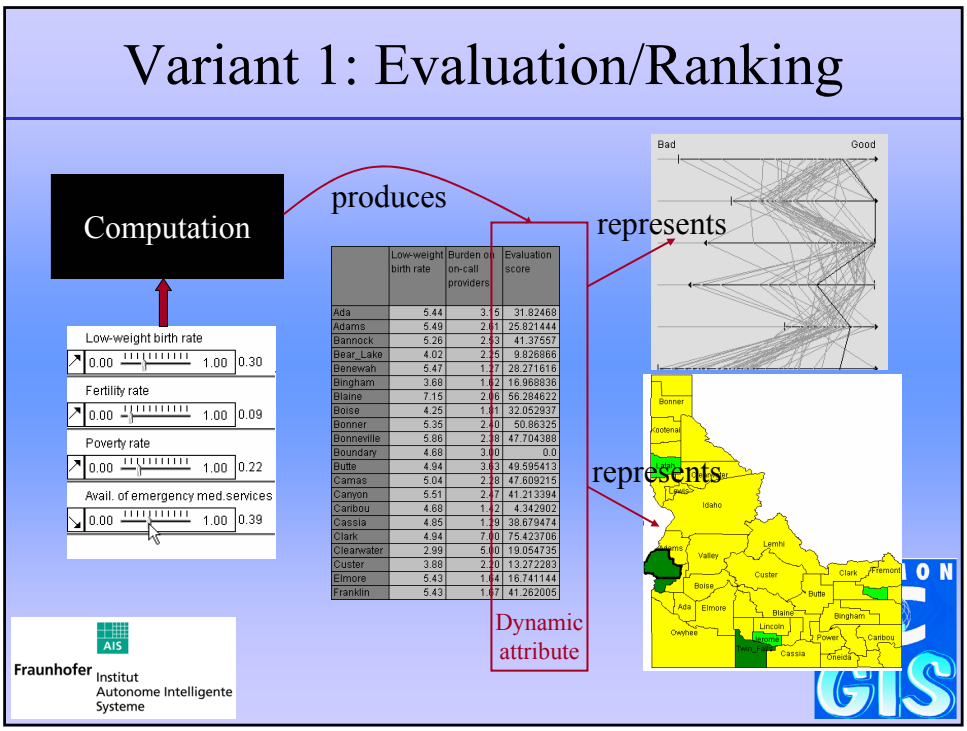
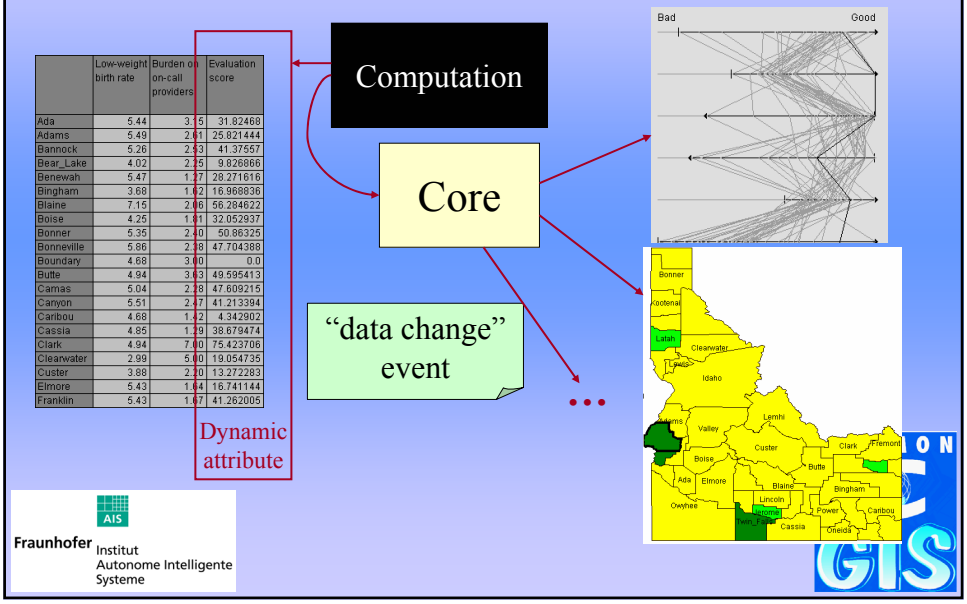
# Visualisation to Support Choice in Spatial Context



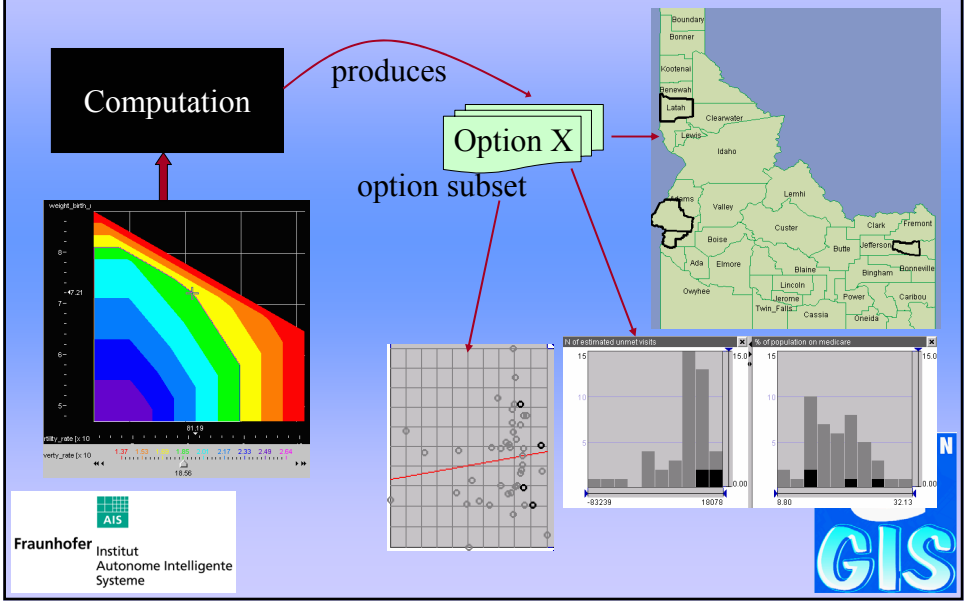

# Variant 1: Evaluation/Ranking



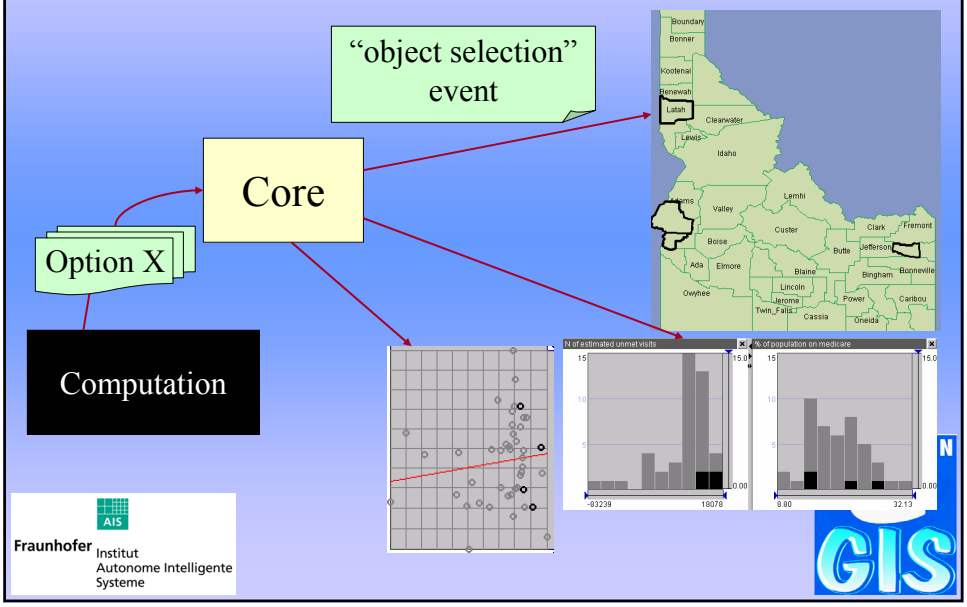
# Coordination Mechanism 1



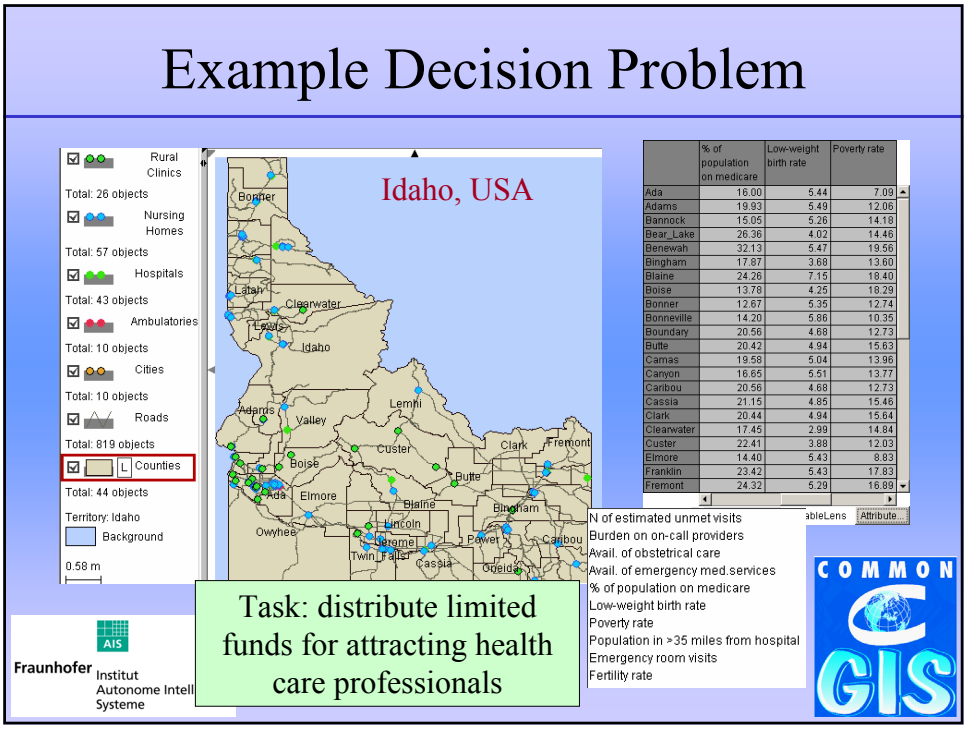

# Variant 2: Goal Approximation



# Coordination Mechanism 2




# Example Decision Problem




| | % of population on medicare | Low-weight birth rate | Poverty rate |
|---|---|---|---|
| Ada | 16.00 | 5.44 | 7.09 |
| Adams | 19.93 | 5.49 | 12.06 |
| Bannock | 15.05 | 5.26 | 14.18 |
| Bear_Lake | 26.36 | 4.02 | 14.46 |
| Benewah | 32.13 | 5.47 | 19.56 |
| Bingham | 17.87 | 3.68 | 13.60 |
| Blaine | 24.26 | 7.15 | 18.40 |
| Boise | 13.78 | 4.25 | 18.29 |
| Bonner | 12.67 | 5.35 | 12.74 |
| Bonneville | 14.20 | 5.86 | 10.35 |
| Boundary | 20.56 | 4.68 | 12.73 |
| Butte | 20.42 | 4.94 | 15.63 |
| Camas | 19.58 | 5.04 | 13.96 |
| Canyon | 16.65 | 5.51 | 13.77 |
| Caribou | 20.56 | 4.68 | 12.73 |
| Cassia | 21.15 | 4.85 | 15.46 |
| Clark | 20.44 | 4.94 | 15.64 |
| Clearwater | 17.45 | 2.99 | 14.84 |
| Custer | 22.41 | 3.88 | 12.03 |
| Elmore | 14.40 | 5.43 | 8.83 |
| Franklin | 23.42 | 5.43 | 17.83 |
| Fremont | 24.32 | 5.29 | 16.89 |

See a demo…

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# Conclusion

- Visualisation tools are useful on the choice stage of decision-making
  - in particular, for testing solution robustness
- 2 mechanisms for integrating computation and visualisation tools suggested
  - dynamic attributes
  - object selection events
- Can be used for other computational tools
  - fast computation required

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# Future

- We seek projects in 6FP for applications and further development
- We seek tool users for getting feedback
- We seek support from industry for integrating our tools with widely used software

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www.CommonGIS.de