

Overview of the Quantitative Histories Workshop

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1 Quantitative Histories Workshop

Curriculum & software development collective
and
research lab

2 Research Problem

Increasingly complex problems require complex tools.
Computational tools support interdisciplinary thinking.

3 Research Problem

Increasingly complex problems require complex tools.
Computational tools support interdisciplinary thinking.

4 Research Problem

Increasingly complex problems require complex tools.

Sub-disciplinary tools require interdisciplinary thinking.

How can information theory inform interdisciplinary curriculum and software development?

5 Information theory

Information theory is a branch of applied mathematics and computer science that deals with the quantification, storage, transmission, and manipulation of information. We take an abstract approach to our study of information.

- Information theory seeks to measure the amount of information contained in a *message* or signal and how efficiently it can be transmitted or stored.
- In this way, our projects define *information* using a curricular perspective.

6 Quantitative history

7 Mathematical sociology

8 Curriculum and software development

Design, development, implementation, and evaluation of computational curricular materials

8.1 Research projects

- ECHO: Education, Community, and Health Observations
 - Information and spatial segregation
- Teaching statistical learning and mathematical modeling
- Theory and quantification



Figure 1: *Historie Quantitative* by Pierre Chaunu



Figure 2: *Journal of Mathematical Sociology*

8.2 Project group 1: Spatial information and racial isolation

How do patterns of racial segregation inform education, community, and health outcomes?

- Historical legacies of injustice
- Traditional modeling approaches
- Modern computational tools

9 Dividing walls

10 Geometric approach

We adopt a **topological** model for spatial segregation on a geographical area, G to develop a theory of dividing walls.

Builds on the topological and topographical work of Short (2011).

Theorem 1. Given any configuration of blue and green towns, there is a dividing wall that separates blue towns from green towns.

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10.1 Is there a dividing wall for an island with coastal towns?

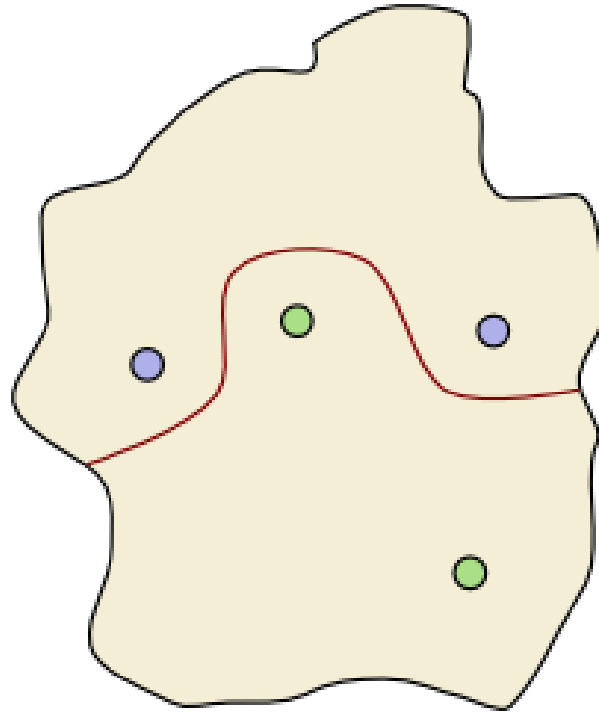


Figure 3: Geographic area with neighborhood units

10.2 Is there a dividing wall for an island with coastal towns?

Theorem 2. Alternating configurations of towns do not have a dividing wall, whereas non-alternating configurations of towns do have a dividing wall.

10.2.1 Algebraic approach

We then develop a algebraic modeling approach using methods from **mathematical sociology**.

Segregation indices

- *Dissimilarity index*: Measures the proportion of one group's population that would need to move to achieve an even distribution across all areas. It ranges from 0 to 1, with higher values indicating greater segregation.

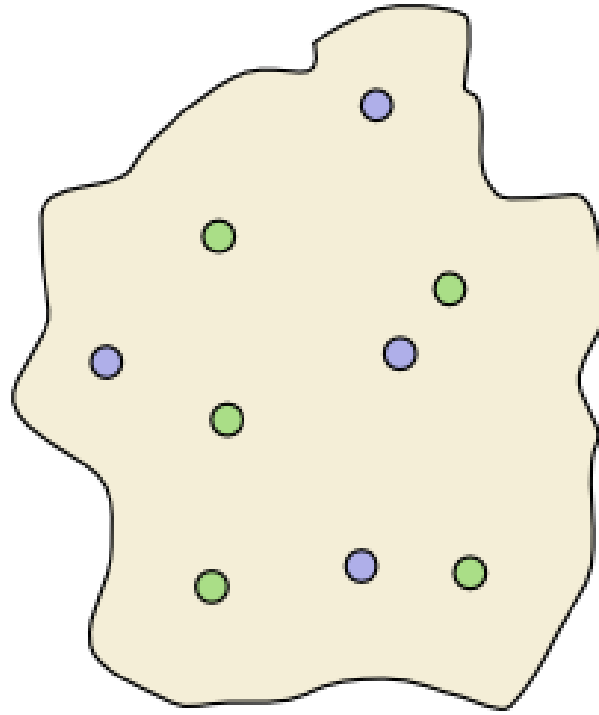


Figure 4: Geographic area with neighborhood units

- *Isolation index*: Measures the extent to which members of a particular group are surrounded by others from the same group. It represents the percentage of people from a specific group who would need to change neighborhoods to achieve an even distribution. Higher values indicate higher isolation and segregation.

10.2.2 Algebraic approach

We then develop an algebraic modeling approach using methods from **mathematical sociology**.

Segregation indices

- *Exposure index*: Measures the extent to which members of one group are exposed to members of another group. It quantifies the likelihood that a randomly selected individual from one group will encounter individuals from another group. Higher values indicate higher exposure and lower segregation.