What's the added value of 'hGIS' for the study of the past?

[and in particular of the European integration]

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- Some previous notes:
  - Bottom line: History makes a lot more of sense with Geography (cfr. Braudel, 1950s)
  - hGIS for spatialize the historical processes: new insight into history (Benner 2004)
  - GIS Equation (Tapiador 1999):

GIS=CAD+DB+**Analysis**

so hGIS=CAD+hDB+**Hcal**. **Analysis**

- More:
  - hGIS allow to extract complex relationships. A new twist on the Quantitative History concept
  - hGIS Analyses go beyond discourse, but hGIS don't make you a good historian
  - Narratives after we get the hGIS results, not before: empirical, comprehensive evidence of historical processes

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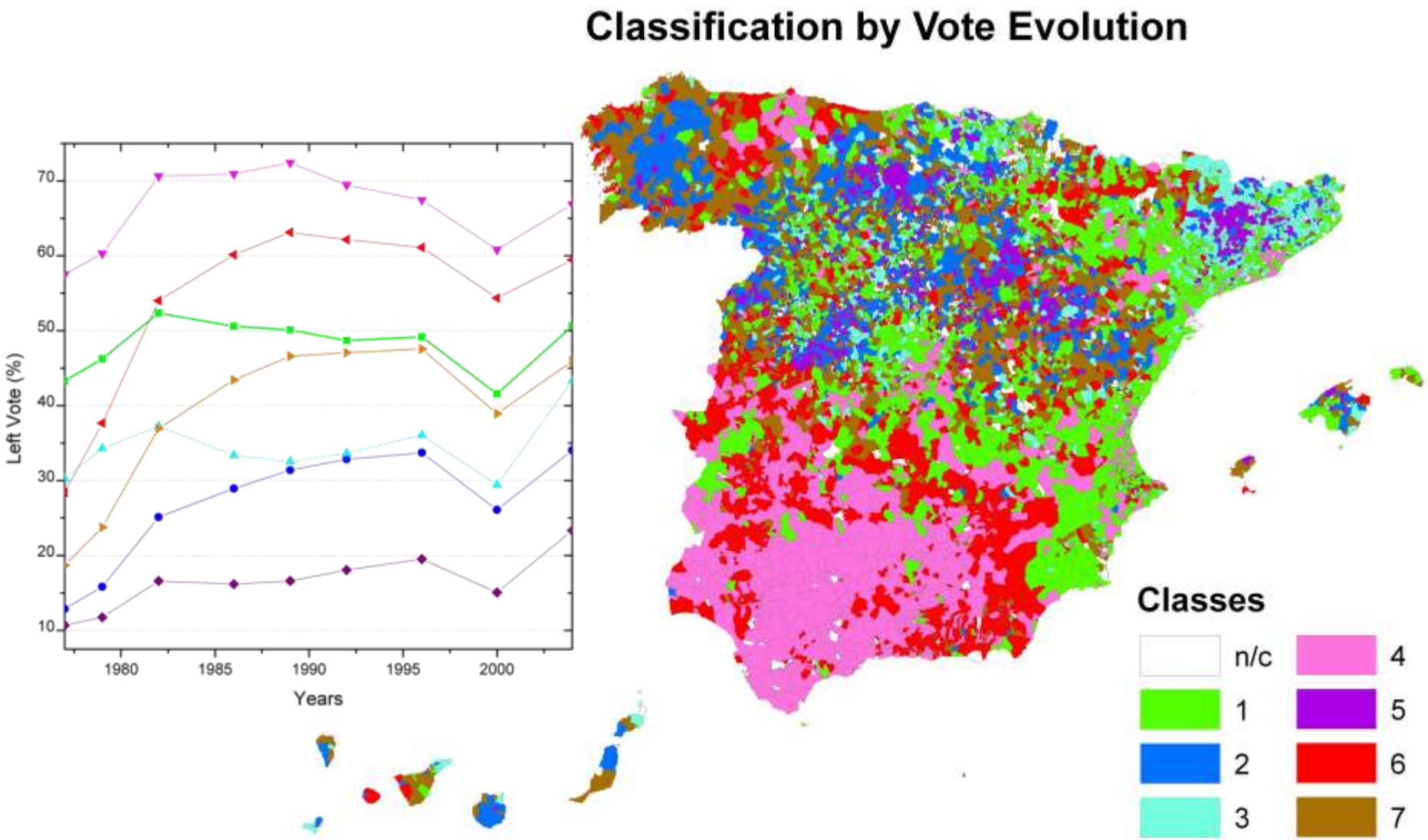

(Tapiador and Mezo 2007)

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hGIS basics:

Mapping, Data Integration and Visualization

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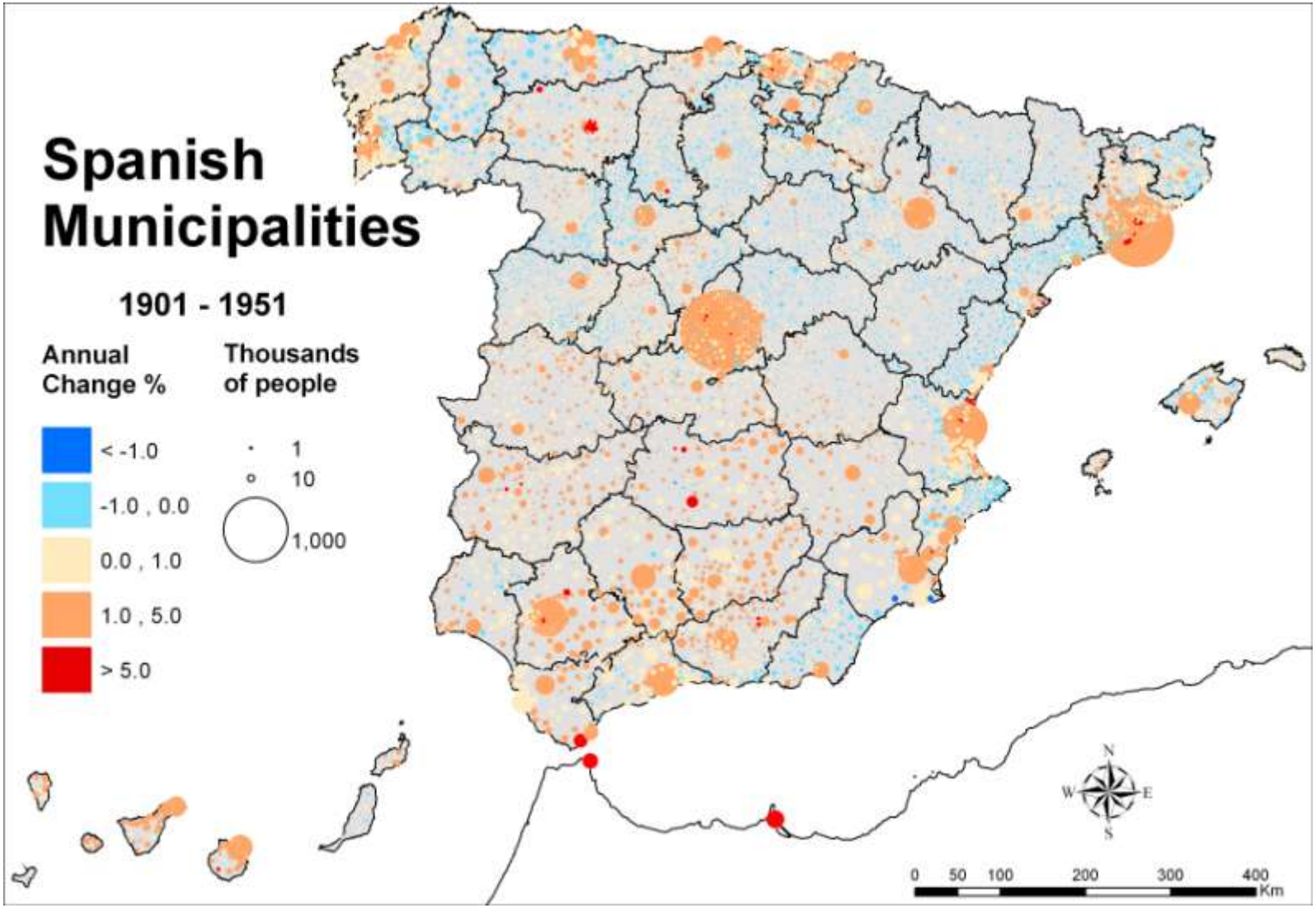

Martí-Henneberg, Pueyo, Simón, Tapiador and Bradshaw, 2007

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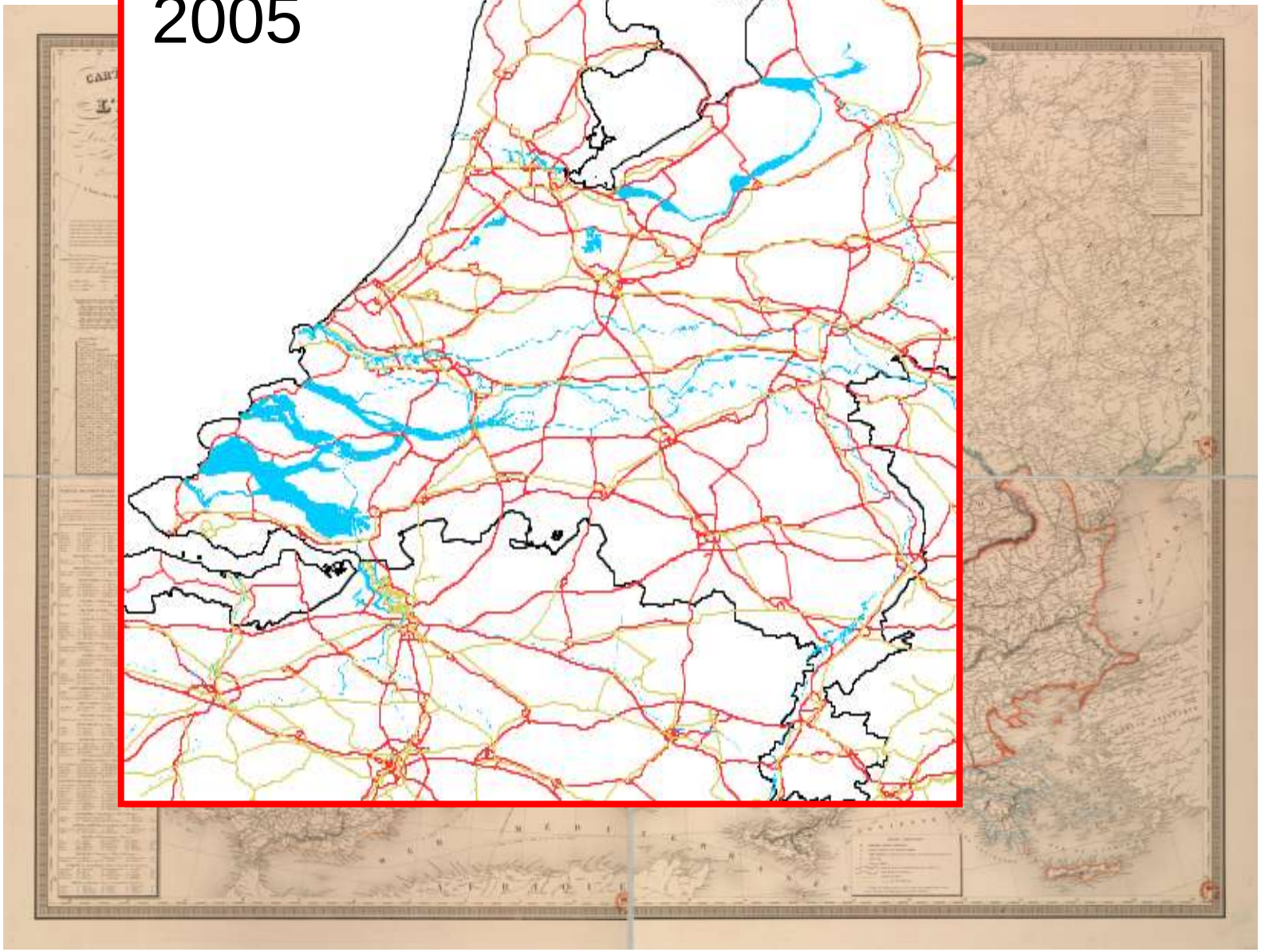

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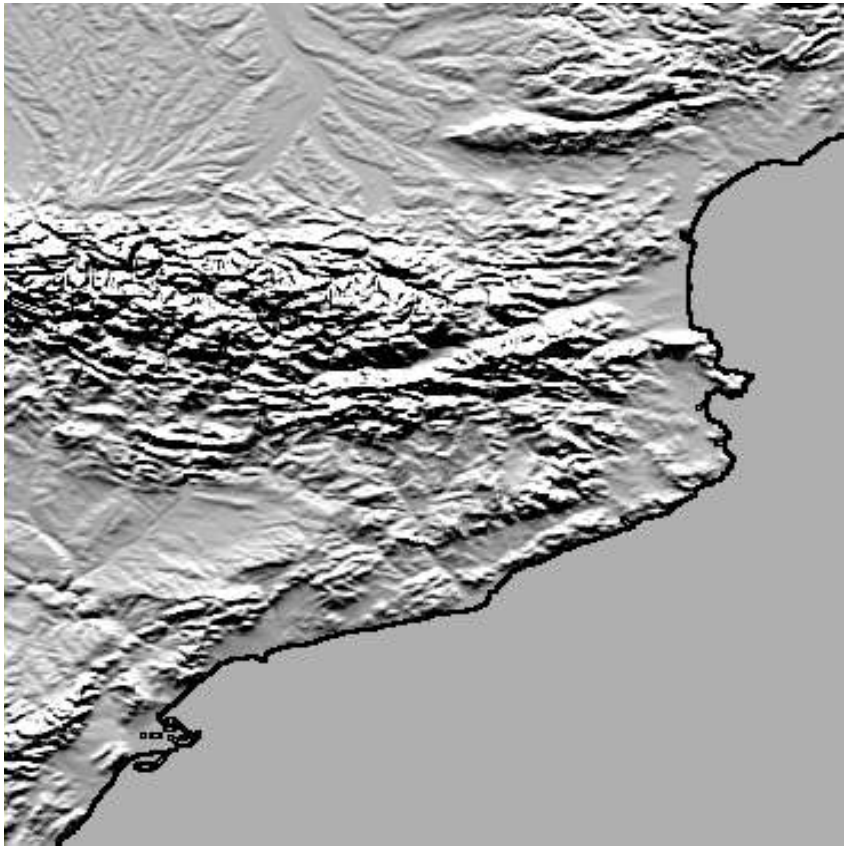

1835, by hand

2005, space shuttle

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(Tapiador and Marti-Henneberg, 2007)

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About added value

Formalization

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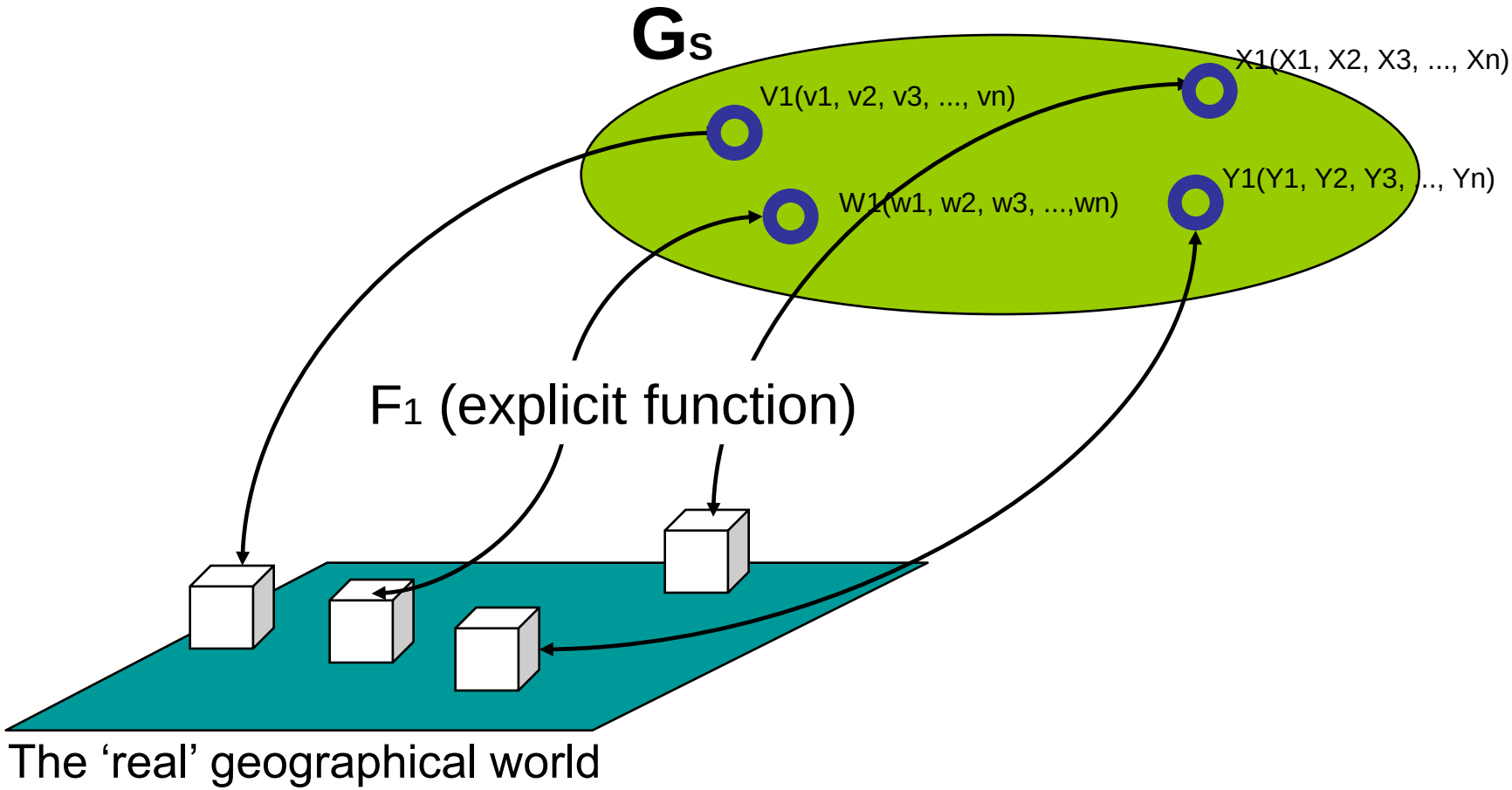
The *geographical space*



(Tapiador and Casanova, 1999)

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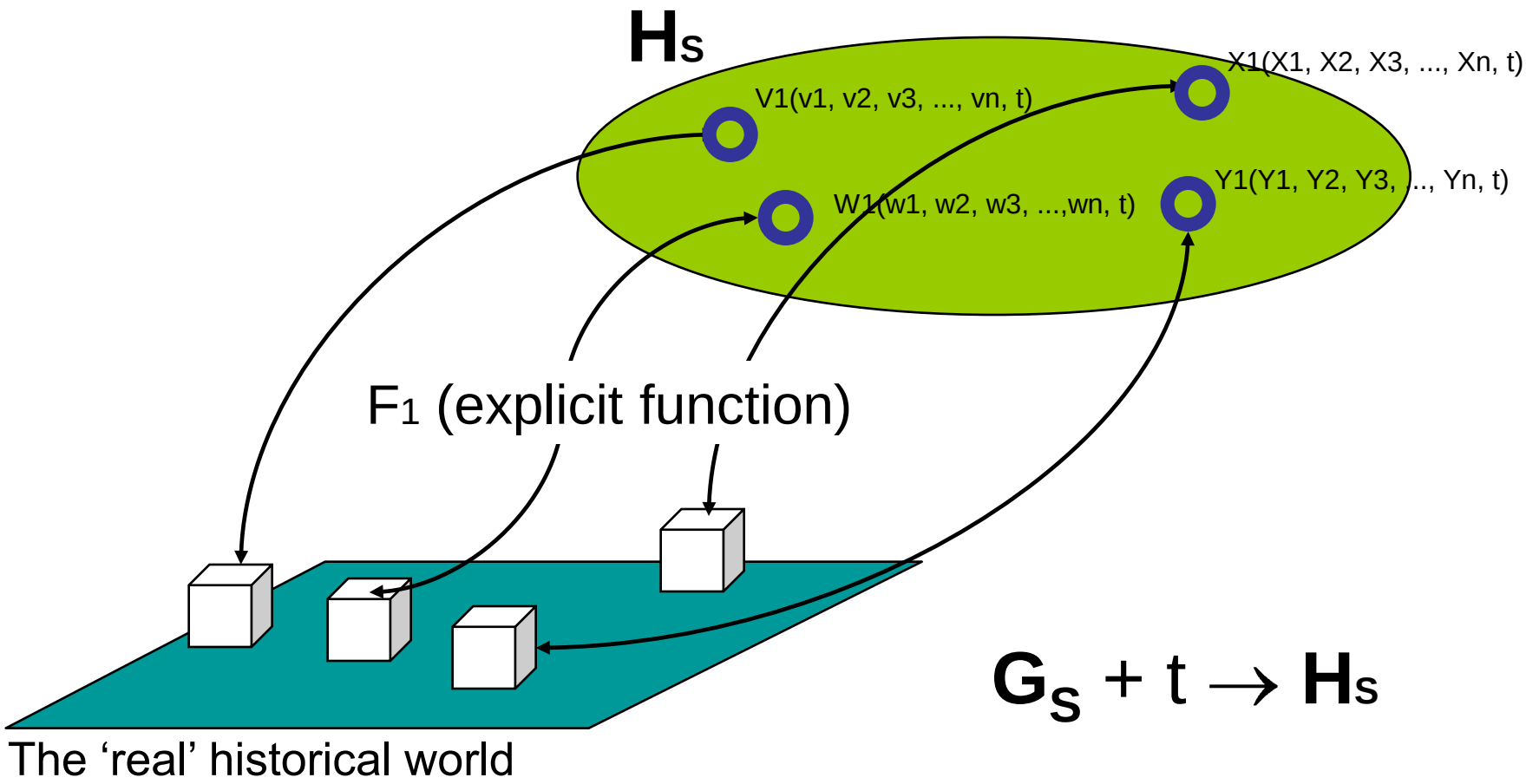
The *historical space*



(Tapiador 2007)

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The *historical space* $\mathbf{H_s}$ is also a topological space

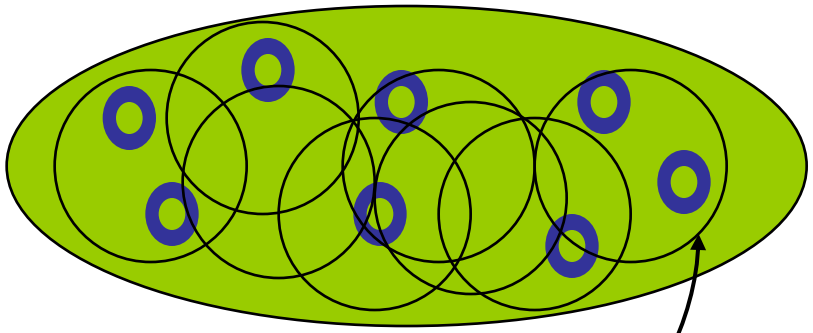
By definition, H_S and A will be a topological space if it is satisfied that:

1) $\varnothing \in A$; $H_S \in A$

2) If $\{A_i\}_{i \in I}$ is an arbitrary family of sets, $A_i \in A \Rightarrow \bigcup_{i \in I} A_i \in A$

3) If $n \in N$, and $A_1,\ldots,A_n \in A \Rightarrow A_1 \bigcap \ldots \bigcap A_n \in A$

which may be demonstrated easily for the Historical Space



Open sets

(Tapiador and Casanova, 1999)

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So what?

- If the H_S is a topological space, we can consistently apply all the mathematical theorems we have
- We know now that all our GIS calculations are fully justified in formal terms
- Comprehensive approaches
- We can do calculations which are not accessible to the discourse: (Egenhofer and Franzosa, 1991, IJGIS, 9-intersection model)
- A step forward towards a full Quantitative History

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About added value

Real world examples with the Historical European GIS

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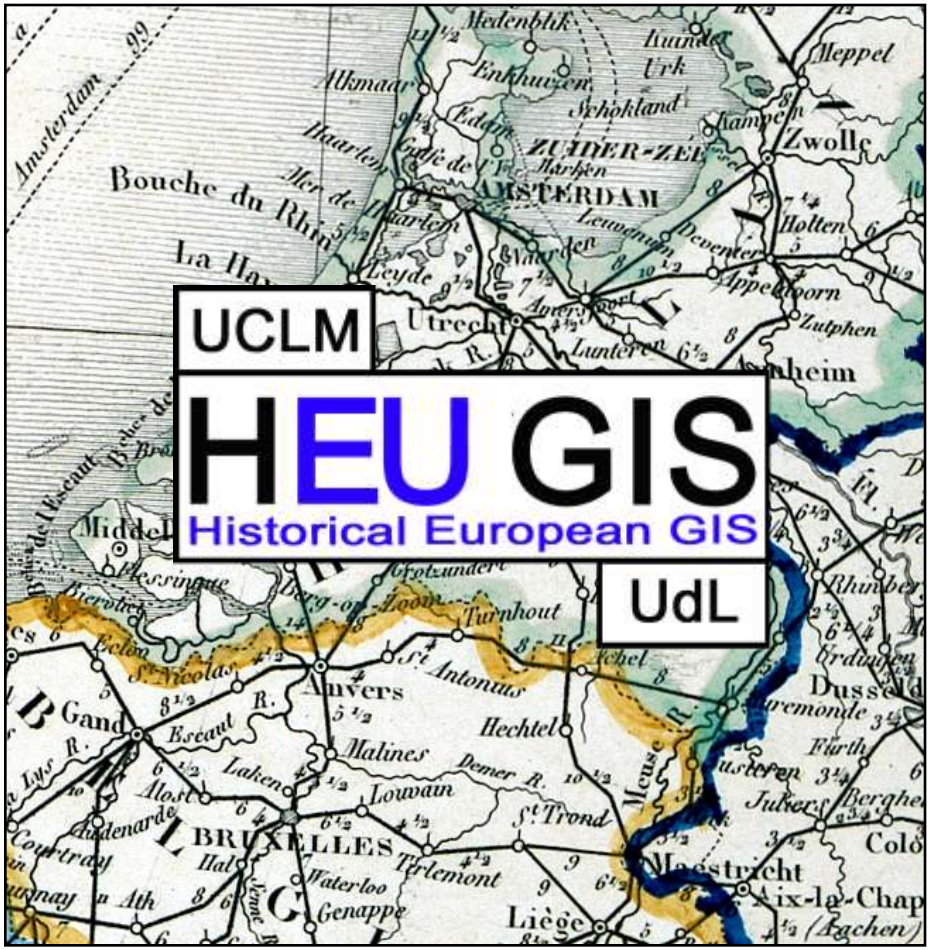
UdL + UCLM

(Martí-Henneberg & Tapiador)

- Funding from 2001
- European-wide scale
- Software+Data+ Analyses



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- Approach to problem solving with the HEU GIS (very simplified):
  - Propose a working hypothesis
  - Select the relevant information
  - Create an empirical base (hGIS)
  - Test the hypothesis (hGIS)
    - Constructs such as accessibility are used here
    - GIS allows for 4D analysis
  - Develop the narratives of the process

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EXAMPLE 1

Did infrastructures shape Europe

or

the making of Europe did shape infrastructures?

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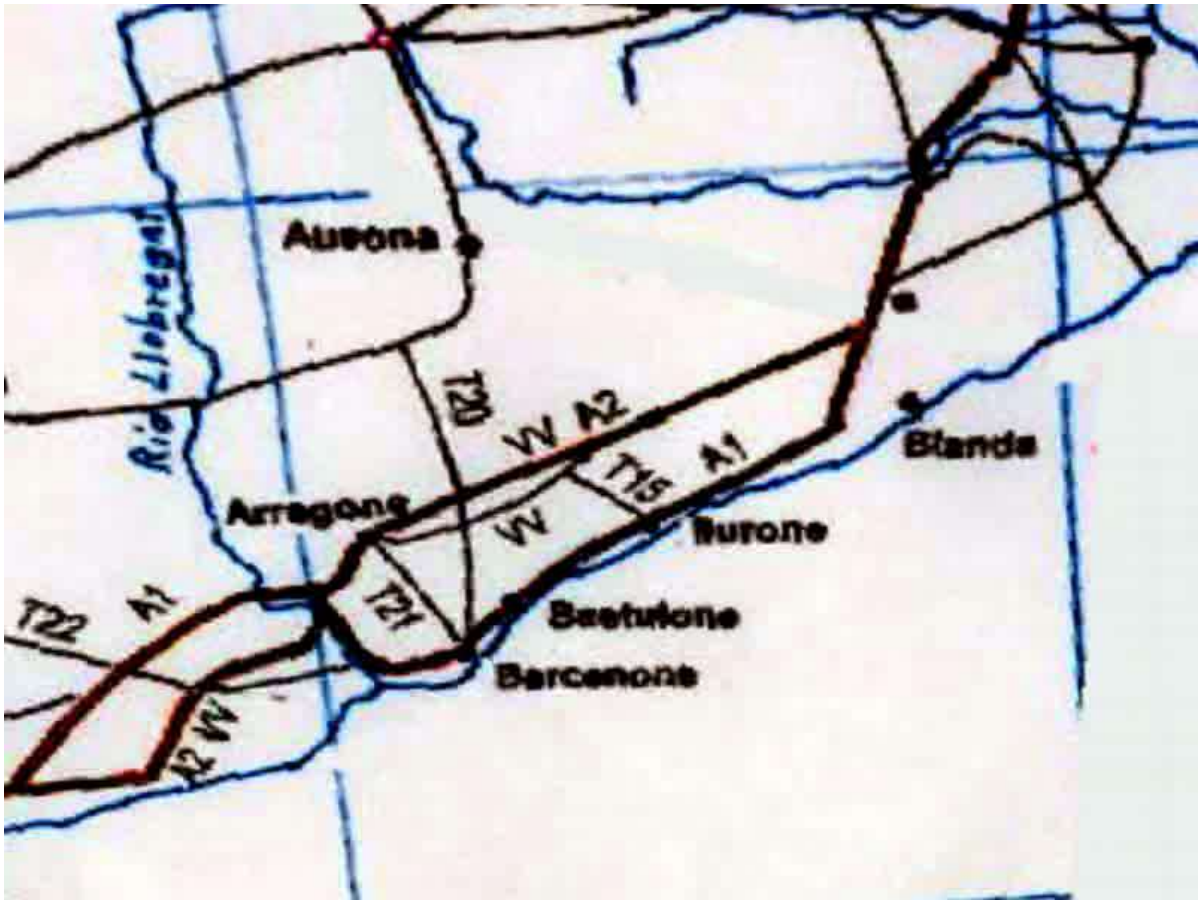
Roman Roads



(Tapiador 2006, original data from G. Arias)

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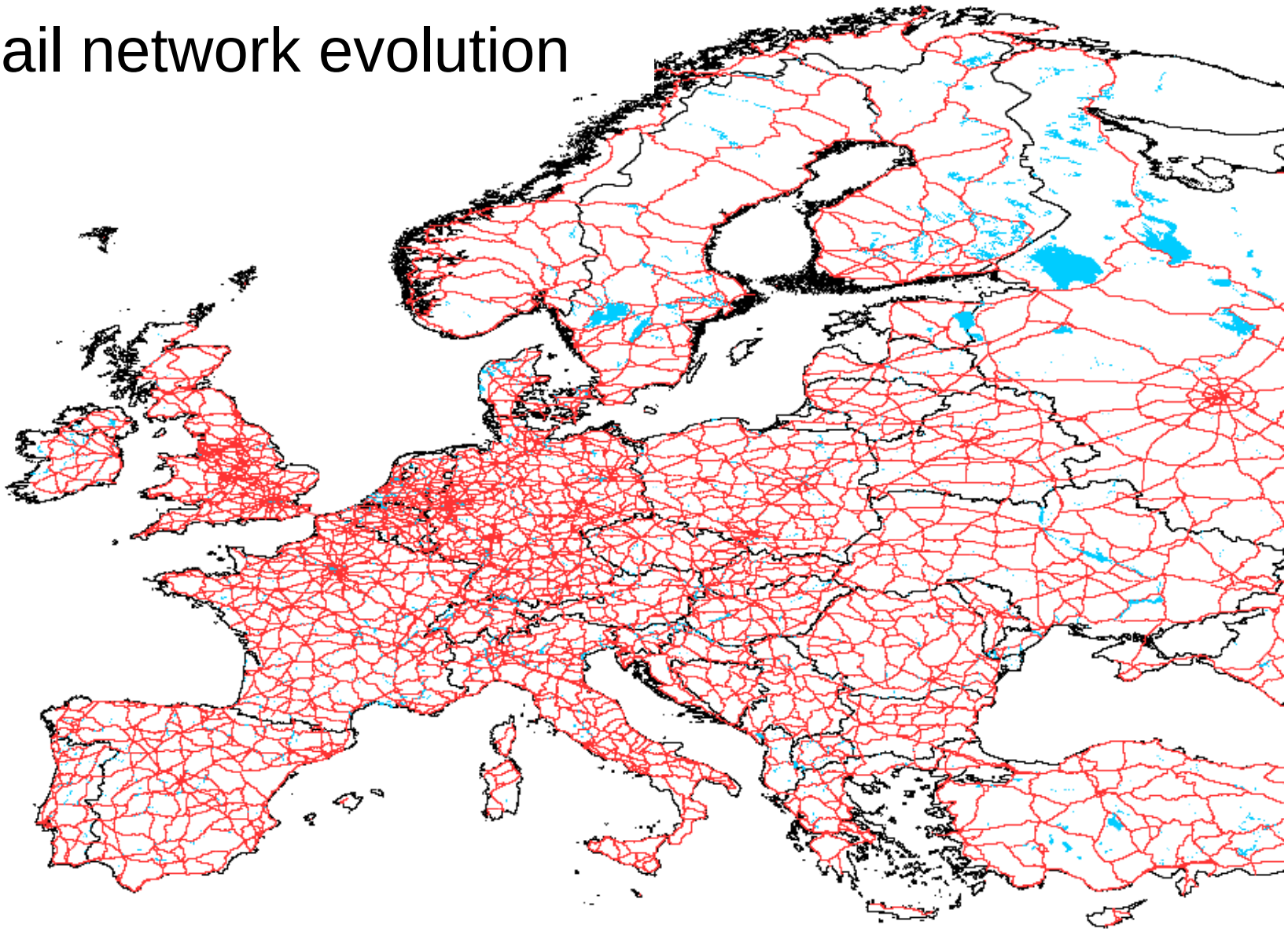
Rail network evolution



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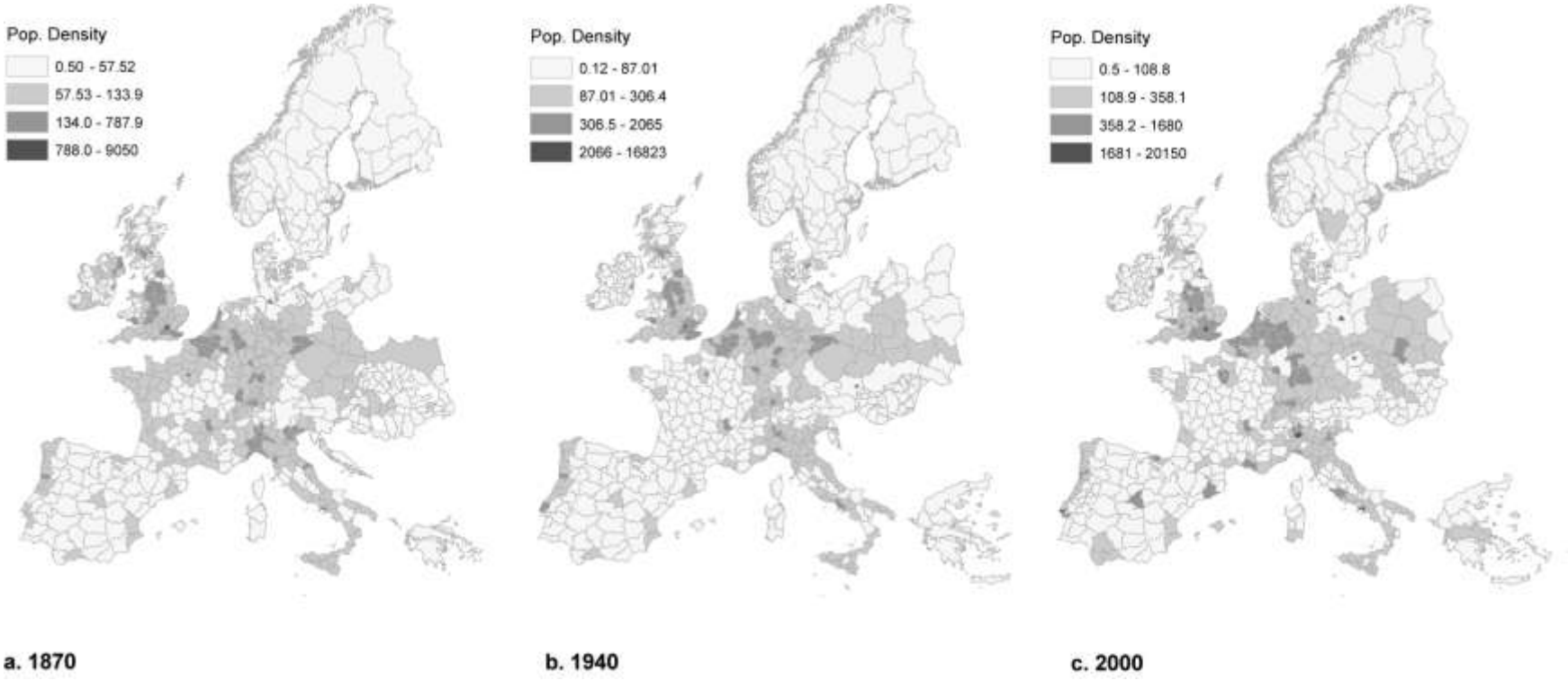
Population (area-interpolated, etc.)



(Gregory, Martí-Henneberg and Tapiador 2007)

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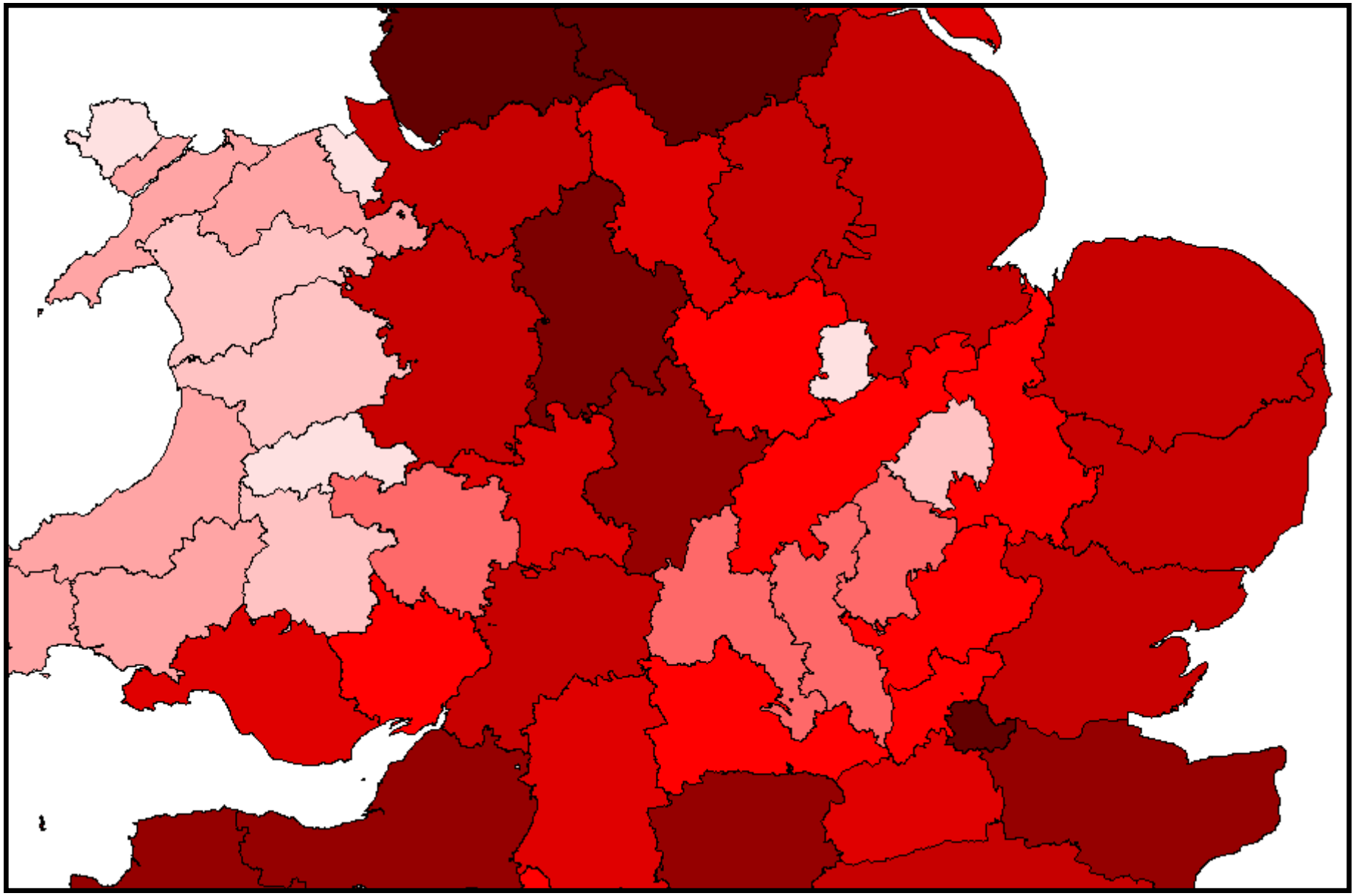
1861 Population at registration county level



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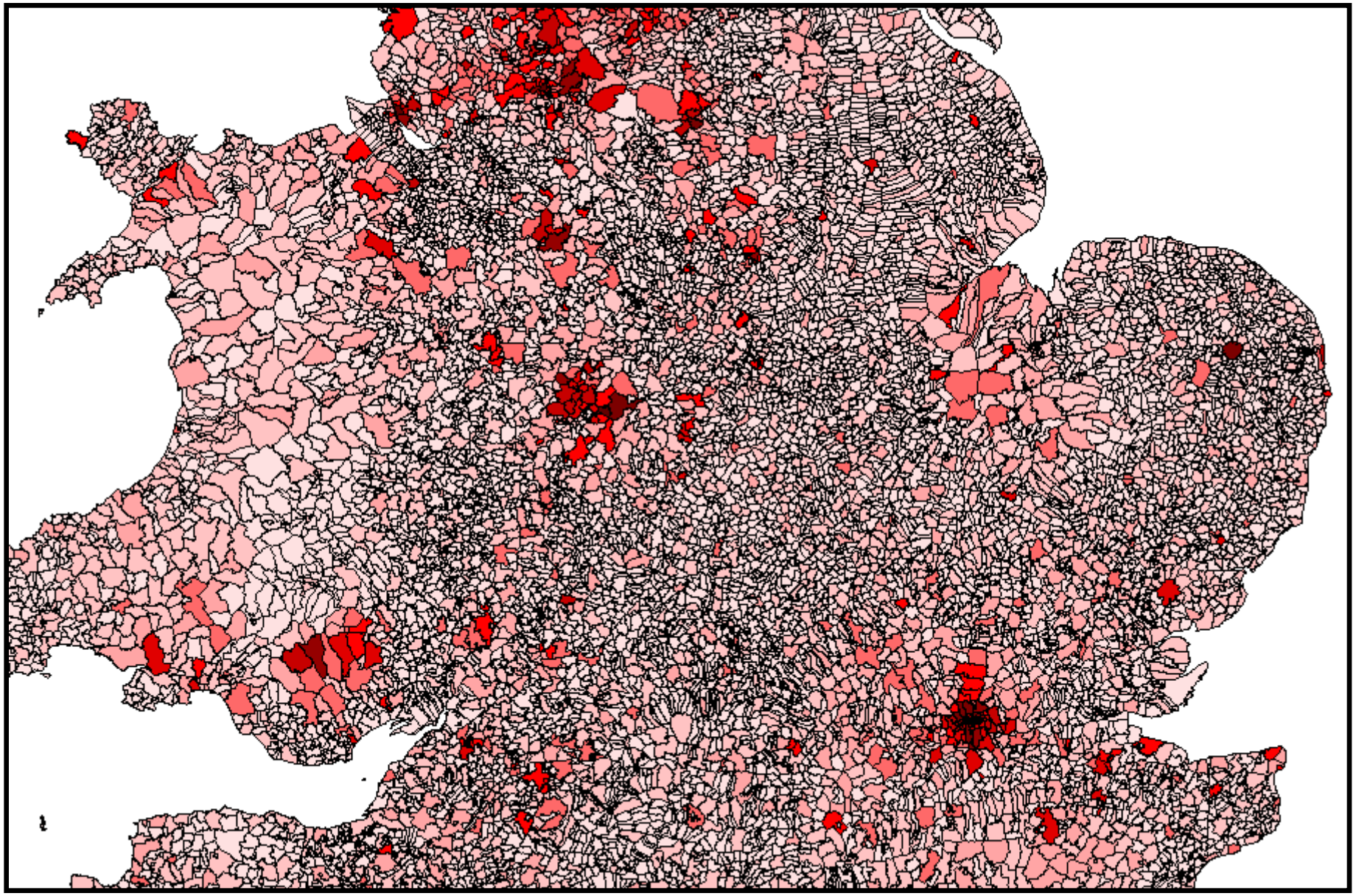
1861 Population at parish level



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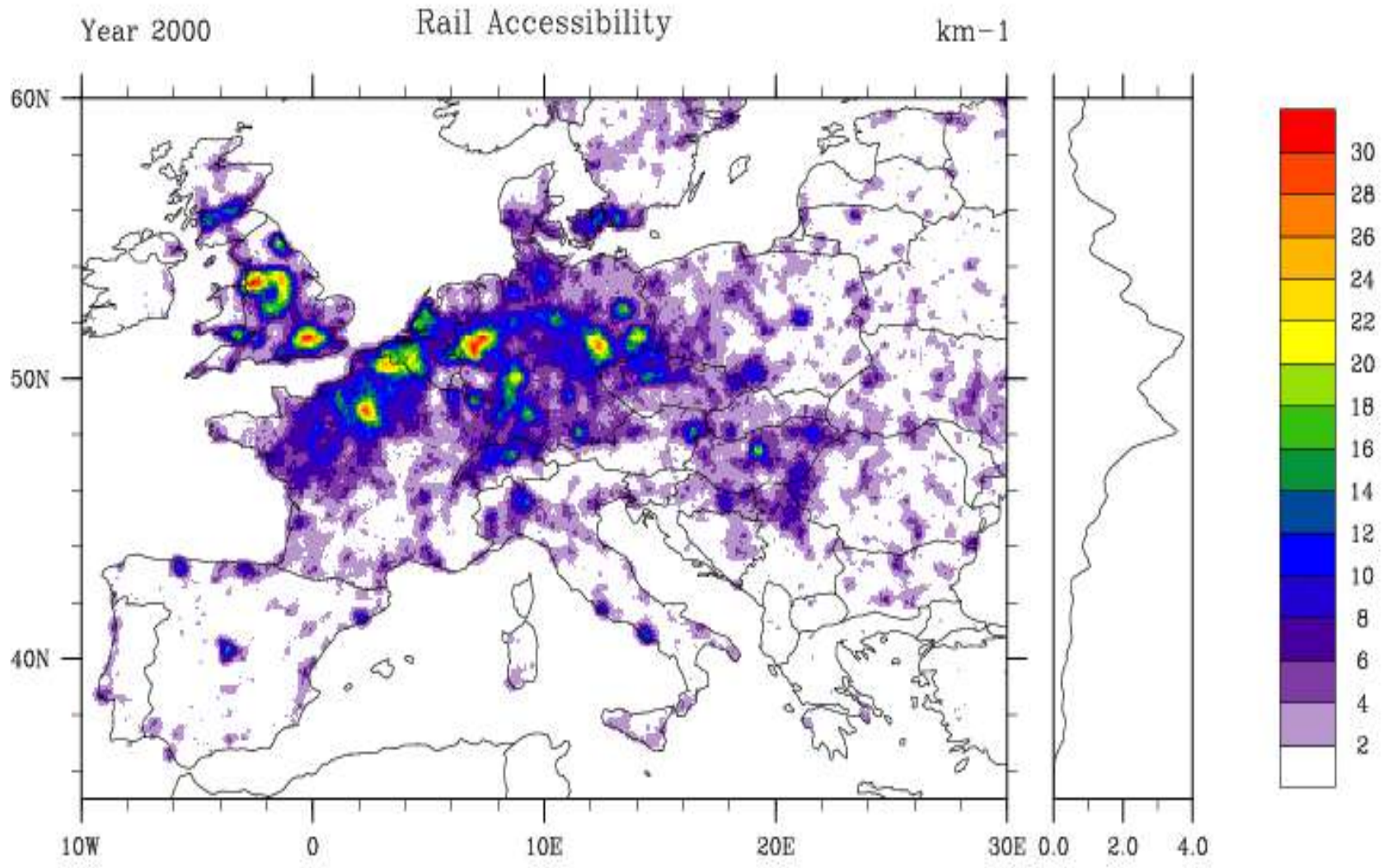

(Tapiador and Martí-Henneberg 2007, in progress)

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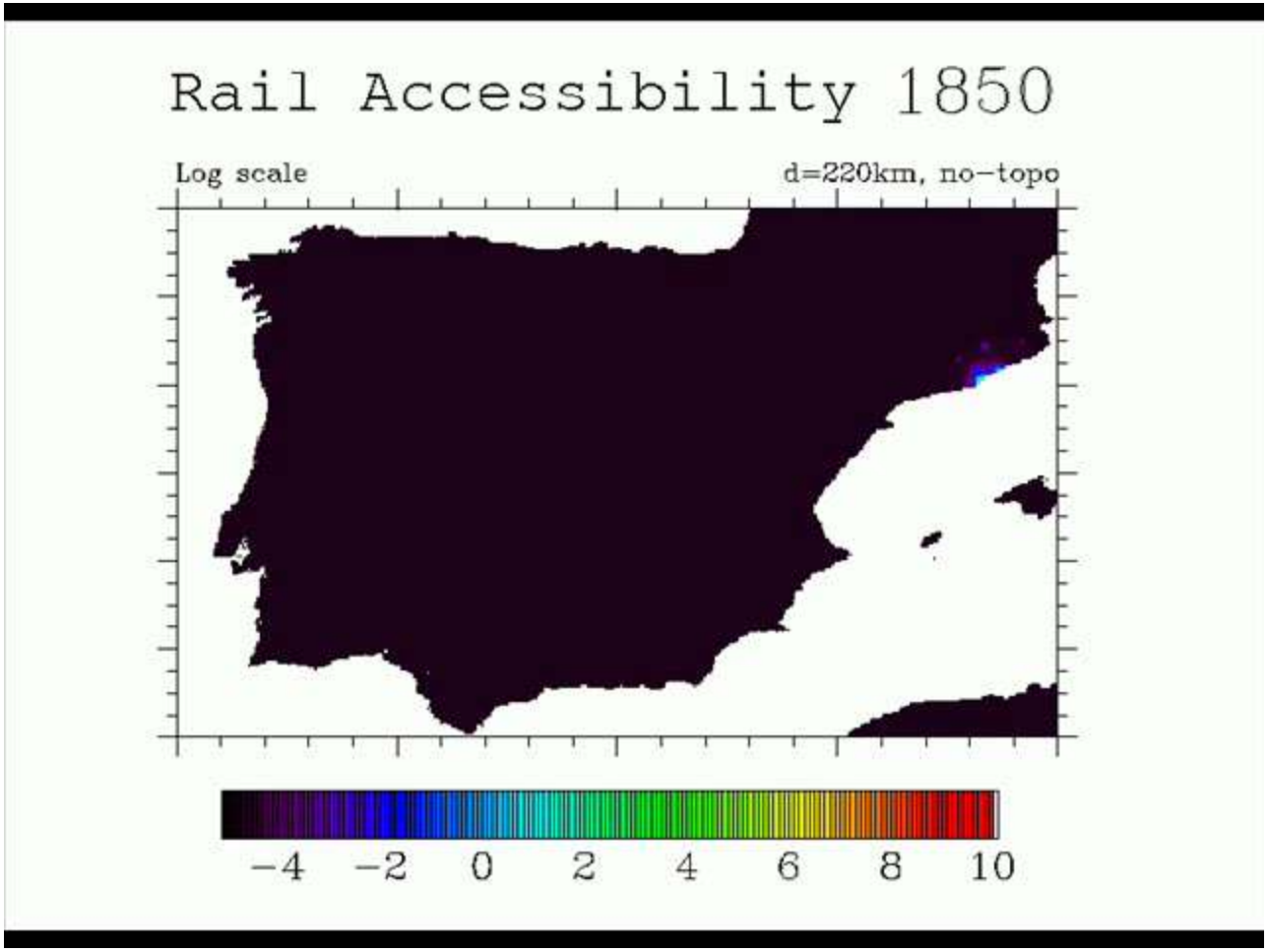

(Tapiador, F.J. Rural Analysis and Management, Springer, 2007)

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EXAMPLE 2

Analysing the evolution of the occupational structure of England

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Data sources

- C.H. Lee. (1979) British Regional Employment Statistics 1841-1971

- H. Southall (2001), 27 occupational classes + not classified

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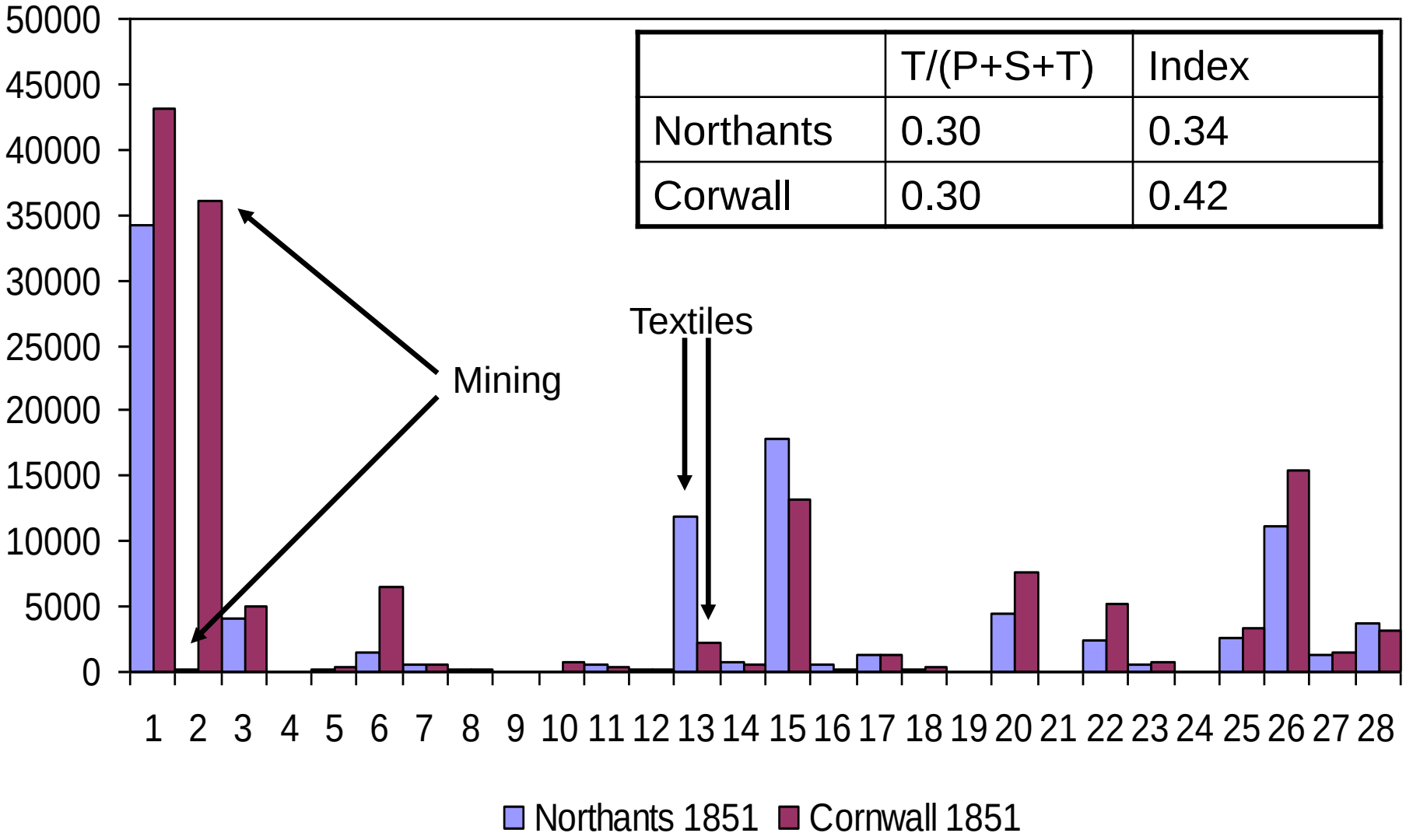
PST or tertiaritation index?

	T/(P+S+T)	Index
Northants	0.30	0.34
Corwall	0.30	0.42



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Specialisation index

- This can be measured calculating the informational entropy of the PDF

$$I_2 \equiv -k \sum_{x=1}^{27} p(x) \log[\, p(x)]$$

$$with \quad k = \log(1/27)$$

- This measures not the 'width' around the mean value of the histogram (the variance) but the relative differences between occupations.

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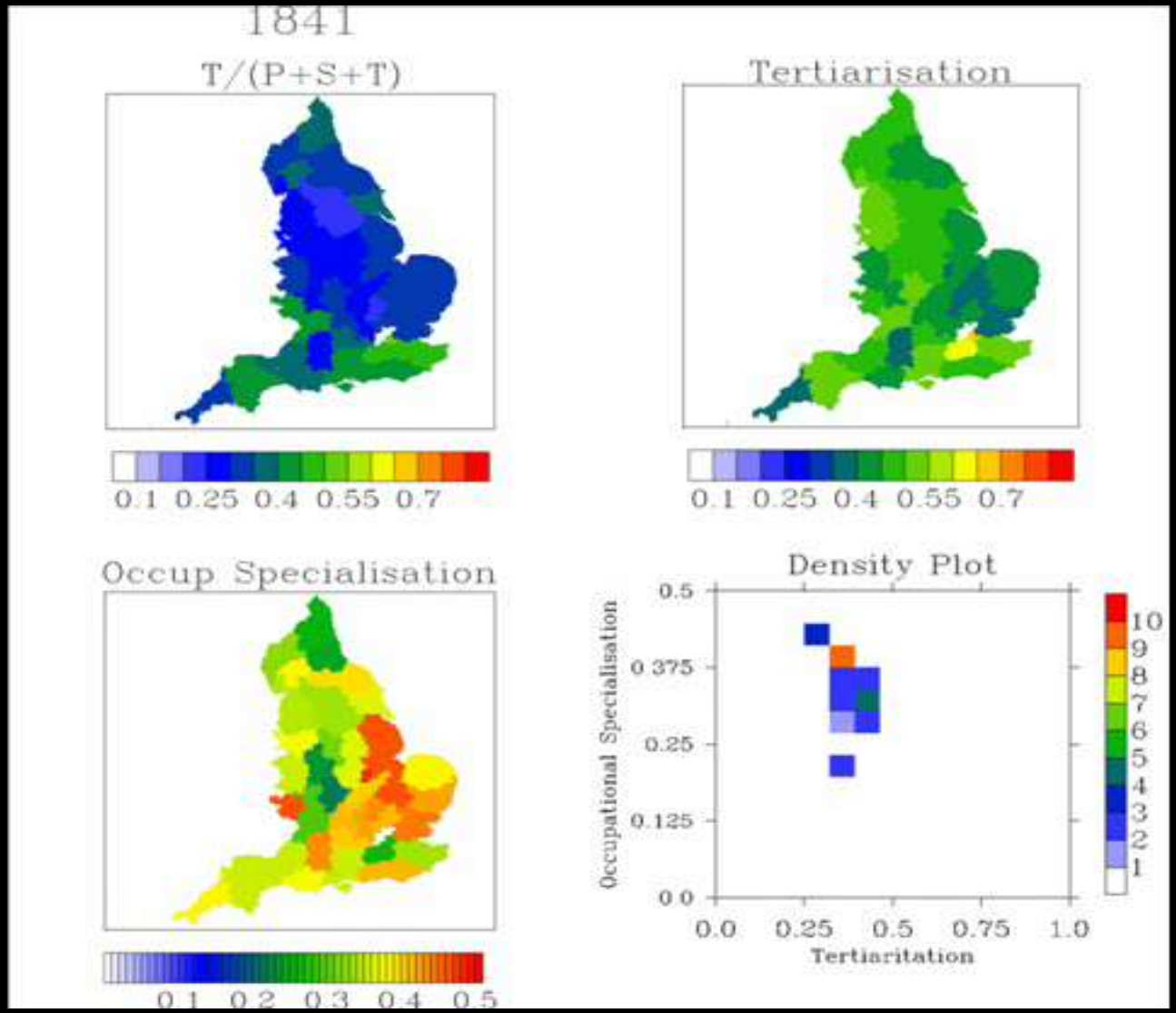

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Southall's 1st & 2nd class occupations

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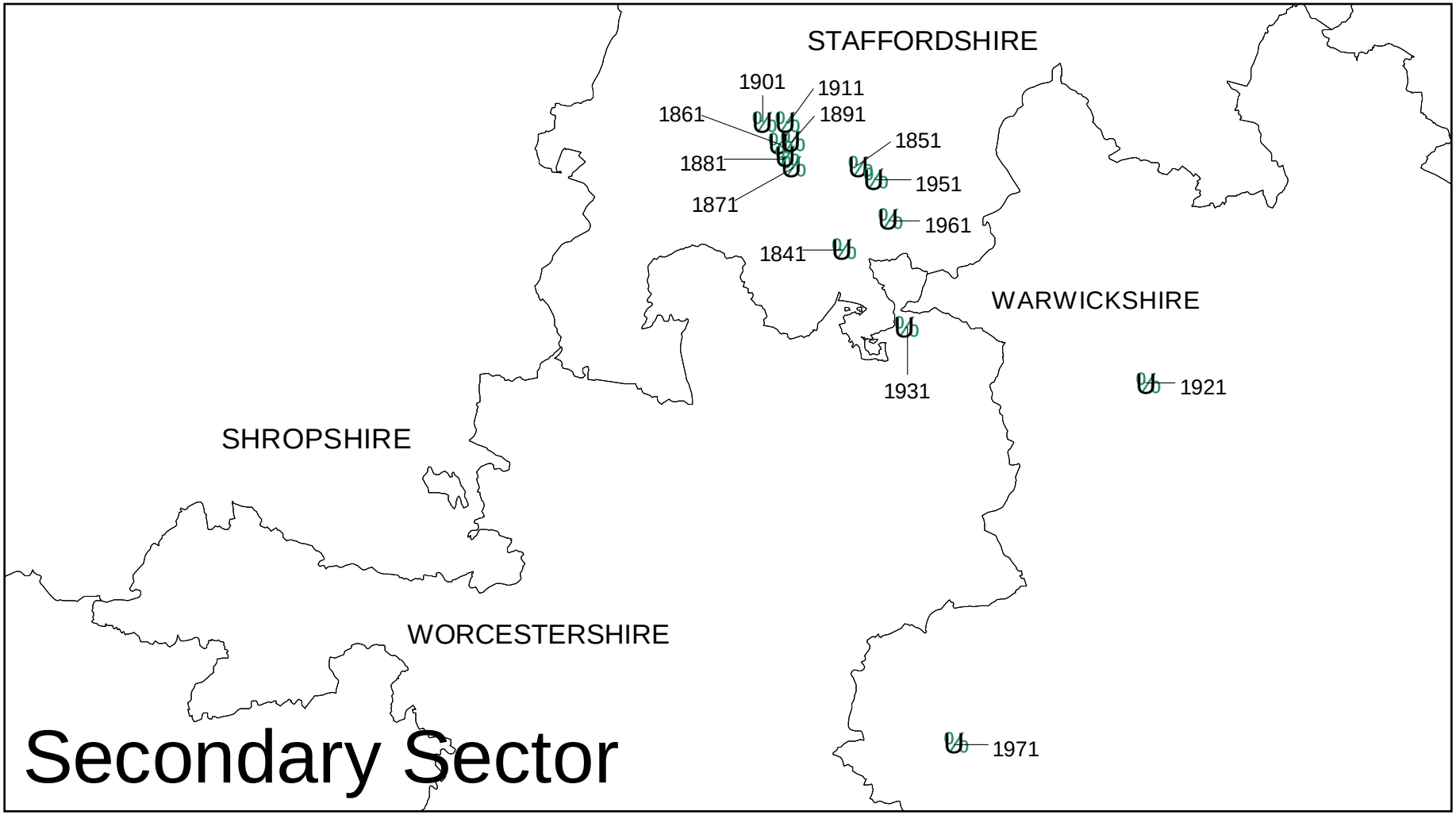
Southall's 3rd to 19th class occupations



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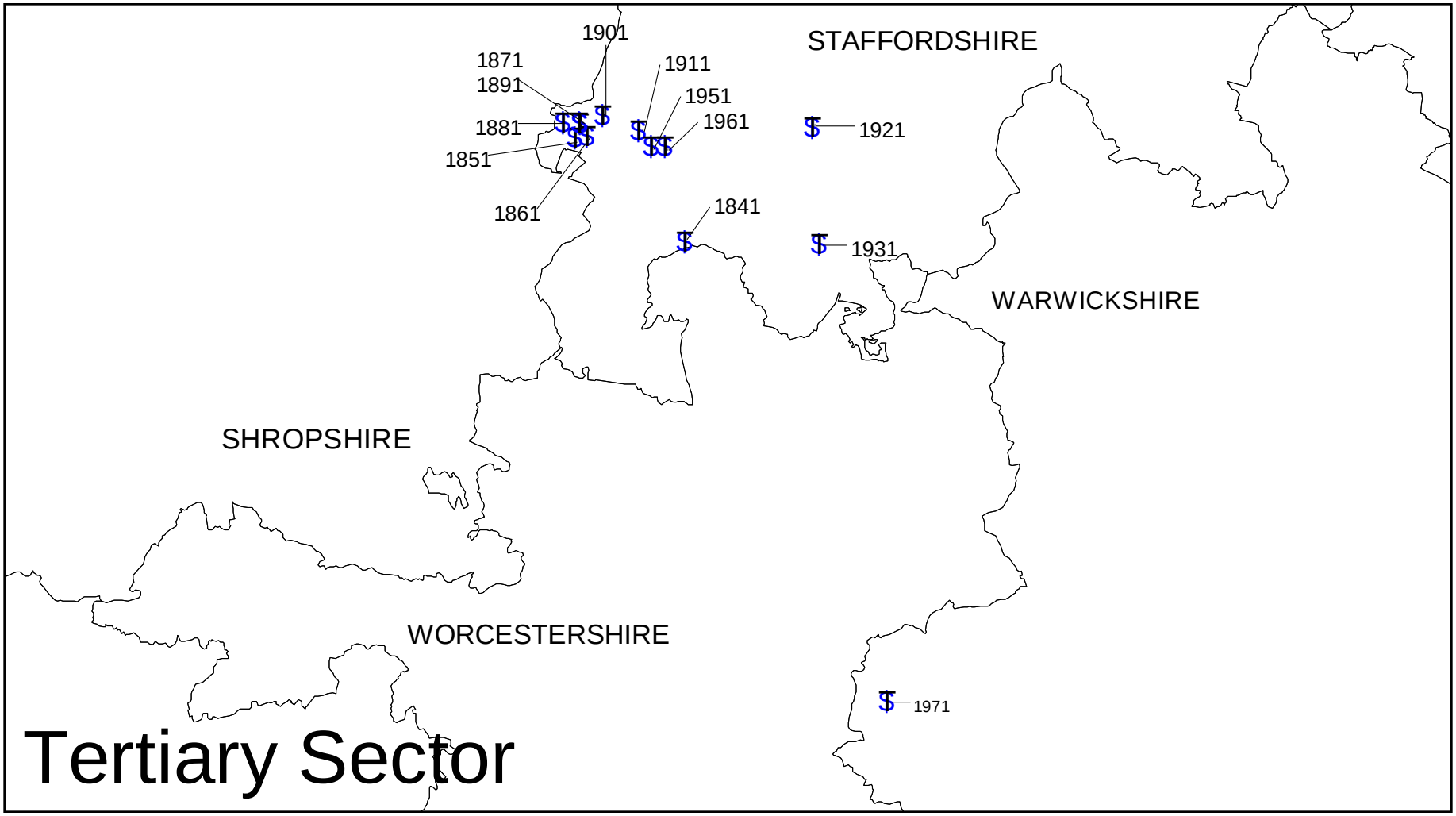
Southall's 20th to 27th class occupations



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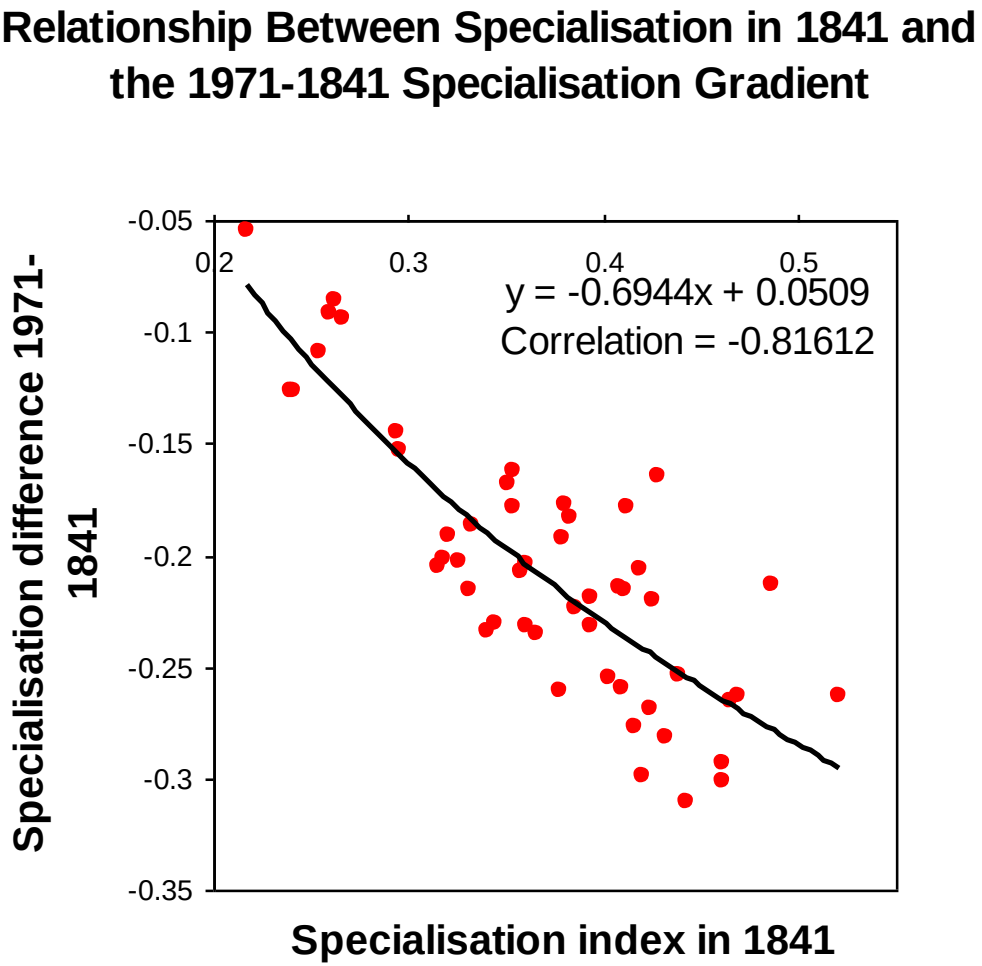
Evidence for the narratives

- Highly specialised areas in 1841 have undergone a quick diversification.
- Poorly specialised areas in 1841 have remain diversified
- Clear global diversification tendency



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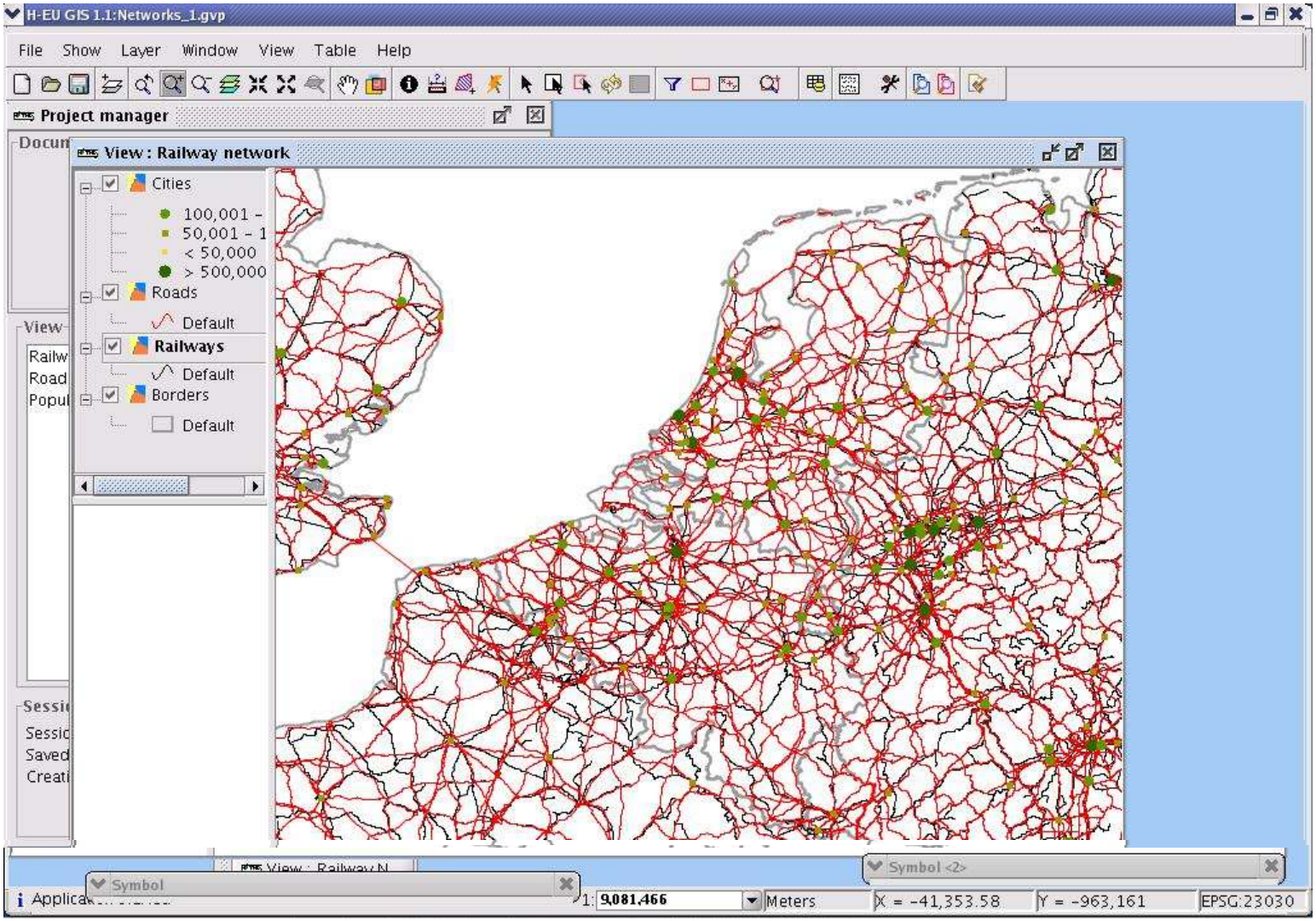

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hGIS issues for analyzing the European integration

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- Analyze regional convergence patterns: beyond the state-nation approach
- Empirical evidence of well-known processes: surprises may appear
- Finding very complicated, interlinked patterns

- Auditable, public information

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- Current efforts into the UCLM HEU GIS Historical European GIS UdL
  - Infrastructures (Rail, Road and Water)
  - Physical geography layout (Climate, etc.)
  - Population (Demography, occupations, etc.)
  - Economic information (GDP, etc.)

  - Design tailored modelling tools

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- What else do we need to analyse the European integration?
  - Voting, political preferences
  - Living standards information
  - Social information (press links)
  - Cultural and scientific evolution

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Discussion

- Likely topics:
  - hGIS added value
    - hGIS as Historical Geographical Information Science
    - The role of formalization
    - Are new tools needed for history? (areal interpolation, 4D-interpolation, etc.)
  - hGIS for analysing the European integration
    - Which data are needed?
    - Are we getting those data?
    - How can we coordinate efforts?