Distance matters.

Or, we move through space in weird ways

A talk of a sort by Jim Thatcher

Assistant Professor, University of Washington Tacoma

Urban Studies

Agenda

- Me, briefly
- Space, time, and distance
  - Some old work
  - Some new work
- Travel-time API demo
- Questions

Me, in brief

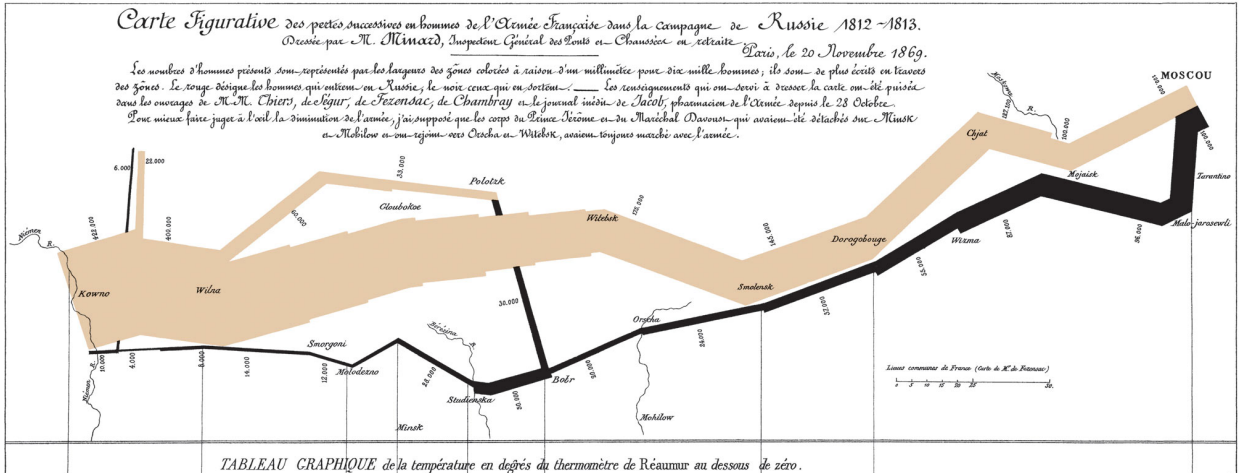
Assistant Professor, Urban Studies, University of Washington Tacoma

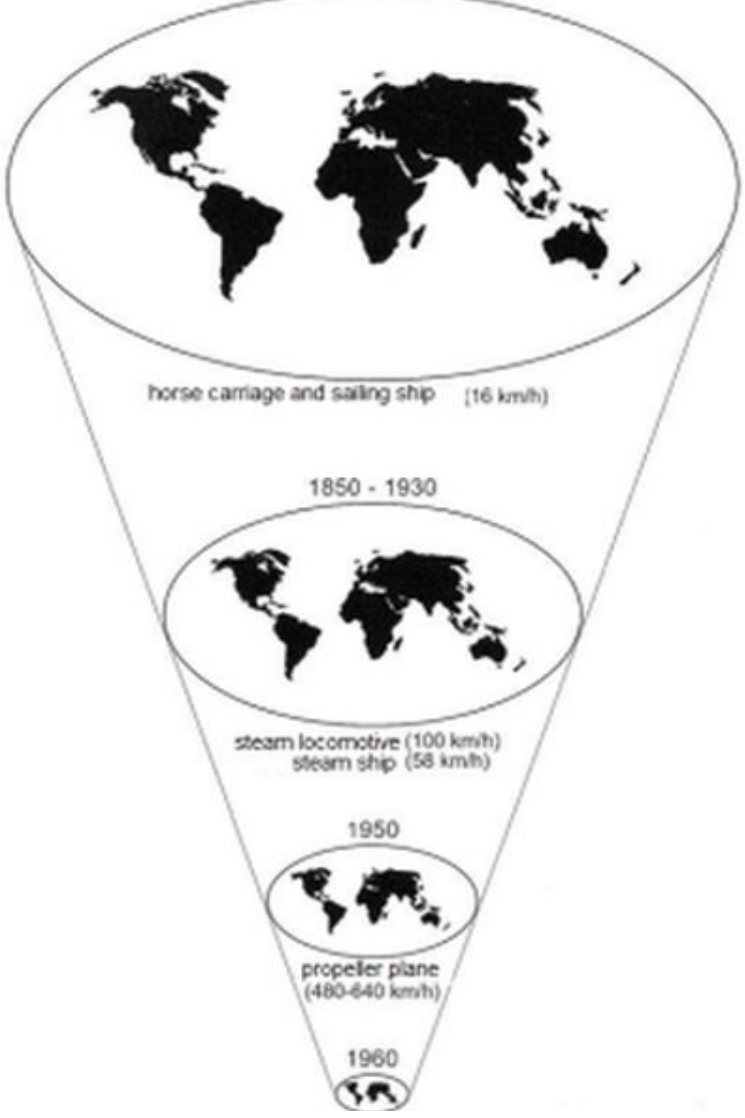
Affiliate Professor, Geography, University of Washington

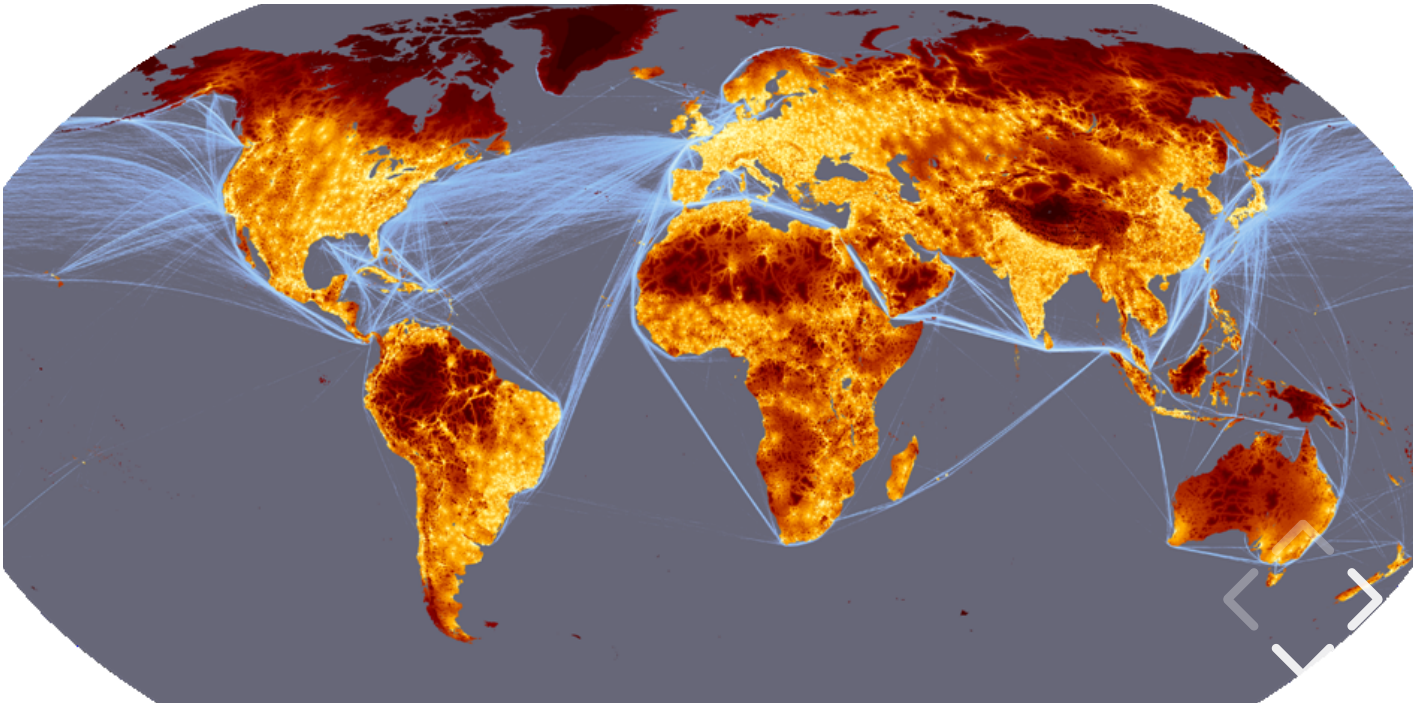
Critical Data Studies, Digital Geographies, Digital Political Ecology, Critical Cartography, etc.

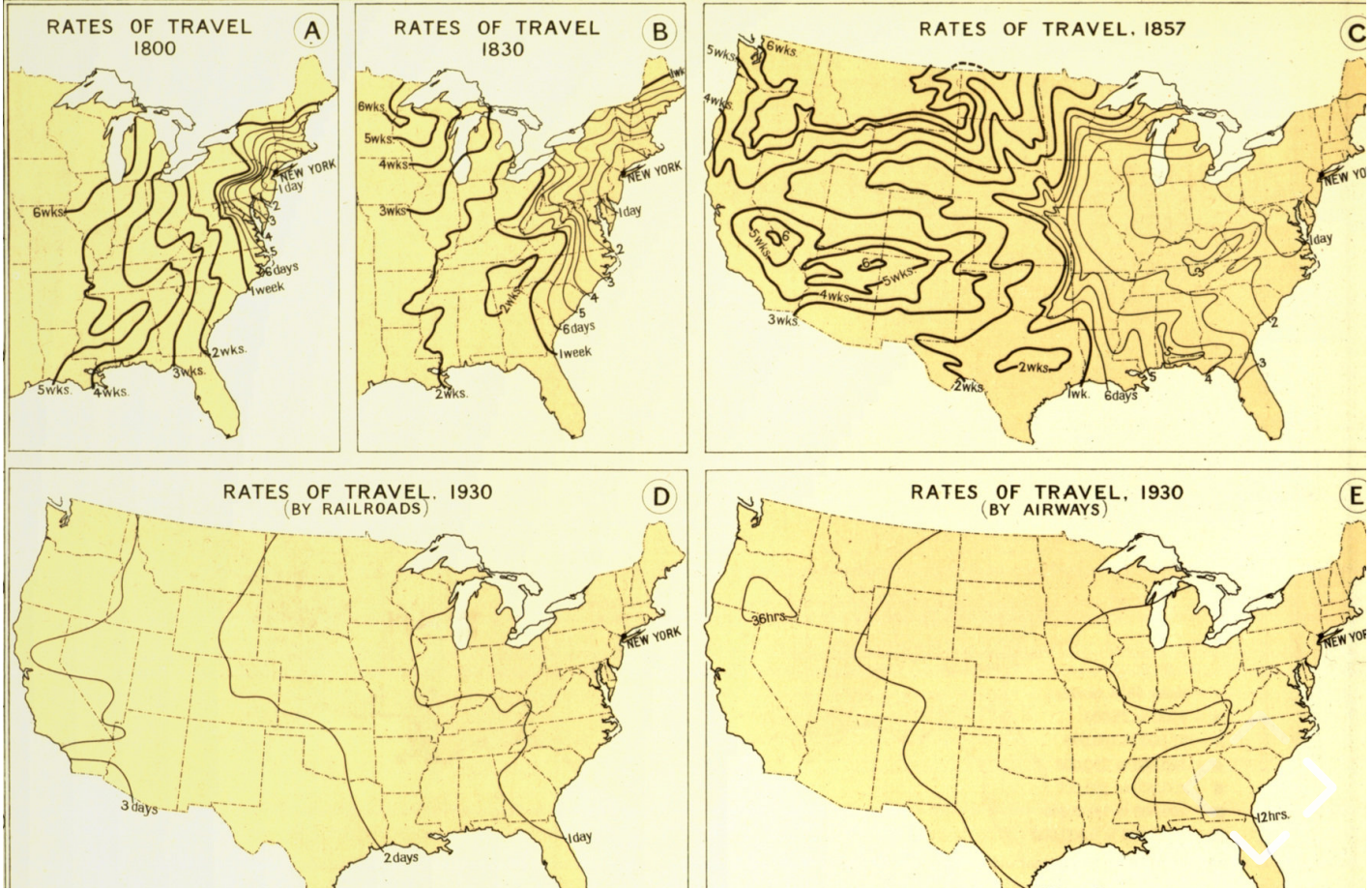
'Old' work on
Space, time, and distance

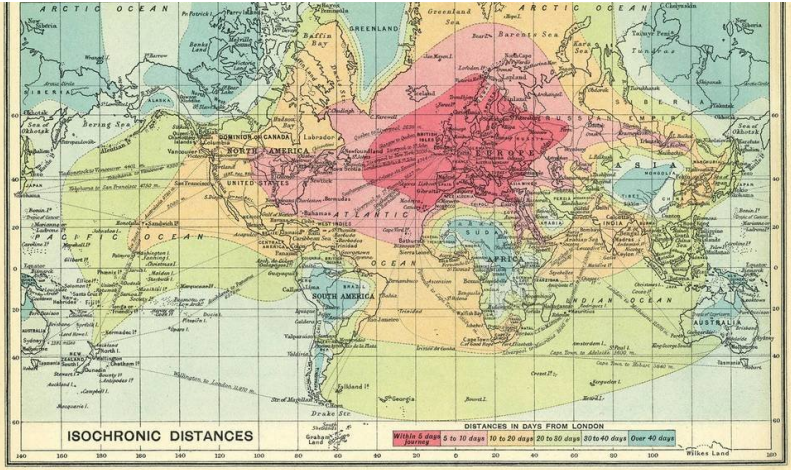
Mapping time is hard.




horse carriage and sailing ship (16 km/h)
1850 - 1930
steam locomotive (100 km/h)
steam ship (58 km/h)
1950
propeller plane
(480-640 km/h)
1960

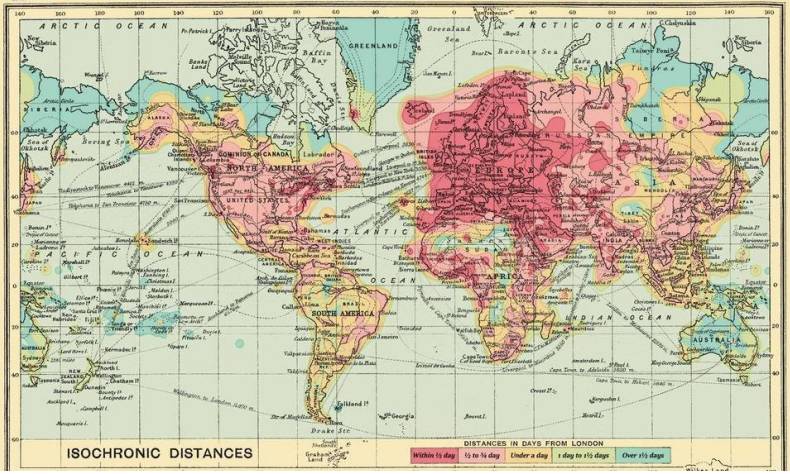



RATES OF TRAVEL
1800
A
NEW YORK
1 day
2
3
4
5
6 days
1 week
2 wks.
3 wks.
4 wks.
5 wks.
6 wks.
RATES OF TRAVEL
1830
B
NEW YORK
1 day
2
3
4
5
6 days
1 week
2 wks.
3 wks.
4 wks.
5 wks.
6 wks.
RATES OF TRAVEL, 1857
C
NEW YO
1 day
2
3
4
5
1 wk.
6 days
2 wks.
3 wks.
4 wks.
5 wks.
6 wks.
RATES OF TRAVEL, 1930
(BY RAILROADS)
D
NEW YORK
1 day
2 days
3 days
RATES OF TRAVEL, 1930
(BY AIRWAYS)
E
NEW YOR
12 hrs.
36 hrs.

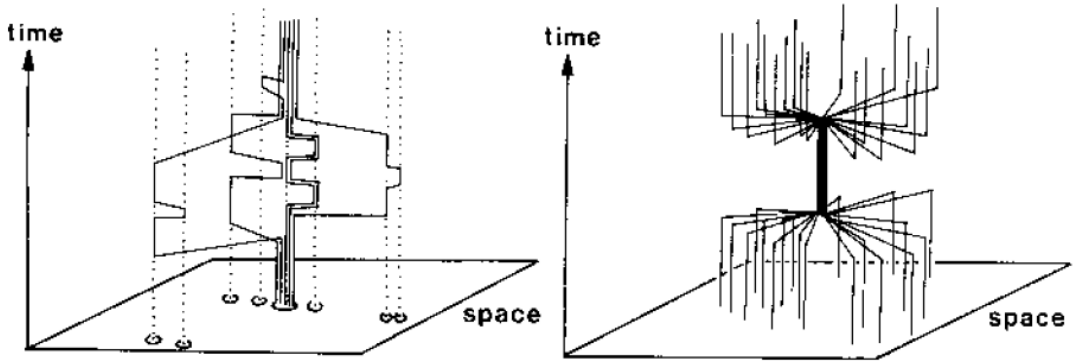

ISOCHRONIC DISTANCES
DISTANCES IN DAYS FROM LONDON
Within 5 days journey
5 to 10 days
10 to 20 days
20 to 30 days
30 to 40 days
Over 40 days
ARCTIC OCEAN
GREENLAND
NORTH AMERICA
SOUTH AMERICA
EUROPE
AFRICA
ASIA
AUSTRALIA
ATLANTIC OCEAN
PACIFIC OCEAN
INDIAN OCEAN

1914

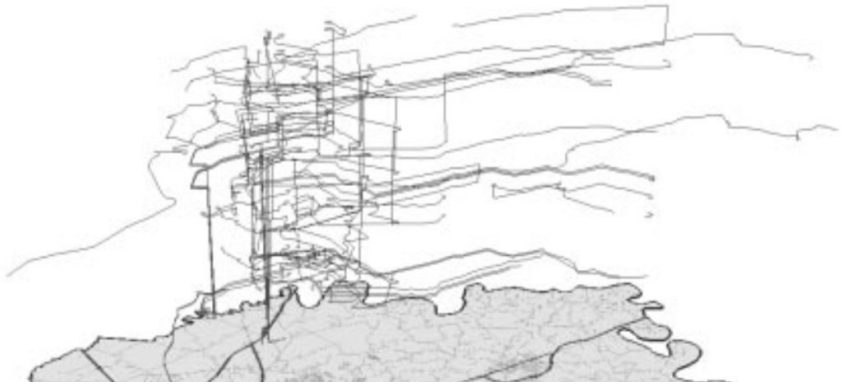
12[5]


ISOCHRONIC DISTANCES
DISTANCES IN DAYS FROM LONDON
Within ½ day
½ to ¾ day
Under a day
1 day to 1½ days
Over 1½ days
ARCTIC OCEAN
GREENLAND
NORTH AMERICA
SOUTH AMERICA
EUROPE
AFRICA
ASIA
AUSTRALIA
ATLANTIC OCEAN
PACIFIC OCEAN
INDIAN OCEAN

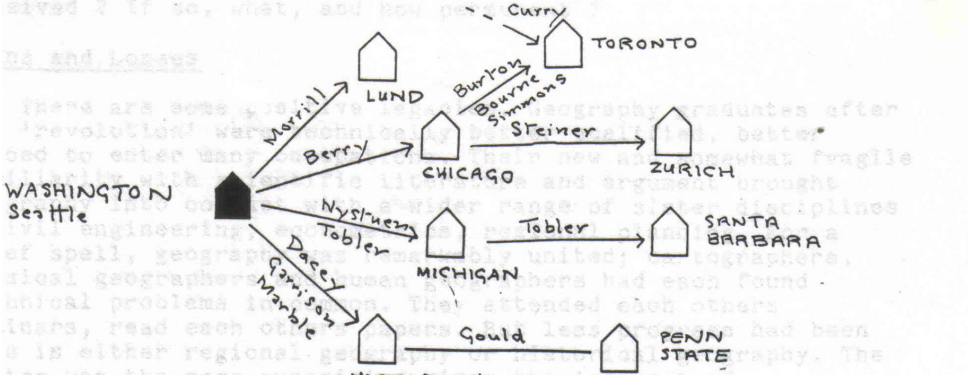
Time Geography



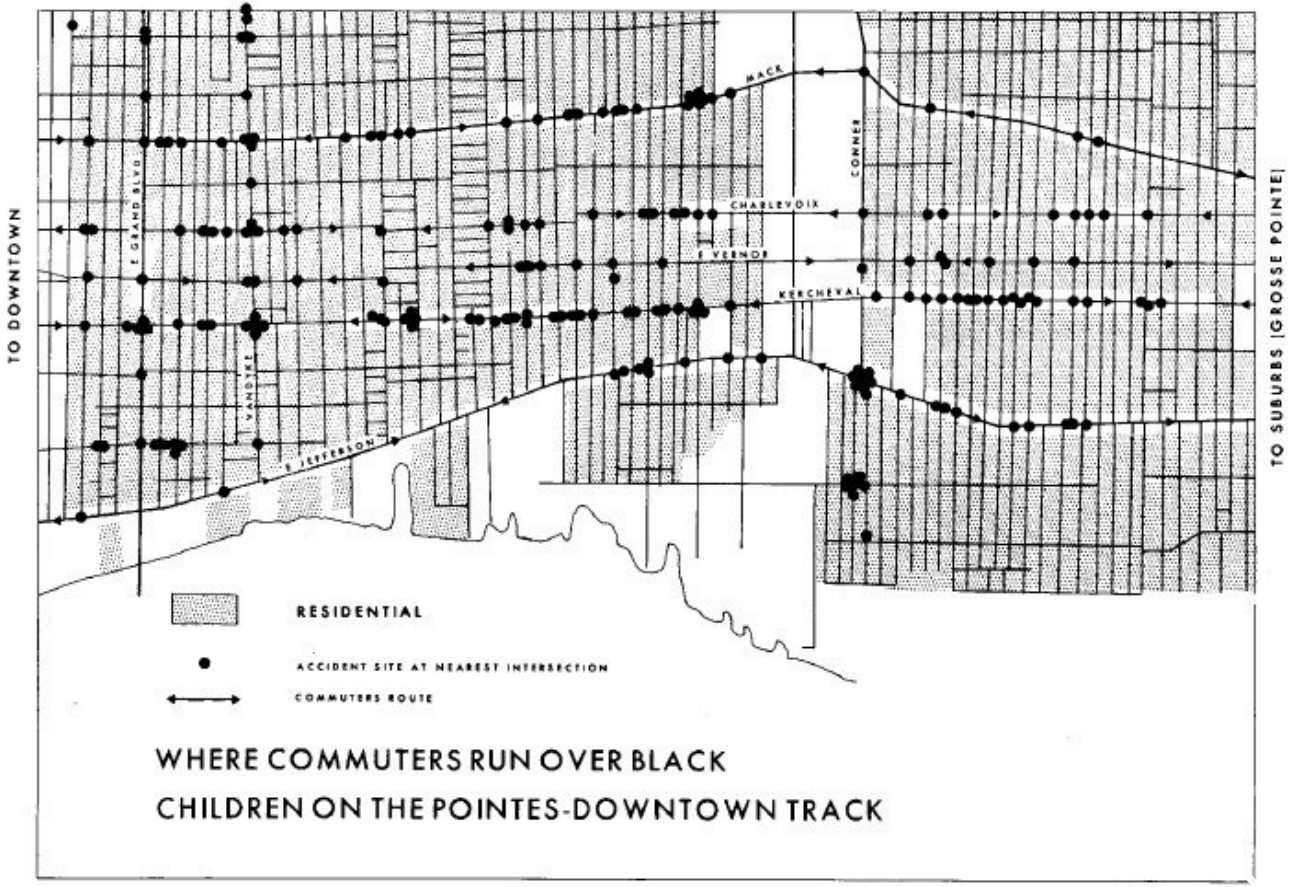
MEI-PO KWAN



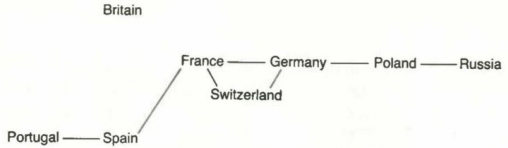
'Quantitative Revolution'



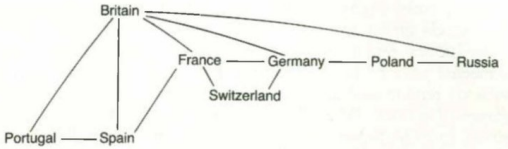
Detroit Geographical Expedition and Institute



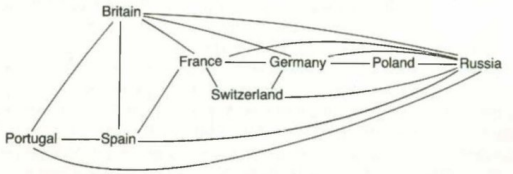
WHERE COMMUTERS RUN OVER BLACK
CHILDREN ON THE POINTES-DOWNTOWN TRACK



European connections assuming land power



European connections assuming land and sea power



European connections assuming land, sea and missile power

Map 2.9 Graph-theoretic 'maps' of Western Europe

The 'shrinking world' concept typically means that the time distances between various points on the earth's surface are rapidly diminishing but in a continuous metric fashion. Actually, the situation is even more alarming because there have been sudden leaps and quantum reversals in spatial relations in recent times. The illustration is essentially a graph showing by simple lines which countries are connected to which others. Notice that before sea travel, say before Phoenician times, Britain was the most isolated. But with sea travel, Britain became the best connected European nation, a quantitative reversal. Similarly, Russia, most isolated under land travel, became only slightly less isolated with sea travel because it is so landlocked. However, with missiles Russia became central, and not with a spatial reform but with a spatial revolution.

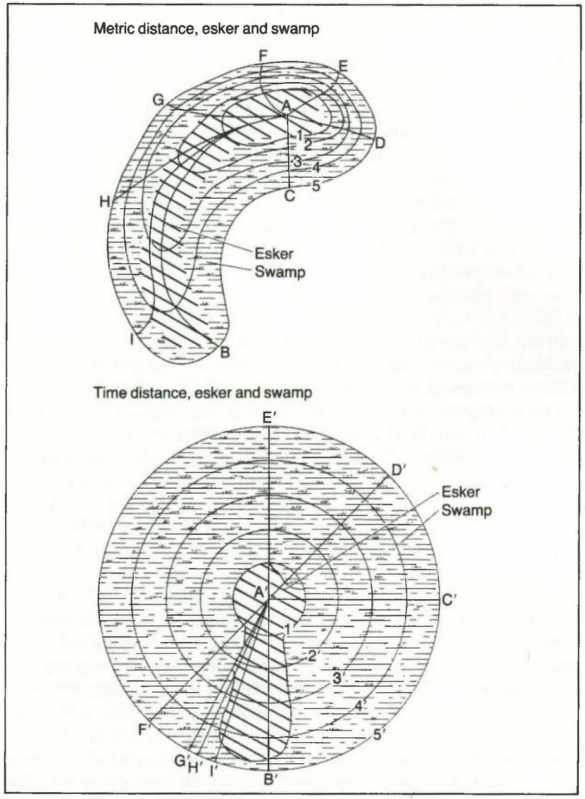


Figure 2.10 Circles of constant time and straight line shortest paths
This figure shows the optimal path for a hiker along a ridge in a swamp. The numbers indicate minutes of travel from A to B, A to C etc.
Source: Bunge and Bordessa (1975)

'New' work on

Space, time, and distance

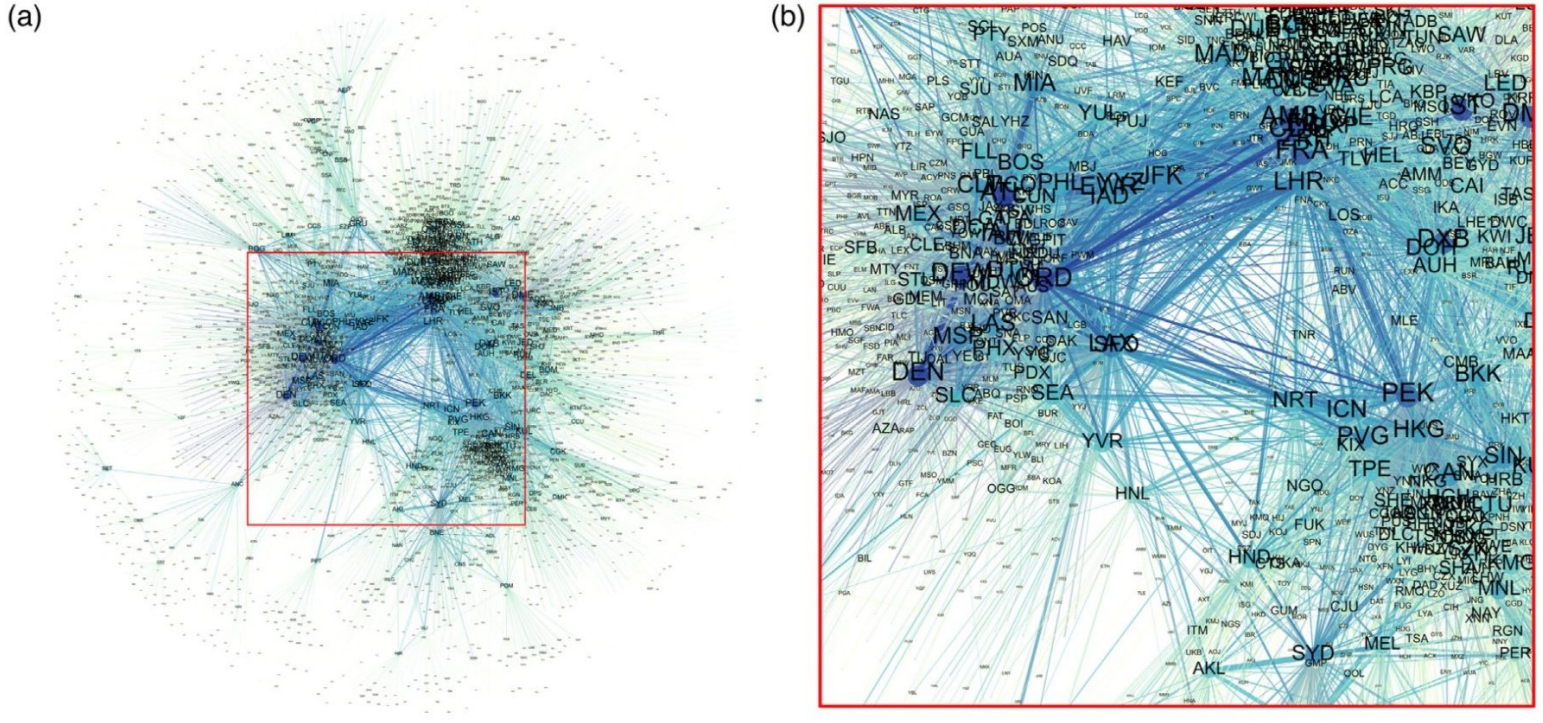


Figure 1

Relational representation of the global flights network from the OpenFlights dataset (2015) shows (a) the whole network and (b) a magnified centr
area as indicated in (a). The network layout used a combination of 3D force-directed layout and the Yifan Hu layout algorithm as implemented
Gephi (Bastian et al. 2009). Airport abbreviations are scaled by numbers of inbound flights at those airports, and edges are coloured from light t
dark according to calculated centrality (darker is more central) of the airports they connect.

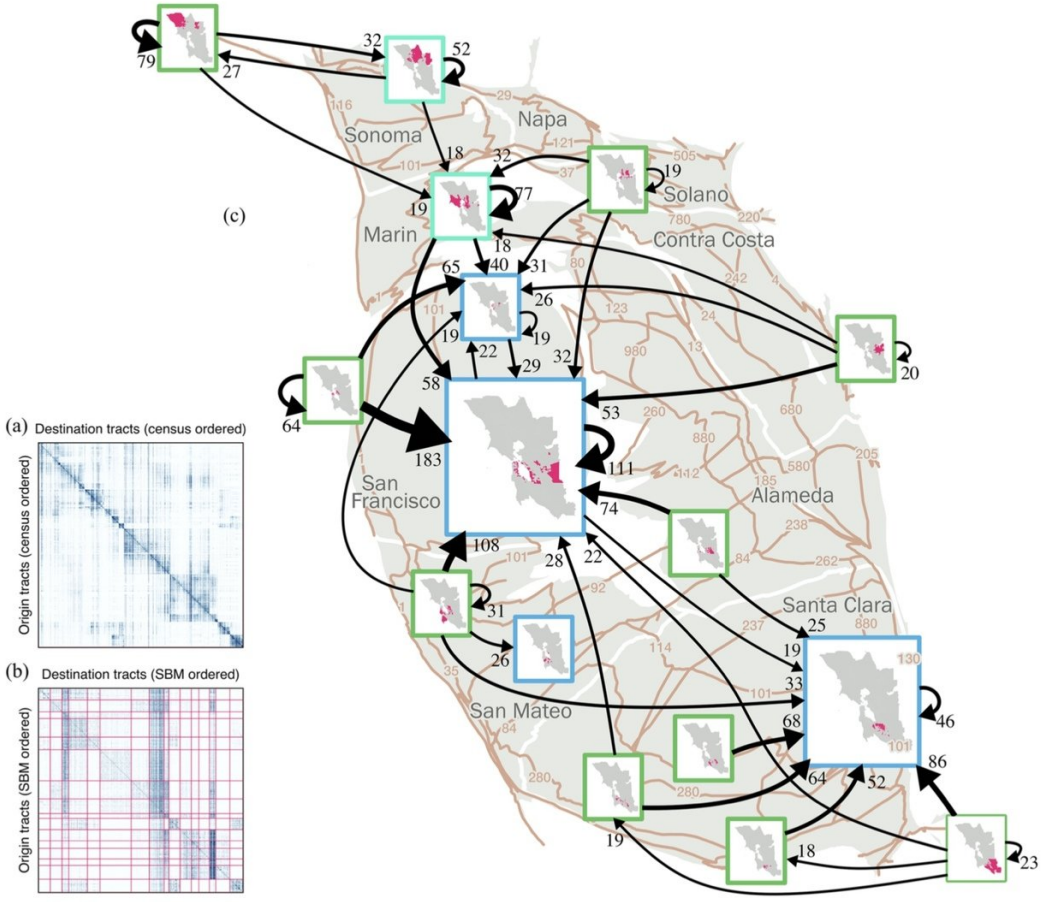


Figure 2
Blockmodeling results for California Bay Area commuter flows. Origin-destination matrices are shown, with darker blue representing larger flows, in (a) Census ID order and (b) reorganized into regions by the stochastic blockmodel, on the basis of relational affinities. Panel (c) shows one level of a hierarchical blockmodel, where areas that are primarily sources (green outline), primarily sinks (blue), or a mixture (cyan) are indicated in the blockmodel nodes. The regions are mapped in red in the small maps on each node. Links are labeled with commute numbers in thousands, and node sizes are scaled by total inbound commutes. The basemap is a cartogram rescaled by total inbound commutes (local jobs), with county names and highway numbers included for orientation.

Space isn't flat.

Space isn't smooth.

Redistricting Revisited

Redistricting Revisited

Revisited

REDISTRICTING REVISITED*

RICHARD L. MORRILL

ABSTRACT. Legislative and congressional districts for the State of Washington were delimited by the author in 1972. Computer models were not used. This article compares the actual with optimal computer plans for the sake of estimating how practical and conceptually satisfactory computer models may be. A "capacity-constrained location-allocation" model is used, finding equally populous districts such that aggregate travel to the set of district centers is the minimum possible. The model iterates between assignment of sufficient population to district centers and relocation of centers, until no further travel savings occurs. Airline, road and time distances are utilized. The hypothesis that computer models would be inferior to human judgment was rejected. On the average the computer-produced districts tended to be more compact and the set of districts are more efficient than was true of the 1972 plan.

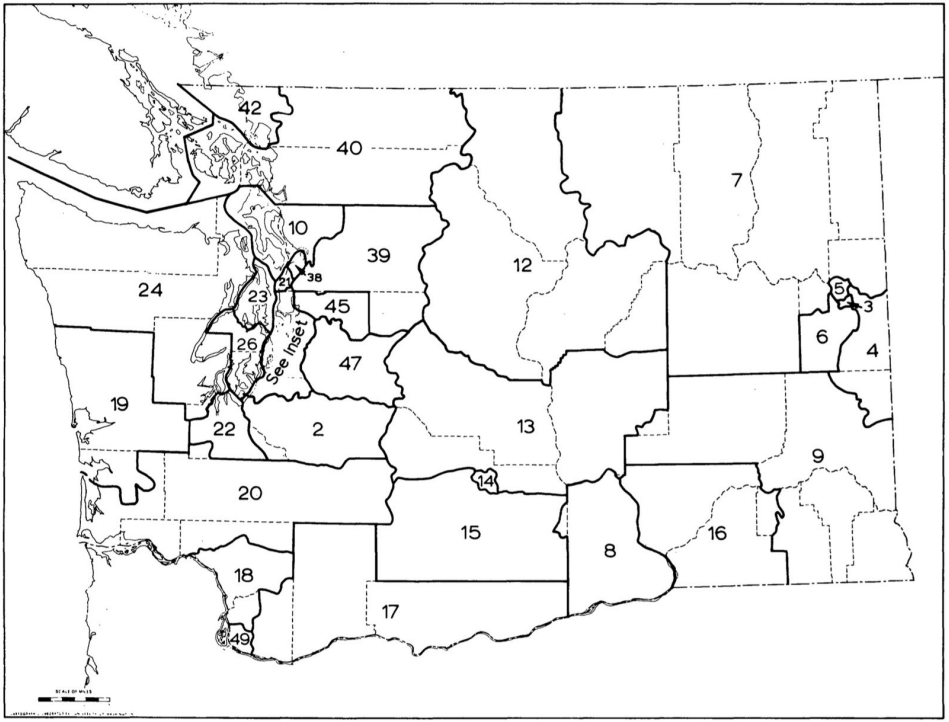


FIG. 4. 1972 Legislative district plan, Washington.

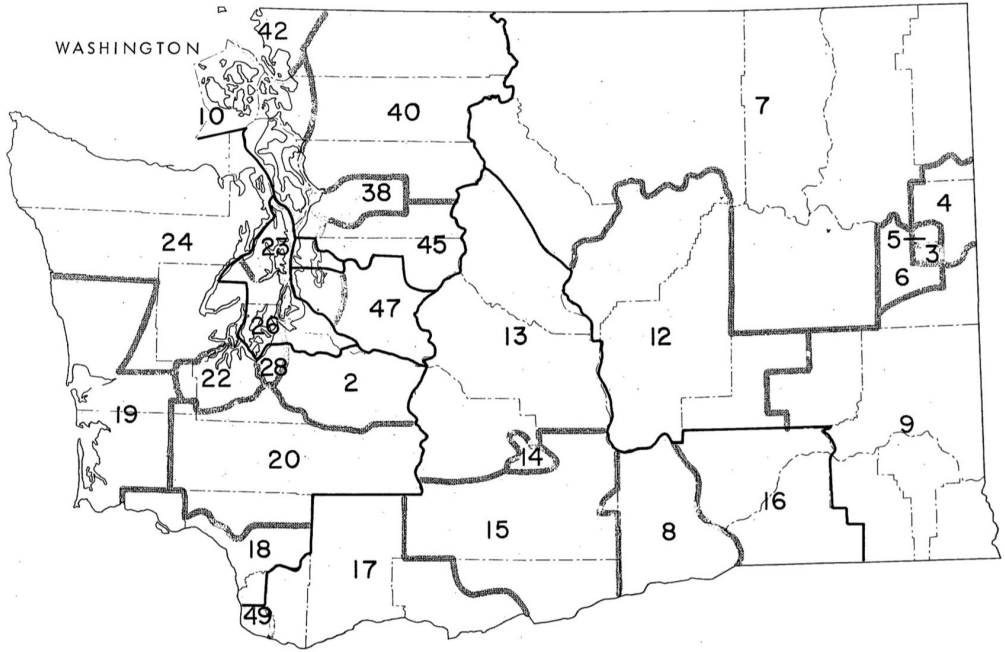


FIG. 5. Computer redistricting plan, Washington.

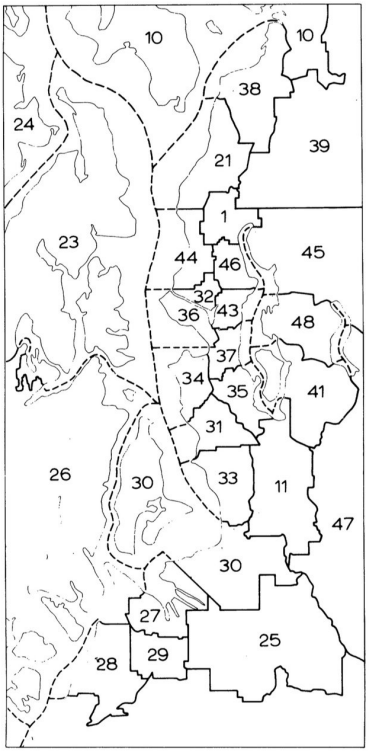


FIG. 6. 1972 Legislative district plan, Seattle area.

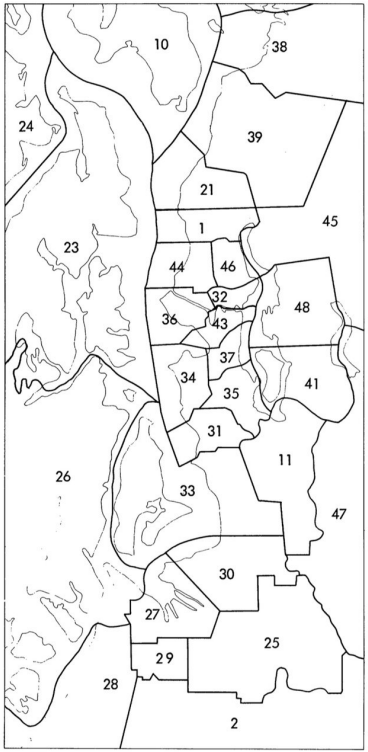
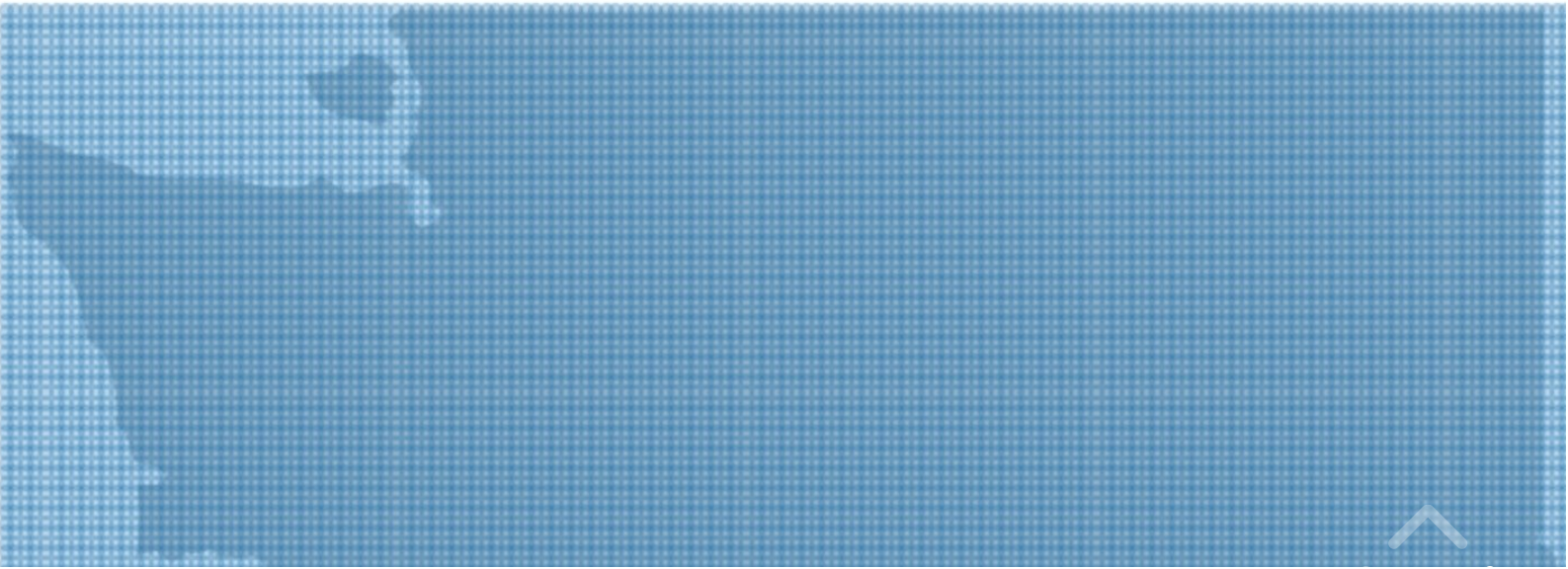


FIG. 7. Computer redistricting plan, Seattle area.

And today?



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dfmatrix
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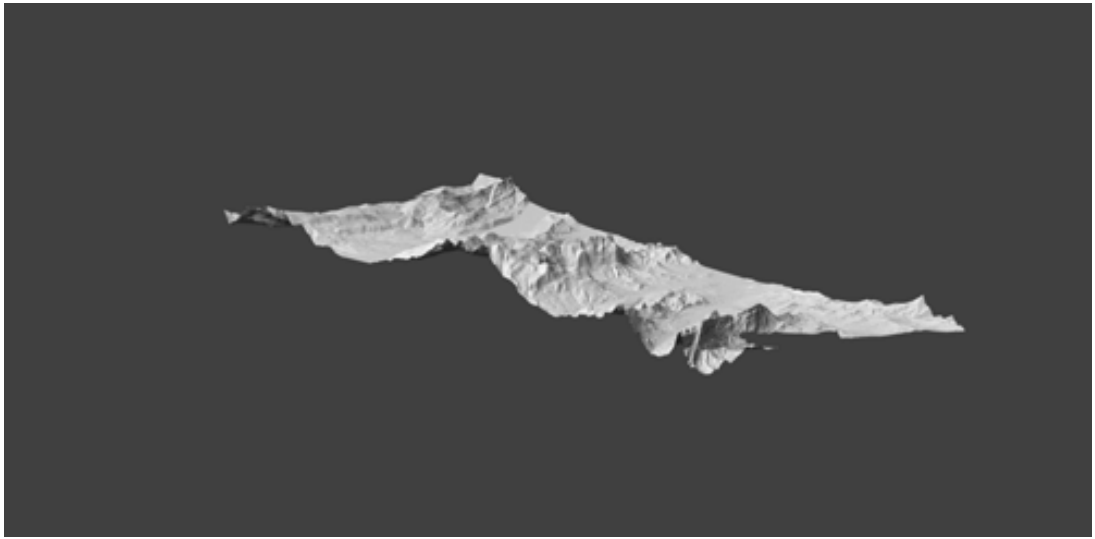
	47.7,-123.9	47.4,-123.9	47.1,-123.9	46.8,-123.9	47.7,-124.2	47.4,-124.2
47.7,-123.9	0	6012	7436	11282	3484	6694
47.4,-123.9	6012	0	1512	5278	3430	2567
47.1,-123.9	7436	1512	0	3748	4807	3927
46.8,-123.9	11282	5278	3748	0	8526	7208
47.7,-124.2	3484	3430	4807	8526	0	4105
47.4,-124.2	6694	2567	3927	7208	4105	0



Questions?

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