

Integration of Historical Data based on Spatiotemporal Information

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Introduction

Role of spatiotemporal information for this project

Visualization onto maps and timelines

Maps and timelines as a workbench



An example of the Historical GIS
(as a goal of the project ?)

Clio Infra <http://www.clio-infra.eu/visualize>

In this presentation

- (1) Software Tools and Data Construction
- (2) Toward Integration of Historical Data

Software Tools and Data Construction

Visualization onto a map (data based on spatial information)

- Software Tools
- Data for maps
- Temporal changes in spatial distribution



Visualization onto a timeline or a time series chart (data based on temporal information)

- Software Tools
- Data for timelines or charts
- Spatial difference in temporal changes



Visualization onto a map

Many kind of GIS software are available



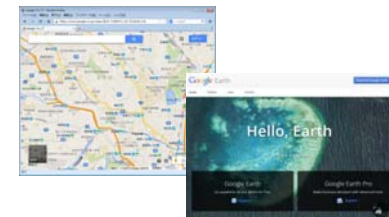
ArcGIS <http://www.esri.com/>



GRASS GIS <http://grass.osgeo.org/>



QGIS <http://www.qgis.org/>



Google Maps & Google Earth <http://www.google.com/>

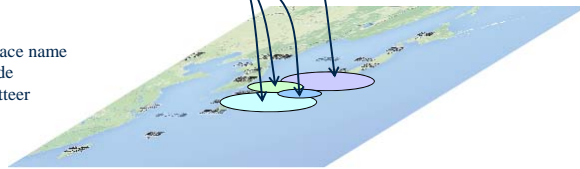
Visualization onto a map

How to make data for maps

latitude	longitude	value
35.680594	139.766865	3,000
34.694047	135.500797	2,500
34.990913	135.755457	1,800
35.174785	136.886881	1,200

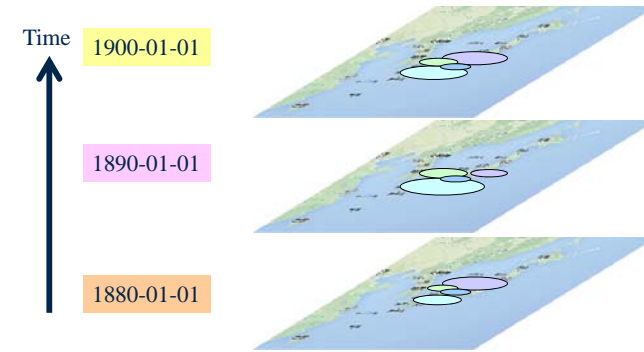
↑ Conversion from place name to latitude / longitude according to a gazetteer

Place	value
Tokyo	3,000
Osaka	2,500
Kyoto	1,800
Nagoya	1,200



Visualization onto a map

Temporal changes in spatial distribution



Temporal differences are expressed as separated layers (maps)

Examples for this type of data

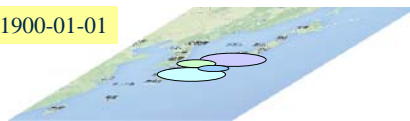
- Historical changes in spatial distribution of population
- Temporal changes in diffusion of polluted material

Visualization onto a map

How to make data to express temporal changes in spatial distribution

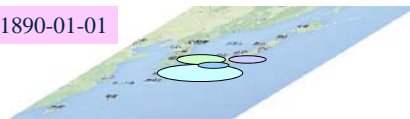
latitude	longitude	time	value
35.680594	139.766865	1900-01-01	3,000
34.694047	135.500797	1900-01-01	2,500
34.990913	135.755457	1900-01-01	1,800
35.174785	136.886881	1900-01-01	1,200

1900-01-01



latitude	longitude	time	value
35.680594	139.766865	1890-01-01	1,800
34.694047	135.500797	1890-01-01	3,200
34.990913	135.755457	1890-01-01	2,200
35.174785	136.886881	1890-01-01	2,000

1890-01-01



latitude	longitude	time	value
35.680594	139.766865	1880-01-01	2,800
34.694047	135.500797	1880-01-01	1,800
34.990913	135.755457	1880-01-01	1,500
35.174785	136.886881	1880-01-01	1,300

1880-01-01



Visualization onto a timeline or a time series chart

There are few kind of available software for temporal information



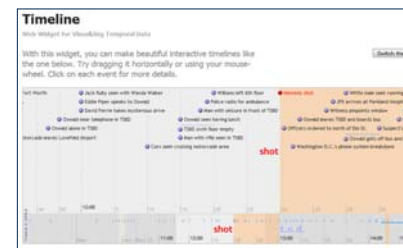
HuTime

<http://www.hutime.org/>



Timeline JS

<http://timeline.knightlab.com/>



SIMILE Timeline

<http://www.simile-widgets.org/timeline/>



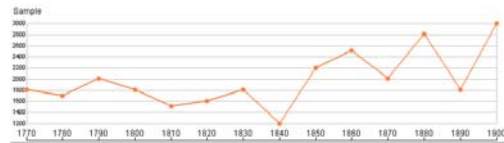
Google Charts

<http://www.google.com/>

Visualization onto a timeline or a time series chart

How to make data for timelines or chars

time	value
1870-01-01	2,000
1880-01-01	2,800
1890-01-01	1,800
1900-01-01	3,000

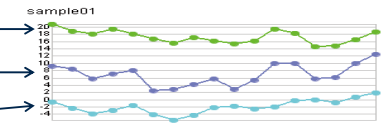
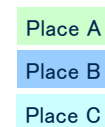
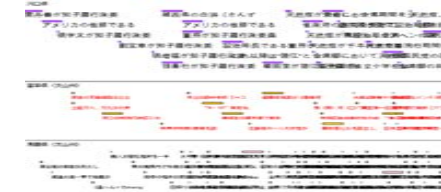
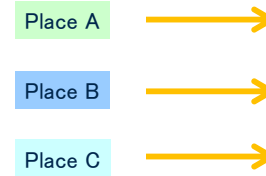


time_from	time_to	event
1802-03-25	1802-03-25	Treaty of Amiens
1803-01-01	1803-12-31	Napoleonic Wars
1811-01-01	1817-12-31	Luddite
1812-06-01	1814-12-31	War of 1812



Visualization onto a timeline or a time series chart

Spatial difference in temporal changes



Spatial differences are expressed as separated timelines or different symbols in a chart

Examples for this type of data

- Difference in histories among countries or regions
- Difference in changes in population among countries

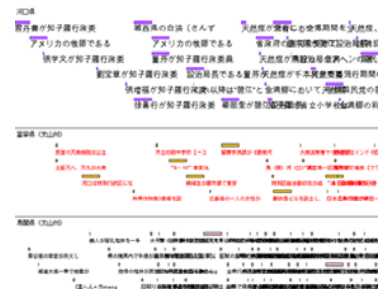
Visualization onto a timeline or a time series chart

How to make data to express spatial difference in temporal changes

latitude	longitude	time_from	time_to	event
34.990	135.755	1870-01-01	1870-01-01	
34.990	135.755	1880-01-01	1880-01-01	2,500
34.990	135.755	1890-01-01	1890-01-01	1,800
34.990	135.755	1900-01-01	1900-01-01	2,000

latitude	longitude	time_from	time_to	event
35.680	139.766	1870-01-01	1870-01-01	3,000
35.680	139.766	1880-01-01	1880-01-01	2,500
35.680	139.766	1890-01-01	1890-01-01	1,800
35.680	139.766	1900-01-01	1900-01-01	2,000

latitude	longitude	time_from	time_to	event
34.694	135.500	1870-01-01	1870-01-01	3,000
34.694	135.500	1880-01-01	1880-01-01	2,500
34.694	135.500	1890-01-01	1890-01-01	1,800
34.694	135.500	1900-01-01	1900-01-01	2,000



Visualization onto a timeline or a time series chart

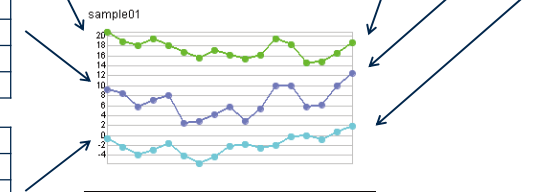
How to make data to express spatial difference in temporal changes

latitude	longitude	time	value
34.990	135.755	1870-01-01	3,000
34.990	135.755	1880-01-01	2,500
34.990	135.755	1890-01-01	1,800
34.990	135.755	1900-01-01	2,000

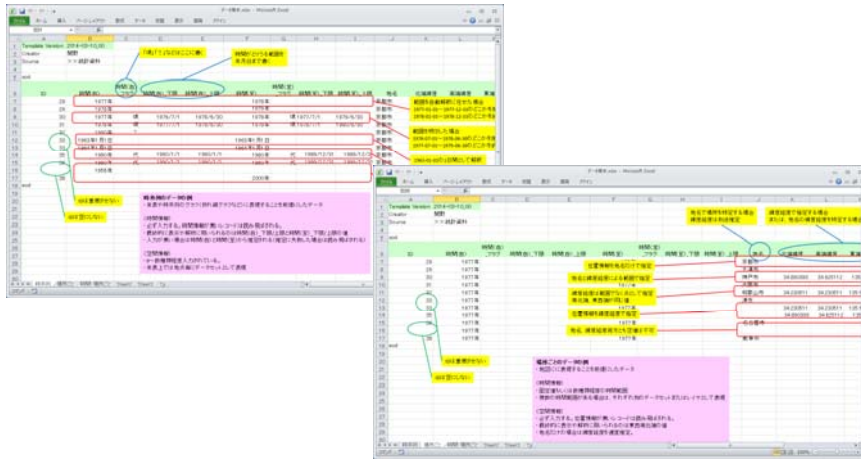
latitude	longitude	time	value
35.680	139.766	1870-01-01	3,000
35.680	139.766	1880-01-01	2,500
35.680	139.766	1890-01-01	1,800
35.680	139.766	1900-01-01	2,000

latitude	longitude	time	value
34.694	135.500	1870-01-01	3,000
34.694	135.500	1880-01-01	2,500
34.694	135.500	1890-01-01	1,800
34.694	135.500	1900-01-01	2,000

time	value (place 1)	value (place 2)	value (place 3)
1870-01-01	3,000	3,000	3,000
1880-01-01	2,500	2,500	2,500
1890-01-01	1,800	1,800	1,800
1900-01-01	2,000	2,000	2,000



Sample data template



The templates have been modified depending on subject.

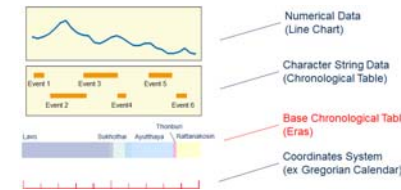
Collection of spatiotemporal basic data

Spatial Information

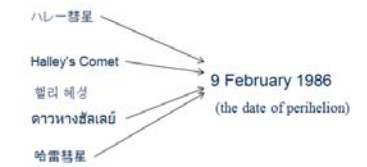
- Base Maps
- Gazetteers

Temporal Information

- Basic chronological tables (correspond to base maps in GIS)
- Index of events (corresponds to gazetteers in GIS)
- Calendar conversion (corresponds to datum conversion in GIS)



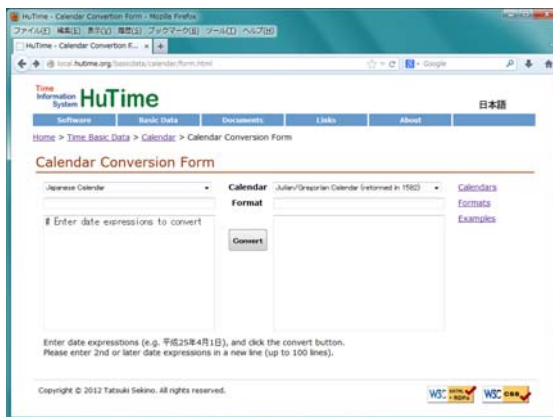
An example of the basic chronological table



An example of the event index

Collection of spatiotemporal basic data

An example of the calendar conversion

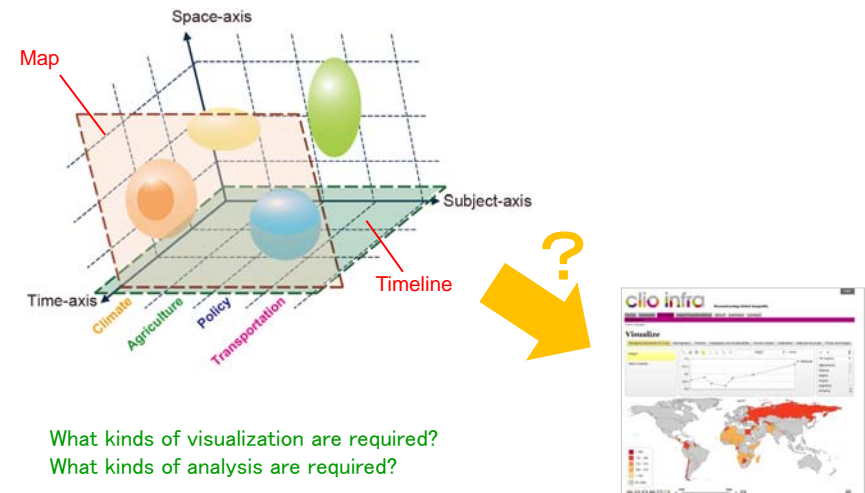


<http://www.hutime.org/basicdata/calendar/form.html>

Features

- Character strings expressing date are interpreted directly
- Chinese characters and expression in a specific calendar are allowed
- Multiple records are converted at once.
- Interpretation and output of the character strings according to user specified format

Interlink between Geographic and Temporal Tools



What kinds of visualization are required?
What kinds of analysis are required?