Impact of Historical Databases on Silk Road Studies

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http://dsr.nii.ac.jp/
Digital Silk Road Project

- Collaborative work between informatics and humanities (digital humanities).
- Several databases and resources are publicly accessible on the Web.

http://dsr.nii.ac.jp/
Toyo Bunko Rare Books

- Digitization of 203 books, 59358 pages.
- Application of OCR for full-text search.
- Access from anywhere in the world.

http://dsr.nii.ac.jp/toyobunko/
Digitization to Applications

• Specialist applications
  – Caves http://dsr.nii.ac.jp/china-caves/
  – Photographs http://dsr.nii.ac.jp/photographs/
  – Place-names http://dsr.nii.ac.jp/digital-maps/
  – Maps http://dsr.nii.ac.jp/geography/

• Public applications
  – Participatory museum http://dsr.nii.ac.jp/senga/
  – Narratives and stories http://dsr.nii.ac.jp/narratives/

• All kinds of content is linked to digitized books.
Senga: Participatory Museum

- Visitors can make their own exhibitions on the Web.
- Museum staff prints the exhibition as a postcard.
- The system connects to a server in NII.
Focus more on Data and Source

Discovery

Evidence

Narrative

Theory

Information

Fact

Data

Source

Database

Our Work

Integration

Criticism

Reliability
Database of Buddhist Cave Temples in China

- **Problem 1**: Existing ID systems are not integrated.
- **Problem 2**: Each cave info is not linked with other references.
- **Solution**: Digital survey for the database of caves.
Digital Survey of Cave IDs

- Stein Number
- Pelliot Number
- Zhang Daqian (張大千) Number
- Shi Yan (史岩) Number
- Current Number (given by Dunhuang Academy)
- **DSR ID** (given by us)

One cave has many IDs

Unique ID for integration
# Integration of IDs

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<th>Stein Number</th>
<th>Zhang</th>
<th>Shi</th>
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<td>CH. IX</td>
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</table>
Source Criticism

- Digital archives includes not only text, but also visual and spatial sources such as maps.
- Criticism of maps has not been well studied in comparison to textual criticism.
- Digital tools are required for map criticism due to a large amount of data involved.
- Human reading has limited capability for quantifiable criticism.
Criticism of Qianlong Map
Massive Geometric Correction

Huge size = W 13 m x H 14 m

Many sheets = 203 sheets in total

Massive pixels = 29 billion pixels

- Control points + lines:
  We proposed a new geometric correction.
Discovery and Digital Survey

• Discovery: 5 sheets have mis-arrangements due to improper reconstruction in the past.

• Digital Survey: Place-names were checked to make a comprehensive gazetteer.
Two Methods of Map Registration

Geometric Correction
- All points are registered.
- Shapes are distorted.

Single-Point Registration
- Single point is registered (but no other points).
- Shapes are not distorted.
Mappinning

Interactive georeferencing by pinning old maps

Digital Silk Road > Database of Ruins in Silk Road > Mappinning

Map data © 2013 Old Map, National Institute of Information "Digital Silk Road". Map data © 2013 AktonWeb, Google Imaging © 2013 TerraMetrics - Terms of Use
• Stein’s Innermost Asia Maps were registered with Google Earth satellite images.
Error Distribution in Tarim Basin

- Error is bigger along longitude than latitude (limitation of survey technology at the time).
- Error tends to be accumulative.
Summary of Errors

- The error consists of direction + distance.
- **Known points**: Errors can be computed.
- **Unknown points**: Errors can be estimated by interpolation in the neighborhood.
Criticism of Multiple Sources

- Oi-tam, ruined fort
- Bögan-tura
- Buluyuk (Shipang, Sassik-bulak, Kazma)
- Murtuk-ruins
- Yoghantura
- Chikkan-köl
- Bedaulat’s town, Bēsh-kāwuk, Kosh-gumbaz
- Yutōgh

Missing Ruins
Error Distribution near Turfan Basin / White: Innermost Asia / Black: Serindia

• Some ruins were reported by 20th expeditions, but are missing in recent survey reports.
Finding “Murtuk Ruins”

Based on error information of maps, our guess about the location of Murtuk Ruins is represented as —

Estimated error: west-southwest 5.6km
Wujiang-bulak (烏江不拉克)

「吐鲁番地区文物普查资料汇编」『新疆文物』1988-3（普查）
「吐鲁番地区遗迹调查报告」『アジア史研究』29号, 2005
Murtuk Ruins (Stein, 1915)

Stein’s map and satellite images for the same area. Each source reports different ruins due to different conceptualization.
Criticism of Visual Sources

伯西哈石窟 (烏江不拉克仏塔)

Murtuk Ruins (M. B. I)

烏江不拉克烽火台

Murtuk Ruins (Ruined Shrine M. C. I)
Our Contribution

1. We proposed new concept of source criticism for visual sources using digital technology.
2. Spatial visual sources such as maps requires computational methods for source criticism.
3. We also built digital tools for map criticism to improve the reliability of map sources.
4. Integration of visual and textual sources will lead to the discovery of new historical facts.
Schematic Diagram of Map Criticism

Textual criticism

Textual source A

Place name S

Textual source B

Place name T

Textual criticism

Geographic relationship
On the map

Place name U

Place name V

Map Source C, D, E...

Map criticism
Map Criticism and Historical GIS

Historical GIS

Source

Criticism by Human

Digital Tools (GIS)

Analyze

Map Criticism

Source

Criticism by H&C

Digital Tools

Analyze
Digital Source Criticism

• Computational algorithms and databases can help source criticism.

• Similar ideas can be applied to textual criticism?
Database for Silk Road Studies

Database for Silk Road Studies

Digital Source Criticism

Source A
Source B
Source C

Search

Ruin
Event
Place-name
Fact
Narrative
Theory
References

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