Criticism of Maps: Methodological Development for the Rediscovery of Silk Road Ruins and the Value of Sources

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Digital Silk Road Project

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|---|-----------------------------|--|
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| Digital Sik Road Project is a research project on creating digital archives of through collaboration between informatics and humanities. [Road More ~~ | cultural bentage] | Projects |
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| Latest News | | 202 |
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2013/5/24

- Started in 2001.
- Digital Humanities: Collaborative work between informatics + humanities people.

Databases and resources are publicly accessible on the Web.

http://dsr.nii.ac.jp/



- Digitization of 203 books, 59358 pages.
- Collection of relevant academic references.
- Automatic OCR for full-text search.
- Manual input of captions and TOCs.

http://dsr.nii.ac.jp/toyobunko/

2013/5/24 hours Induced Internets (RETRETION) and the Top Barrie (RETRETION & S8th Int. Conf. Eastern Studies オウェブサイトに爆撃するデジタル交ん資源の無断転動加強くお送りいたします。

From Digitization to Databases

- Databases for research and study
 - Caves http://dsr.nii.ac.jp/china-caves/
 - Place-names http://dsr.nii.ac.jp/digital-maps/
 - Photographs http://dsr.nii.ac.jp/photographs/
 - <u>Maps</u> http://dsr.nii.ac.jp/geography/
- Databases for education and outreach
 - Participatory museum http://dsr.nii.ac.jp/senga/
 - Narratives and stories http://dsr.nii.ac.jp/narratives/
- Digitized books = Hub of databases.

[Q] Map is Fact? Data is Fact?



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From Data to History



Digital Tools: Computational Algorithms and Databases

Data Criticism (Map Criticism)

Textual Criticism

- Well developed.
- Qualitative.
- Human reading and interpretation.
- Text-oriented.

Data Criticism

- Not so explored.
- Quantitative.
- Computational algorithm.
- Spatial and visual sources, or multimedia sources.

Case Studies

- 1. Qianlong Map (Beijing)
 - Massive geometric correction.
 - Digital survey and discovery of mis-arrangement.
- 2. Stein Map (Silk Road)
 - Evaluation of error distributions.
 - Identification of "missing" ruins.
- 3. Grünwedel Map (Gaochang)
 - Interpretation of topological maps.
 - Rediscovery of the value of "untrusted" sources.

1. Qianlong Map (Beijing)



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 misarrangements due to improper reconstruction in the past.
- **Digital Survey**: Place-names were checked to make a comprehensive gazetteer.

2. Stein Map (Silk Road)



• Stein's map "Innermost Asia" was registered and displayed on Google Earth satellite images.

Two Methods of Map Registration

Geometric Correction



Map 1 Map 2 Map 2 A B C Register 'B'

Single-Point Registration

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

Mappinning

http://dsr.nii.ac.jp/digital-maps/mappinning/



Error Distribution in Tarim Basin



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

Comprehensive Guide on Errors

| | Oasis | Brine near the Oasic | Serindia | | InnermostAsia | |
|---------------|----------|-------------------------------|-----------|--------------|---------------|-------------|
| | Name | Ruins near the Gasis | Direction | Distance(km) | Direction | Distance(kn |
| 1 | Käshgar | | SW | 4.5 | NW | 1.2 |
| | | 三仙洞 | SW | 8.53 | S | 6.19 |
| | | Hannuoyi (ruined town, 罕諾依古城) | | | ESE | 9.05 |
| | | Mor stūpa (莫爾仏塔) | | | ESE | 4.5 |
| 2 | Aksu | | w | 17 | w | 26.7 |
| 3 | Kuchā | | w | 19 | w | 3.2 |
| | | Cave temples (Kizilgaha) | w | 16.99 | w | 2.86 |
| | | Ming-oi (of Kum-tura) | W | 20.06 | E | 1.7 |
| | | Simsin ruins | W | 21.41 | w | 4.7 |
| 4 | Korla | | SE | 4.3 | SW | 20.3 |
| 5 | Bugur | | w | 17.93 | W | 6.5 |
| - | | Lapar-kona-shahr (輪台故城) | | | WNW | 8.5 |
| 6 | Khötan | | NE | 5.1 | N | 1.2 |
| - | | Yotkan | NE | 5.29 | NE | 2.57 |
| Ð | Niya | | E | 2.6 | E | 3.1 |
| | | Niya stūpa(泥雅佛塔) | E | 2.7 | E | 3.8 |
| 8 | Charklik | | ENE | 4.4 | WNW | 10 |
| | | Charklik stūpa mound | ENE | 3.6 | WNW | 12.39 |
| 9 | Turfān | | SW | 4.9 | WSW | 8.2 |
| | | Kara-khoja (高昌故城) | WNW | 3.23 | SW | 5.87 |
| | | Yar-khoto (交河故城) | SW | 7.7 | w | 6.41 |
| 10 | Hāmi | | SW | 6.2 | SW | 6.2 |
| | | Ata-ram temple ruins (廟児溝) | SW | 9.1 | SW | 8.6 |
| Ð | Barkul | | | | w | 12.9 |
| 12 | Mīrān | | NE | 2.67 | NW | 12.34 |
| - | | Mīrān fort | NE | 2.9 | NW | 11.79 |
| 13 | Anixi | | E | 13.3 | E | 15.2 |
| | | Yulin Cave (楡林窟) | E | 4.3 | E | 6.3 |
| | | So-yang-chieng (鎮陽城) | E | 8.5 | E | 9.71 |
| Ð | Suzhou | | E | 4.7 | E | 3.5 |
| (1 5) | Ganzhou | | E | 32 | E | 15.6 |

1. Discription and Distances of Farmer on Chain Ma

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

Identification of "Missing" Ruins



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

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Error Distribution near Turfan



Error Distribution in Turfan Basin / White: Innermost Asia / Black: Serindia

 Some ruins were reported by 20th expeditions, but are missing in recent survey reports.

Locating "Murtuk Ruins"



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

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Wujiang-bulak (烏江不拉克)

「吐魯番地区文物普查資料匯編」『新疆文物』1988-3(普查) 「吐魯番地区遺跡調査報告」『アジア史研究』29号,2005



2000 010 E02 000 000

<mark>烏江不拉克故城</mark>



1000

伯西哈石窟 Murtug Anlage 2



1499 1

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Murtuk Ruins (Stein, 1915)



Visual Sources as Evidence



伯西哈石窟(烏江不拉克仏塔)







305. RUIN, M.B. I, AT MURTUR IN COURSE OF CLEARING.

Murtuk Ruins (M. B. I)



303. BUINED SHRINES, M.C., AT MUETUK, TURFAN

Murtuk Ruins (Ruined Shrine M. C. I)

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3. Grünwedel Map (Gaochang)



How to use the previously "untrusted" map?

Incosistencies in Gaochang Maps



Albert Grünwedel

Aurel Stein

Topological Map



Source: Tokyo Metro Co. Ltd. / http://www.tokyometro.jp/station/common/pdf/rosen_eng.pdf

Topological Search for Features



Where is v and µ? We have multiple candidates... Search for a road in north of γ and o, and a road between the inner wall to the wall gate. Hypothesize the location of v and μ (to be verified later).

Maps designed for navigation purposes should preserve the topology, not to get lost.

Need more sources?



Where is Tempel y and Ruine o?

Photographs as Evidence



Fig. 8, Tempel γ L: Current Situation(2012.10.29), R: Le Coq, 1904(Le Coq, 1913, Tafel. 70, I)

• By synthesizing multiple sources as evidence, the credibility of the hypothesis is increased.



Identification of Most Ruins



Connection between expedition results and recent surveys opens up new opportunities.



Error Distribution at Gaochang



Red circles represent the grouping of TOC of the expedition report.

- Composed of several regions with different error patterns.
- Hypotheses need to be verified by more evidences.
- "Topology" is the key for reasonable interpretation.

Our Contribution

- 1. We proposed a basic strategy for the criticism of spatial / visual sources, especially maps.
- 2. Data criticism and inquiry can increase the value of previously "untrusted" sources.
- 3. Data criticism requires digital tools for a comprehensive and quantitative survey.
- 4. Integration of visual and textual sources may lead to the discovery of new historical facts.

Advantage of Map Criticism



Map Criticism and Historical GIS



Data Criticism



- Computational algorithms and databases help criticism and inquiry.
- Similar ideas can be applied to textual criticism?

Digital Silk Road Project



- Website
 - http://dsr.nii.ac.jp/
- Toyo Bunko Digital Archive
 - http://dsr.nii.ac.jp/toyobunko/
- Silk Road Maps
 - http://dsr.nii.ac.jp/geography/



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