

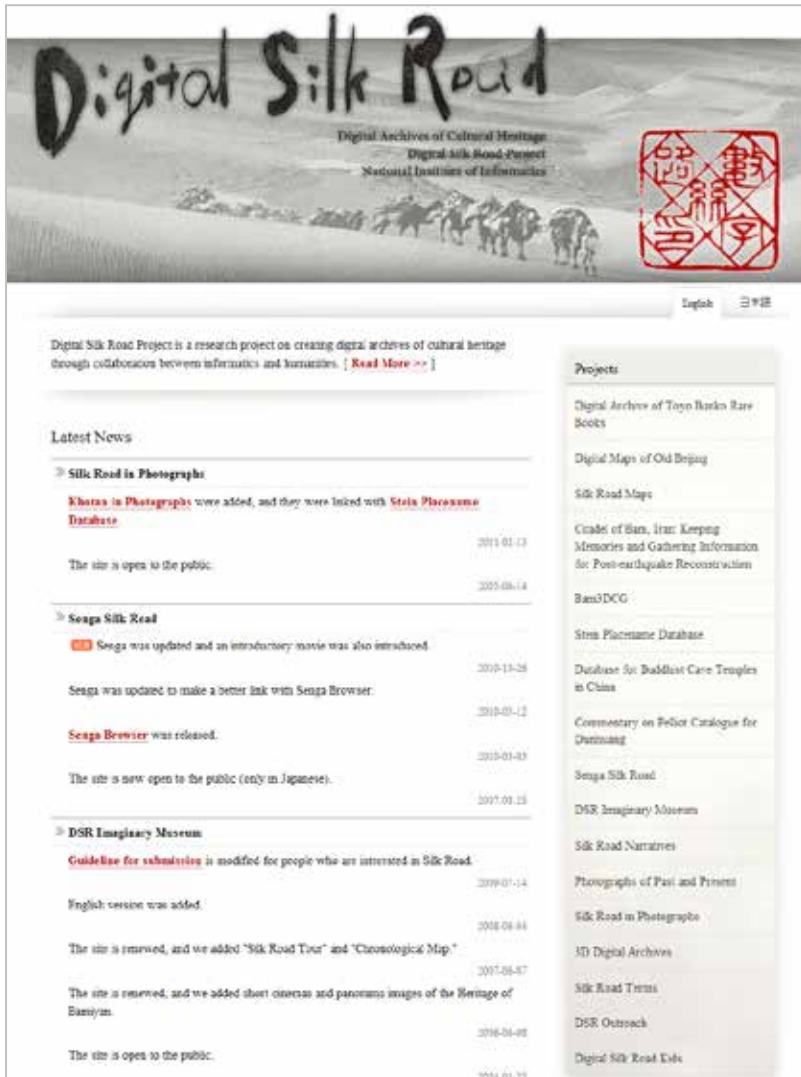
Impact of Historical Databases on Silk Road Studies

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

Digital Silk Road Project



- Started in 2001.
- 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.
- Manual edition of captions and TOCs.
- Access from anywhere in the world.



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.

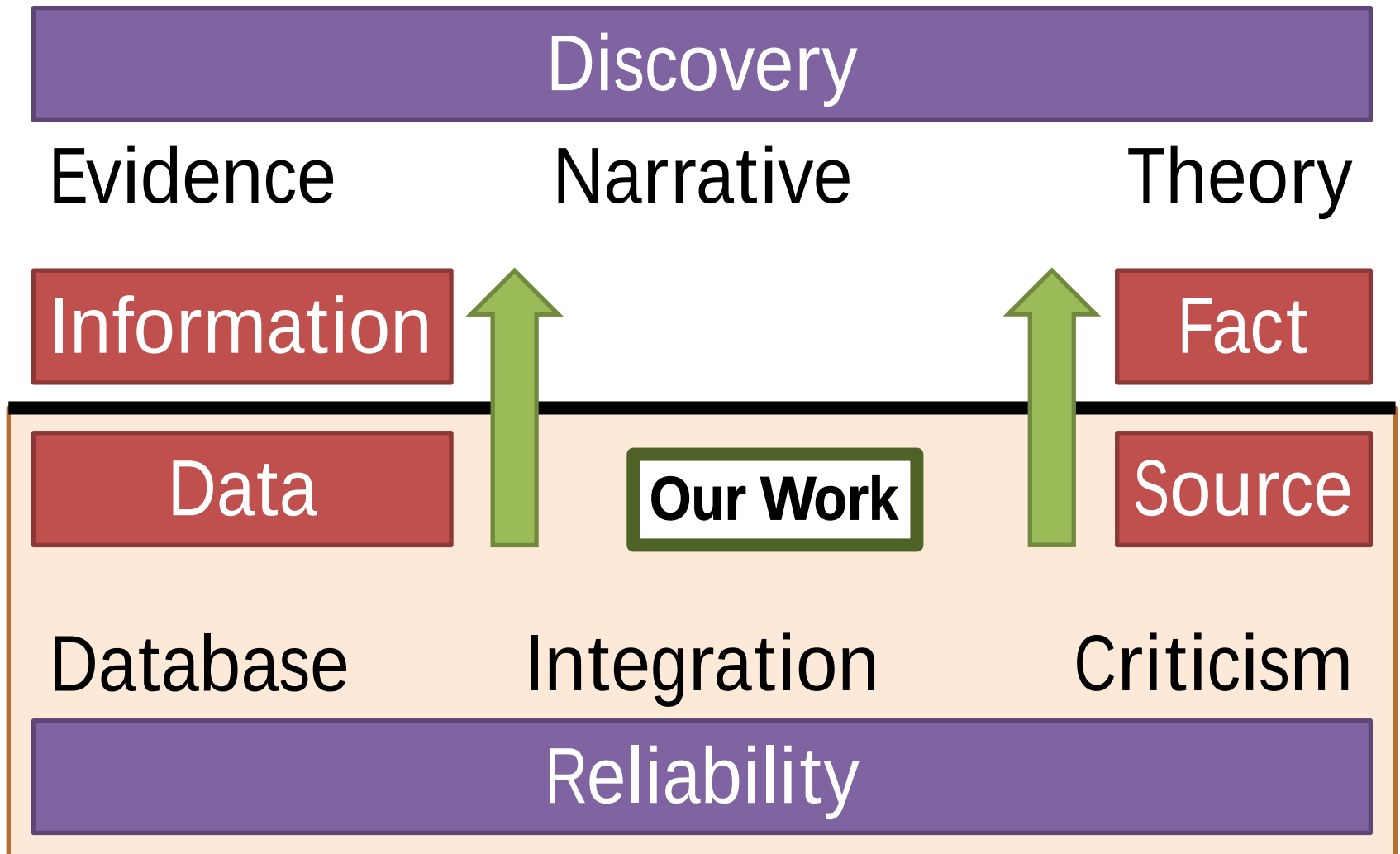
Senga: Participatory Museum



- 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



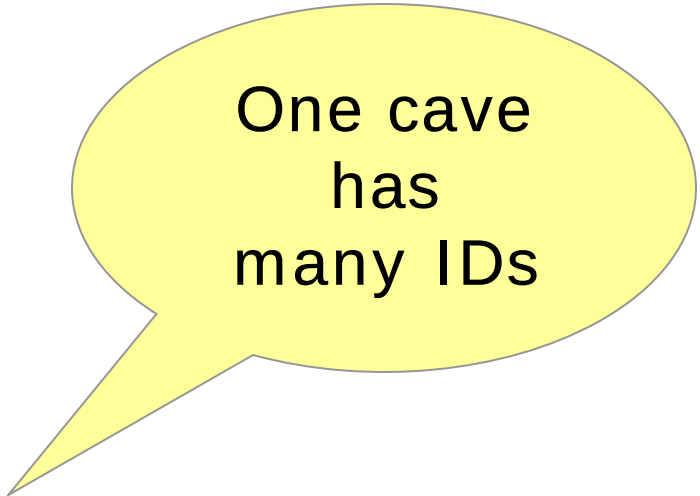
Database of Buddhist Cave Temples in China



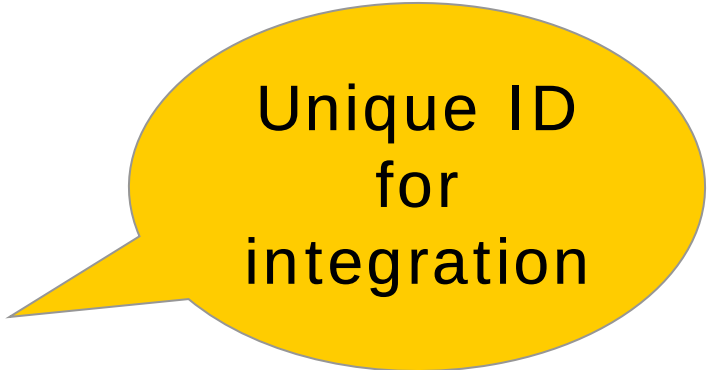
- **Problem 1:** Existing ID systems are not integrated.
- **Problem 2:** Each cave info is not linked with other references.
- **Solution:** Digital survey for the database of caves.

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

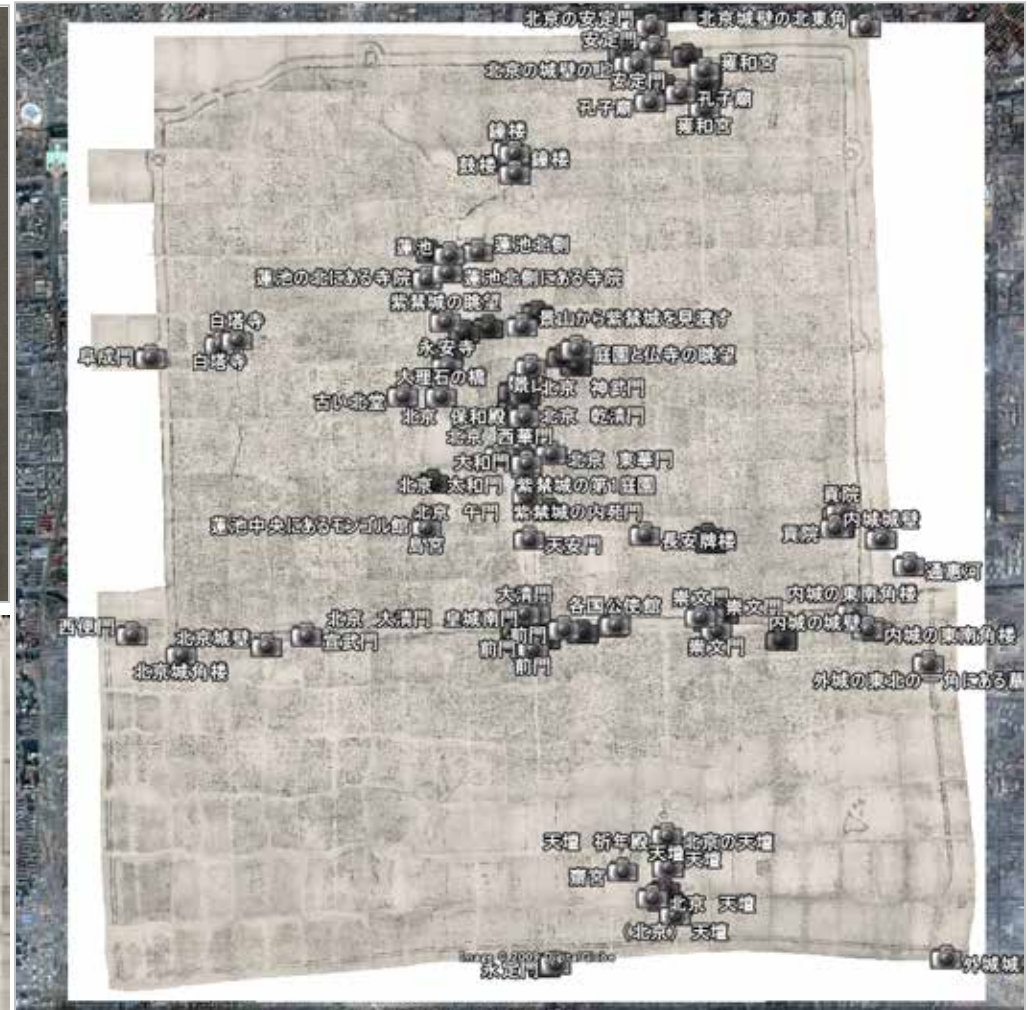
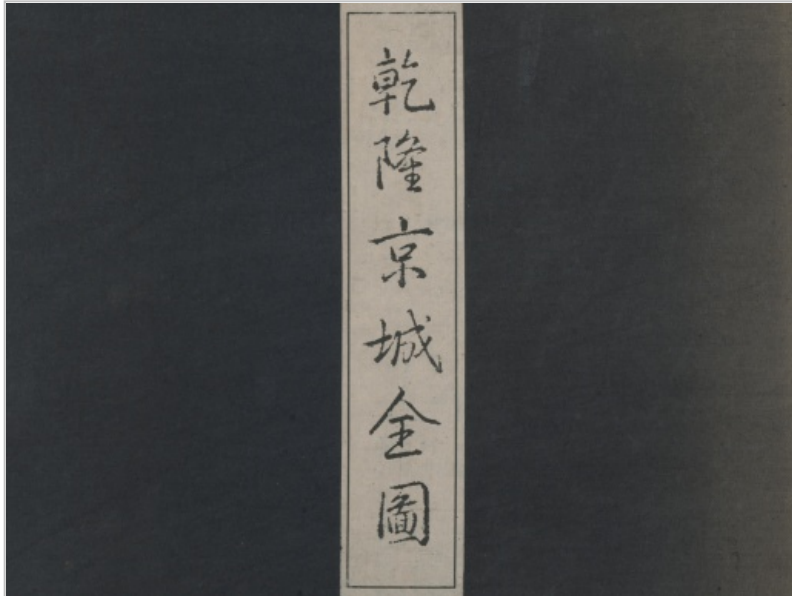
Integration of IDs

Current Number	Pelliot Number	Stein Number	Zhang	Shi
320	139	CH. IV	125	281
321	139a		126	323
322	139b		127	324
323	140		128	325
324			128 +	325-31
325			128 +	325-32
326	141		129	326
327	142		130	327
328	143	CH. IX	131	328

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



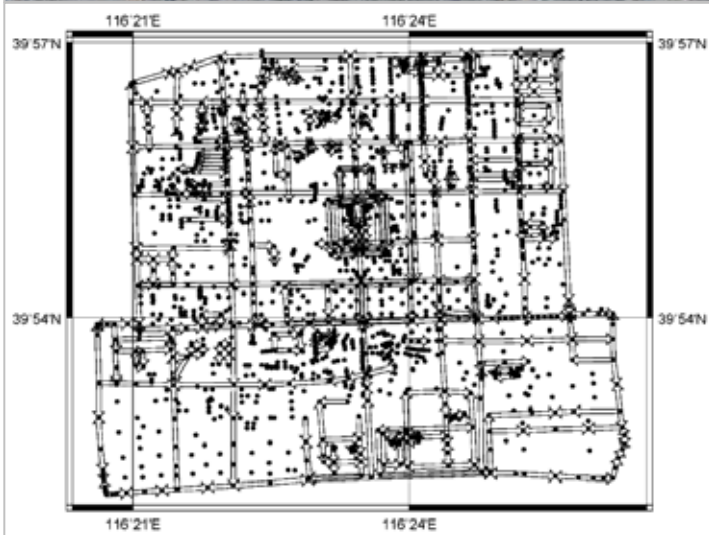
Huge size = W 13 m x H 14 m

Many sheets = 203 sheets in total

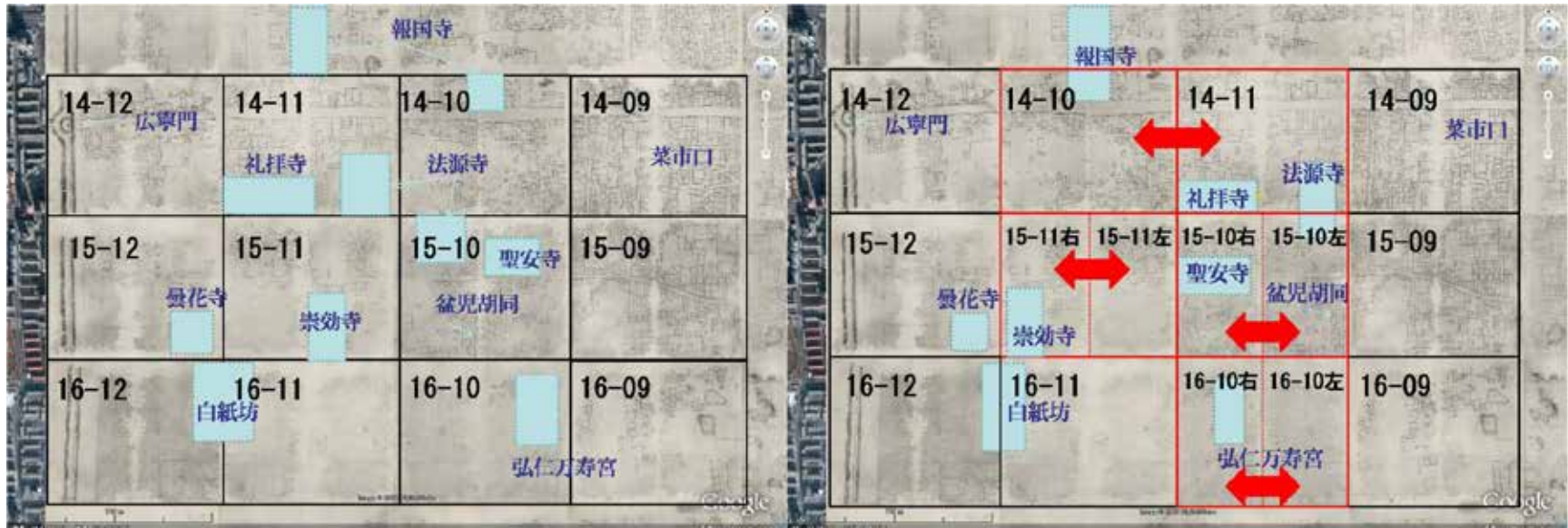
Massive pixels = 29 billion pixels

- Control points + lines:**

We proposed a new geometric correction.



Discovery and Digital Survey

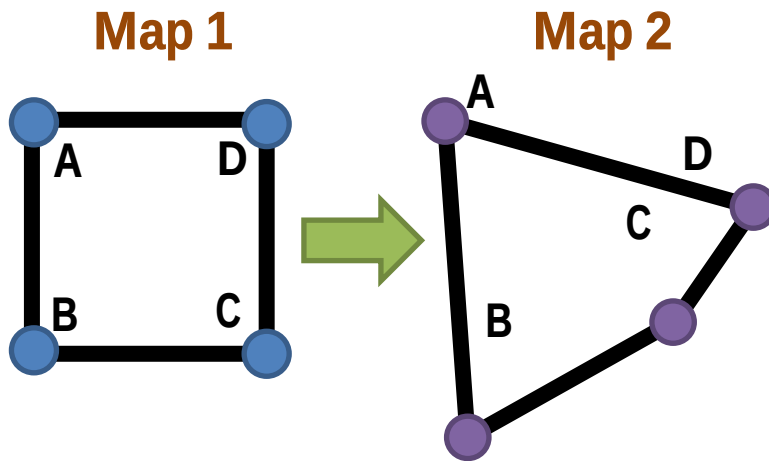


2013/2/28

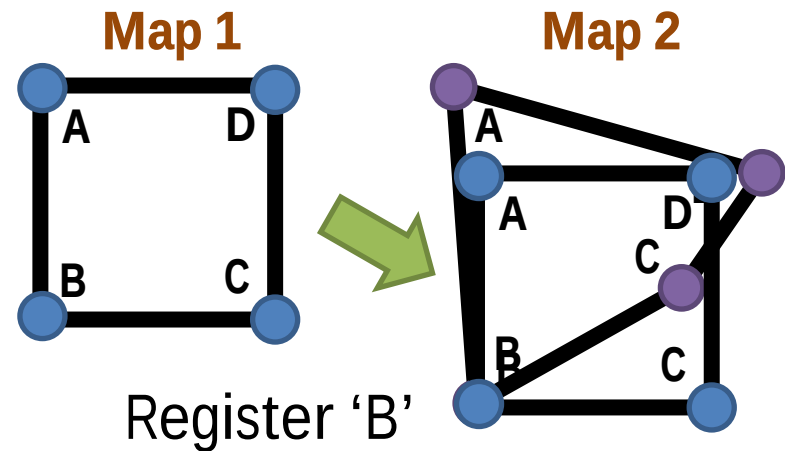
- **Discovery:** 5 sheets have misarrangements due to improper reconstruction in the past.
- **Digital Survey:** Place-names were checked to make a comprehensive gazetteer.

Two Methods of Map Registration

Geometric Correction



Single-Point Registration



- All points are registered.
- Shapes are distorted.

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

Mapping

Mapping
Interactive georeferencing by pinning old maps

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

日本語 | English | 简体中文

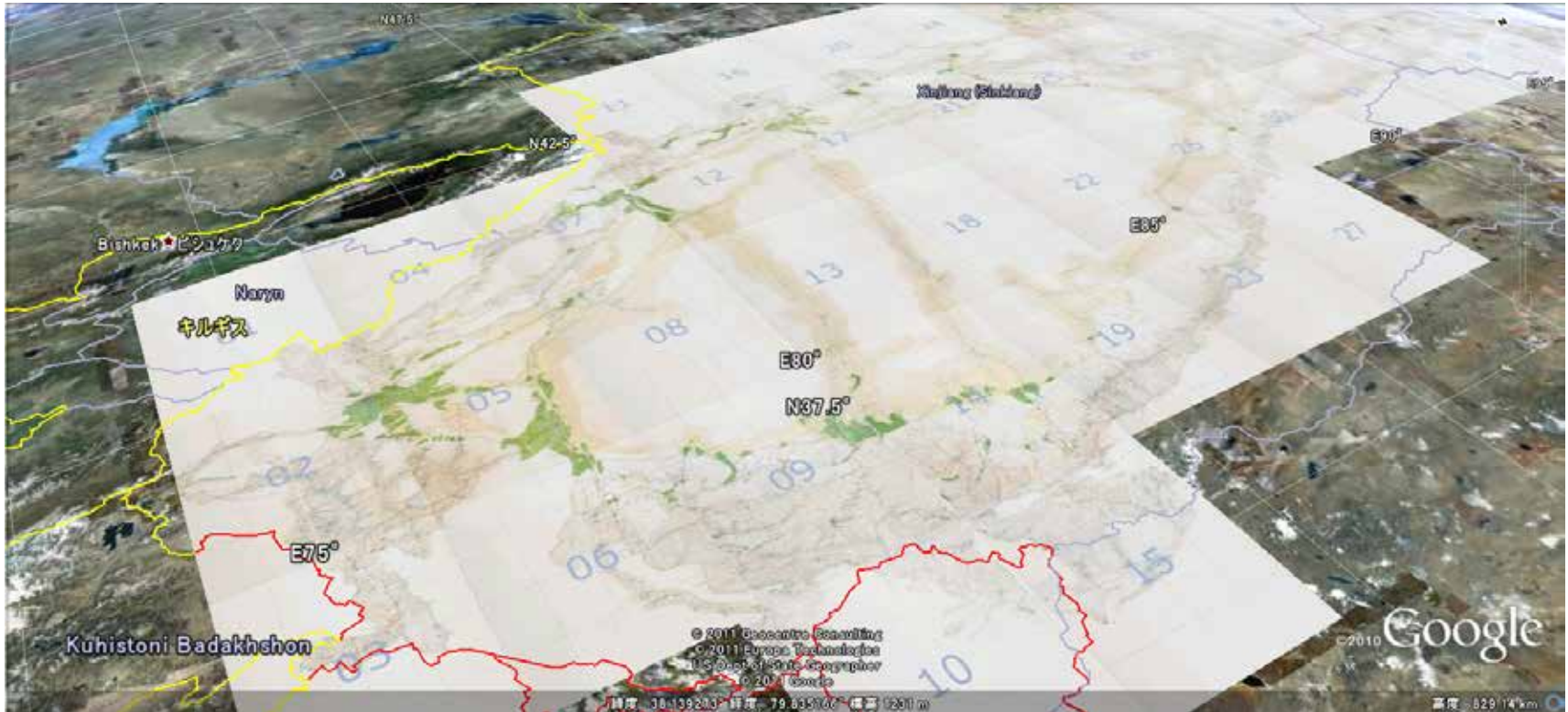
Map Satellite

Inmst Asia

kara-khoja
Registrant:yoko
Location:42.831,89.464
Error:-0.02,-0.064
5.69km
高昌故城

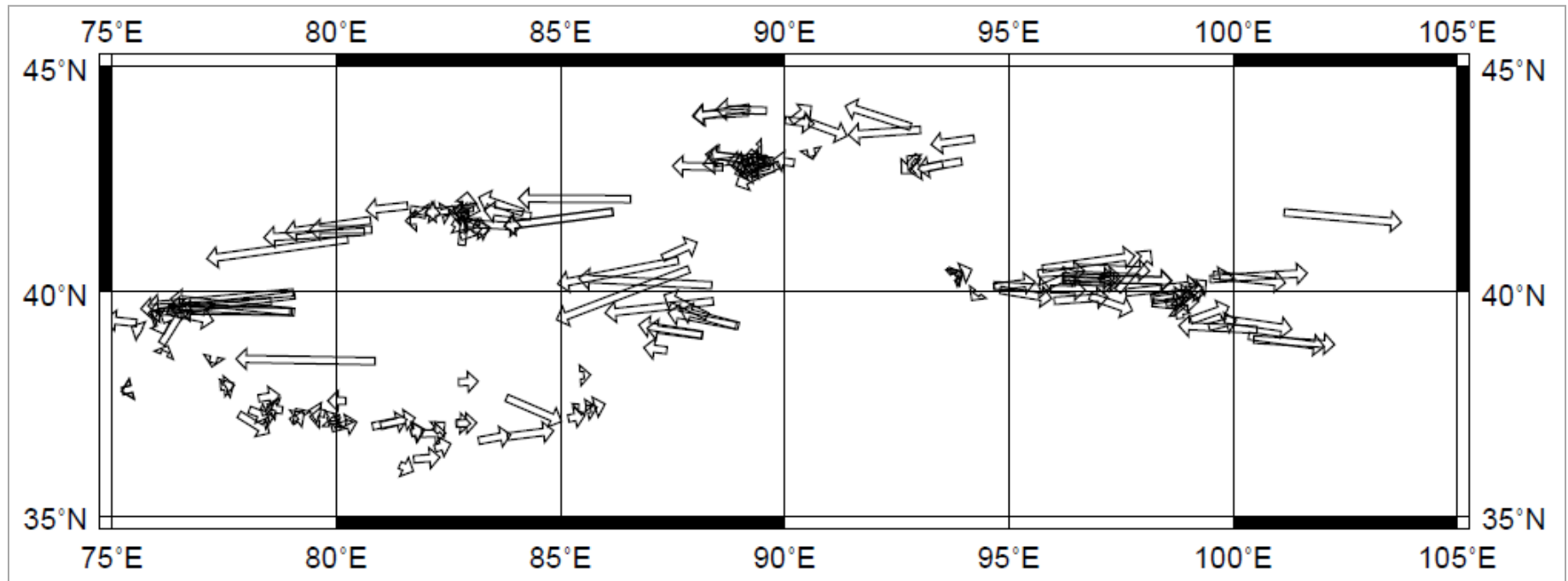
Map data ©2013 Old Map: National Institute of Informatics "Digital Silk Road"
Map data ©2013 AutoNavi, Google Imagery ©2013 TerraMetrics - Terms of Use

Criticism of Stein Map



- 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.

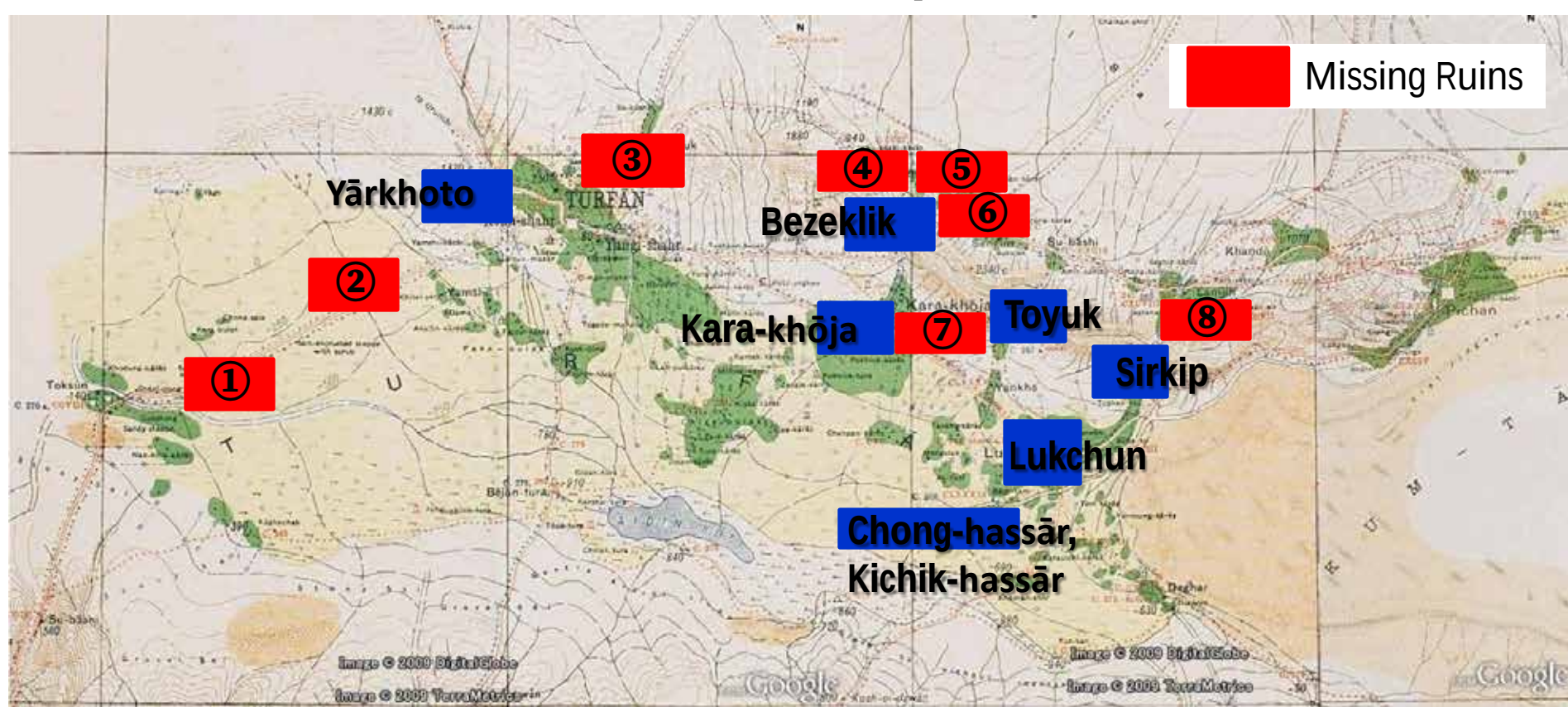
Summary of Errors

Fig. 1: Direction and Distance of Errors on Stein Maps

	Oasis Name	Ruins near the Oasis	Serindia		Innermost Asia	
			Direction	Distance(km)	Direction	Distance(km)
①	Kāshgar		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	Kucha		W	19	W	3.2
		Cave temples (Kizilgaha)	W	16.99	W	2.86
		Ming-ci (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	Khōtan		NE	5.1	N	1.2
		Yotkan	NE	5.29	NE	2.57
⑦	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 (廟兒溝)	SW	9.1	SW	8.6
⑪	Barkul				W	12.9
⑫	Mirān		NE	2.67	NW	12.34
		Mirān fort	NE	2.9	NW	11.79
⑬	An'xi		E	13.3	E	15.2
		Yulin Cave (榆林窟)	E	4.3	E	6.3
		So-yang-ch'eng (鎖陽城)	E	8.5	E	9.71
⑭	Suzhou		E	4.7	E	3.5
⑮	Ganzhou		E	32	E	15.6

- 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



Missing Ruins

① Oi-tam, ruined fort

② Bögan-tura

③ Buluyuk (Shipang, Sassik-bulak, Kazma)

④ Murtuk-ruins

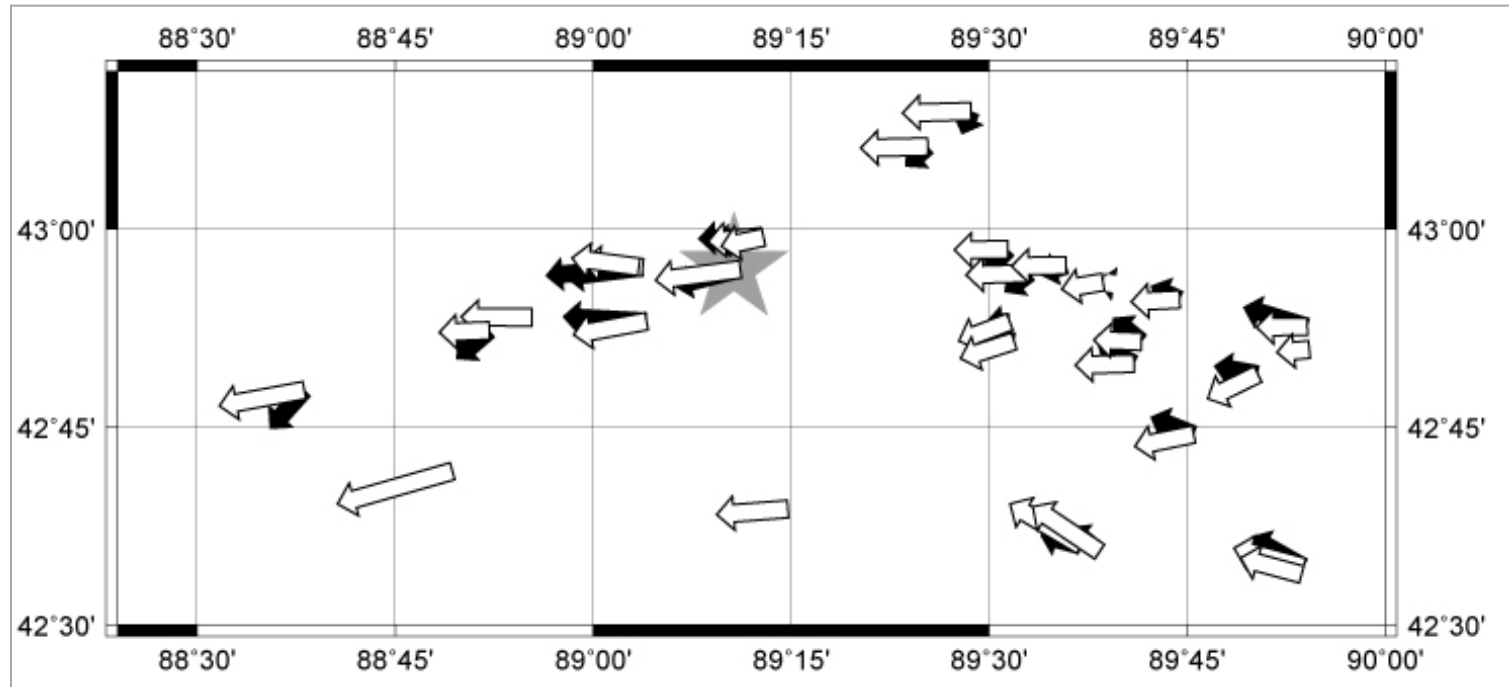
⑤ Yaghan-tura

⑥ Chikkan-köl

⑦ Bedaulat's town, Bēsh-kāwuk, Kosh-gumbaz

⑧ Yutōgh

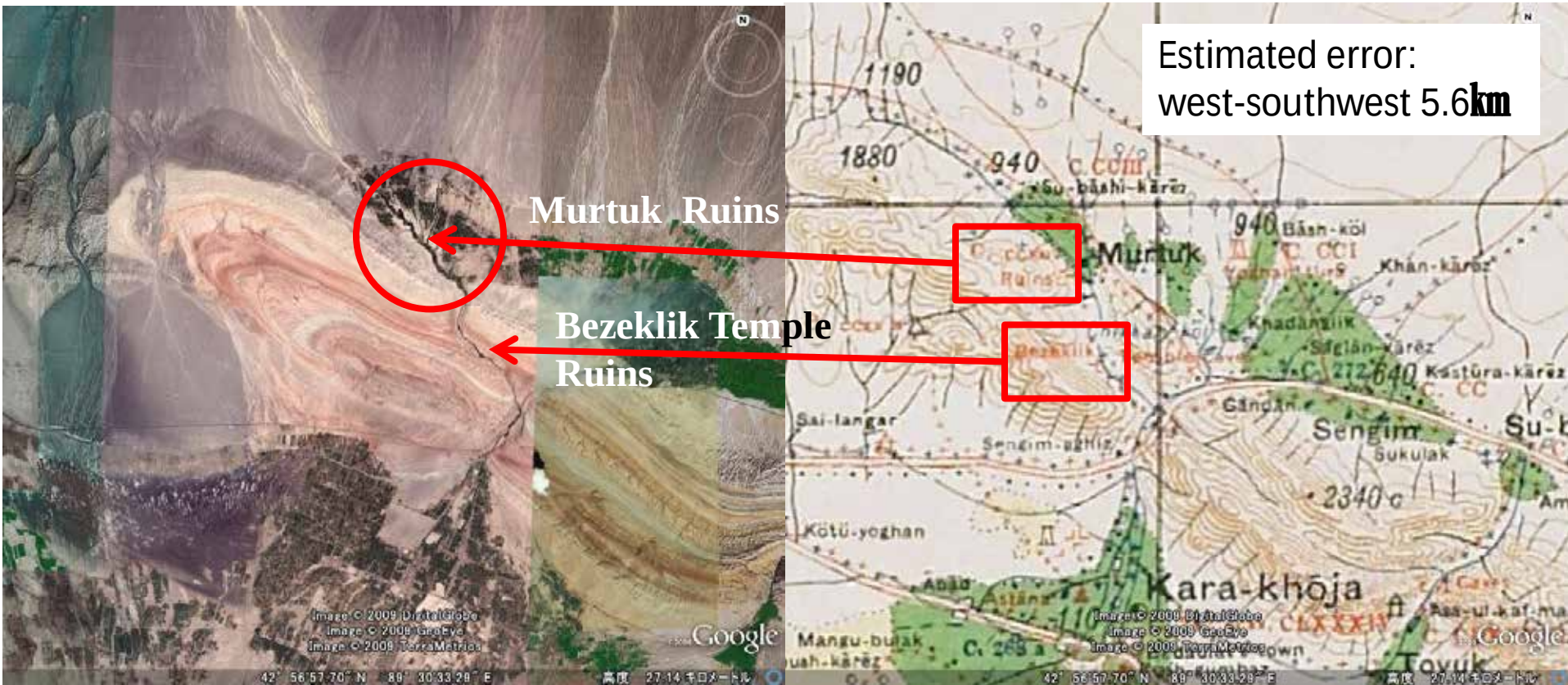
Error Distribution near Turfan



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

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

Finding “Murtuk Ruins”



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

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)
「吐魯番地区遺跡調查報告」『アジア史研究』29号, 2005

烏江不拉克烽火台

烏江不拉克故城

烏江不拉克古墓

伯西哈石窟
Murtug
Anlage 2

2013/2/28

DSR Symposium 2013

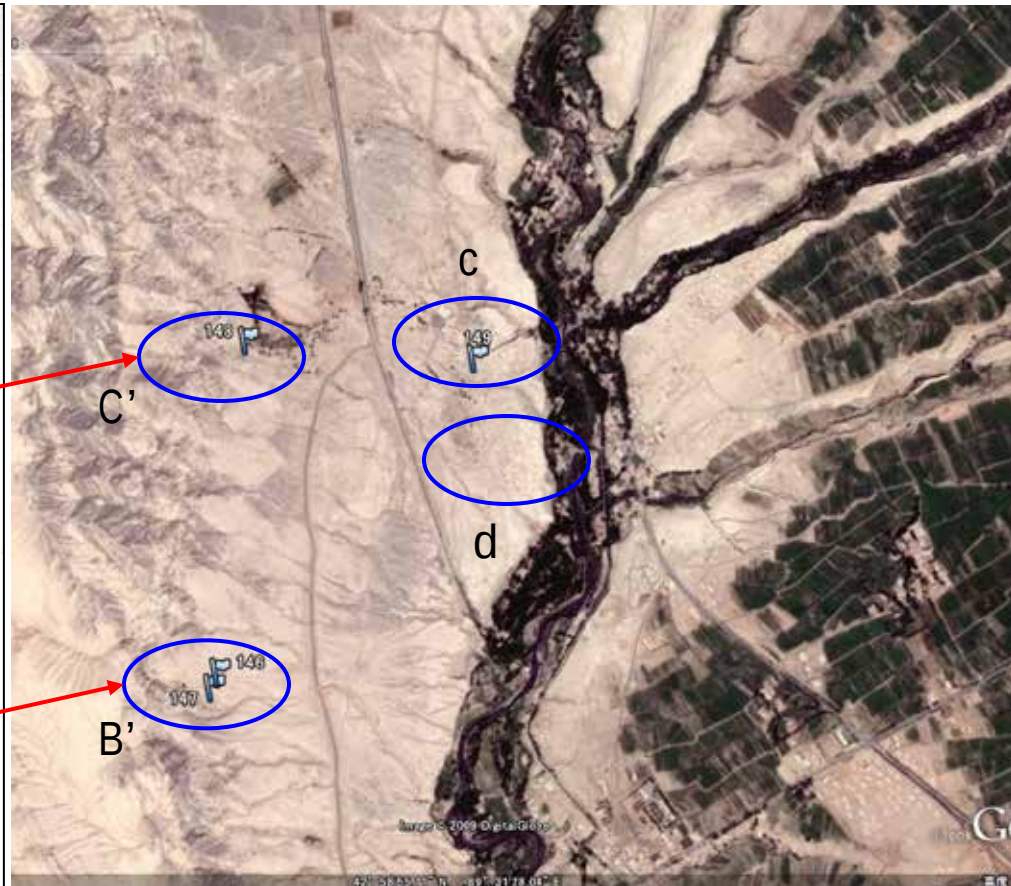
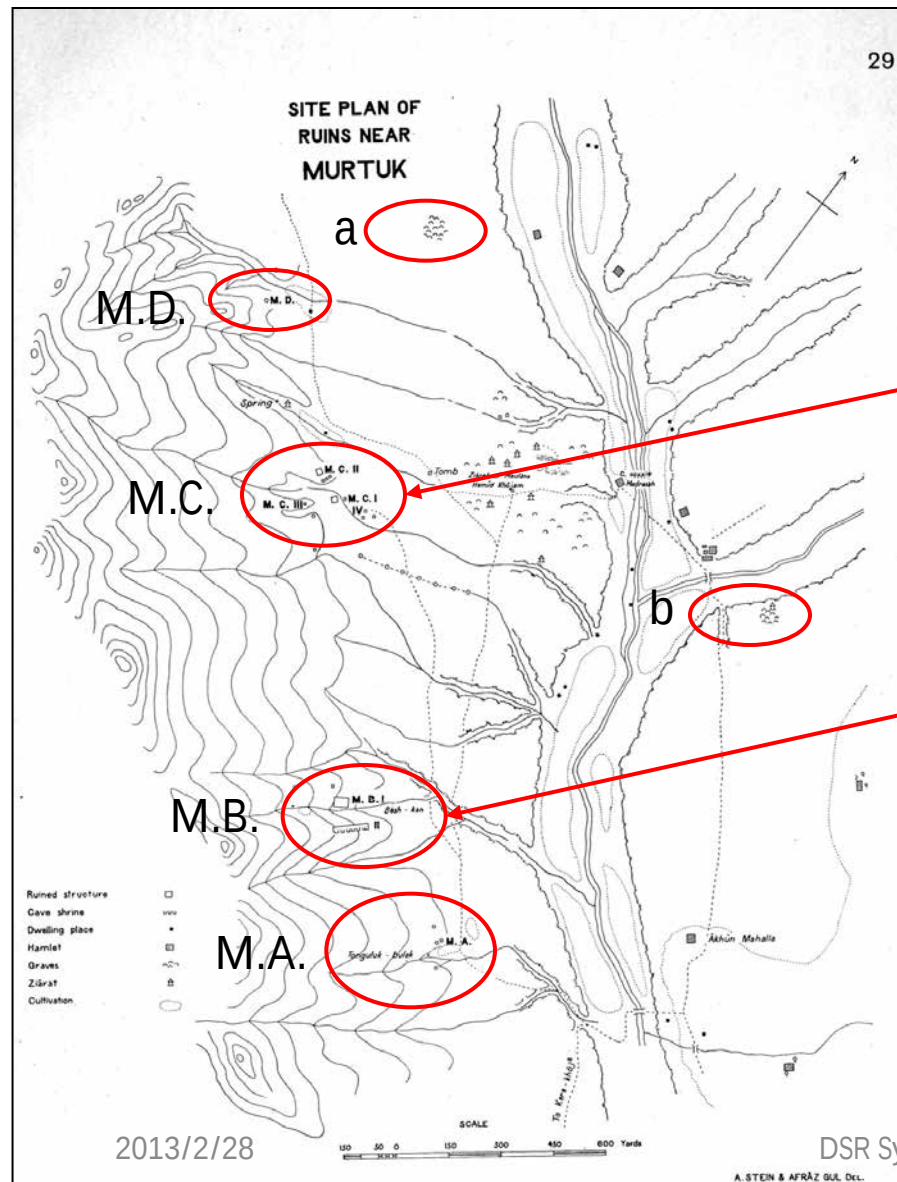
Google
22

影像取得日: 2005年6月27日

42° 58' 55.11" N 89° 31' 28.04" E

高度: 8654.21m

Murtuk Ruins (Stein, 1915)



Stein's map and satellite images for the same area. Each source reports different ruins due to different conceptualization.

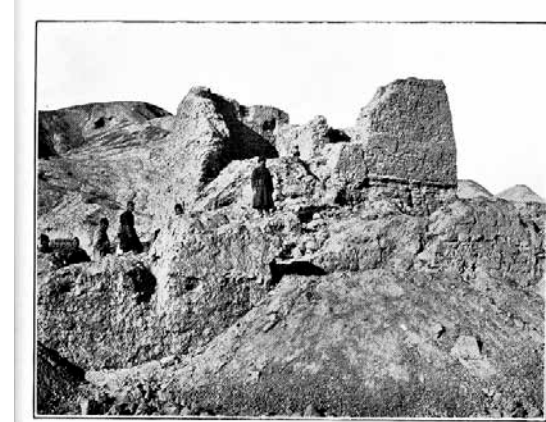
Criticism of Visual Sources



伯西哈石窟(烏江不拉克仏塔)



烏江不拉克烽火台



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

Murtuk Ruins (M. B. I)



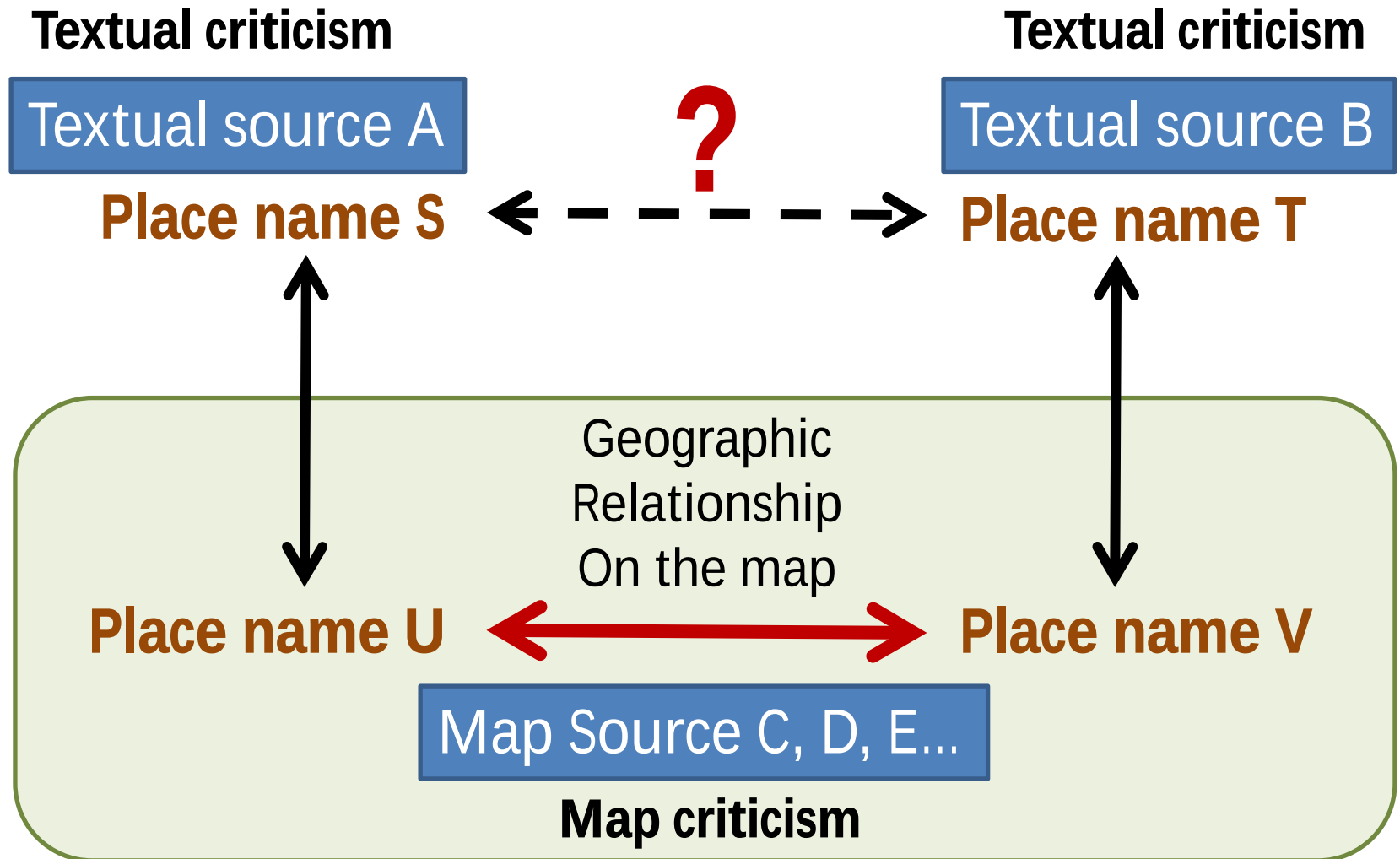
303. RUINED SHRINES, M.C., AT MURTUK, TURFAN.

Murtuk Ruins (Ruined Shrine M. C. I)

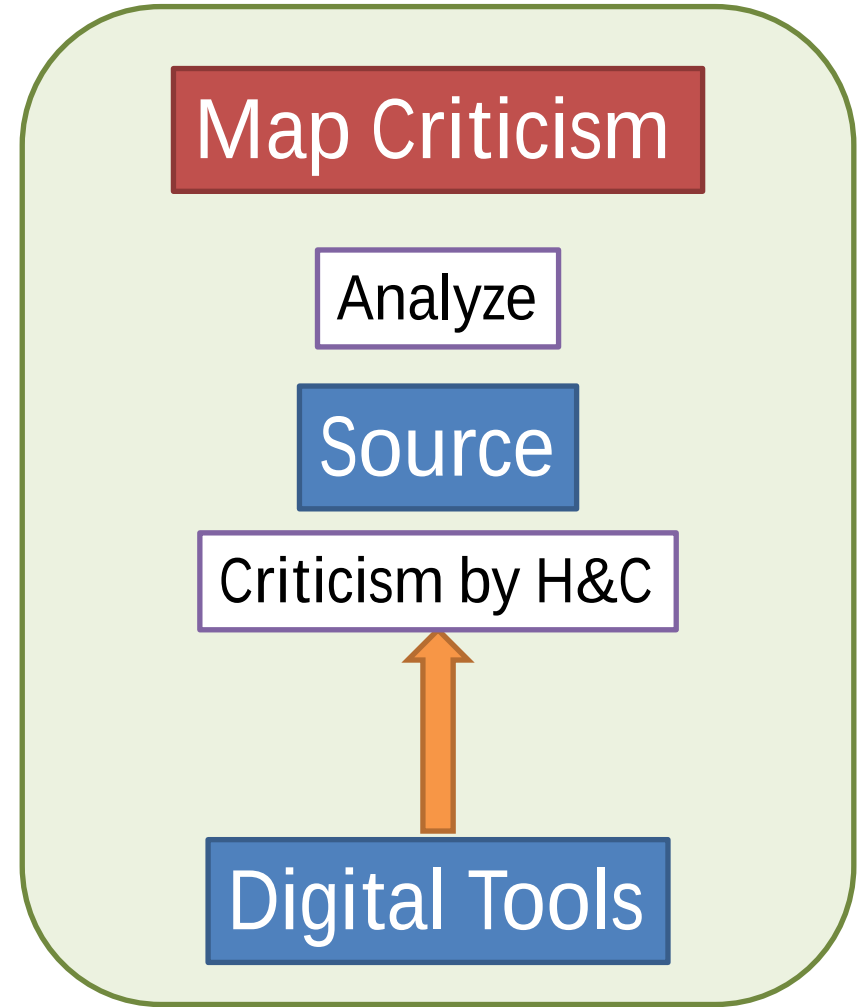
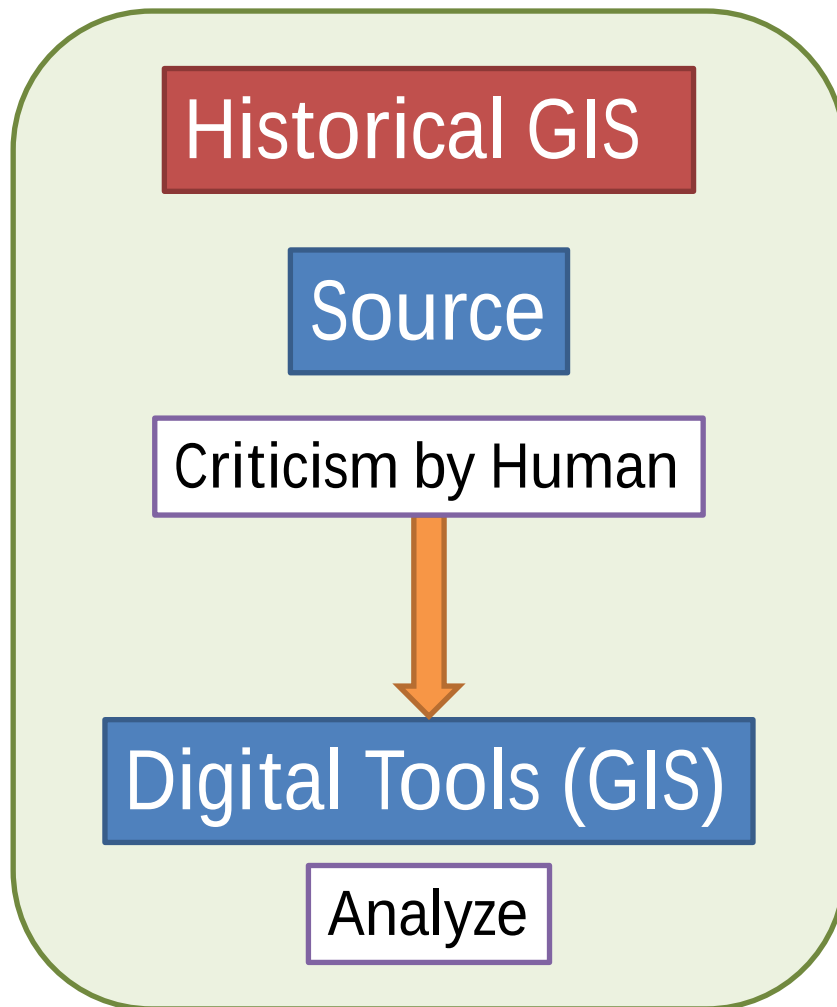
Our Contribution

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**.

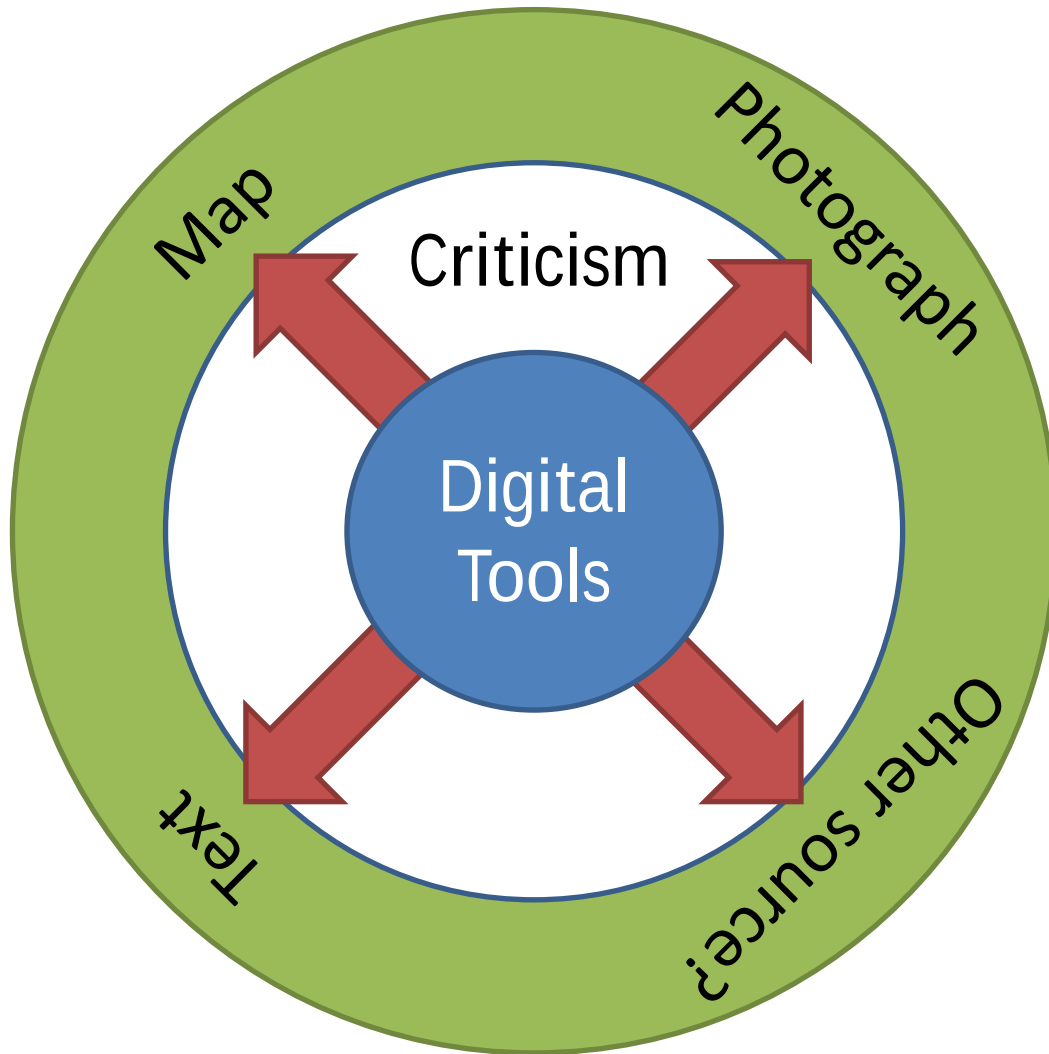
Schematic Diagram of Map Criticism



Map Criticism and Historical GIS

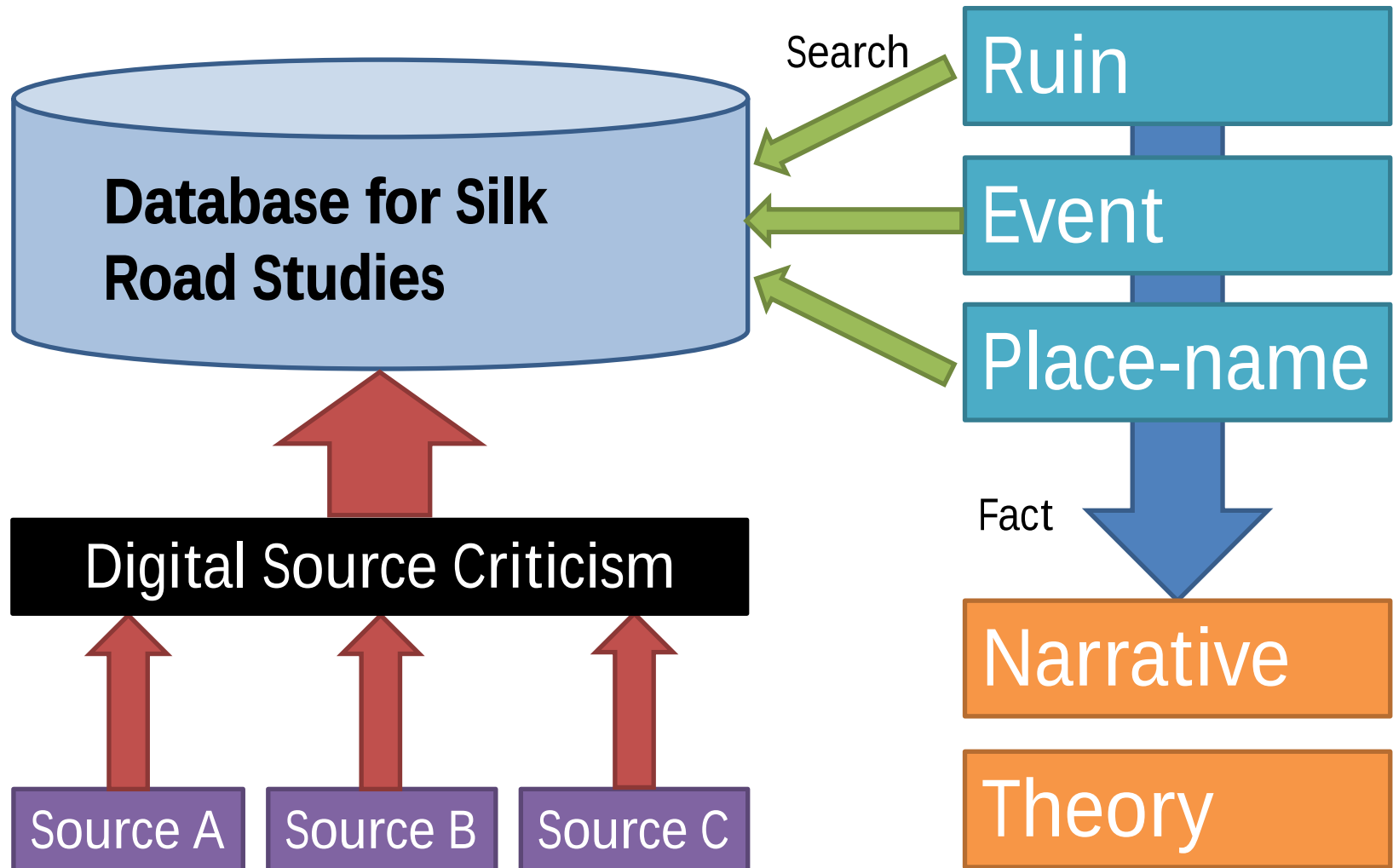


Digital Source Criticism



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

Database for Silk Road Studies



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