DIGITIZING BOROBUDUR
A Perspective on Sociotechnological Co-Production

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A Collaboration project of the Indonesian Institute of Sciences, Ritsumeikan University, and Borobudur Conservation Office
Borobudur as a Global Sociotechnical Imaginary

World Heritage Site (1991)

Memory of the World (2017)

Archive of Borobudur reconstruction and restoration since the Dutch Colonial time
Sociotechnical Imaginary:

…. collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology (Jasanoff, 2015: 4)

Co-Production:

… is shorthand for the proposition that the ways in which we know and represent the world (both nature/technology and society) are inseparable from the ways in which we choose to live in it (Jasanoff, 2015: 3)
HERITAGE TECHNOLOGY

How we represent heritage materials through technology emerges from how we stabilize value and assess our experience of the materials.

The desired future of the nation (sociotechnical imaginary) is envisioned and attainable through advances in heritage technology.
Sociotechnical Imaginaries and Co-Production: STS Perspective (adapted from Jasanoff)

**Technological Material domain**
- Hardware
  - Infrastructures
  - Machines

**Social Practical domain**
- Agency
  - Actors
  - Institutions

**Sociotechnical Imaginaries**

**Software**
- Algorithm
- Coding
- Design

**Norm**
- Legal
- Religious
- Political
- Cultural
- Gender

**Social Practical domain.**

**Technological Material domain.**
Actor-Network Assemblage Co-Production Sites

- Photogrammetric Fields
- Borobudur Office
- Economic Centers
- Art Studios
- Museums
- Ritsumeikan Lab
- Legal Papers
- Academic Journals
- Performances
Practical Sites of Co-Production (Borobudur Project and Other Projects)

PRACTICES
Sociotechnological Assemblages

- CLASSIFICATION
- DISCOURSE

National Heritage Database

3D Modeling and Simulation

Borobudur Database

REPRESENTATION

CLASSIFICATION
VISUALIZATION
Technological Materials and Co-Production Process

3D Model

Global Temple
- Model of entire temple
- Time-lapse of construction / restoration
- Taken with aerial scanning, photogrammetry
- Restoration history
- Cultural heritage policies

Partial Temple (Exposed)
- Models of corridors, walls, floors, gates
- Taken with photogrammetry
- Architectural function
- Religious function
- Tourism function

Partial Temple (Buried)
- Model of buried parts
- Taken with photo scanning
- Architectural function
- Conservation
- Myth
- Cultural heritage policy

Landscape
- Models of temple’s surrounding: vegetation, topography
- Taken with aerial scanning
- Legends of place-name

Relief - Narrative
- Models of relief story or event
- Taken with photogrammetry
- Archaeological research
- Educational function
- Religious function

Relief - Item
- Models of specific item of material culture or behavior
- Taken with photogrammetry
- Archaeological research
- Educational function
- Economic development
Assemblage and Co-Production of Temple Visualization (Global and Partial, Analog to Digital)

Dutch Colonial Government
- Restore the damaged building
- Conservation purpose
- Sociotechnical imaginary of antiquariat – specific knowledge of the past
- Archaeology means conservation

Indonesian Government (Sukarno Administration – Lembaga Purbakala)
- Conservation: repairing and reconstruction
- Sociotechnical imaginary of Sukarno (?)
- Archaeology means conservation

Indonesian Government
- Collaboration with Institut Géographique National (IGN)
- Mapping and cadastral measurement
- Conservation: structural reinforcement
- Sociotechnical imaginary of heritage value
- Archaeology means scientific recording and conservation

Indonesian Government (Directorate General of Culture)
- 2005 Partial recording with TLS (Terrestrial Laser Scanning)
- 2009 First digital photogrammetry
- Sociotechnical imaginary of scientific recording
- Archaeology means cultural heritage management

Van Erp
- 1907

Office of Antiquity
- 1960

UNESCO
- 1973

Borobudur Office
- 2005
1973 Restoration by Indonesian Government and UNESCO
Coordination meeting with IGN
Agreed upon continuation of photogrammetry

IGN France
Cameras: SMK 120, SMK 40, Hasselblad North and south side

UNESCO
Recording main walls
Conservation purpose

UNESCO
Photogrammetry recording of major walls completed

Timeline of Analog Photogrammetry

1972
Coordination meeting with IGN
Agreed upon continuation of photogrammetry

1973
IGN and UNESCO
First IGN phase completed
Arrival equipments
Arrival Japanese experts

1974
UNESCO
Recording main walls
Conservation purpose

1975
UNESCO
Photogrammetry recording of major walls completed

1980
1973 Borobudur Analog Photogrammetry
Application of Analog Photogrammetry (1973)

Gambar 1. Pengukuran denah candi sistem diagonal (Mulyono Supardi, 1971)

Diagonal measurement

Measurement of tilted wall
Arrival of Terrestrial Laser Scanning (Supplied by UNESCO)

2005

Staff training, TLS recording of Borobudur

2006

Recording is carried out by Borobudur staff who have received training)

From 2006

Application of digital recording to other heritage sites (e.g. Vredeburg, Bukittinggi Clock, Prambanan Temple, etc.)

2009

Digital Photogrammetry of Borobudur
On-going 3D Visualization by Ritsumeikan Scientists and Borobudur Office Staff (led by Prof. TANAKA Satoshi)

Since 2018

- Composite transparent visualization of Karmawibhangga buried part
- Transparent visualization of inner mound
On-going 3D Visualization by Ritsumeikan Scientists and Borobudur Office Staff (led by Prof. TANAKA Satoshi) Since 2018
Few questions on 3D visualization......

- How does the 3D visualization interpellate (Althusser) us?
- How does the transparent visualization open up emerging affordances with regard to interpretation of the building structurally and symbolically?
- Does the 3D model and transparent visualization change the affective relation of people (visitors, archaeologists, painters, etc.) to the temple?
- Would this digital visualization create interpretive flexibility among archaeologists and heritage managers?
- Would the visualization help stabilize a particular type of interpretation?
DATABASES
Community Development and Co-Production Process
(How visualization relates to communities)

Heritage Tourism Narrative
- Experimental project of Gadjah Mada University
- Identified 8 narratives related to the temple
- Digital visualization planned

Village Economic Center (Balkondes)
- Relation between business (CSR) and village government
- Have not yet involved digital models
- E-commerce: marketing platform

Public Education - Museum
- Borobudur Park Museum (Ministry of Tourism)
- Digital representation of Samudraraksa ship

Art Gallery / Art Group
- Temple as visual object
- Temple as background
- Temple as spiritual source
- No digital visualization

Relief - Itemized
Models of specific item of material culture or behavior
- Taken with photogrammetry
- Archaeological research
- Educational function
- Economic development

Ruwat Rawat Ritual
- Private initiative of a cultural figure (Sucoro)
- Involving groups from local and outside Borobudur
- Maintain YouTube channel
- Producing digital visual recording

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Each village has one Village Economic Center

A center collaborates with and receives financial assistance from a state-owned company (banks, telecommunication, power plant, etc.) in the form of CSR program
Balkondes Ngadiharjo Village

Balkondes Borobudur Village
Balkondes in Resort Style
Heritage Tourism Narratives of Borobudur
(Gadjah Mada University)

1. Maritime Culture
   Narrative of maritime technology and story

2. Sacred Myth: Folklore and Ritual
   Beliefs related to the temple and its surrounding

3. Technological and Scientific Knowledge
   Architectural technique, astronomy, and natural science

4. History of Borobudur Reconstruction
   Narrative of reconstruction processes

5. Flora and Fauna
   Narrative of local ecological diversity

6. Geology
   Narrative of local geological change

7. Spiritual Being
   Story of symbolic creatures

8. Pilgrimage
   Narrative of past and present spiritual journeys
Manual reconstruction of architectures depicted on Borobudur reliefs

(Reconstructed by Yogyakarta Archaeological Office)
“Laboratories” of Borobudur Database
Assemblage and Co-Production of Databases (Borobudur and National)

**Borobudurpedia**

Borobudur Office Program
- Initiated by Borobudur Director
- Launched in 2017
- Online wiki platform
- Public Database: open encyclopedia, publications, images
- Targeted to become public educational platform
- Sociotechnical imaginary: Scientific informational center for anything related to Borobudur

**Memory of the World**

Borobudur Office and Ministry of Culture Program
- Initiated collaboratively by Borobudur Director and Director General of Culture
- Database: Images of restoration process by the Dutch and Indonesian
- Sociotechnical imaginary: Knowledge of building and restoration of the temple as universal value
National registration; Archeological research/data

National identity; Nation building

Socio-technical imaginary

Data input

National Heritage Database

Institutional relation

Structure; Metadata; Query; Access

Platform

Expert body; Ministries of Education or Tourism; Local government
LEGAL GOVERNANCE

Standardization of Heritage Technology embedded in National Imaginary

Law No. 11/2010 on Cultural Heritage (National)

Law No. 5/2017 on Cultural Advancement (National)

Regional Laws
- Law of Cultural Heritage Protection
- Law of Regional Expert Board
- Law of Urban Planning
- Etc.
… some reflexive thoughts and questions

Borobudur as an actant

Emerging actor-networks:
- Scientific networks
- Organizational networks
- Spiritual networks
- Economic networks
- Legal networks

Digitizing project as assemblages of co-production, each constituting social–technological relation

From the fieldsites to laboratories, experimental projects (database, VR, etc), legal papers, etc. Each creates controversies and black-boxes (stabilizations)

Does making digital models mean disembodying oneself from the temple?

Understanding subjective relation to digital and non-digital models, what remains, what disappears