AHRC TOWARDS A NATIONAL COLLECTION

The Congruence Engine: Digital Tools for New Collections-Based Industrial Histories

PRESENTATION TO THE INSTITUTION OF ENGINEERING AND TECHNOLOGY

TIM BOON, ALEX BUTTERWORTH, JANE WINTERS

13 May 2023
The Congruence Engine: Digital Tools for New Collections-Based Industrial Histories

Principal Investigator: Dr Timothy Boon, Science Museum Group

• Funding and Team
• The core problem under investigation
• Previous attempts
• Our Research Approach
• Progress so Far
TOWARDS A NATIONAL COLLECTION FUNDING AND PURPOSE
Transforming Collections: Reimagining Art, Nation and Heritage

Principal Investigator: Professor Susan Pui San Lok, University of the Arts London

Project partners: Tate, Art Council Collection, Art Fund, Art UK, Birmingham Museums Trust, British Council Collection, Contemporary Art Society, Glasgow Museums, Iniva (Institute of International Visual Art), JISC Archives Hub, Manchester Art Gallery, Middlesbrough Institute of Modern Art, National Museums Liverpool, Van Abbe Museum (NL), and Wellcome Collection.

The Sloane Lab: Looking back to build future shared collections

Principal Investigator: Professor Julianne Nyhan, University College London and TU Darmstadt

Project partners: British Museum, Natural History Museum, British Library, Historic Environment Scotland, Royal Botanic Garden Edinburgh, National Museums of Scotland, Community Archives and Heritage Group, Down County Museum, National Galleries of Scotland, Oxford University Harbours, collecting the West project funded by the Australian Research Council & metaphors.

Our Heritage, Our Stories: Linking and searching community-generated digital content to develop the people's national collection

Principal Investigator: Professor Lorna Hughes, University of Glasgow

Project partners: The National Archives, Tate, British Museum, University of Manchester, Association for Learning Technology, Digital Preservation Coalition, Software Sustainability Institute, Archives, Dictionaries of the Scots Language, National Lottery Heritage Fund, National Library of Scotland, National Library of Wales, Public Record Office of Northern Ireland & Wikimedia UK.

Unpath'd Waters: Marine and Maritime Collections in the UK

Principal Investigator: Mr Barney Sloane, Historic Buildings & Monuments Commission for England (Historic England/English Heritage)

Towards a National Collection (TaNC)
KEY PROJECT DATA

- £2.9M three-year research project, the biggest ever for the Group. 1 of 5 Discovery Projects.
- Hits priorities of SMG and AHRC / UKRI ‘Towards a National Collection’ funding.
- Is exploring what it will be like when it is possible to work across the UK’s collections, rather than silo-by-silo.
- Is on territory of industrial history and collections, especially: textiles, energy and communications.
- 13 Co-investigators and 15 partners / participating organisations including 4 universities, National Museums, Local Museums, BFI, BBC History, Historic England.
CO-INVESTIGATING ORGANISATIONS

Science Museum Group
University College London
University of Leeds
Liverpool University
School of Advanced Study, University of London
Historic England
British Film Institute
National Museums Scotland
Bradford Industrial Museum
Discovery Museum, Newcastle
Manchester Digital Laboratory
Wikimedia UK
DATA PARTNERS

BBC History and Heritage
Birmingham Museums Trust
BT Archives
Grace’s Guide to Industrial History
History of Science Society: Isis Bibliography
The National Archives
National Museum Wales

National Museums of Northern Ireland
The National Trust
Saltaire World Heritage Education Association
Society for the History of Technology Bibliography
Tools of Knowledge Project
Victoria and Albert Museum
University of Leicester
THE PROBLEM
FORMS 100

Inventory No. 1914-112
Object: 24 specimens of pipard cottons mounted on two cards

(No. in old Divisional Register )

Position. A6 23d
Date of Receipt. 16 2 14
Regd. paper No. 14/320
Acquired from (Presented) W. S. Murphy, Esq.
Kara
Lowe Landen,
Bridgwater, Kent

Inventory No. 1914-469
Object: One red Spitfields handloom for silk weaving fitted with Jacquard machine, also lamp for use with same

(No. in old Divisional Register )

Position. Kant 20100
Acquired from (Presented) Elvers, Warner & Sons.
344, Newgate Street, E1.
**Cotton Staples**

**Made:** 1800-1814 in unknown place

Twenty four specimens of prepared staples of cottons, mounted on card within two wooden and glass cases.

### DETAILS

- **Subject:** Textiles Machinery
- **Object Number:** 1814-112
- **Materials:** cardboard, complete, cotton (fibre), glass and wood (unidentified)
- **Measurements:** Individual: 270 mm x 230 mm x 20 mm
- **Type:** sample
- **Accession:** Gift of Mr. W.S. Murphy

### CITE THIS PAGE

Science Museum Group, Cotton Staples.

### Rights

We encourage the use and reuse of our collection data.

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‘Although third-party search engines such as Google usually account for the overwhelming proportion of visits to online collections ... search engines generally poorly ‘understand’ [heritage] collections online. The result is that they do not provide discovery beyond surfacing individual objects, and they usually struggle with search ranking objects from different institutions. Ranking is usually a measure of the search ranking and optimisation of the institution’s website rather than the relevance of individual objects to the user’s search terms.’

PREVIOUS APPROACHES
# Ongoing Investigations

- Investigation proposal process
- Investigation write-ups

The database below holds information on the investigations being considered or actively worked through as part of the project.

<table>
<thead>
<tr>
<th>CE Investigations</th>
<th>Status</th>
<th>Investigation inc.</th>
<th>Theme</th>
<th>Researchers</th>
<th>Collection / data</th>
<th>Techniques</th>
<th>Risk &amp; media</th>
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<td>Using Machine learning to see</td>
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ACTION RESEARCH CYCLES

Illustration of a basic action research cycle (Ejbye-Ernst, D. and Jørring, N.T., 2017: 53).
• prototypes a framework for the creation of a national datascape of cultural heritage as an act of cathedral building: generational in its trajectory, with the capacity to incorporate new methods of knowledge representation, data integration and mediated exploration

We start 2023 with a double-sized special issue showcasing the Congruence Engine project. Part of the Arts and Humanities Research Council (AHRC) Towards a National Collection suite of discovery projects, Congruence Engine explores how linking the nation’s collections using digital tools can enable new kinds of research and practice. Like the project itself the issue is experimental, exploring new forms of writing, collaborative authorship and article formats. Guest-edited by Tim Boon, the project lead, with Simon Popple and Nina Webb-Bourne, the 18 papers include scene-setting pieces from academic leads in the history of textiles (Will Ashworth), communications (Jon Agar), energy (Graeme Gooday) and digital humanities (Jane Winters), collaborators come together to discuss key words for the project (Arran Rees, Anna-Maria Sichini, Stefania Zardini Lecedelli) and perspectives on community and forms of knowledge (Simon Boon, Tim Boon, Simon Popple, Nina Webb-Bourne).
The Congruence Engine

7. processes and manages knowledge whose operation crosses multiple spatial and temporal scales and levels of detail. Ease of movement between these states is a key principle for the exploratory but contextualised representation of that knowledge.
July 30th 1776
Tom Bottom has been off at home this week 2 days
August 1st 2 days
he went home August 5th
he was at home all July time
17 Days at 8 d per day
36
Sept 17th at home this week
24 at home at Manchester this week
from Sept 24th to October 11
32 weeks 82 days
23
Bottom Dr on the aforesaid 70
Dec 17th Nigh paid Dr for rent this year 880
Paid 1000 pounds in last 2 years
May 1876
Mr. Goodwin
Gent
Continued
invoiced the order he sends direct to the purchaser, as to his financial position we have very little information, but think he might be answered to the amount of 100 or three hundred pounds
34th February 1876
W. Metcalfe
Chemical Manuf.
Church Street
Is a respectable man and inducements and is considered trustworthy for a Credit of your Amount (over 200) He writes his Capital to his utmost Capacity in consequence he is sometimes put to inconvenience to Chester Bank by the Banker of the Union Bank to whom he has been in the Union Bank of July 1876
Analogue Sources – Ripe for Digitisation

Photos, Bradford Industrial Museum (Belle-Vue Studios, Christopher Platt)
The City as Organism (Thrum through Time)

From 'Dear Diary', Stephanie Posaved and Georgia Lupia

Unfolding Shanghai, Till Nagel
Capturing the Past (in Machine-readable form)

Pattern Book, Science and Industrial Museum, Bradford (K. Belshaw)
The shell is mounted with a wharl, and receives motion off the driving-drum on the same principle as the spindle in the "fly" frame. Sketch 24 will give an idea of what this arrangement for spinning is like. The spindle, s, and cap, c, are the stationary parts. The latter is a hollow cup shaped like the bobbin. Its lower rim is perfectly smooth and polished, to occasion as little friction as possible on the thread as it rapidly whirls against it. Around the wharl, w, the driving cord or strap travels- this wharl gives motion to the tube and the latter to the bobbin.

*Woollen and Worsted, Beaumont (1897)*
To Add or Reveal Semantic Structure?
Investigation: Oral Histories

Topic modelling Oral Histories of Mining (Stef di Sabbata)
Investigation: Industrial Bradford's Global Reach

Hattersley/Parsons Order Books: mapping global flows
Investigation: The View from Above

Lost Mills and spatial linkage to mid-C20th aerial photographs
## Investigation: Connecting Collections Metadata

### Table: Electrical Warnings and Switches

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<th>Description</th>
<th>Relevancy</th>
<th>Sub-theme</th>
<th>Master-theme</th>
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Investigation: A Multimodal Discovery of Affinities
Investigation: The Surprising Uses of ChatGPT

query

Which machines require yarn as input?

output

The machines that require yarn as input are the yarn twist testing machine, the yarn balance, the knitting machine, and the hank winding machine.
Cross-fertilisation of Methods
Engineering a Process of National Collection

**The Congruence Engine**

4. constitutes a mechanism for negotiation between human and computationally legible information, which must recognise and mediate twin ideals: of precision and standardisation; and expressive nuance, idiosyncrasy and fluidity

5. embraces the tentative and provisional, the partial and incomplete, the imperfect and the contradictory, modelling these as spaces for imaginative engagement and participatory contribution

6. recognises that knowledge is in a state of continual construction, the provenance of the information used and the condition in which it is held - often uncertain, ambiguous, a balance of probabilities - is recorded and made accessible as an invitation to improvement
Investigation: Horizons of Immersive Magic

Reanimating past places with Neural Radiance Field imaging (NeRFs)
Augmented Attention
Towards the Design of a Social Machine

• The Congruence Engine as a Social Machine
• A pattern of actors and requirements, not a pipeline
• Digitally mediated interfaces: social and socio-technical
• A flexible modular system that can accommodate flux
A Proposition
Machines vs. People or Machines & People?

• The data held in cultural heritage institutions is messy because it reflects the human experience
• Processing this data is time-consuming, resource intensive and difficult to automate fully
• It is not a question of if human intervention and curation is needed, but at what point in the pipeline
• What are the most useful human contributions, and how does this vary across potential contributing groups? What part does co-creation have to play? Who can get involved?
The social machine

• ‘Social machines have the potential to empower, via a democratic spirit of cooperation and respect. They bring people together, using technology to enable cooperation and communication at scale.’

• They’re co-created by human participants and the technologies they interact with

• A key underlying principle is that ‘no-one knows everything, but everyone knows something’

• It’s not just about using technology but about technology evolving in response to the aspirations of humans, and human aspirations evolving in response to the technology
Social machine

A social machine is an environment comprising humans and technology interacting and producing outputs or action which would not be possible without both parties present. It can also be regarded as a machine, in which specific tasks are performed by human participants, whose interaction is mediated by an infrastructure (typically, but not necessarily, digital). The growth of social machines has been greatly enabled by technologies such as the Internet, the smartphone, social media and the World Wide Web, by connecting people in new ways.

Concept

The idea of social machines has been around for a long time, discussed as early as 1846 by Captain William Allen, and also by authors such as Norman Maier, Gilles Deleuze and Félix Guattari.

Social machines blur the lines between computational processes and input from humans. They often take the form of collaborative online projects which produce web content, such as Wikipedia, citizen science projects like Galaxy Zoo, and even social networking sites such as Twitter have also been defined as social machines.

However, a social machine does not necessarily produce outcomes which directly affect the individuals or machines involved and an alternative viewpoint states that Social Machines are “rather than being an intentionally engineered piece of software - the substrate of accumulated human cross-system information sharing activities”.

Nigel Shadbolt et al. say that the telos of the social machine is specific to its participants, whereas the telos of a platform is independent of its participants’ purposes; the platform is there to facilitate communication. A social machine may also spread across more than one platform, depending on how its participants interact, while a platform like Twitter could host many thousands of social machines.

An academic field investigating the idea has been active since Tim Berners-Lee’s book Weaving the web. Social machines are characterised as “social systems on the Web ... computational entities governed by both computational and social processes”. Tim Berners-Lee and James Hendler expressed some of the underlying scientific challenges with respect to AI research using semantic web technology as a point of departure.

Recent work focuses on the idea that certain social machines can be regarded as autonomous and goal-driven agents, and should be analysed and regulated as such. Nello Cristianini and Teresa Scantamburlo argued that the combination of a human society and an algorithmic regulation forms a social machine. Cristianini’s book “The shortcut” discusses extensively social machines as a model for many online platforms where participants automatically annotate content during usage, in this way contributing to the overall behaviour of the system.
WELCOME TO THE ZOONIVERSE

People-powered research

See All Projects

FEATURED PROJECTS

WildCam Gorongosa
WILDCAM GORONGOSA

DUNA

DENTAL DISEASE DETECTION

BURSTS FROM SPACE: MEEKAT
What social machines are good at

- Solving complex problems in real time
- Generating as well as operating with huge amounts of data – working at scale
- Displaying network effects – the more people involved in the social machine, the greater the benefits for individual participants
- Allowing everyone to make a contribution, no matter how small
- Allowing people to pursue their own agendas in support of overarching goals
- Empowering participants
The Congruence Engine as social machine

• The Congruence Engine manifesto: CE ‘coordinates and harmonises a range of digital technologies, and human curiosities and capabilities, to generate new constellations of collective knowledge’

• Creating and supporting diverse communities that have shared and/or overlapping goals and interests

• Working towards the collective endeavour of creating a national collection that is about data and technology, but also about people and how they interact with technology and each other

• Building something that can be diverse, representative and at least partially self-sustaining
The Congruence Engine as social machine

- The project investigations are deliberately diverse and in the early days of the project, at least, relatively undirected – what were people interested in exploring?

- Three guiding threads that supported the overall aims of the social machine:
  - What digital insights did they generate?
  - What social insights did they inspire?
  - What historical insights did they produce?

- Now that we’re nearing the third year of the project, the core motivations, interests and methods have become clearer
The power of digital storytelling

• Storytelling is an important part of the human experience, but search engines don’t tell stories
• Linking data and making connections enables new stories to be told about the collections within and beyond the Science Museum Group
• The digital reassembling of scattered collections can shift the focus away from large national collections towards smaller specialist institutions
• Digital storytelling can combine different media – text, photographs, sound and moving image, 3D scanned objects – to present industrial histories in the round
Heritage Connector Metadata Explorer

As part of the Heritage Connector project we've built a knowledge graph from the Science Museum Group and V&A collections using machine learning techniques. This is an experimental interface designed to let you explore the connections in this knowledge graph, in a way that feels familiar.

project website | blog | github

Try some interesting starting points we've found...

Jimi Hendrix | Osaka | Indian Rebellion of 1857 | Issey Miyake | Tibetan alphabet | Brookhaven National Laboratory | John F. Kennedy | Joy Division | 2012 Summer Olympics | Queen Victoria

...or enter a URL

This URL can be from the Science Museum Group's online collections, blog or academic journal, or from some select categories in the V&A's online collections. (Note that some newer pages won't work, as we processed our last batch of data in 2020).
Heritage Connector Metadata Explorer: John F. Kennedy

http://www.wikidata.org/entity/Q9696

Connections to this record:

From NER & NEL

V&A collection

Poster [VAMOBJECT:O1162082] -> HC:entityPERSON -> this

Princess Lee Radziwill [VAMPERSON:C4109] -> HC:entityPERSON -> this

Kennedy for President [VAMOBJECT:O107709] -> HC:entityPERSON -> this

Ervine Metzl [VAMPERSON:AUTH349685] -> HC:entityPERSON -> this

La violencia esta contra las olimpiadas! [VAMOBJECT:O102315] -> HC:entityPERSON -> this

John Herschel Glenn Jr. [VAMPERSON:N4874] -> HC:entityPERSON -> this

Bernard L. Barker [VAMPERSON:N4912] -> HC:entityPERSON -> this

La violencia esta contra las olimpiadas! [VAMOBJECT:O102318] -> HC:entityPERSON -> this

Jacqueline Kennedy Onassis [VAMPERSON:N4515] -> HC:entityPERSON -> this

Connections from this record:

Existing record metadata

Literal (raw value)

this -> RDFS:label -> John F. Kennedy

Related records:

Ronald Reagan [WD:Q9960] (96.2%)

Robert F. Kennedy [WD:Q25310] (95.7%)

Richard Nixon [WD:Q9588] (95.1%)

John Connally [WD:Q311293] (94.6%)

Lyndon B. Johnson [WD:Q9640] (94.6%)

Lee Harvey Oswald [WD:Q48745] (94.4%)

Allan Shivers [WD:Q402676] (94.1%)

Jack Ruby [WD:Q192519] (94.1%)

Harry S. Truman [WD:Q11613] (94.0%)

Bill Clinton [WD:Q1124] (94.0%)

Dwight D. Eisenhower [WD:Q9916] (93.9%)

Wesley L. McDonald [WD:Q7983952] (93.7%)

Abraham Lincoln [WD:Q91] (93.7%)

Edward Steichen [WD:Q313899] (93.6%)

Hernando de Soto [WD:Q60657] (93.5%)
Photographic and typographic. Two photographs of John F. Kennedy and Marilyn Monroe.

OBJECT DETAILS

CATEGORIES  Entertainment & Leisure  Prints

OBJECT TYPE Poster

BRIEF DESCRIPTION Poster advertising Kennedy’s Children


DIMENSIONS • Poster height: 50.3cm
• Poster width: 31.7cm

MARKS AND INSCRIPTIONS • Stamped with Theatre Museum, V.A.M. stamp.


COLLECTION Theatre and Performance Collection

ACCESSION NUMBER 5,483-1994

Not currently on display at the V&A
Curator Doug Millard explores the unknown story of the father of the space age, Sergei Korolev.

In December 1965 Sergei Pavlovich Korolev was finally put in charge of the Soviet Union’s manned lunar programme. He would go on to lead its two projects: one to fly a cosmonaut crew around the Moon; the other to land one on the surface.

The nation’s secret assault on the Moon – a delayed response to President Kennedy committing the United States to do the same – had already faced huge challenges: insufficient funding;
Textile Collections

Ricciardo Sisters: the interactive story

Our life in the Mill: the Ricciardo Sisters

MARCH 1937
POSTCARD FROM THE MILL
When we arrived in Dover there were two men and two Italian women (Maria and Yola) waiting to meeting us on behalf of the mill. They took all 16 of us to a coffee shop. They had a post card of the mill, and showed us around.

How to navigate

Every life is a unique story. And each story is like a thread which connects places, people, objects, events and wider social and historical topics.

In this prototype, the personal story of three textile migrant workers of the Bradford district has been geolocalized and connected with images, movies or objects from different archives and museum collections, Wikidata and other online sources. To visualize these connections, click on the title of each memory. This will open a new page where you can explore further links.
Minett Stories

REMIXING INDUSTRIAL PASTS IN THE DIGITAL AGE

START
Steel, smoke and dust
Industrial bleakness, with rows and rows of workers’ houses...
Dirty, unkempt streets...
Swarms of uncombed, bratty street urchins...
Workers with bad eyesight and skin tanned from the dust of the mines and factories...

Ah, we're finally arrived!
Let's hope there's at least a decent café in this place.
Taking care with industrial histories

• ‘Care, contribution and connection’ as guiding principles of the project
• Care to respect and value all forms of knowledge and expertise
• Care for the collections themselves, wherever they’re held (in large museums or by local communities)
• Care for the data derived from those collections, and the work that goes into its creation
• Care ‘to make sense of the past and enliven its relevance for today’
• A careful approach to the connections that are made
Taking care with industrial histories

• And finally, taking care to use artificial intelligence responsibly for the exploration of cultural heritage data
• Acknowledging bias and knowledge gaps
• Working to share knowledge through the social machine about ways in which AI can either expose bias or amplify it
• Developing a shared understanding that the connection of cultural heritage materials can be transformative ...  
• ... which is why it brings a duty of responsibility to the people who are data points in our collections