

Digital researchers and data experts

We create digital tools
to explore academic
research in new ways.

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- **2400 words. Don't go slowly.**
- Many thanks for inviting me to speak here.

The Digital Humanities & the Digital Modern (Palgrave Macmillan, 2017).

- Digital humanities need to be understood in the context of 'the digital modern'.
 - Reflexive Modernity (Anthony Giddens et al).
- We need to develop critical theories that can help us both understand digital media & culture and build working digital tools / products.
 - Postphenomenology (Donald Ihde, Peter-Paul Verbeek et al).



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- My background is in the history of ideas, literature and technology but I've become increasingly fascinated by the 'collision' in digital humanities (and eScience generally) between our inherited analogue traditions, and the engineering and mathematical principles that enable and constrain computationally-intensive research and digital product development.
- Reconciling these two aspects of contemporary research experience – in an intellectually satisfying way - is a generational challenge.
- That's the focus of my recent book, titled *The Digital Humanities & the Digital Modern*.
 - It's an attempt to rethink our assumptions about the digital humanities, by considering them in relation to what sociologist Anthony Giddens refers to as 'second' or 'reflexive modernity'. That is to say, I think it's obvious that digital humanities are, to some degree, an expression of something we might call 'the digital modern', and a full understanding of them requires an understanding of their relationship to that wider context.
 - Perhaps more radically, though, I claim that the defining aspect of the digital humanities is – or should be, or could be – the development of critical theories and methods that can help us both understand digital media & culture *and build working digital tools and products*. This might sound trivial, but it is proving to be surprisingly difficult. My feeling is that most people underestimate the depth of the challenge: if we want to do it in a sophisticated ways we need to confront deep epistemological, and even ontological, issues related to our experience of the world, the limits of mathematics and computing, and what postphenomenologists like Donald Ihde would refer to as our 'entanglement' with technological artefacts.



The Antikythera mechanism (Fragment A – front), 150-100 BC.



The IBM Blue Gene/P "Intrepid" supercomputer, Argonne National Laboratory.



Amazon Echo 'AI' assistant.

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- So we need to find ways to integrate DH into the 'deep' history of the humanities, at the level of epistemology and method.
- Once again, the core problem is how to develop critical theories and methods that can help us *both understand the digital world and engineering working digital products*.
- One of my long-term projects is to explore the longue duree of machine epistemology, in an effort to understand how humans have used machines to construct meaning over millennia.
- In doing so, by charting the epistemological (cultural) history of machines from early Greek computers to Chinese water clocks, supercomputers, and our current fascination with products powered by so-called 'artificial intelligence', I hope to be able to better contextualize our current efforts in digital cultural heritage, digital humanities and digital social science.
- Despite what some US critics of digital humanities might think, humans have used machines to explore the nature of their worlds for millennia: by recovering that history we will be better positioned to increase the sophistication of digital humanities as a field.

- Laboratories are key sites in the construction of knowledge, and hence meaning.
- Scientists worked out what they are, and how they work best, 100 years ago.
- Humanists and social scientists are still working that out. The better we understand it, the better our labs (and the knowledge & meaning they produce) will be.



James Gillray. Scientific Researches: New Discoveries in Pneumatics, 1802. National Portrait Gallery, London.



Molecular Biology Technics Laboratory at Faculty of Biology of Adam Mickiewicz University in Poznan (Wikipedia).

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- But why focus on laboratories in this talk?
- It's a side project, in many ways, to ensure I think about the development of KDL in a critical way.
- The interesting thing for me, as a historian of ideas, is that the concept of a 'laboratory' didn't (of course) evolve fully formed. Scientists didn't always have them, and the contemporary form of laboratory we know today took over one hundred years to evolve.
- As with our general attitude to machines, the better we understand the nature of our laboratories - ideally by studying existing examples – the better our labs (and the meaning and knowledge they produce) will be.

We must not only search for, and procure a greater number of experiments, but also introduce a completely different method, order, and progress of continuing and promoting experience. For vague and arbitrary experience is (as we have observed), mere groping in the dark, and rather astonishes than instructs. But when experience shall proceed regularly and uninterruptedly by a determined rule, we may entertain better hopes of the sciences.

Francis Bacon, *Novum Organum*, 1620.

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- The more I think about it, the more I think the era of Natural Philosophy can inform our activities, and connect us to long-standing humanities traditions in epistemology and method.
- The word 'laboratory' was first used by Ben Jonson in a masque performed at the court of James I in 1610, in which Mercury drives alchemists out of a laboratory in favour of Prometheus, Nature, and twelve "sons of nature". Laboratories were integral to the development of natural philosophy during the Enlightenment, and fundamentally entangled with the development of experimental science in the late sixteenth and early seventeenth centuries. Drawing on a flowering of activity in these 'mechanical arts' across Europe, Francis Bacon famously recommended to Queen Elizabeth I that she establish libraries and zoos and botanical gardens to better understand the natural world. These prototypical laboratories took the alchemical tradition, where people attempted to turn base metals into gold, and reoriented them towards mathematically-grounded methods based on observation and repeatability.
- Bacon described the rationale for this in one of the foundational texts of modern scientific method, *Novum Organum* (1620). I hope this quotation shocks some of you: it points to the 'collision' I referred to earlier.
- In the centuries that followed Bacon, laboratories became the "myth-laden headwaters of scientific knowledge" where methods like these were deployed in increasingly controlled 'clean' environments enabled by a mixture of tools and methods. Andrew Pickering's claim that laboratory method is as much "performance" as process is telling: laboratories have come to symbolise not only science but a mode of techno-scientific instrumentalism that lies at the heart of modern industrial capitalism.



Fig. 2. The first Colorado site of Flinn's Kewbury's brick factory, into the market of "Red" (Barney M. Bull Papers, Box 1, Folder 19C-17, Bancroft Library, University of California, Berkeley, CA).



Fig. 4. River-Ship Station (Water Survey, 1894-95 (Blount-Kent) Flood Survey, Champaign, IL, negative no. 875).



Fig. 6. University of Pennsylvania (University of Pennsylvania Archives, Philadelphia, PA).

Robert E. Kohler, "Lab History: Reflections." *Isis* 99, no. 4 (2008).



Cern. Brücke-Osteuropa. CC0.



Ivanka Trump in the lab, 2018.
meme by @MaryViglione

- This is in tension with the values of many humanities researchers but it is important not to get drawn into simplistic definitions of a 'laboratory', assuming they lead inexorably – deterministically – towards empirical and instrumentalist modes of research.
- Robert Kohler and other historians remind us of labs' rich history, from river barges and herbariums, to modern sites like CERN as well as genomics, engineering, and all manner of other forms. There is no such thing as a 'standard' laboratory, and never has been.
- Ivanka Trump's attempt to cash in on simplistic articulations of laboratory research earlier this year suggests something of the politics here: 'real' scientists voiced outrage at her stage managed photo op, and pointed out the radical heterogeneity of their research methods.
- Humanities laboratories have an infinite range of methods at their disposal, from the rigidly empiricist, to the experimental and creative.
- More significantly in terms of the history of ideas, laboratories allow us to engage with research methods – and broader currents in epistemology - that reach back to the Enlightenment and beyond. What we make of that is up to us.

King's Digital Lab

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- But what does that mean in practical terms, for labs like KDL?

Established late 2015.

Supported by external funding, under-written internally.

12 permanent staff: Director, Deputy-Director, Project Manager, 3 Analysts, 4 Software Engineer, 2 UI/UX Developers, 1 Systems Manager. 1 contract analyst. Research Affiliates / Visiting Fellows.

2015: 1 woman, 6 men; 2017: 6 women, 8 men.

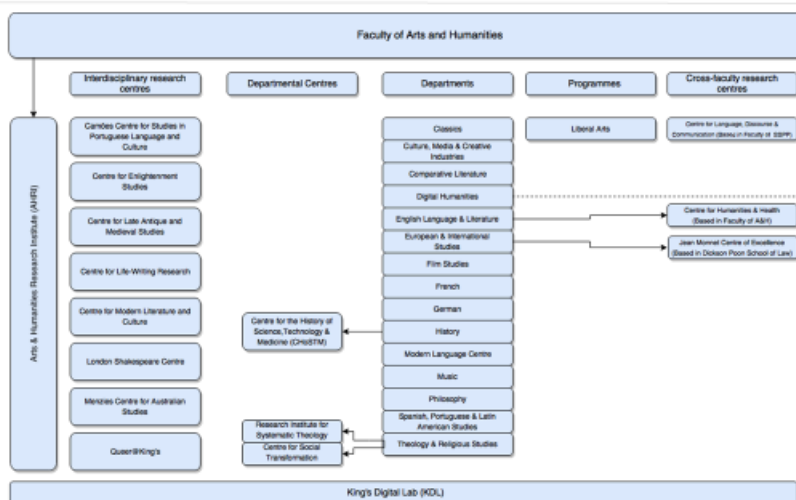
8 countries of origin, 11 languages.

~200 virtual machines, ~1TB RAM, ~45TB data; ~100 inherited projects, 20 ongoing. ~5 million digital objects.



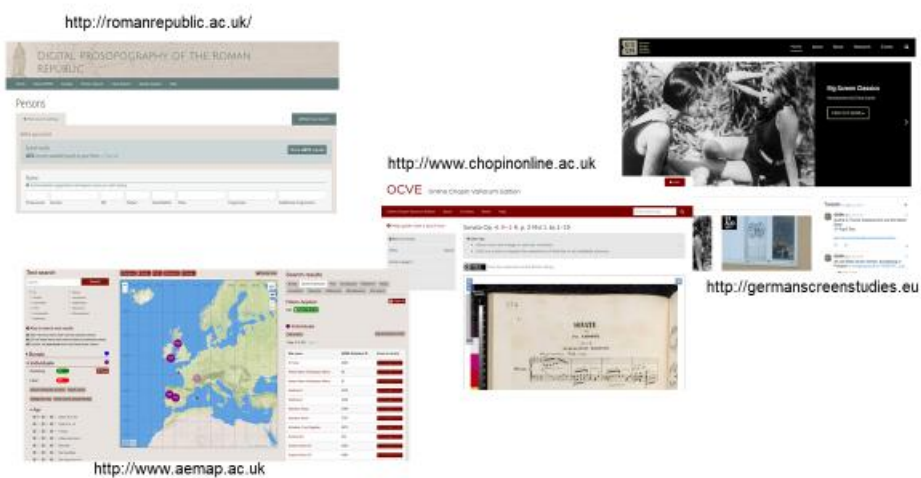
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- KDL evolved out of 30 years of activity at King's College, against a background of rapid innovation and change in first Humanities Computing, then Digital Humanities.
- This was based around the Centre for Computing and the Humanities (1991), and later the Centre for eResearch in the Humanities (2008), which merged into the Department of Digital Humanities (2011-).
- In recent years it has become increasingly apparent, though, how difficult it is to undertake intensive software engineering inside an academic department:
 - Problems emerged, related to project management, financial control, infrastructure, human resourcing, and quality control.
 - We are talking, of course, about the evolution of digital humanities from a 'server under the desk' model to something close to industrial scale.
- KDL was established in late 2015 to fill this gap, and given a mandate to consciously explore what it means to be a humanities-based digital research laboratory.



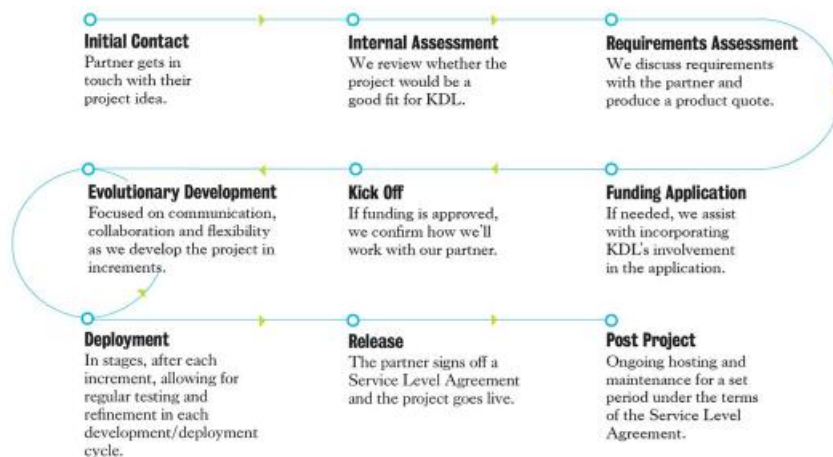
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- We exist to increase digital capability across the entire Faculty of Arts & Humanities, with a special – dotted line – relationship to the Department of Digital Humanities.



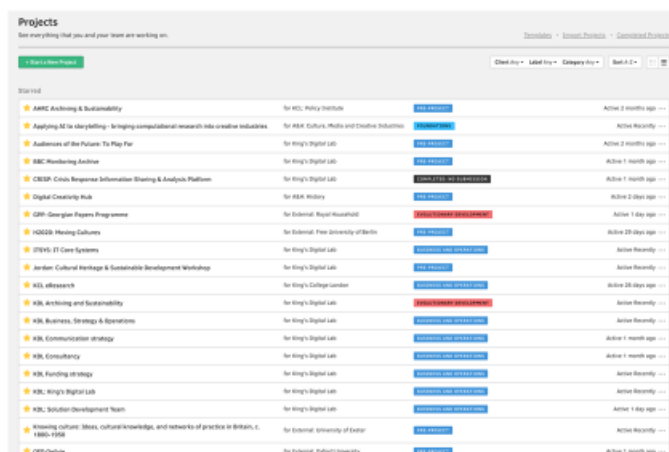
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- I don't have time to get into the details of projects, but suffice to say we're involved in a very wide range of digital cultural heritage projects, from legacy projects we've inherited to new ones, ranging from historical databases to archive development, scholarly networks, and now mobile apps, big data analysis, visualization, and virtual reality.



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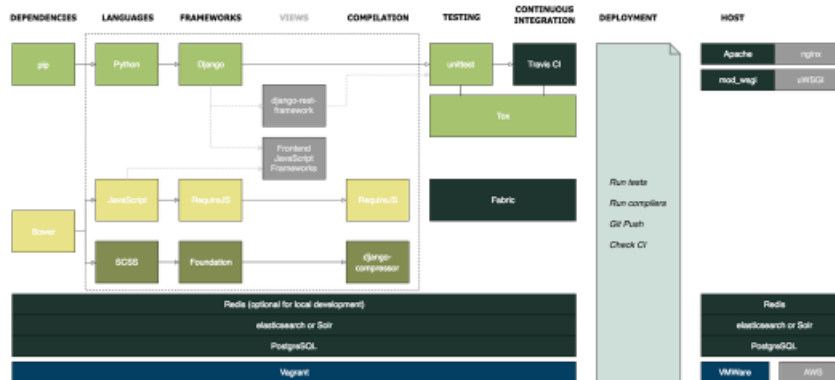
- We've developed a bespoke Software Development Lifecycle (SDLC) based on the Agile methodology, that we've tailored to a research environment:
 - It covers everything from pre-grant analysis to archiving and research data management.
 - I won't go into this in detail, but you'll note the different phases we work through with our research partners.



Project Name	Client	Status
AMRC Archiving & Sustainability	for AMRC, Policy Institute	Active 2 months ago
Applying AI to library catalogues - bringing computational research into creative industries	for AMRC, Culture, Media and Creative Industries	Active Recently
Addresses of the Future: To Play For	for King's Digital Lab	Active 2 months ago
ABC: Benchmarking Archive	for King's Digital Lab	Active 1 month ago
CRISD: Crisis Response Information Sharing & Analysis Platform	for King's Digital Lab	Active 1 month ago
Digital Creativity Hub	for AMRC, History	Active 2 days ago
GRF: Georgian Papers Programme	for National, Royal Household	Active 1 day ago
HO200: Hermitage Cultures	for National, Free University of Berlin	Active 29 days ago
IT24/5: IT Case Systems	for King's Digital Lab	Active Recently
Jordan Cultural Heritage & Sustainable Development Workshop	for King's Digital Lab	Active Recently
KSL: eResearch	for King's College London	Active 26 days ago
KSL: Archiving and Sustainability	for King's Digital Lab	Active Recently
KSL: Business, Strategy & Operations	for King's Digital Lab	Active Recently
KSL: Communication Strategy	for King's Digital Lab	Active 1 month ago
KSL: Consultancy	for King's Digital Lab	Active 1 month ago
KSL: Funding Strategy	for King's Digital Lab	Active Recently
KSL: King's Digital Lab	for King's Digital Lab	Active Recently
KSL: Solution Development Team	for King's Digital Lab	Active 1 day ago
Knowing Cultural: Ideas, cultural knowledge, and networks of practice in Britain, c. 1800-1950	for National, University of Exeter	Active Recently
QED: Optica	for National, Oxford University	Active 1 month ago

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- This is a screengrab of our project management tool, showing some of the projects we're working on.
- Each row represents a project, and there are many more than you can see in this screengrab. We were involved in £26m of funding bids and over 35 grant submissions last year, and work on 6 – 10 projects, at various stages of development, at any one time.
 - It's a significant management task just keeping everything on track.
 - So this is where that 'collision' I was referring to occurs: between the industrial management methods we need to use to manage complexity, and the intellectual and research cultures we exist to support.
 - To me, that's less a troubling tension, than the very basis of our existence. This is the challenge our generation of scholars are facing (previous years had their own, no doubt!).



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- This attempt to both manage complexity and ensure continuity with our scholarly traditions extends right down to the way we've defined our 'technology stack':
 - We try to think about everything we do, from the type of machines and operating systems we use, to the programming languages we invest in, and the data models we develop.
 - Ideally, they'll all be appropriate to our research context. They're our equivalent of flasks and beakers, and centrifuges.

Digital Labs as Socio-technical Systems

What *is* a digital humanities lab, and how might we try to understand them?

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- So now I think I've reached the point here I can ask that question:
 - What is a digital (humanities / social science) lab, and how might we try to understand them?



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- So I view KDL as a socio-technical system where research, computing, engineering, infrastructure, and business collide.
- It's a complex zone: We need to 'read' it from a variety of STS (Science & Technology Studies) perspectives:
 - History of Technology: We need to remember the material, engineered, reality of the lab: The computers, the 'wires and boxes'. And we need to remember how they are connected to, and are influenced by, a global history of computing that reaches much further than Silicon Valley.
 - Social Studies of Science: Reminds us of the constructed nature of the lab, the way it has been designed, and evolved under the pressure of only (we have to admit) intellectual concerns, but administrative and financial. This 'ethnographic' view of the lab emphasises the role of people, and the tacit knowledge they have, in shaping the everyday life of the lab.
 - We can go further, and assert that the lab can only be properly understood if we properly understand the phenomenological entanglement of KDL staff with the infrastructure and machines we use on a daily basis: we are tied to them through rituals of maintenance, and limited in the research questions we can ask or enable because of them.
 - So at this point the issue devolves towards epistemology: the nature of the knowledge creation process instantiated in the lab, and quality of the 'Truths' or understanding, or meaning, generated within it.

Karin Knorr-Cetina, *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science* (Pergamon Press, 1981), p.47:

To restore the contextuality of science, we have had to go into the laboratory and observe the process of knowledge production. In view of the opportunistic logic we found at work in this process, "scientific method" can be seen as a locally situated, locally proliferating form of practice, rather than a paradigm of non-local universality. It is context-impregnated, rather than context-free. And it can be seen as rooted in a site of social action, just as other forms of social life are.

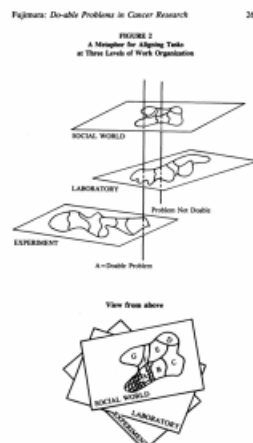
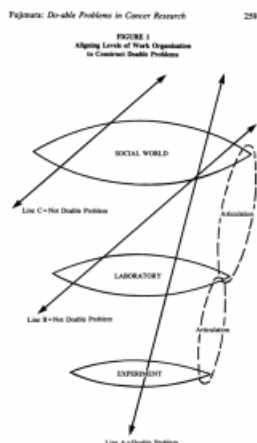
Peter Kroes, "Theories of Technical Functions: Function Ascriptions Versus Function Assignments, Part 1," *Design Issues* 26, no. 3 (2010), p.62:

So engineers and philosophers, each in their own way, struggle with the role of physical structures and human intentions in explicating what it means for a technical artifact to have a function.

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- We should be looking for local instances of knowledge production, tailored to different contexts, scales, financial models / circumstances, and methodological traditions and research interests.
- We should be looking at how different laboratories treat their digital tools and methods – how they deploy their 'flasks and beakers'. How are they changing traditional functions of computers to suit humanities and social science research?
- This should alert us to how the material reality of digital laboratories is entangled with the humans who use them.
- Most importantly, it should indicate the *agency* of the 'humans' in the socio-technical loop.

"...technology alone cannot make problems doable. Doability is better conceptualised as the alignment of several levels of work organisation."



Juan H. Fujimura, "Constructing 'Do-able' Problems in Cancer Research: Articulating Alignment," *Social Studies of Science* 17, no. 2 (1987): 257–293.

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- Once we understand the basic socio-technical structure of our digital laboratories we should start to explore how they influence the research questions we ask – the problems we explore *and the problems we choose not to explore*.
- Joan Fujimura offered an interesting way to look at this issue in her classic 1987 essay on so-called 'doable' problems in cancer research.
- Fujimura was working after the first wave of work in the sociology of laboratory science that started in the 1970s with the likes of Bruno Latour.
- Her insight was that experienced laboratory scientists were very good at quickly determining which experiments would yield the most value to them, and which weren't worth undertaking – however much they might be of interest.
- It's a key insight into the *pragmatic reality* of laboratory science: rather than being sites of pure research, labs are constrained by a complex set of socio-technical realities. Revealingly, for digital humanities labs, Fujimura points out that "...technology alone cannot make problems doable. Doability is better conceptualised as the alignment of several levels of work organisation."
- Rather than merely doing experiments that are of interest, successful laboratories conduct experiments that are aligned (and possible because of) to:
 - their social world: in KDL's case, the faculties of Arts & Humanities and Social Science & Public Policy, but also – more remotely – Informatics, Education, and Health Sciences;
 - the laboratory: and, in particular, the range of experiments already or historically carried out in the laboratory, resulting in tacit knowledge that informs new ones;
 - the experiment itself: in our case the availability and tractability of data or content for digitization, infrastructure, and the programming frameworks, tools, and set of tasks that need to occur for the experiment to occur (or tool to be built).
- Each digital humanities laboratory will have a different range of 'doable problems', then:
 - My last lab, in New Zealand, was small and had limited capabilities. We specialised in born digital archiving of post-disaster content, and could do a little around the edges related largely to teaching basic text analysis or web development. Any other work was unthinkable without significant additional investment in staff and infrastructure.

- KDL has a significantly larger range of doable problems, but we are actively investing time and resource – when available – in extending our capabilities into areas like augmented reality, virtual reality, and visualization that are on the border of our social and laboratory worlds.

- Digital laboratories imply ethical as well as epistemological and methodological load:
 - Ethical duty to continue the humanities tradition as *traditionally conceived*.
 - Ethical duty to avoid the replication of inequities of tech-sector culture.
 - Ethical duty to manage our financial responsibilities transparently – and perhaps even aim to profit - in consciousness of the opportunity costs for our colleagues.
 - Epistemological duty to safeguard but also extend the modes of knowledge creation and interpretation open to humanities researchers *in a manner in keeping with the humanities tradition*.
 - Methodological duty to be experimental and innovative – and embrace the possibility of failure – but also transparent.
 - An epistemological / methodological duty to embrace the full spectrum of 'meaning construction' in the humanities, from deformance to empiricism.

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Some tentative conclusions:

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