Towards a Global Research Infrastructure

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Long title	Towards a Global Research Infrastructure
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Vannevar Bush gave us the most consequential, imaginary conceptualization of a machine for research infrastructure for the 20th century ([Memex](#)) and was one of the prime movers in the creation of the National Science Foundation (NSF) – a superb, if flawed, administrative research infrastructure. Superb: blue sky research; flawed: in some areas it's been invaded by people representing particular schools of research and excluding others. In some kind of concert, though more perhaps cacophonously, new tools and new academic forms have been developed over the past seventy-five years.

To see what has been at stake, let us first take a step back, to the period when (Serres, 1995) the x-ologies (sociology, biology and so forth) were created. In the early nineteenth century the familiar, stultifying array of 'disciplines' was put into place and frozen into the very architecture of our universities. Partly this was about the nineteenth century being one to develop classification of and within the sciences as a core tool – arguably tracing back to the rise of what Foucault has called 'governmentality'. This was the epoch where 'we' (the universalizing West) discovered that we had to manage nature (as Serres put it, we developed a 'natural contract' to rival Rousseau's social contract) – resources were finite and populations were exploding. And classification is core to every good bureaucracy. Partly too, it was about the rise of new media – first the journal (with its fixed 'real estate' – number of pages to be filled – per year) and now the electronic journal with unlimited real estate. This explosion of publishing has left natural philosophers no longer able to range over the whole of knowledge and resulted in the inexplicable, wasteful, counter-productive dizzying array of specialist journals in the world today. The average paper is lucky to be read in depth by more than one or two, in a world where citation is easy – google, cut and paste the reference – and reading is hard. As Chad Wellmon has argued in *Organizing Enlightenment* (Wellmon, 2015), with information explosion came the need to divide and control.

Fast forward to the mid twentieth century, and the specter of human-caused destruction of our environment seemed to be ever more menacing. The [*Club of Rome report*](#) (Meadows et. al., 1972) cried wolf but also spoke fundamental truths. The canonical science of this epoch was cybernetics – the science of communication and control - which modeled humans and societies as vast, dynamic systems. Again, there was an apposition between new forms of governmentality based on developments in bureaucracy (harking back to census technology in the late nineteenth century and the rise of International Business Machines or IBM), new media and scientific insight – everything could be understood in terms of information being processed by a computer. There was a general recognition that things were deeply interconnected – one impulsion to founding the NSF in 1950 was the desire for interdisciplinary science. Breaking down the disciplinary silos, in the tired newspeak of modern academia and then business.

In the twenty-first century, we have witnessed a proliferation of attempts to map the world and its biodiversity as dynamic systems. In the US, this has taken the form of projects such as GEON, NEON and Earthcube for example, whose unmet goal has been to create vast interoperable databases of earth systems and ecosystem science. (There is a complexity here – the problem is not with the projects – it's with expectations that infrastructures can be built in 5 years – they generally take at least 50 to 100 years. Paradoxically, in terms of globability, almost all of these

systems have been parochial and partial. International platforms such as GBIF for biodiversity or the ILTER for long term ecological research have been underfunded and plagued with difficulties – indeed, as Paul Edwards in *A Vast Machine* (Edwards, 2010) has shown, even something as seemingly basic as climate data is neither reconcilable nor consistent across continents.

In general, as the Re:Ex (reenlightenment) scholars argue, the knowledge enterprise is broken right now. On the surface this takes the form of far too many publications of far too little import. Under the hood, there is a badly broken research infrastructure. A few examples at random:

- There used to be some kind of a reasonable pipeline leading from doing a doctorate to getting a job. Now many universities seem to losing any fiduciary principles – we are producing far too many PhDs because they act as cheap labor both in teaching and on research teams.

- We still cleave to publication at all costs – we know it's silly, but there's no other way to get ahead. Consider someone working on a scientific database. This is fundamental infrastructural work, but it is heavily underfunded and underrecognized.

- In general, there should be reward structures for people who build the database, who curate it (most scientific databases need extensive tending before they are useful, as Antonia Wolford and others have shown), who design the algorithms which render it tractable and so forth. In fact, the myth of the individual scientist hides this vital, unrecognized labor.

Then there is the computer and its possibilities. The last time we had a fundamentally new medium for expressing knowledge – with the development of the printing press – it took us about 200 years to work out how best to deploy that infrastructure. Chapter headings, footnotes, bibliographies and periodical literature did not just magically appear. It is threatening to take us equally long to really take on board the possibilities of computer mediated communication. It is unclear to me that we need books or articles at all. We could take the database as being a fundamental form for our time – as Lev Manovich has argued in *The Language of New Media* (Manovich, 2002) – and take the work of database design as being core to the output of interdisciplinary teams. Equally, we are now presented with media which enable us to engage all of our senses in the exploration of knowledge (yes, even down to smell – though this has never been done very well). Why do we cleave to the world of print?

The challenge is to think proactively about the research infrastructure that we need both to address the global issues which we face and to develop genuinely new forms of knowledge. The question as ever with infrastructure, is where to start. There's no point building a national highway system if you don't have cars, petrol stations and peripatetic people to populate them. The necessary bootstrapping work is already occurring, and should be highlighted and celebrated.

When people talk of the death of the humanities and the triumph of scientists and scientism in this process, I am shocked. The humanities are absolutely vital to shaping and understanding the new knowledge infrastructures (Edwards, 2013) we need. Patrick Svennson for example has studied the kinds of spaces that make knowledge infrastructures work. Generically, issues of

data sharing across the sciences are both about technical issues (metadata is important and understudied) and about cultural issues (some sciences like to share uncertain data, others hold their results until they are absolutely certain. Most importantly, databases are cultural products – we need to develop a critical apparatus for understanding them much as literary studies has done (under numerous banners) for literature. Under our conditions of intensifying globalism, we need our senses and our technologies to be working to produce useful, creative knowledge. The answers don't lie in the present headlong pursuit of academic prestige, but in the deliberate fostering of new kinds of academic infrastructure.

We would all like a truly global research infrastructure, in much the same way as many would like world peace and global democracy. The point really is that we wouldn't just like it, we need it. There's a scale argument here. In the good old days, geologists dealt with very long time scales, historians with the day to day. Fernand Braudel canonized with his three rhythms of history – courte, moyenne and longue durée. Now all the time scales are clashing. What we do as humans is erupting into the geological record at a global level. We have created a brave new world with new temporalities (the femtoseconds of computers and the petaseconds of geology) are mixed together. We cannot separate discipline from discipline, nor country from country as we try collectively to move to the next stage of human evolution.

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