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Title
Research Data, Libraries, and Croatia

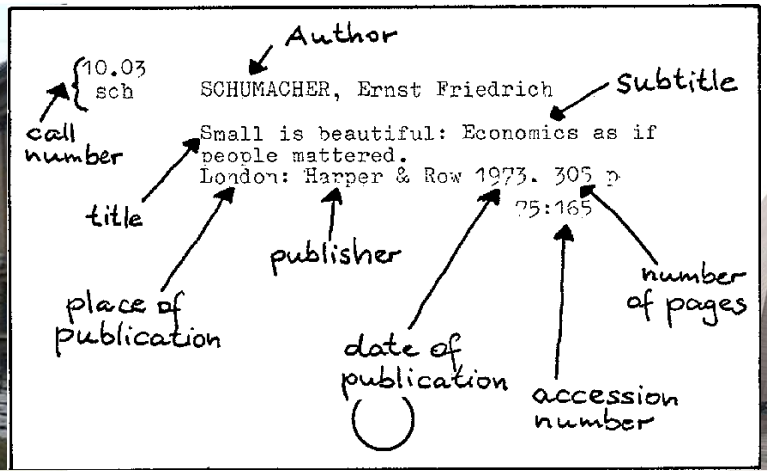
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Author
Borgman, Christine L.

Publication Date
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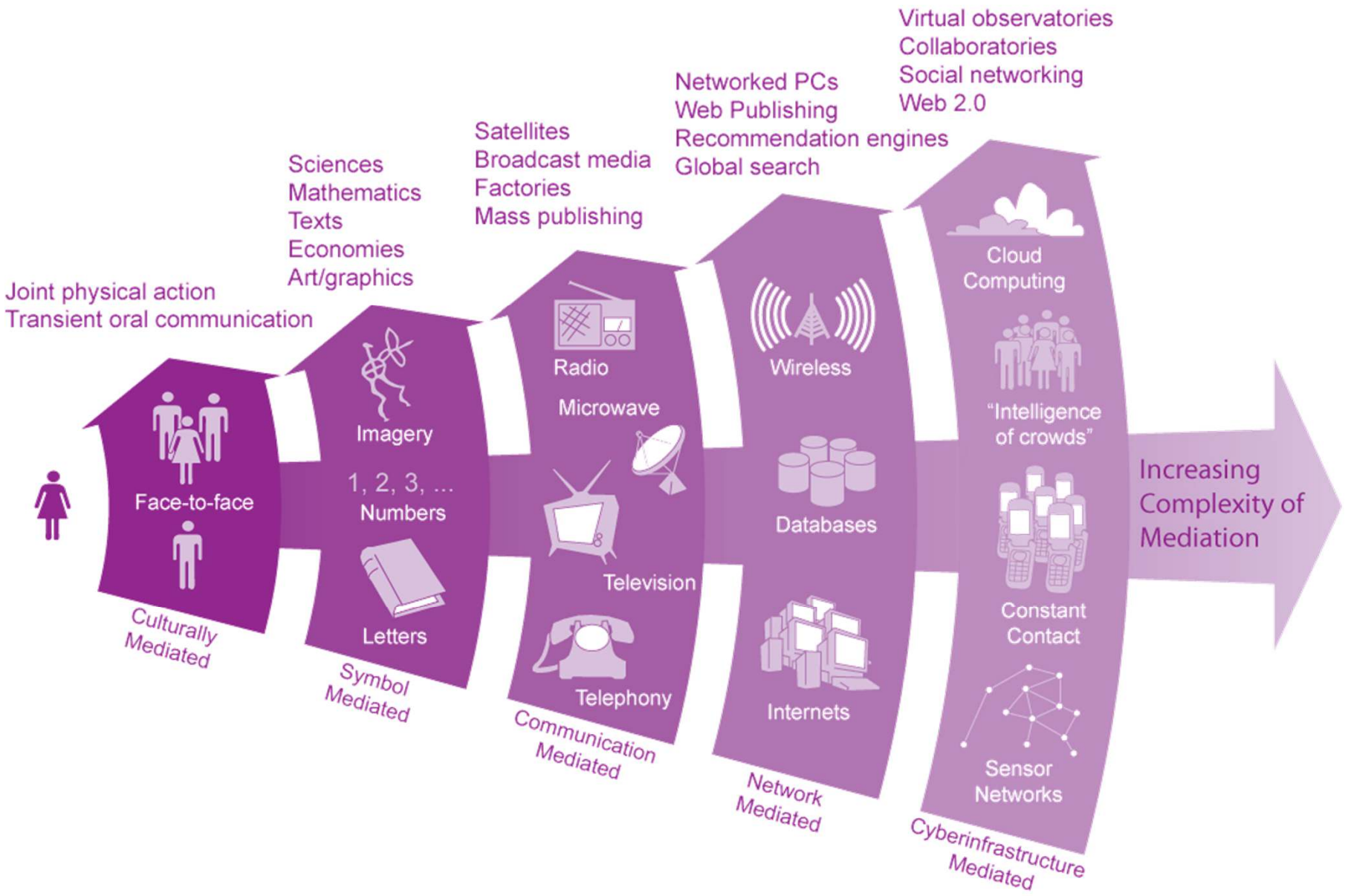
Research Data, Libraries, and Croatia

University of Zadar, Croatia, 27 September 2014

Christine L. Borgman

Professor and Presidential Chair in Information Studies
University of California, Los Angeles
and
Visiting Professor KNAW, Digital Archiving and Network Services (DANS)
Netherlands
http://christineborgman.info

Technological advances in mediated communication



Borgman, C. L., Abelson, H., Dirks, L., Johnson, R., Koedinger, K. R., Linn, M. C., … Szalay, A. (2008). *Fostering Learning in the Networked World: The Cyberlearning Opportunity and Challenge.* National Science Foundation. http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf08204

Image: Jillian Wallis and Roy Pea

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Yugoslavia

Plan for a Yugoslav Scientific-Technical Information Network

December 1972

by B.V. Tell

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Serial No. 2873/RMO.RD/DBA
Paris, March 1973

Unesco



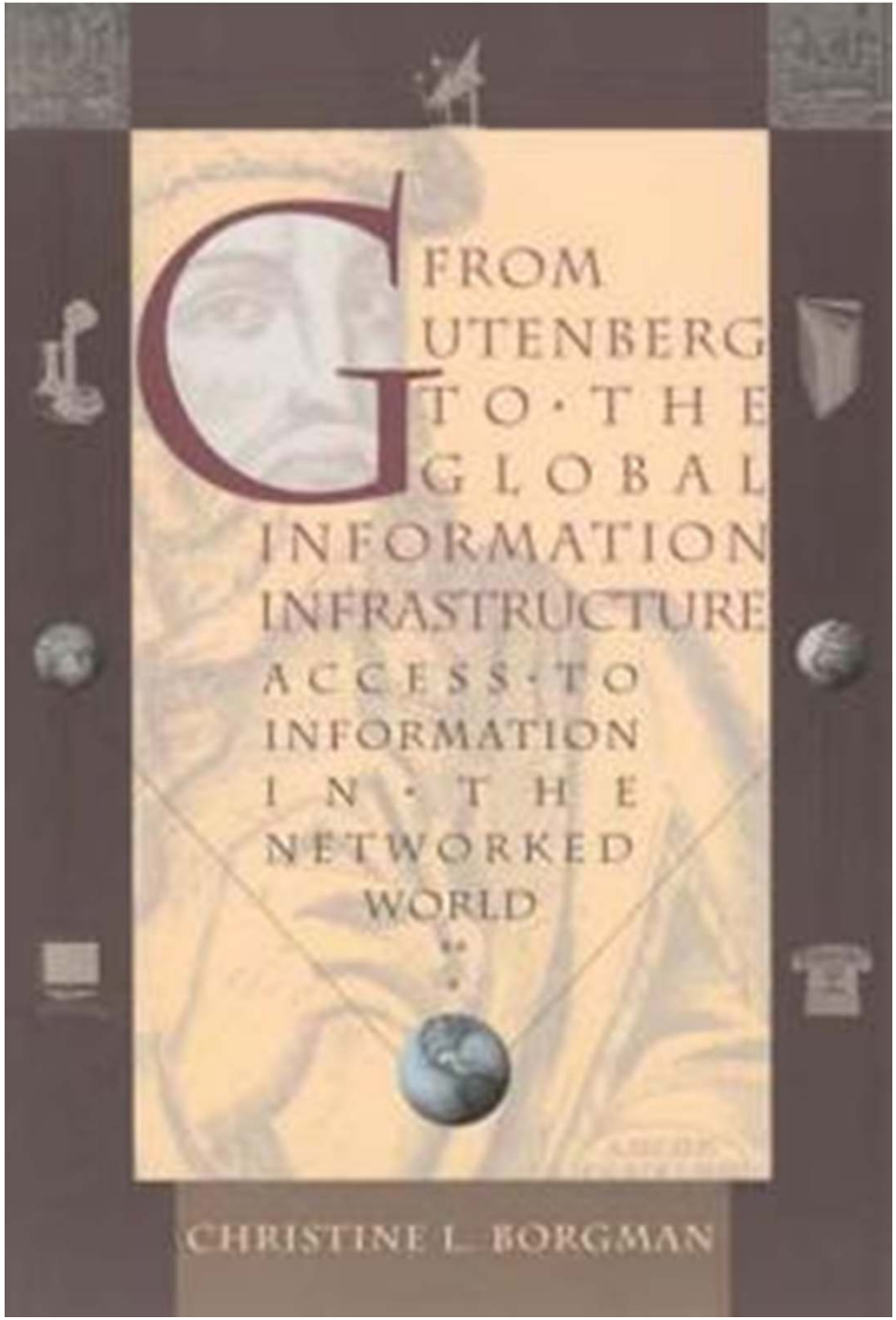


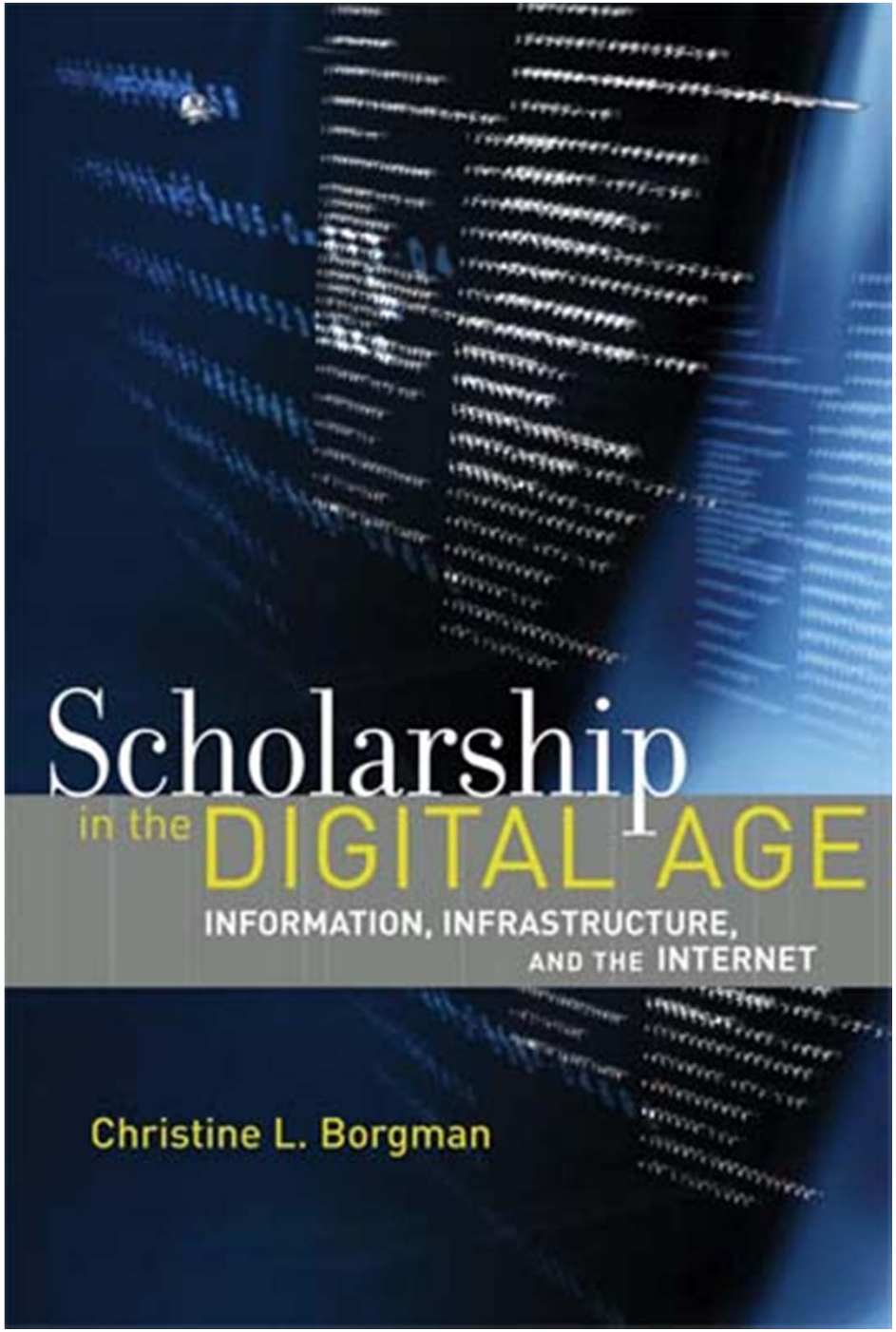






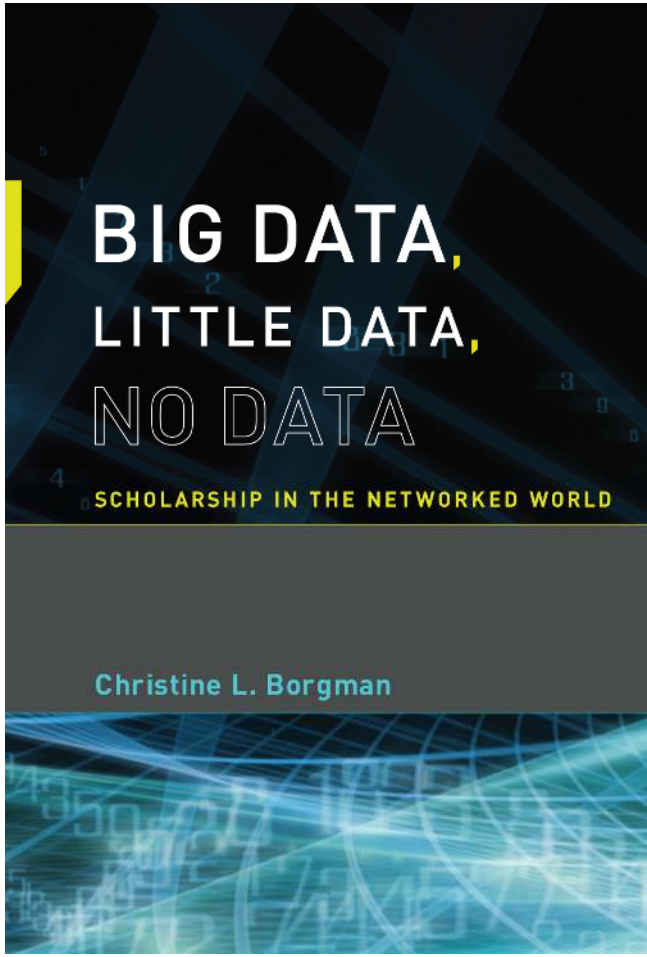
ZNANSTVENA KNJIŽNICA ZADAR
1855.


FROM GUTENBERG TO THE GLOBAL INFORMATION INFRASTRUCTURE
ACCESS TO INFORMATION IN THE NETWORKED WORLD
CHRISTINE L. BORGMAN


Scholarship
in the DIGITAL AGE
INFORMATION, INFRASTRUCTURE, AND THE INTERNET
Christine L. Borgman

Big Data, Little Data, No Data: Scholarship in the Networked World*

- Part I: Data and Scholarship
  - Ch 1: Provocations
  - Ch 2: What Are Data?
  - Ch 3: Data Scholarship
  - Ch 4: Data Diversity
- Part II: Case Studies in Data Scholarship
  - Ch 5: Data Scholarship in the Sciences
  - Ch 6: Data Scholarship in the Social Sciences
  - Ch 7: Data Scholarship in the Humanities
- Part III: Data Policy and Practice
  - Ch 8: Releasing, Sharing, and Reusing Data
  - Ch 9: Credit, Attribution, and Discovery
  - Ch 10: What to Keep and Why



*C. L. Borgman (2015, January) MIT Press


Science
12 September 2008 | $10
AAAS


Science
11 February 2011 | $10
scientific
data
information
climate
research
new
analysis
visualization
researchers
access
many
human
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brain
science
sharing
need
model
cell
use
change
future
knowledge
example
AAAS

Neelie Kroes, VP European Commission:



To collect, curate, preserve and make available ever-increasing amounts of scientific data, new types of infrastructures will be needed. The potential benefits are enormous but the same is true for the costs. We therefore need to lay the right foundations and the sooner we start the better.

Wood, J., Andersson, T., Bachem, A., Best, C., Genova, F., Lopez, D. R., … Hudson, R. L. (2010). *Riding the wave: How Europe can gain from the rising tide of scientific data*. Final report of the High Level Expert Group on Scientific Data. Retrieved from http://cordis.europa.eu/fp7/ict/e-infrastructure/docs/hlg-sdi-report.pdf

Open access policies

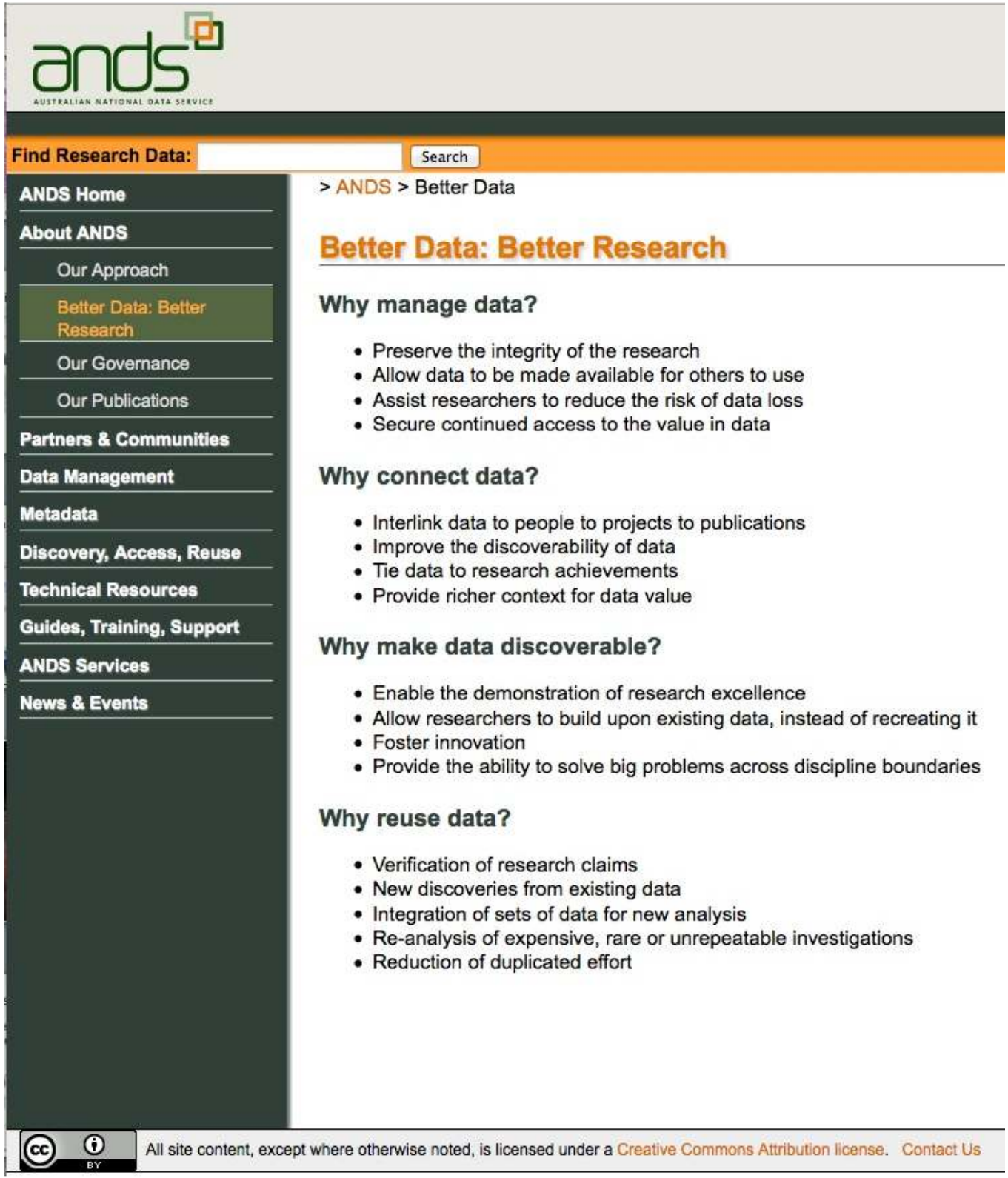
- Australian Research Council
  - Code for the Responsible Conduct of Research
  - Data management plans
- National Science Foundation
  - Data sharing requirements
  - Data management plans
- U.S. Federal policy
  - Open access to publications
  - Open access to data
- European Union
  - European Open Data Challenge
  - OpenAIRE
- Research Councils of the UK
  - Open access publishing
  - Provisions for access to data





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Better Data: Better Research

Why manage data?

- Preserve the integrity of the research
- Allow data to be made available for others to use
- Assist researchers to reduce the risk of data loss
- Secure continued access to the value in data

Why connect data?

- Interlink data to people to projects to publications
- Improve the discoverability of data
- Tie data to research achievements
- Provide richer context for data value

Why make data discoverable?

- Enable the demonstration of research excellence
- Allow researchers to build upon existing data, instead of recreating it
- Foster innovation
- Provide the ability to solve big problems across discipline boundaries

Why reuse data?

- Verification of research claims
- New discoveries from existing data
- Integration of sets of data for new analysis
- Re-analysis of expensive, rare or unrepeatable investigations
- Reduction of duplicated effort

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EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

February 22, 2013

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: John P. Holdren
Director

SUBJECT: Increasing Access to the Results of Federally Funded Scientific Research

1. Policy Principles

The Administration is committed to ensuring that, to the greatest extent and with the fewest constraints possible and consistent with law and the objectives set out below, the direct results of federally funded scientific research are made available to and useful for the public, industry, and the scientific community. Such results include peer-reviewed publications and digital data.

Scientific research supported by the Federal Government catalyzes innovative breakthroughs that drive our economy. The results of that research become the grist for new insights and are assets for progress in areas such as health, energy, the environment, agriculture, and national security.

Chinese science gets mass transformation

Teamwork at centre of Chinese Academy of Sciences reform.

David Cyranoski

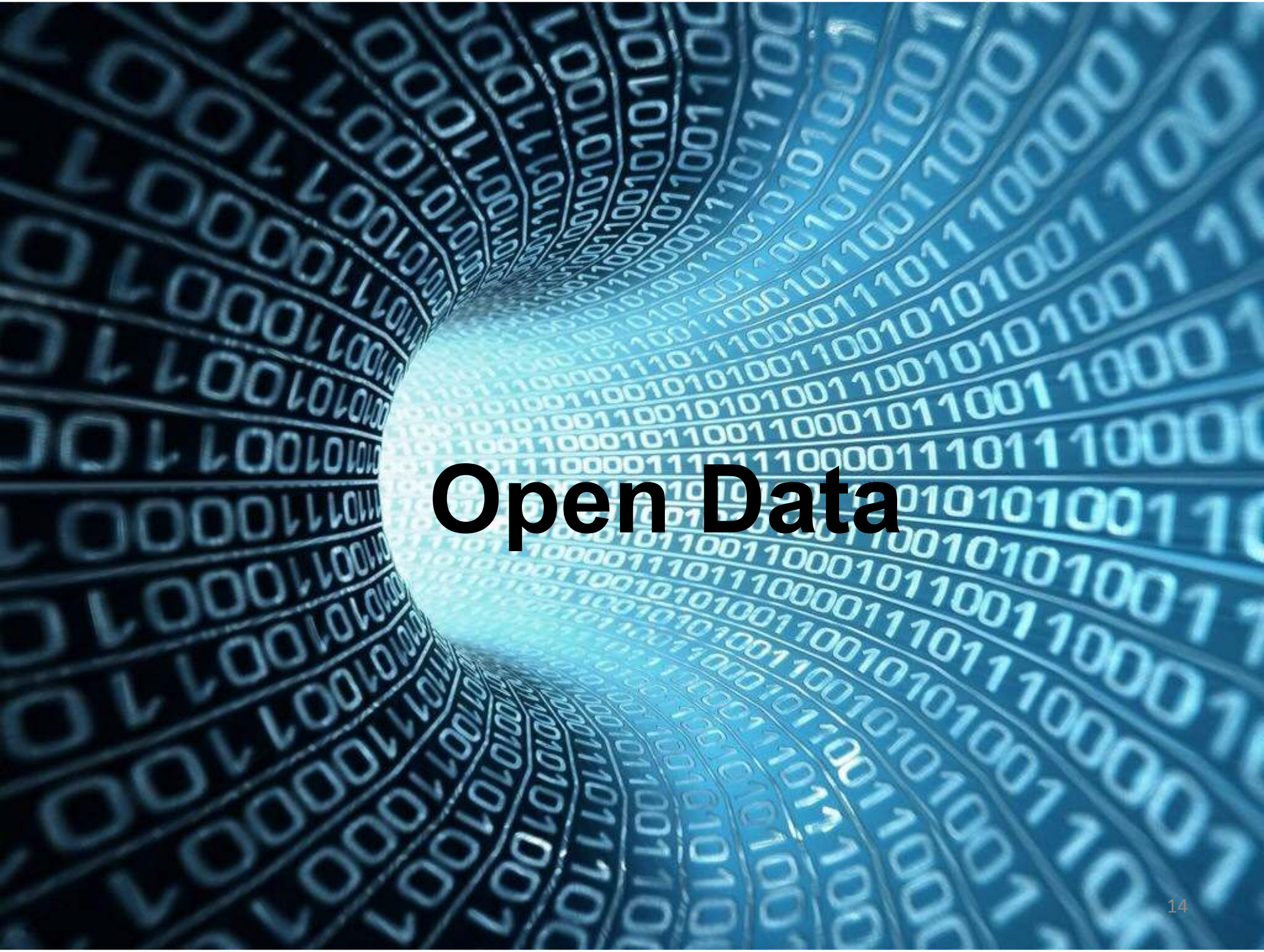
23 September 2014

BEIJING

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Pang Xinglei/Xinhua Press/Corbis


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Open Data Commons. (2013). Home page. http://opendatacommons.org/

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                           /comma 2 def
                                        /period 3 def
                                                     /W 4 def
                                                          /a 5 def
                                                               /b 6 def
                                                                    /c 7
```

Research Area	Status	Round 1	Round 2	Totals
Application Scientists	Faculty	7	6	13
	Staff	5	2	7
	Student	3	2	5
Technology Researchers	Faculty	4	2	6
	Staff	1	2	3
	Student	2	7	9
Totals		22	21	43

doi:10.1371/journal.pone.0067332.t001

Open Data

- Data that meets the criteria of intelligent openness. Data must be accessible, useable, assessable and intelligible.

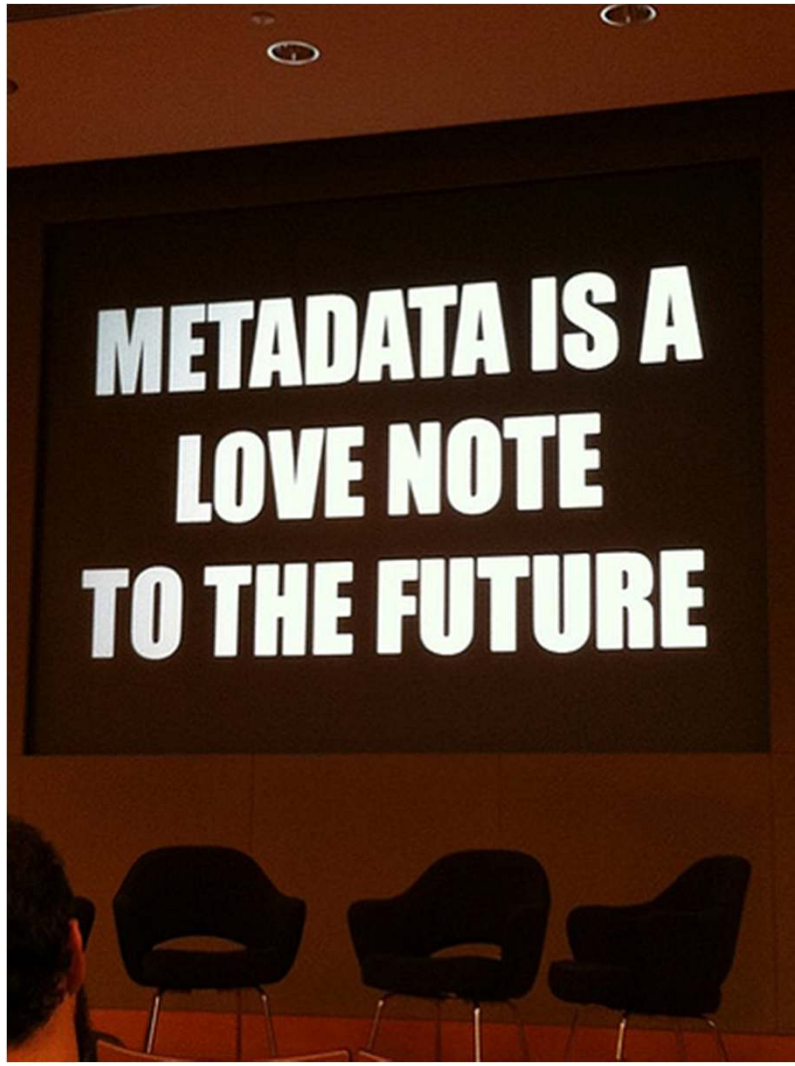


Boulton, G., et al. (2012). Science as an open enterprise. *The Royal Society*. http://royalsociety.org/policy/projects/science-public-enterprise/report/

Indian Girl Pitching up Haystack
Uploaded by The U.S. National Archives on December 9, 2009

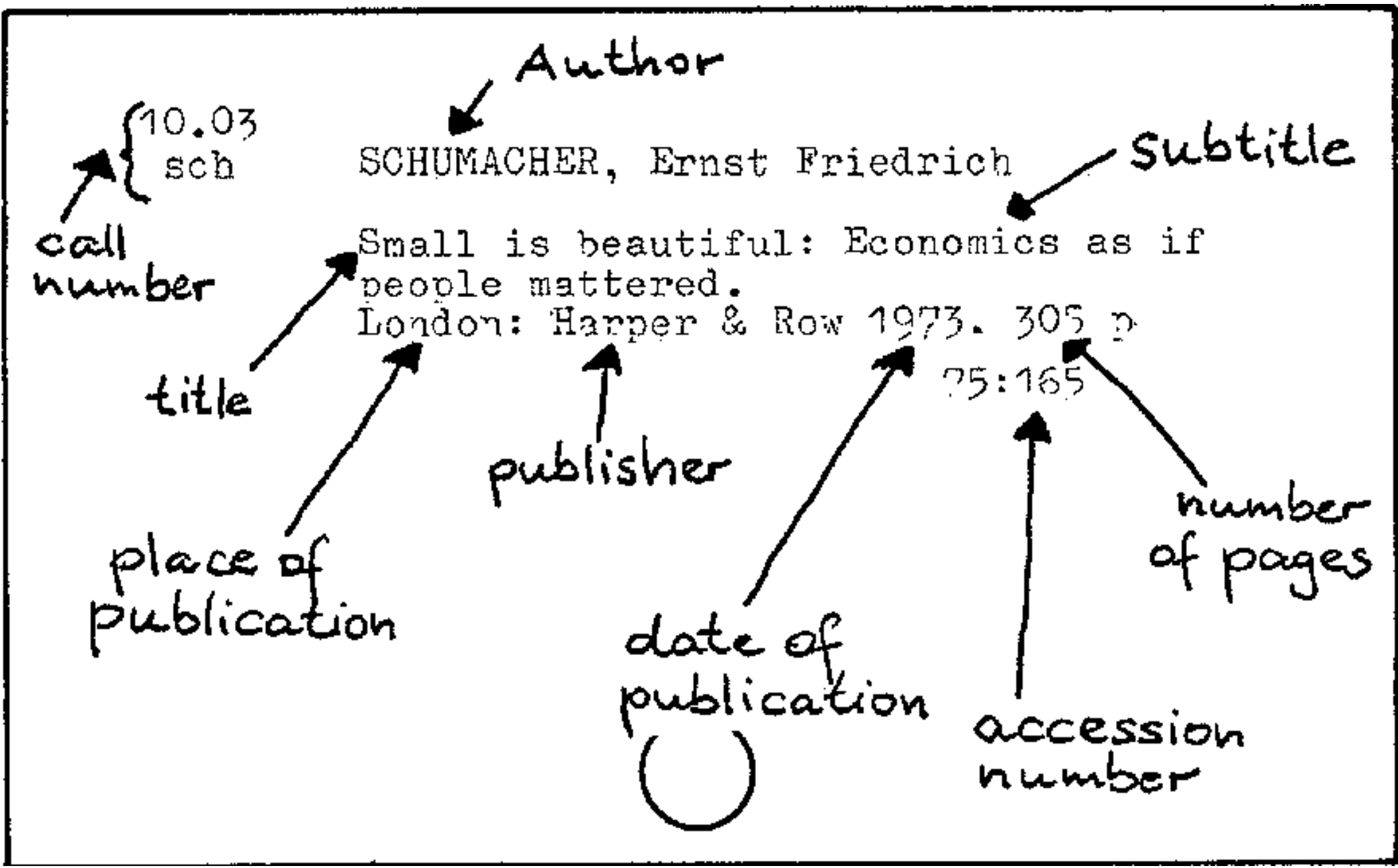
Metadata

- Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource.*
  - descriptive
  - structural
  - administrative

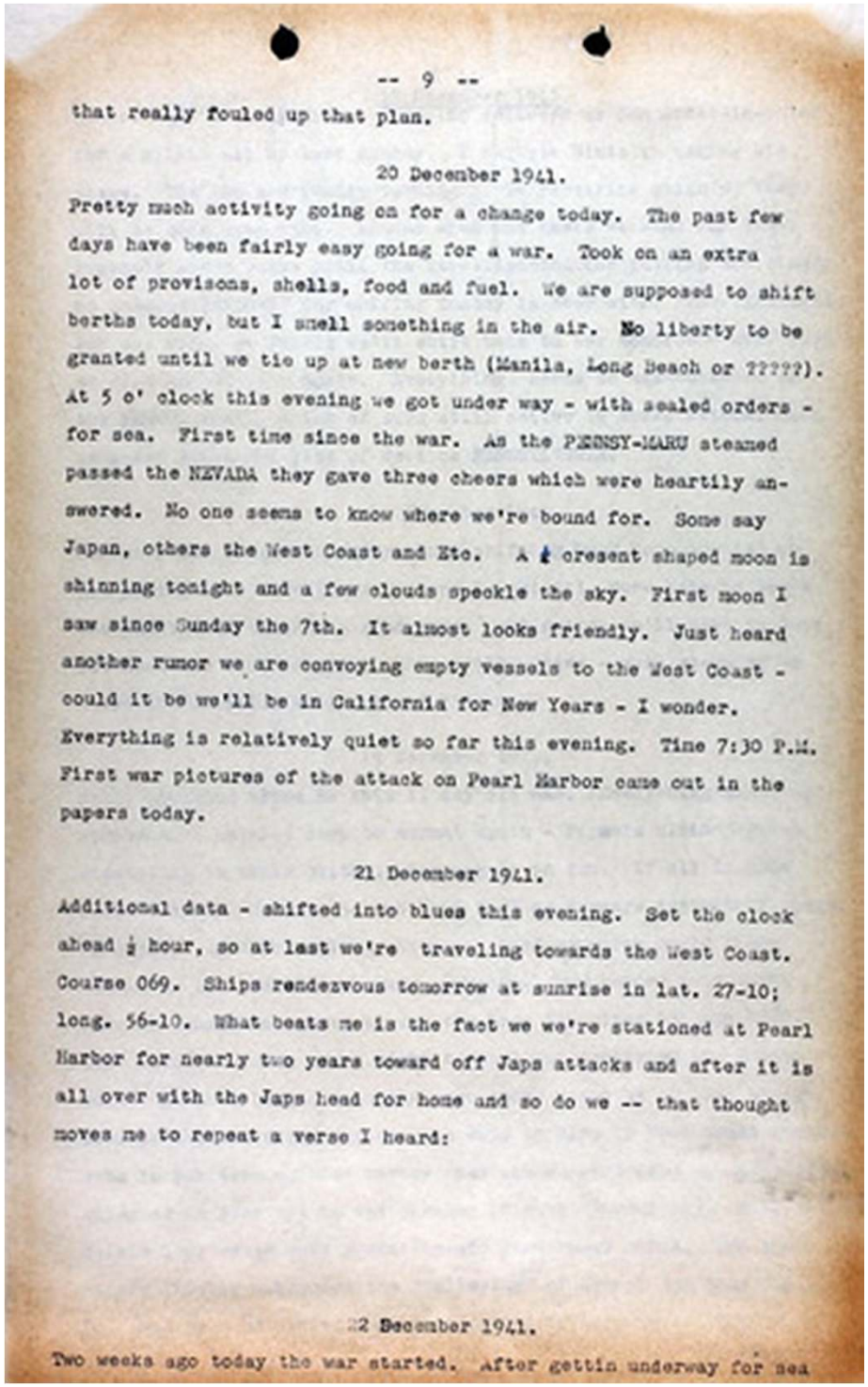


*National Information Standards Organization 2004

photo by @kissane]



http://www.nzdl.org/gsdl/collect/fnl2.2/archives/HASH01a1/51ac3343.dir/p027.gif



-- 9 --

that really fouled up that plan.

20 December 1941.

Pretty much activity going on for a change today. The past few days have been fairly easy going for a war. Took on an extra lot of provisions, shells, food and fuel. We are supposed to shift berths today, but I smell something in the air. No liberty to be granted until we tie up at new berth (Manila, Long Beach or ?????). At 5 o' clock this evening we got under way - with sealed orders - for sea. First time since the war. As the PENNSY-MARU steamed passed the NEVADA they gave three cheers which were heartily answered. No one seems to know where we're bound for. Some say Japan, others the West Coast and Etc. A ¢ cresent shaped moon is shinning tonight and a few clouds speckle the sky. First moon I saw since Sunday the 7th. It almost looks friendly. Just heard another rumor we are convoying empty vessels to the West Coast - could it be we'll be in California for New Years - I wonder. Everything is relatively quiet so far this evening. Time 7:30 P.M. First war pictures of the attack on Pearl Harbor came out in the papers today.

21 December 1941.

Additional data - shifted into blues this evening. Set the clock ahead ½ hour, so at last we're traveling towards the West Coast. Course 069. Ships rendezvous tomorrow at sunrise in lat. 27-10; long. 56-10. What beats me is the fact we we're stationed at Pearl Harbor for nearly two years toward off Japs attacks and after it is all over with the Japs head for home and so do we -- that thought moves me to repeat a verse I heard:

22 December 1941.

Two weeks ago today the war started. After gettin underway for sea

Document from the Pearl Harbor Dispatch Special Collection which details the attack and the days following it.

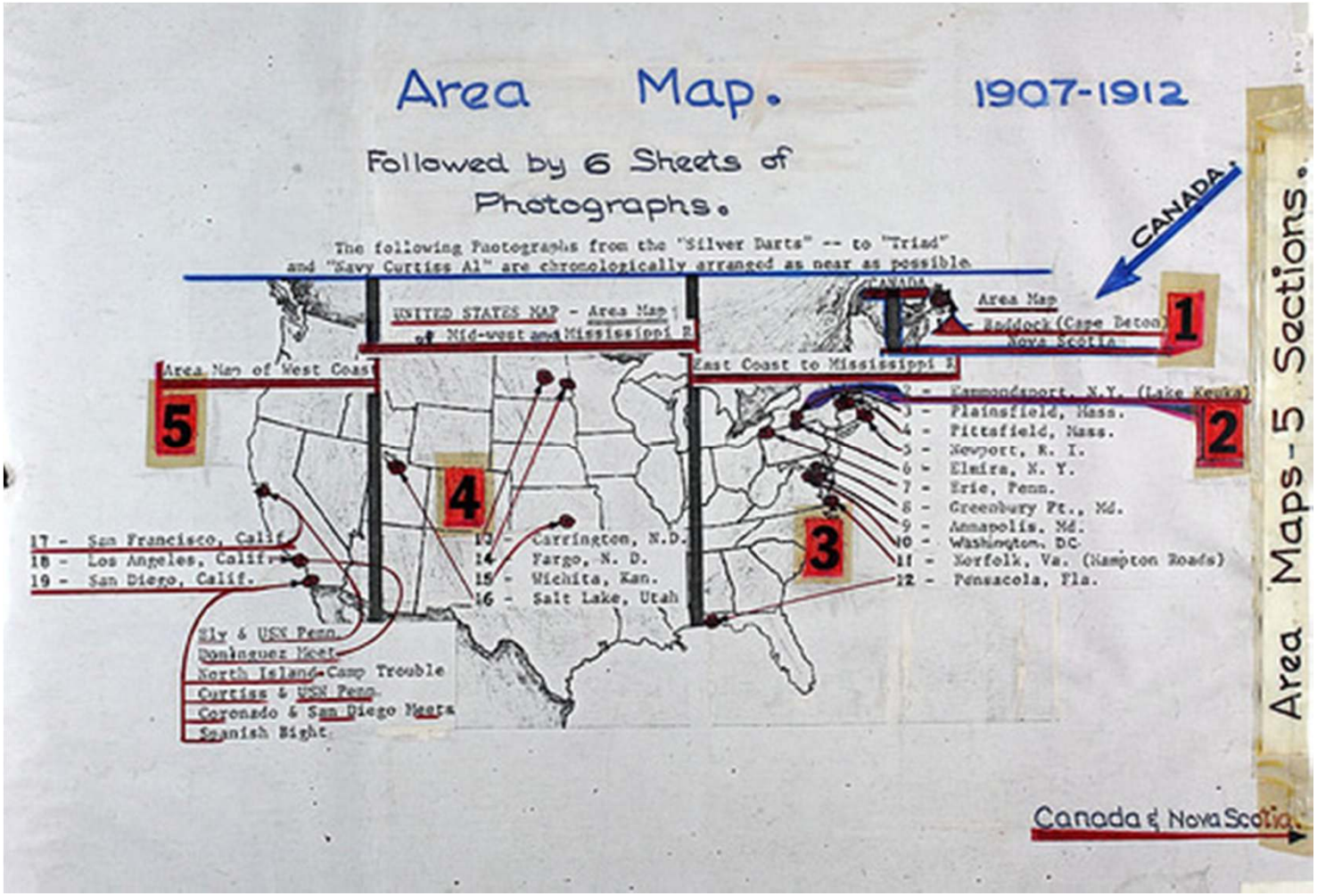


Image from a photo album (AL-27) which belonged to Ray Fife, a pioneer aviation mechanic who built a complete plane at age 16. In 1963 he built a reproduction Curtiss Pusher Biplane. This album documents the building of the pusher and also contains photos used to research the project.

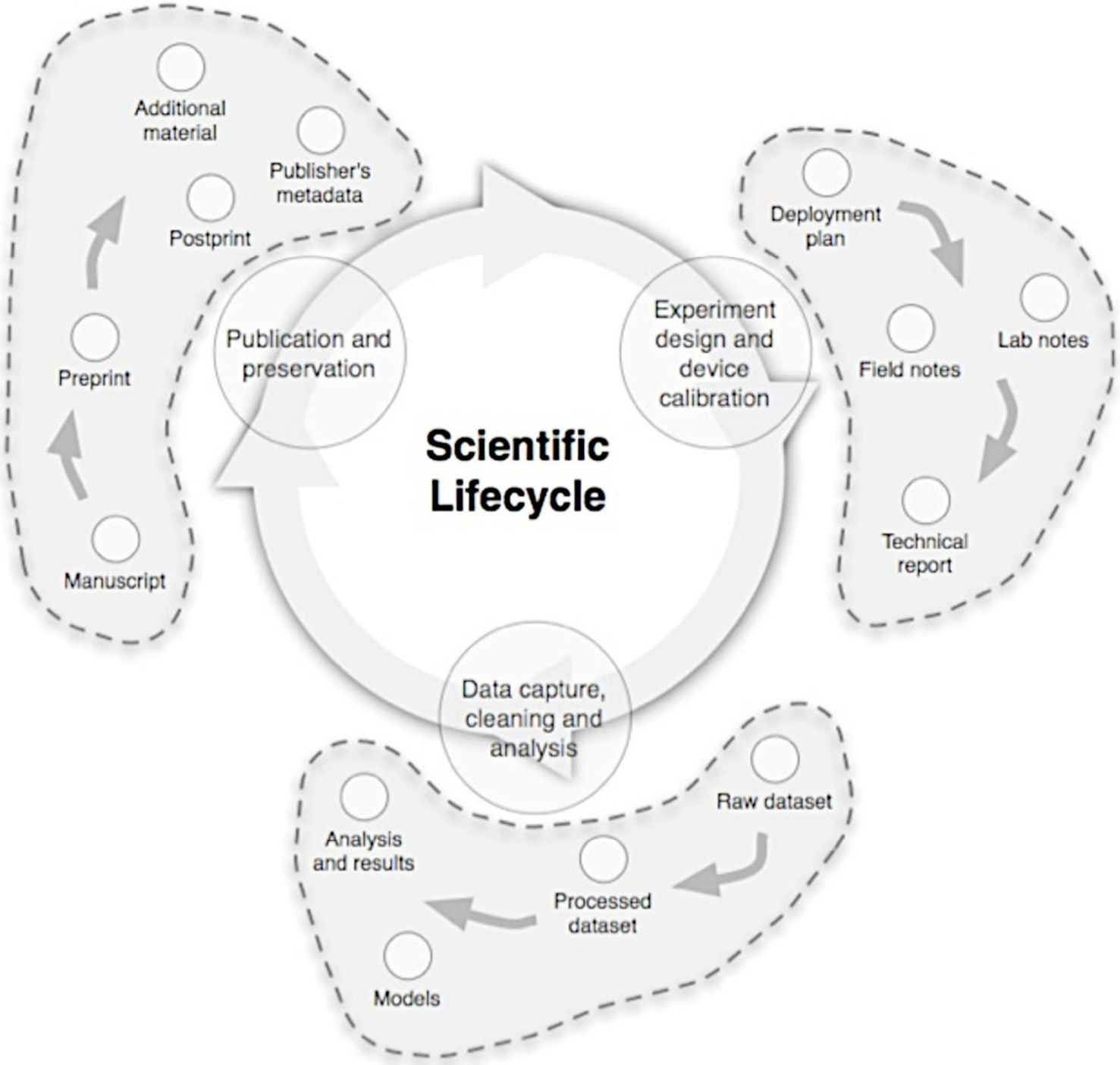
Provenance



- Libraries: Origin or source
- Museums: Chain of custody
- Internet: Provenance is information about entities, activities, and people involved in producing a piece of data or thing, which can be used to form assessments about its quality, reliability or trustworthiness.*

*World Wide Web Consortium (W3C) Provenance working group

Bestiary - caption: 'Owl mobbed by smaller birds'



Pepe, A., Mayernik, M. S., Borgman, C. L. & Van de Sompel, H. (2010). From Artifacts to Aggregations: Modeling Scientific Life Cycles on the Semantic Web. Journal of the American Society for Information Science and Technology, 61(3): 567–582.

Open Data

- Openness, flexibility, transparency, legal conformity, protection of intellectual property, formal responsibility, professionalism, interoperability, quality, security, efficiency, accountability, and sustainability.

Organization for Economic Cooperation and Development. (2007). *OECD Principles and Guidelines for Access to Research Data from Public Funding* (pp. 1–24). http://www.oecd.org/dataoecd/9/61/38500813.pdf

Discovery and Interpretation

- Identify the form and content
- Identify related objects
- Interpret
- Evaluate
- Open
- Read
- Compute upon
- Reuse
- Combine
- Describe
- Annotate…

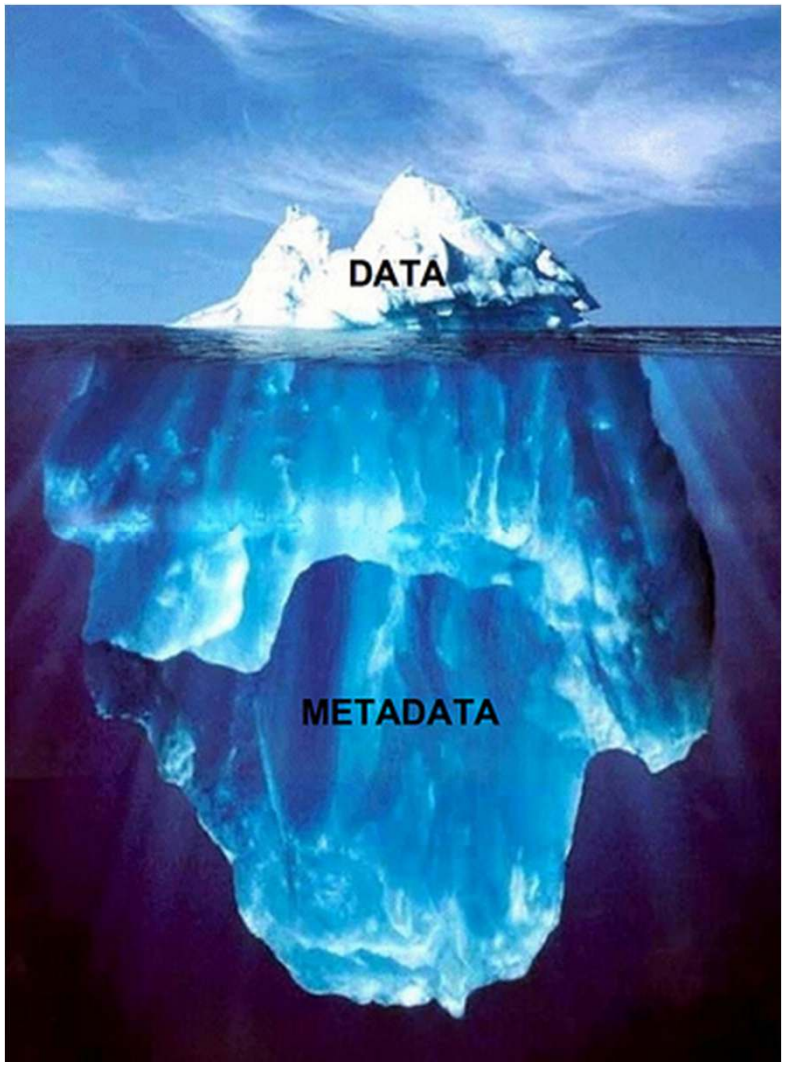
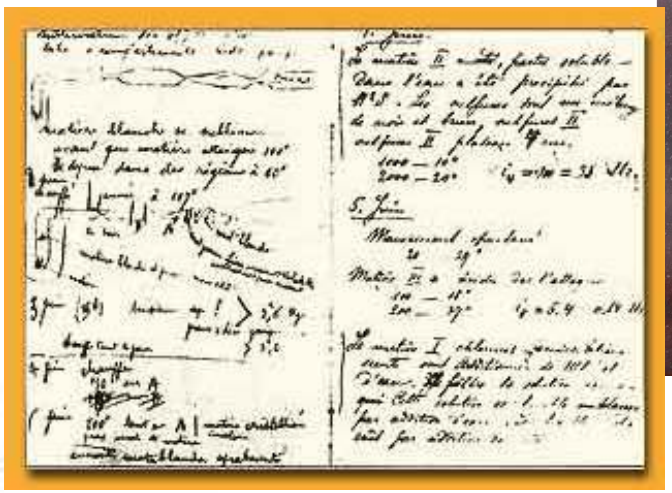


Image from Soumitri Varadarajan blog. Iceberg image © Ralph A. Clevenger. Flickr photo

What are data?



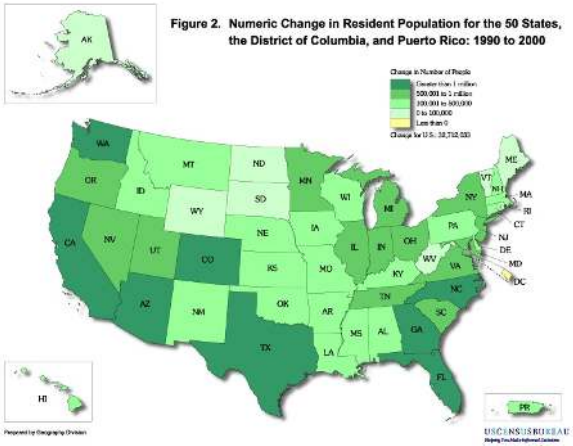
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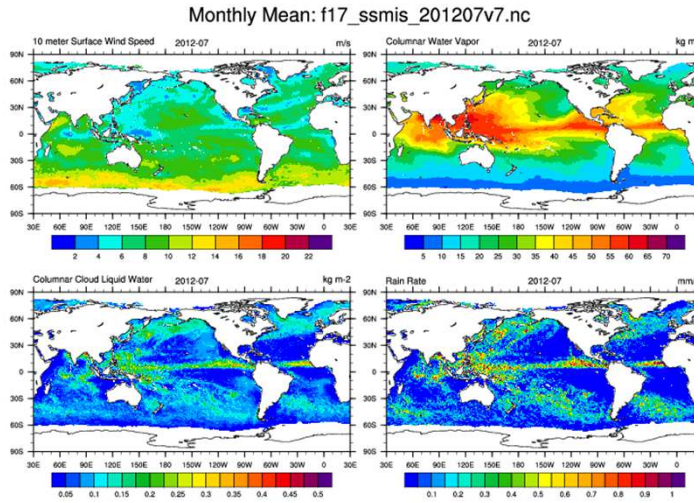
Marie Curie's notebook aip.org



NASA Astronomy Picture of the Day



http://www.census.gov/population/cen2000/map02.gif



ncl.ucar.edu

Date:1/2.07.75 Place:Sakaltutan
Zafor
He will grow old in his present house; new house is for sons - 5 sons. Not sure they want to live in village. He will only build another if they want him to. eS came from Germany and did the plastering. He arranged the carpentry in Kayseri. Çok para gitti. {much money went} Has a tractor.

Date:July1980 Place:Sakaltutan
Zafor:
Household now Zafor and wife; Nazif Unal and wife and youngest son, still a boy. They run two dolmuß; one with a driver from Süleymanli. Goes in and out once a day. He gets 8,000 a month. Zafor then said, keskin de©il. { not sharp - i.e.? not profitable} I said he did very well on 8,000 TL with only two journeys a day. Nazif Unal has "bought" a Durak {dolmuß stop} from Belediye and works all day in Kayseri.

http://onlineqda.hud.ac.uk/Intro_QDA/Examples_of_Qualitative_Data.php



LETTERS

A role for self-gravity at multiple length scales in the process of star formation

Alyssa A. Goodman[1,2], Erik W. Rosolowsky[2,3], Michelle A. Borkin[1]†, Jonathan B. Foster[2], Michael Halle[1,4], Jens Kauffmann[1,2] & Jaime E. Pineda[3]

Self-gravity plays a decisive role in the final stages of star formation, where dense cores (size ~0.1 parsecs) inside molecular clouds collapse to form star-plus-disk systems[1]. But self-gravity's role at earlier times (and on larger length scales, such as ~1 parsec) is unclear; some molecular cloud simulations that do not include self-gravity suggest that 'turbulent fragmentation' alone is sufficient to create a mass distribution of dense cores that resembles, and sets, the stellar initial mass function[2]. Here we report a 'dendrogram' (hierarchical tree-diagram) analysis that reveals that self-gravity plays a significant role over the full range of possible scales traced by ^{13}CO observations in the L1448 molecular cloud, but not everywhere in the observed region. In particular, more than 90 per cent of the compact 'pre-stellar cores' traced by peaks of dust emission[3] are projected on the sky within one of the dendrogram's self-gravitating 'leaves'. As these peaks mark the locations of already-forming stars, or of those probably about to form, a self-gravitating cocoon seems a critical condition for their existence. Turbulent fragmentation simulations without self-gravity—even of unmagnetized isothermal material—can yield mass and velocity power spectra very similar to what is observed in clouds like L1448. But a dendrogram of such a simulation[4] shows that nearly all the gas in it (much more than in the observations) appears to be self-gravitating. A potentially significant role for gravity in 'non-self-gravitating' simulations suggests inconsistency in simulation assumptions and output, and that it is necessary to include self-gravity in any realistic simulation of the star-formation process on subparsec scales.

Spectral-line mapping shows whole molecular clouds (typically tens to hundreds of parsecs across, and surrounded by atomic gas) to be marginally self-gravitating[5]. When attempts are made to further break down clouds into pieces using 'segmentation' routines, some self-gravitating structures are always found on whatever scale is sampled[6,7]. But no observational study to date has successfully used one spectral-line data cube to study how the role of self-gravity varies as a function of scale and conditions, within an individual region.

Most past structure identification in molecular clouds has been explicitly non-hierarchical, which makes difficult the quantification of physical conditions on multiple scales using a single data set. Consider, for example, the often-used algorithm CLUMPFIND[8]. In three-dimensional (3D) spectral-line data cubes, CLUMPFIND operates as a watershed segmentation algorithm, identifying local maxima in the position–position–velocity (p–p–v) cube and assigning nearby emission to each local maximum. Figure 1 gives a two-dimensional (2D) view of L1448, our sample star-forming region, and Fig. 2 includes a CLUMPFIND decomposition of it based on ^{13}CO observations. As with any algorithm that does not offer hierchically nested or overlapping features as an option, significant emission found between prominent clumps is typically either appended to the nearest clump or turned into a small, usually 'pathological', feature needed to encompass all the emission being modelled. When applied to molecular-line



Figure 1 | Near-infrared image of the L1448 star-forming region with contours of molecular emission overlaid. The channels of the colour image correspond to the near-infrared bands J (blue), H (green) and K (red), and the contours of integrated intensity are from ^{13}CO(1–0) emission[9]. Integrated intensity is monotonically, but not quite linearly (see Supplementary Information), related to column density[10], and it gives a view of 'all' of the molecular gas along lines of sight, regardless of distance or velocity. The region within the yellow box immediately surrounding the protostars has been imaged more deeply in the near-infrared (using Calar Alto) than the remainder of the box (2MASS data only), revealing protostars as well as the scattered starlight known as 'Cloudshine'[11] and outflows (which appear orange in this colour scheme). The four billiard-ball labels indicate regions containing self-gravitating dense gas, as identified by the dendrogram analysis, and the leaves they identify are best shown in Fig. 2a. Asterisks show the locations of the four most prominent embedded young stars or compact stellar systems in the region (see Supplementary Table 1), and yellow circles show the millimetre-dust emission peaks identified as star-forming or 'pre-stellar' cores[3].

Initiative in Innovative Computing at Harvard, Cambridge, Massachusetts 02138, USA. [2]Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts 02138, USA. [3]Department of Physics, University of British Columbia, Okanagan, Kelowna, British Columbia V1V 1V7, Canada. [4]Surgical Planning Laboratory and Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts 02115, USA. †Present address: School of Engineering and Applied Sciences, Harvard University, Cambridge, Massachusetts 02138, USA.

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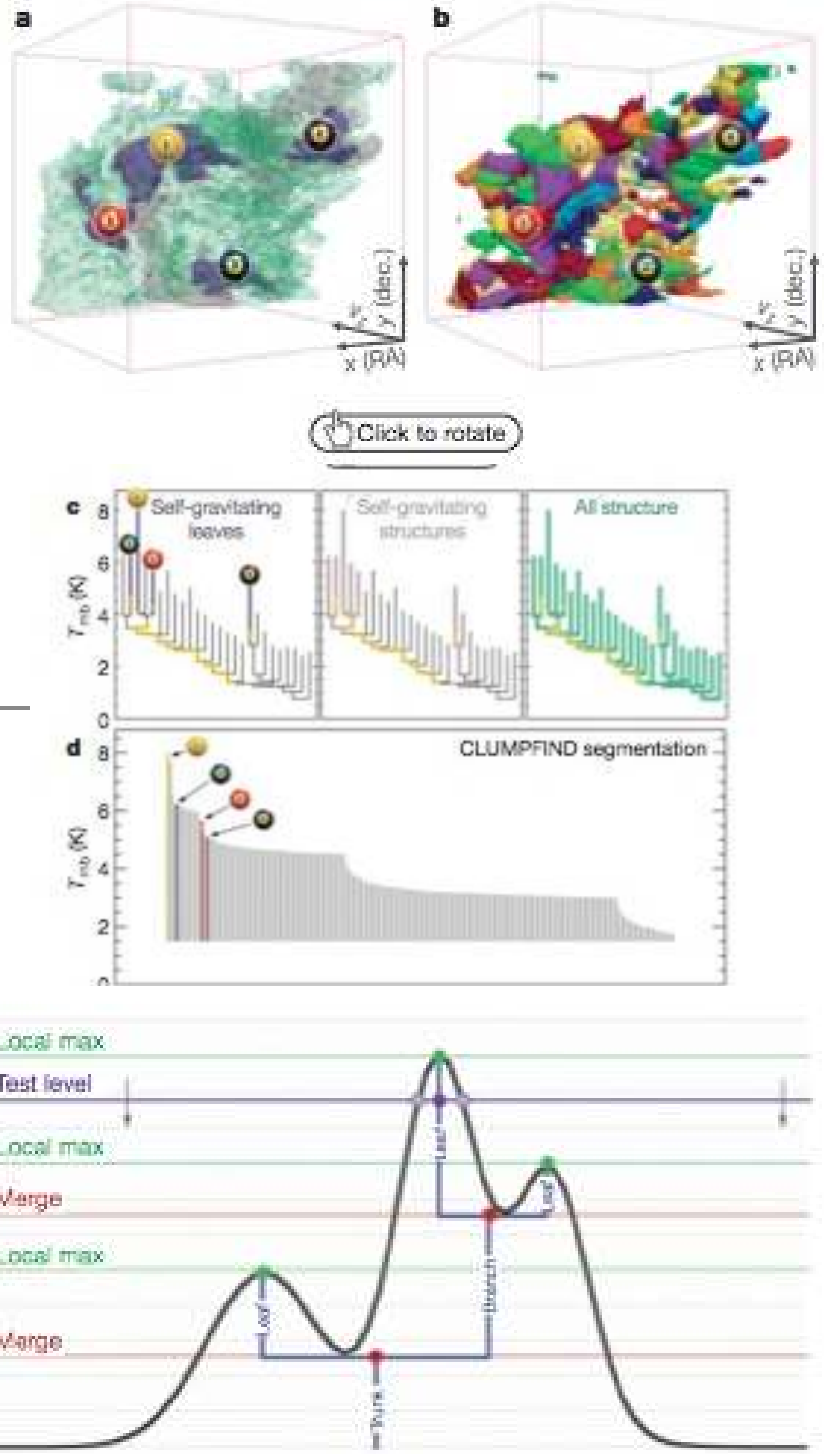
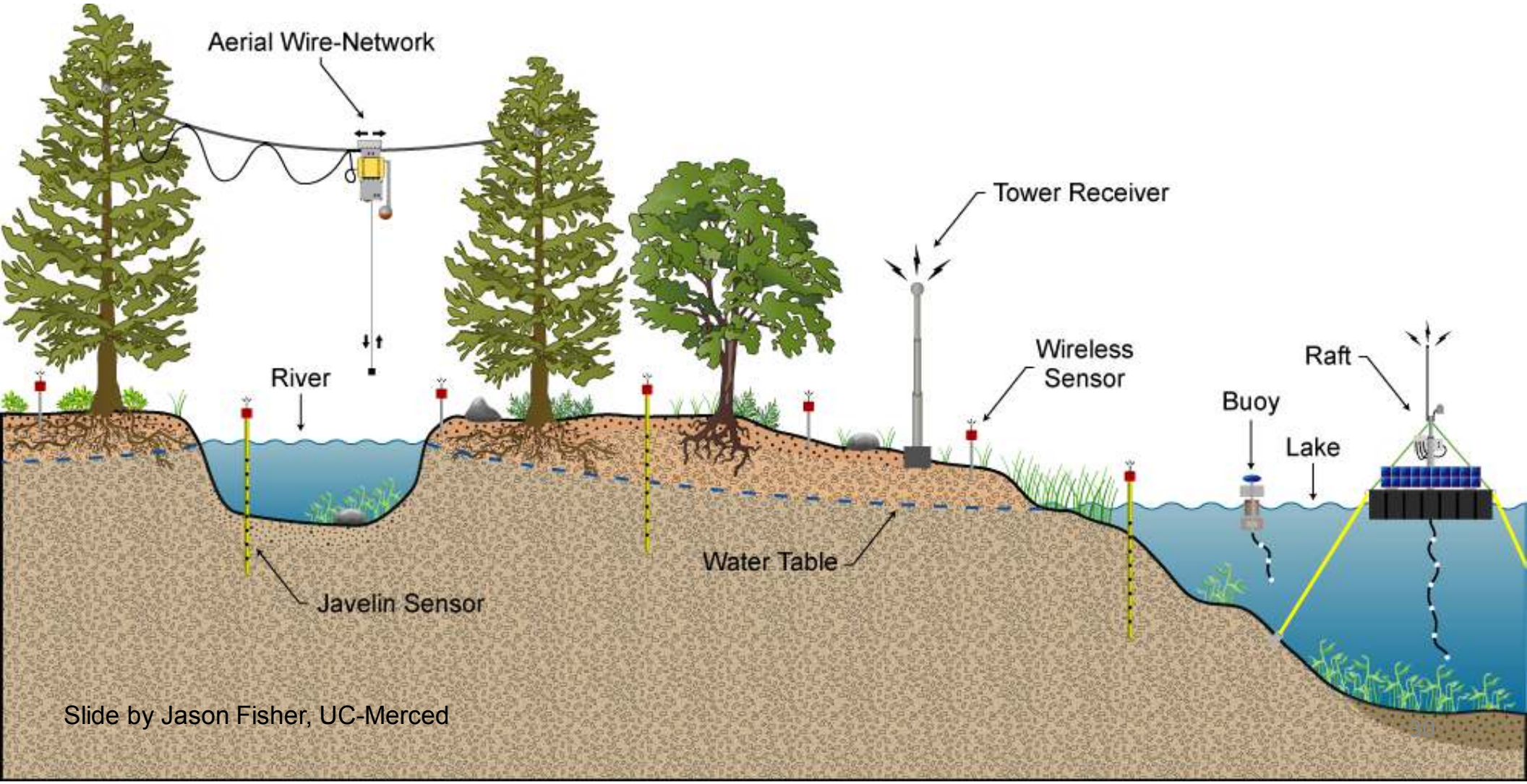


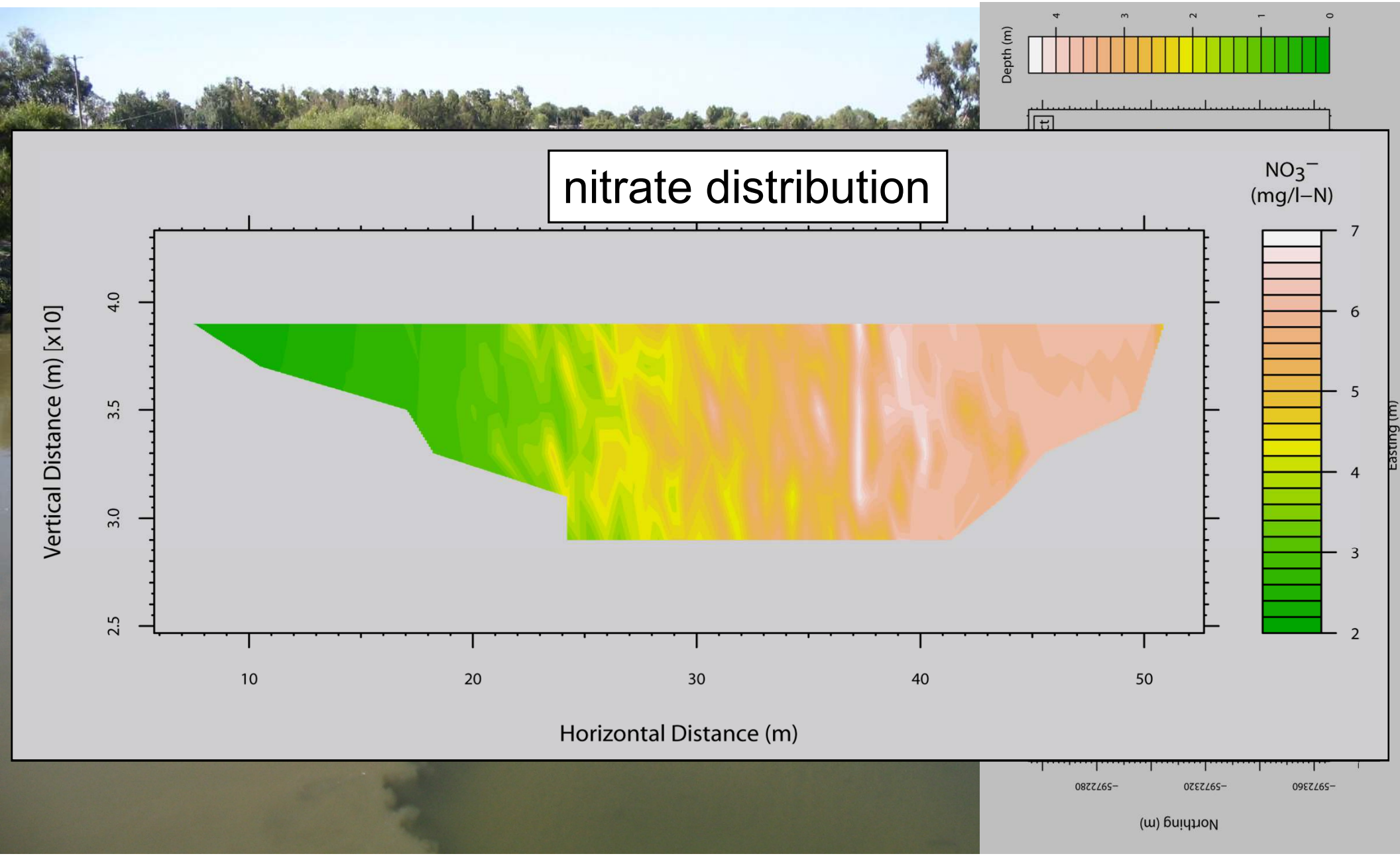
Figure 3 | Schematic illustration of the dendrogram process. Shown is the

Sensor networked science



Slide by Jason Fisher, UC-Merced

Sensor network data



Social science data

56. Generally speaking, do you usually think of yourself as a Republican, Democrat, Independent, or what?

RESPONSE	PUNCH	YEAR									COL: 240
		1972-82	1982B	1983-87	1987B	1988-91	1993	1994	1996	1998	ALL
Strong Democrat	0	2197	143	1271	151	864	227	423	400	370	6,046
Not very strong Democrat	1	3482	109	1655	89	1,282	321	644	577	597	8,756
Independent, close to Democrat	2	1768	44	904	51	578	190	341	356	349	4,581
Independent (Neither, No response)	3	1736	30	855	32	721	205	369	457	477	4,882
Independent, close to Republican	4	1106	8	743	9	571	158	282	258	244	3,379
Not very strong Republican	5	2011	8	1259	15	1,170	299	519	500	484	6,265
Strong Republican	6	1009	8	751	2	662	180	321	307	239	3,479
Other party, refused to say	7	243	0	75	1	44	17	44	43	63	530
Don't know	8	10	0	0	0	0	0	0	0	0	10
No answer	9	64	4	29	3	15	9	49	6	9	188

See Appendix D: Recodes, for original question format and method of recoding. See Appendix N for changes across surveys. If planning to perform trend analysis with this variable, please consult GSS Methodological Report No. 56.

http://dss.princeton.edu/images/gss.gif

Social science data

56. Generally speaking, do you usua … Independent, or what?

RESPONSE	PUN				COL: 240
			1994	1996	1998	ALL
Strong Democrat		27	423	400	370	6,046
Not very strong Democrat		21	644	577	597	8,756
Independent, close to Democrat		10	341	356	349	4,581
Independent (Neither, No response)		15	369	457	477	4,882
Independent, close to Republican		8	282	258	244	3,379
Not very strong Republican		19	519	500	484	6,265
Strong Republican		10	321	307	239	3,479
Other party, refused to say		7	44	43	63	530
Don't know		0	0	0	0	10
No answer		9	49	6	9	188

See Appendix D: Recodes, for origi … Appendix N for changes across surveys. If planning to perfor … GSS Methodological Report No. 56.



http://dss.princeton.edu/images/gss.gif

Humanities data



karmāntājīvā virahitākuśalakāyavāṅmanas-karmāntājīvāś[109] ca bhavanti sma

§ 1.66 (147c 28-148a 1)

一切衆生得平等心，展轉相瞻如父、如母、如兄、如弟、如姊、如妹，各各同心，等無偏邪，皆行慈心。

PG 4r 4-5 (Ś 18, 22-19, 1; PD 10, 1-2; PSL *kā* a 4-5): sarvasatvāś ca sarvasatveṣu samacittā abhūvan* yad uta[110] mātāpitṛbhrātṛbhaginisamacittāḥ mitrajñātisahāyasamacittāḥ[111]

§ 1.67 (148a 1-2)

一切群萌悉修十善，清淨梵行，無有塵埃。

PD 10, 2-3 (PG 4r 5-6; Ś 19, 2-3; PSL *kā* a 5): daśakuśalakarmapathasevinaś ca bhavanti sma[112] / brahmacāriṇaḥ śucayo nirāmayagandhāḥ[113]

§ 1.68 (148a 2-4)

一切黎庶悉獲安隱，所得安隱猶如比丘得第三禪。于時衆生而致智慧，而悉具足善快調定，離於卑劣，逮得和雅。

PG 4r 6-8 (PD 10, 3-8; PSL *kā* a 5-6; Ś 19, 3-8): sarvasatvās tasmin samaye sarvasukhasamarpitā abhūvan* evaṃrūpeṇa sukhena samanvāgatās[114] tadyathā {s} tṛtīyadhyānasamāpannasya bhikṣoḥ sukhaṃ sarvasatvāś ca tasmin samaye evaṃrūpayā prajñayā samanvāgatā abhūvan* yad evaṃ jānaṃti sma[115] • sādhu dānaṃ sādhu damaḥ sādhu saṃyyamaḥ[116] sādhu satyaṃ • sādhv apramādaḥ sādhu maitrī sādhu karuṇā sādhv avihiṃsā prāṇibhūteṣu[117] •

---

[110] sarvasattvāś ... yad uta: not in PD & PSL.

[111] PG wrongly repeats verbatim this latter compound. PD 10, 2 and PSL have at this point a longer reading: mitrāmātyajñātisālohitasamacittā. Note that Ś has all the words construed as one compound.

[112] PG 4r 5-6 & Ś 19, 2: daśakuśalakarmapa(tha)samanvāgatā [Ś without daśa-] abhūvan.

[113] PG 4r 6, Ś 19, 3 and PSL *kā* a 5: nirāmagandhāḥ, which seems to be the correct reading; after this word, PG & Ś + sarvākuśalavitarkavigatāḥ.

[114] PD 10, 4 & PSL *kā* a 5: idṛśaṃ sukhaṃ pratilabhante sma.

[115] yad ... sma: PD 10, 6 & PSL *kā* a 6: yad anyabuddhakṣetrasthā buddhā bhagavanta evam [PSL + udānam] udānayanti sma.

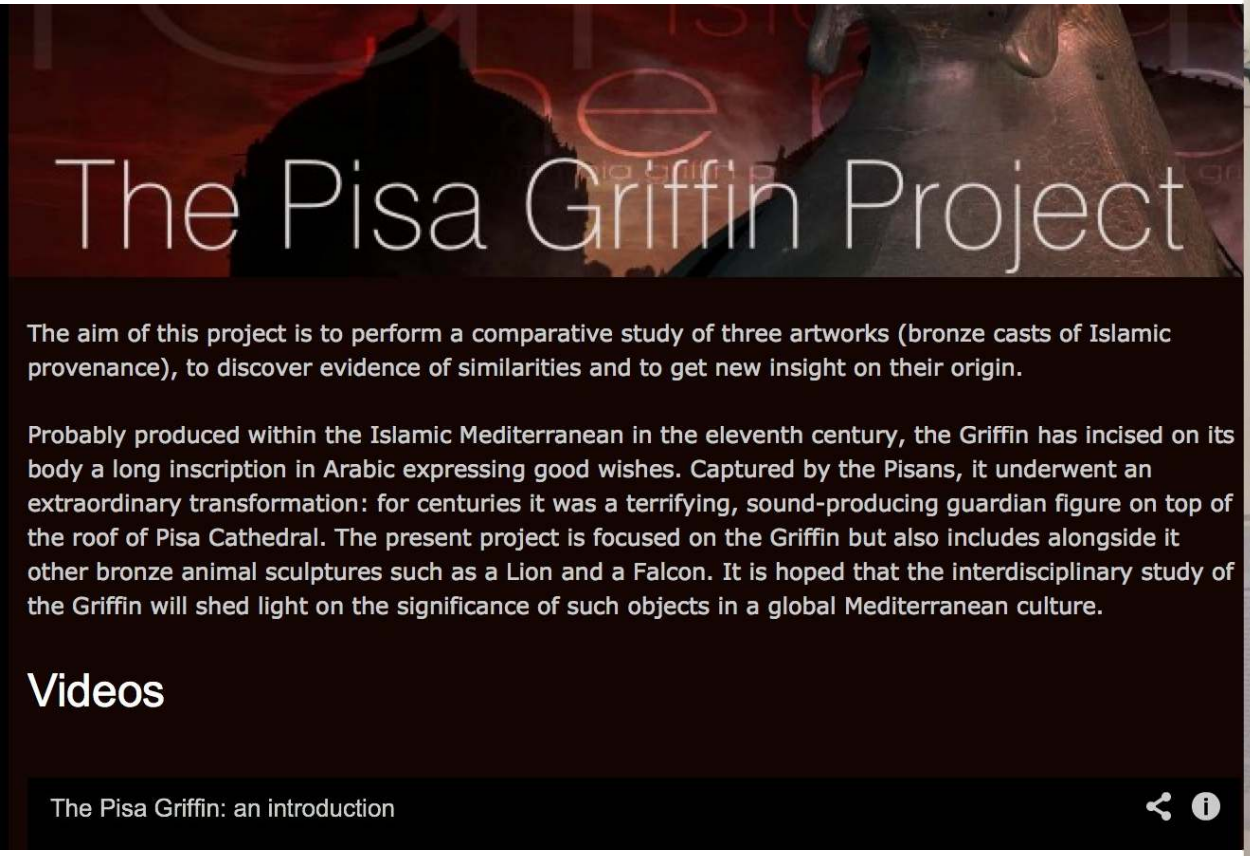
[116] Ś 19, 7: saṃyamaḥ.

[117] sādhu dānaṃ ... prāṇibhūteṣu: PD 10, 7-8 & PSL *kā* a 6: sādhu damaḥ [PSL + sādhu śamaḥ] sādhu saṃyamaḥ sādhu ctṛṇo brahmacaryyāvāsaḥ sādhu prāṇibhūteṣv avihiṃseti.

Zacchetti, S. (2005). In Praise of the Light: A Critical Synoptic Edition with an Annotated Translation of Chapters 1-3 of Dharmaraksa's Guang zan jing, Being the Earliest Chinese Translation of the Larger Prajnaparamita. Tokyo, Japan: The International Research Institute for Advanced Buddhology, Soka University. Retrieved from http://iriab.soka.ac.jp/orc/Publications/BPPB/index_BPPB.html



http://data.clarosnet.org/



http://vcg.isti.cnr.it/griffin/



Arte islamica, ippogrifo, XI sec 03, own work

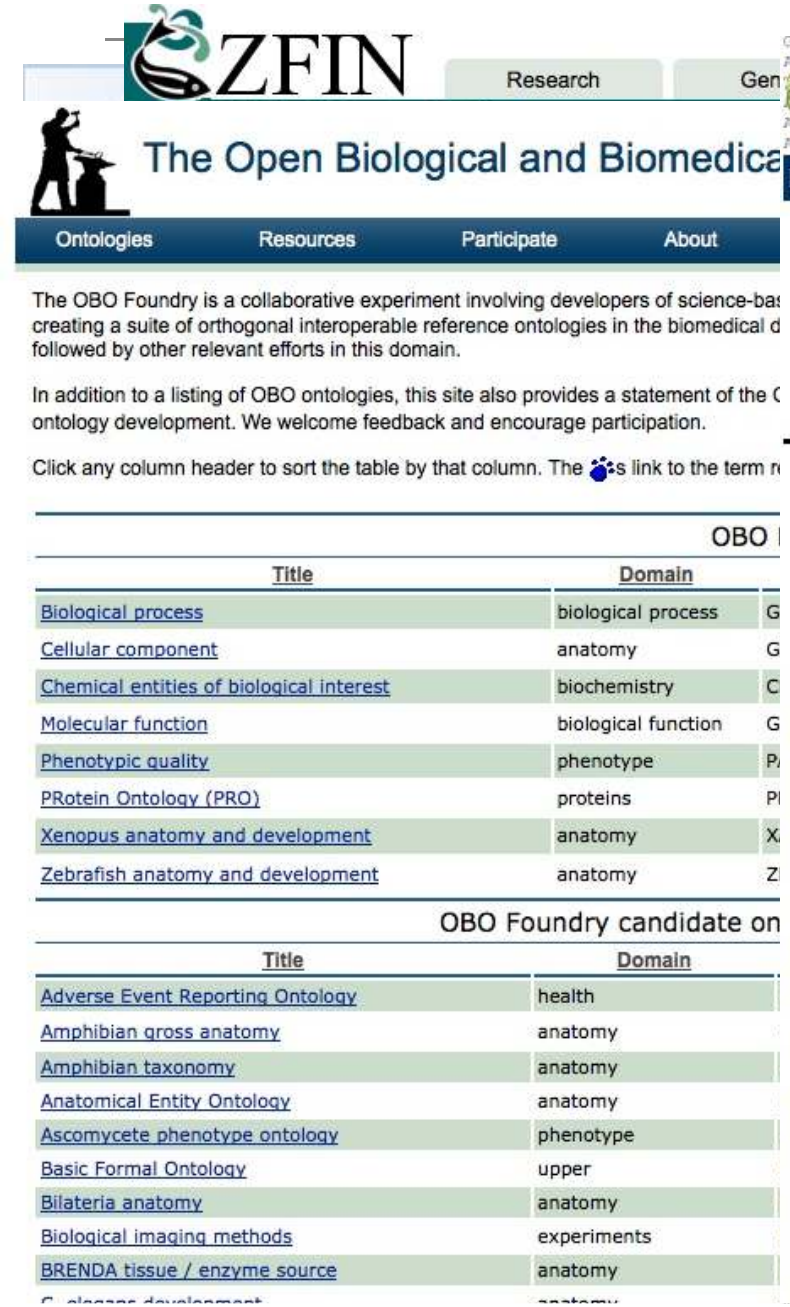


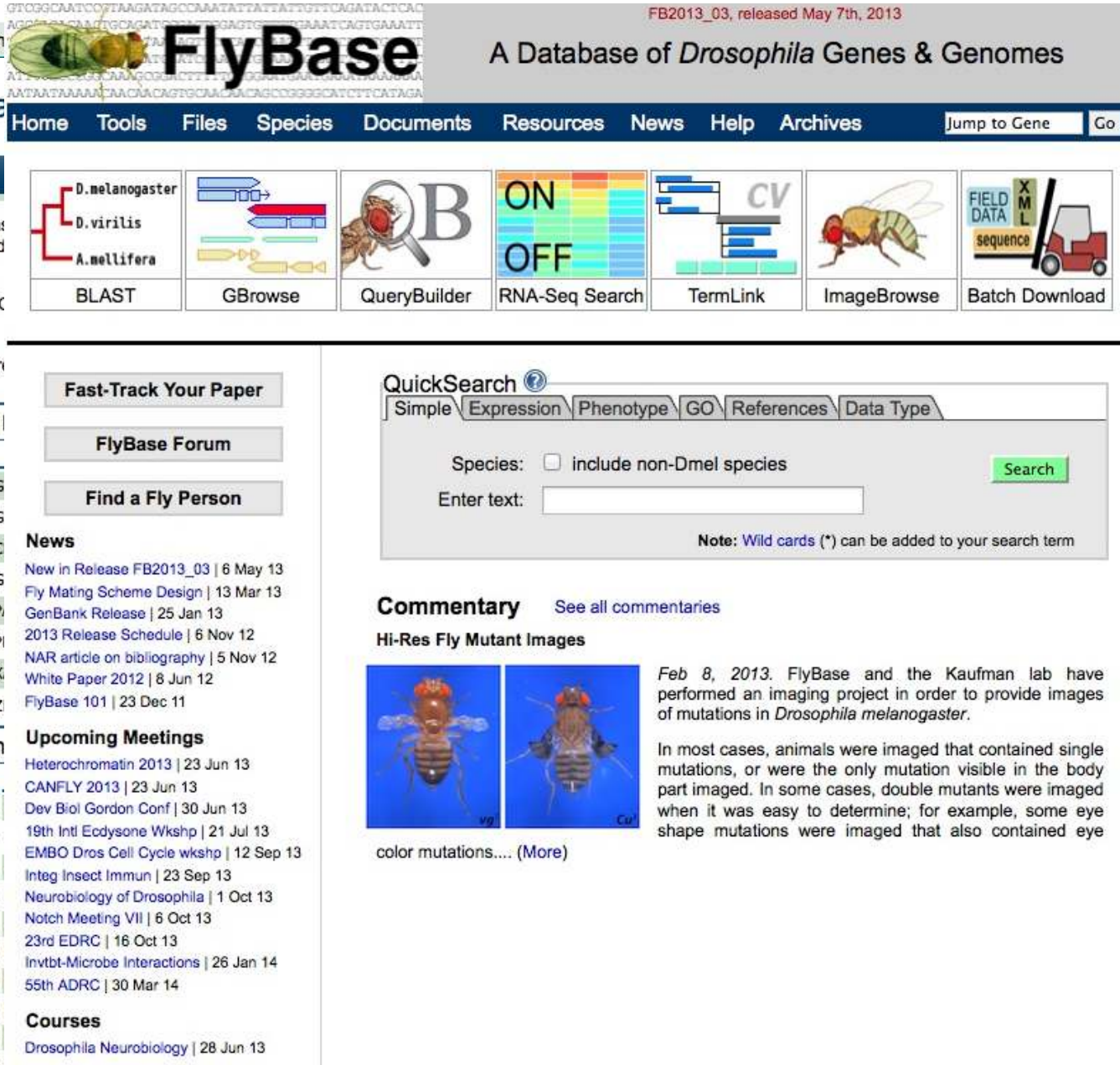
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Data are representations of observations, objects, or other entities used as evidence of phenomena for the purposes of research or scholarship.

C.L. Borgman (2014, forthcoming). *Big Data, Little Data, No Data: Scholarship in the Networked World*. MIT Press

Description and Classification







Precondition:

Researchers share data

Rewards

- Publications
- Publications
- Publications
- Publications
- Publications
- Publications
- Grants
- Awards and honors
- Teaching
- Service
- Data



http://blog.startfreshtoday.com/Portals/170402/images/improve-credit-score1.jpg

Incentives

- Publications that report the research

Vs.

- Data that are reusable by others

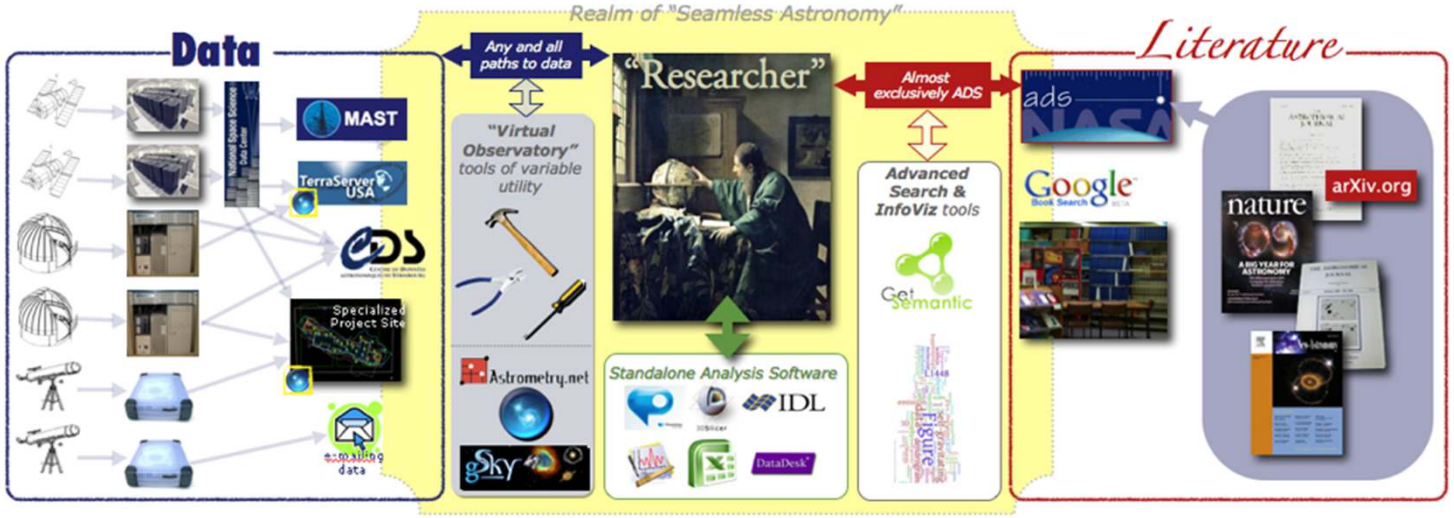


Image: Alyssa Goodman, Harvard Astronomy

Functions of Scholarly Publications

- Legitimization
  - Authority, quality
  - Priority, trustworthiness
- Dissemination
  - Awareness
  - Diffusion
  - Publicity
- Access, preservation, curation
  - Availability
  - Discovery
  - Retrieval
  - Persistence







Borgman, C.L. (2007). Scholarship in the Digital Age: Information, Infrastructure, and the Internet. MIT Press.

Responsibility

Publications are arguments made by authors, and data are the evidence used to support the arguments.



C.L. Borgman (2015). *Big Data, Little Data, No Data: Scholarship in the Networked World*. MIT Press

Responsibility



- Publications
  - Independent units
  - Authorship is negotiated
- Data
  - Compound objects
  - Ownership is rarely clear
  - Attribution
    - Long term responsibility: Investigators
    - Expertise for interpretation: Data collectors and analysts



hudsonalpha.org

Attribution of data

- Legal responsibility
  - Licensed data
  - Specific attribution required
- Scholarly credit: contributorship
  - “Author” of data
  - Contributor of data to this publication
  - Colleague who shared data
  - Software developer
  - Data collector
  - Instrument builder
  - Data curator
  - Data manager
  - Data scientist
  - Field site staff
  - Data calibration
  - Data analysis, visualization
  - Funding source
  - Data repository
  - Lab director
  - Principal investigator
  - University research office
  - Research subjects
  - Research workers, e.g., citizen science…





http://knowledgeinfrastructures.org

Australian National Data Service

Our Vision: More Australian researchers reusing research data more often

ANDS is enabling the transformation of:

Data that are:	to	Structured Collections that are:
Unmanaged	→	Managed
Disconnected	→	Connected
Invisible	→	Findable
Single-use	→	Reusable

More>>

Australian Research Data Commons

ANDS is building the Australian Research Data Commons: a cohesive collection of research resources from all research institutions, to make better use of Australia's research data outputs.

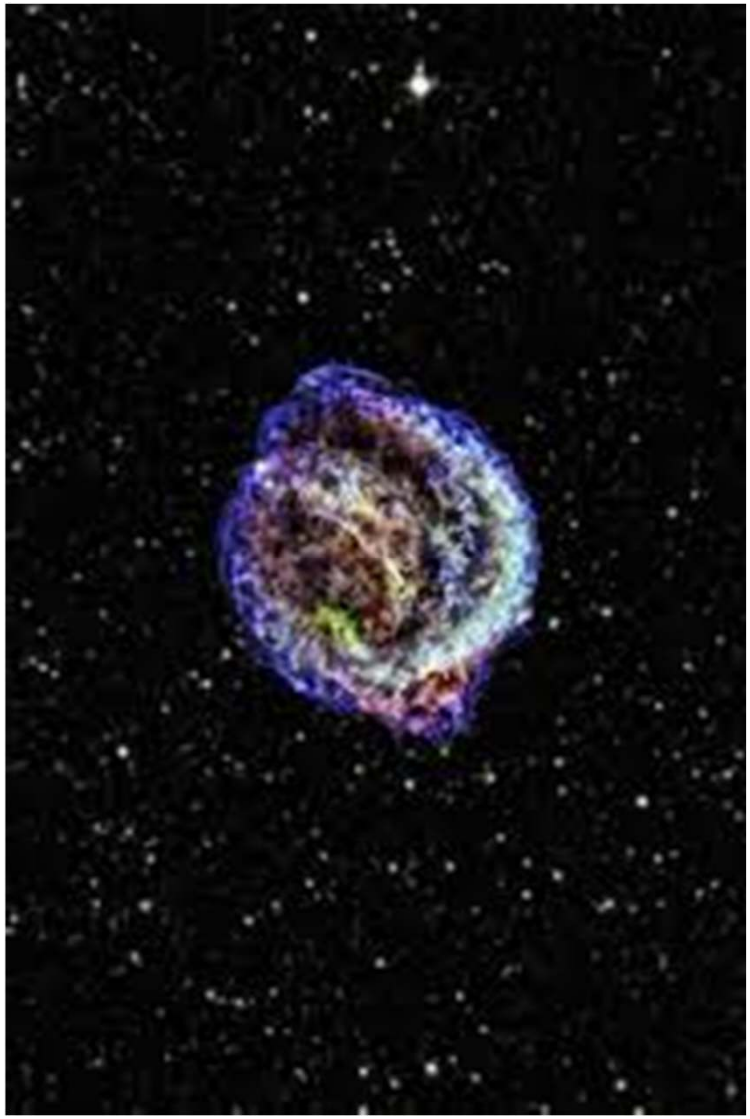
Research Data Australia

Research Data Australia, ANDS' flagship service, provides a comprehensive window into the Australian Research Data Commons. It is an Internet-based discovery service designed to provide rich connections between data, projects, researchers and institutions, and promote visibility of Australian research data collections in search engines.

Search for research data on researchdata.ands.org.au

Reuse across place and time

- Reuse by investigator
- Reuse by collaborators
- Reuse by colleagues
- Reuse by unaffiliated others
- Reuse at later times
  - Months
  - Years
  - Decades
  - Centuries



http://chandra.harvard.edu/photo/2013/kepler/kepler_525.jpg

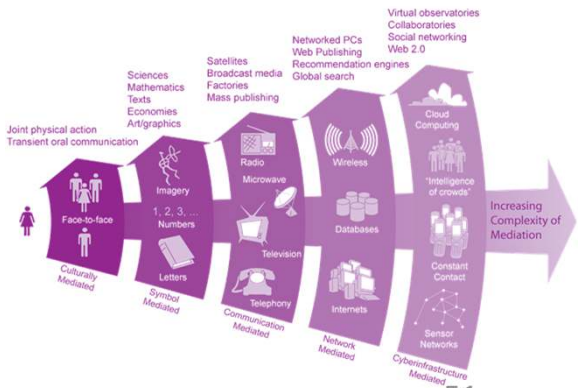
Economics of the Knowledge Commons

	Subtractability / Rivalry		
		Low	High
Exclusion	Difficult	**Public Goods** General knowledge Public domain data	**Common-pool resources** Libraries Data archives
	Easy	**Toll or Club Goods** Subscription journals Subscription data	**Private Goods** Printed books Raw or competitive data

Adapted from C. Hess & E. Ostrom (Eds.), *Understanding knowledge as a commons: from theory to practice*. Cambridge, Mass.: MIT Press.

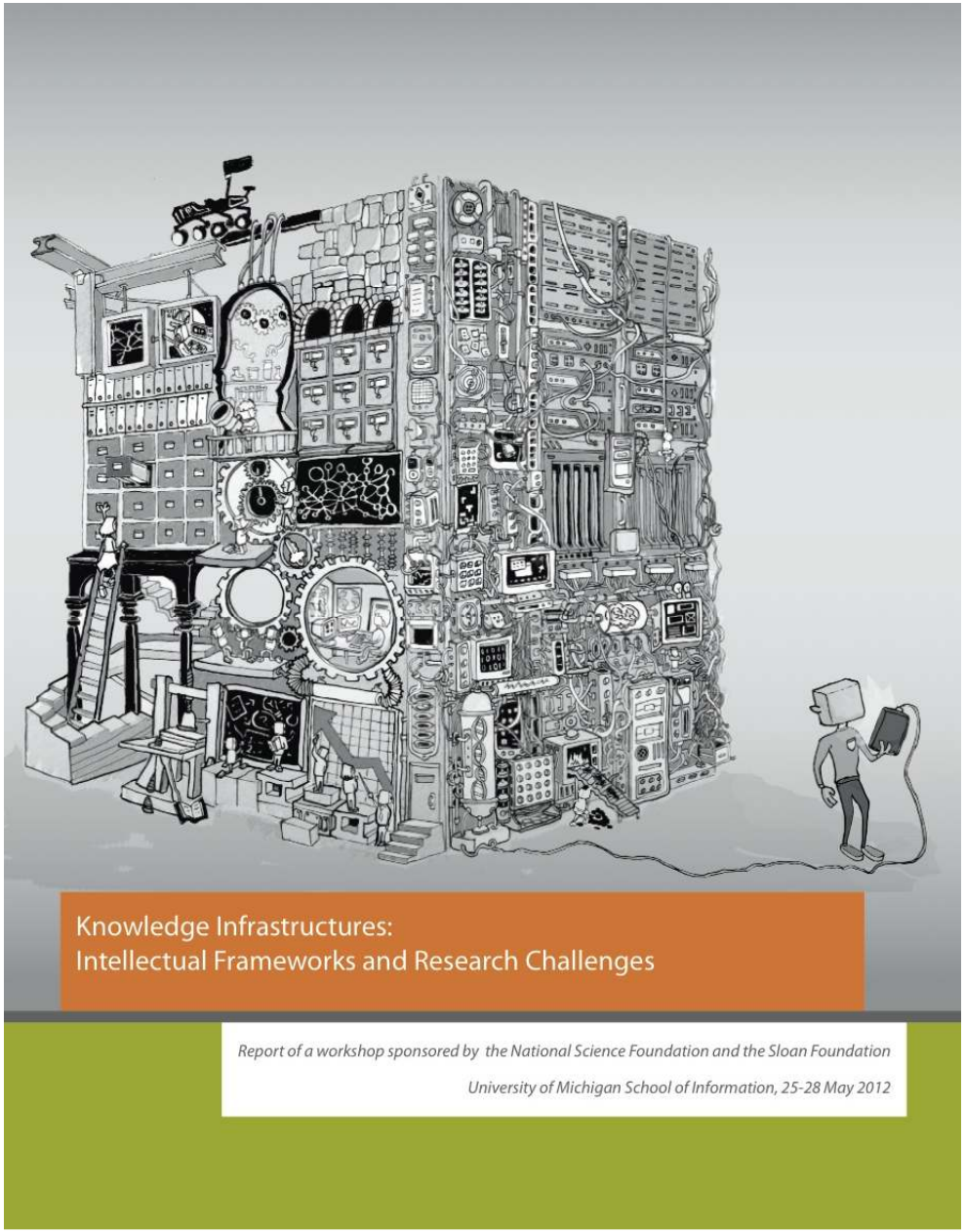
Conclusions

- Stakeholders
- Economics
- Sustainability
- Knowledge infrastructures



Stakeholders in digital stewardship

- Scholars
- Students
- Readers / public at large
- Universities
- Funding agencies
- Repositories
- Governments
- Private enterprise
- Libraries
- Archives
- Museums…



Economics of knowledge commons

- Private goods
- Common-pool resources
- Toll or club goods
- Public goods



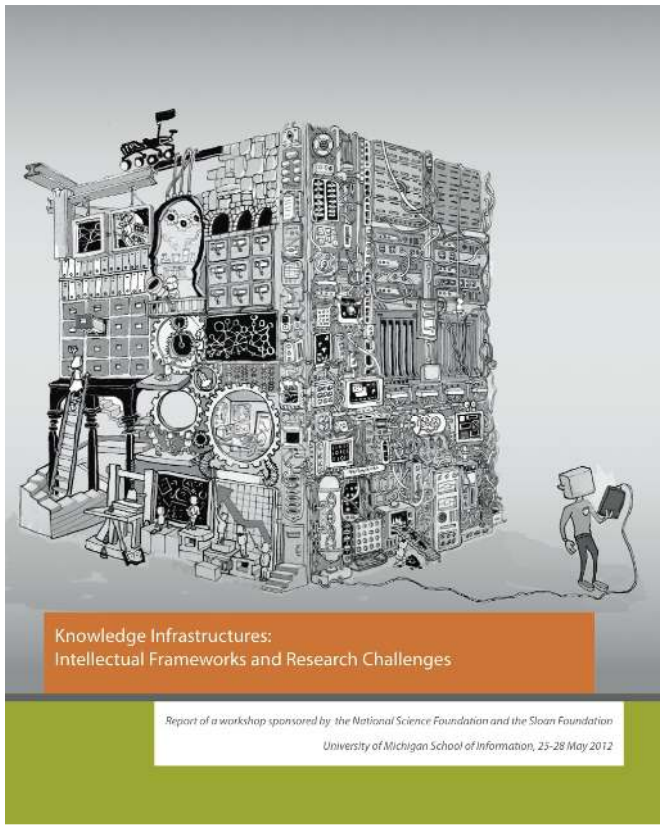
Sustainability

- What to keep
- Why to keep them
- How to keep them
- How long to keep them
- Who will govern them
- How to manage free riders
- What kinds of expertise are required



Knowledge Infrastructures

- Technical fabric
  - Data archives
  - Metadata, provenance, classification, collections
  - Tools, services, support
- Social fabric
  - Data curation workforce
  - Digital stewardship workforce
- Trust fabric
  - Memory institutions
  - Stewardship



Sewing with the Needle in the Haystack

- Add value to data early and often
  - Metadata
  - Provenance
- Invest in tools and services for interpretation
- Anticipate reuses
- Support serendipity



Uploaded by the State Library and Archives of Florida on October 21, 2010; Taken in Florida. Title: Cowpea and Beggarweed hay being stacked

Acknowledgements

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