

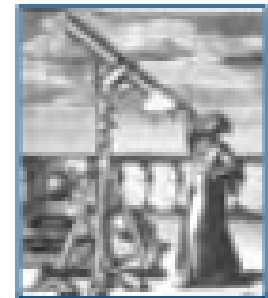
Data: Its rising importance in research, and where to find it



*Bradley Gulliford, MS/IRM
Data Management & Curation
University of Texas at Arlington*

Science Paradigms

- Thousand years ago:
science was **empirical**
describing natural phenomena
- Last few hundred years:
theoretical branch
using models, generalizations
- Last few decades:
a **computational** branch
simulating complex phenomena
- Today: **data exploration** (eScience)
unify theory, experiment, and simulation
 - Data captured by instruments
or generated by simulator
 - Processed by software
 - Information/knowledge stored in computer
 - Scientist analyzes database/files
using data management and statistics



$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{4\pi G\rho}{3} - K\frac{c^2}{a^2}$$

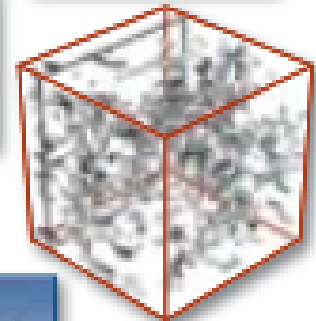


FIGURE 1

The Approximation Tower in Computational Science: Why Testing Scientific Software Is Difficult

Hinsen, Konrad

Jun-23
2015

Citizen Science with Hubble Space Telescope Data

Christian, Carol

Jun-23
2015

Open XDMoD: A Tool for the Comprehensive Management of High-Performance Computing Resources

Palmer, Jeffrey T. ; Gallo, Steven M. ; Furlani, Thomas R. ; Jones, Matthew D. ; DeLeon, Robert L. ; White, Joseph P. ; Simakov, Nikolay ; Patra, Abani K. ; Sperhac, Jeanette ; Yearke, Thomas ; Rathsam, Ryan ; Innus, Martins ; Cornelius, Cynthia D. ; Browne, James C. ; Barth, William L. ; Evans, Richard T.

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Defining and Measuring Success in Online Citizen Science: A Case Study of Zooniverse Projects

Cox, Joe ; Oh, Eun Young ; Simmons, Brooke ; Lintott, Chris ; Masters, Karen ; Greenhill, Anita ; Graham, Gary ; Holmes, Kate

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Citizen-Based Litter and Marine Debris Data Collection and Mapping

Jambeck, Jenna R. ; Johnsen, Kyle

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Cloud-Based Software Platform for Big Data Analytics in Smart Grids

Simmhan, Y. ; Aman, S. ; Kumbhare, A. ; Rongyang Liu ; Stevens, S. ; Qunzhi Zhou ; Prasanna, V.

Nov-14
2013

Big Data Applications Using Workflows for Data Parallel Computing

Jianwu Wang ; Crawl, D. ; Altintas, I. ; Weizhong Li

Aug-19
2014

Writing Software Specifications

Hinsen, K.

Apr-22
2015

Python for Scientific Computing

Oliphant, Travis E.

Jun-18
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Heinrich, J. ; Weiskopf, D.

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2015

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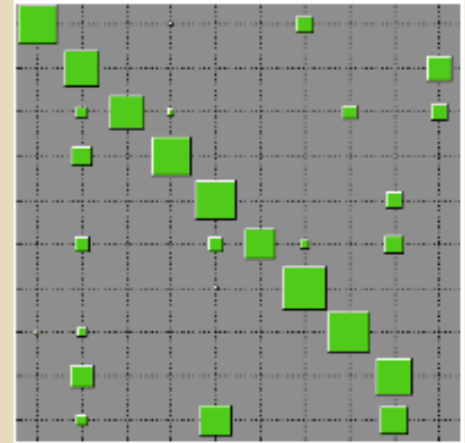


Data Science Lab

Location: ERB306, ERB204

Leading Faculty: [Heng Huang](#), [Chris Ding](#)

Mission: Our lab focuses on developing machine learning and big data mining algorithms to solve the applications in health informatics, bioinformatics, computer vision, neuroinformatics, natural language processing, medical image computing, information retrieval, and computational sustainability.



Database Exploration Laboratory (DBXLAB)

Location: ERB 514

Leading Faculty: [Gautam Das](#)

Mission: At Database Exploration Lab (DBXLab), we seek to investigate fundamental research issues arising in Big Data. Our research encompasses diverse areas such as data mining, information retrieval, data uncertainty and probabilistic methods, approximate query processing, data summarization, data analytics and data exploration of hidden web databases, social and collaborative media.



Master of Science in Business Analytics (MSBA) - A STEM Program

The MSBA offers a blend of technical expertise and business knowledge.

Designed in conjunction with an advisory board comprising top-performing companies in the region, the MSBA

- Emphasizes solving practical analytical problems from diverse disciplines, including healthcare, marketing, accounting, finance, economics, and human resources
- Affords an opportunity to engage with a company and work on a real-world problem through a project-based capstone course
- Stresses a holistic view of data, continually reminding students of the need to integrate outside sources of data (e.g., social media, social graphs) and internal data to acquire business and/or marketing intelligence.

The MSBA addresses a growing demand.

According to [Venture Beat News](#), the big data industry is expected to be a \$53.4 billion industry by 2016.

Industry predictions point to a shortage of data-knowledgeable employees. [McKinsey Global Institute \(MGI\)](#) projects that by 2018 the United States may face a 50 to 60 percent gap between supply and the requisite demand of deep analytic talent, i.e., people with advanced training in statistics or machine learning.

The MSBA significantly increases your marketability.

Be prepared for such jobs as data analyst, data scientist, big data architect, and analytics manager. As reported by [Data Jobs.com](#) Data Scientist salaries can range from \$85,000 to \$170,000 while salaries for Data Science/Analytics Manager can range from \$90,000 to \$240,000 depending on the number of reporting employees. And, the field is expanding.

New initialism!

(Oh, joy.)

Social,

Behavioral, and

Economic



Actual data sites

More to come!

- [Dataverse Network](#)
Open Source Web application for sharing, citing, analyzing, and preserving research data. Various universities participate in the network.
- [Data.gov](#)
Data sets generated and held by the U.S. government, including Census, NOAA, USGS. University and state government data sets are available also.
- [Dryad](#)
Biological data collection service run by University of North Carolina Metadata Research Center
- [Protein Data Bank](#)
Research Collaboratory for Structural Bioinformatics
- [NOAA Satellite and Information Service](#)
National Environmental Satellite, Data, and Information Service--extensive data offerings
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For the social sciences and humanities.
- [Data repositories](#)
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Data repositories linking to MEDLINE (PubMed) citations.

University sites

More than data files.

UT Arlington pages

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 - [Statistics & Data Resource Guide](#)
- [D0SAR](#) (Distributed Organization for Scientific and Academic Research)

[University of Oregon Research Data Management](#)

[University of Alberta Data Library](#)

[Columbia University Center for Digital Research and Scholarship](#) promotes publishing as well as maintains digital repository

[Islandora](#) , a robust digital asset management system developed by the University of Prince Edward Island library using Drupal (content management [linking]) and Fedora (content management [linking, large collection management]) software

[Indiana University Data to Insight Center](#)

[MIT subject guide on data management funder requirements \(NIH, NSF\)](#)

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Corrections101 Boson Dynamics ... 5.1.1 Structure of Parametric

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level. Therefore, the energy and the total number of **bosons** in the system ...

Any particle with integer spin is a **boson**. In this notes, we will discuss the main features of the statistics of N non-interacting **bosons** of spin S ($S = 0, 1, \dots$). We will only discuss cases without magnetic field so that the energy of the **levels** ...

conditions again select the same allowed **levels**, given by: $2\pi n_x 2\pi n_y 2\pi n_z k_x = k_y = k_z = (1) ; ; L L L$ where n_x, n_y, n_z can be any integers. So again we can index any **level**

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[Color online a Bosonic current-noise frequency spectrum, \$S_b, b/2|b\$, versus \$g\$ for \$b = 1, L = R = 0.01, = 0.5, b = 0.05, = 0.0\$, and a range of temperatures. The pink regions also denoted by sub- ...](#)

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in the **quantum** regime. Figure 6 c verifies this and shows The squeezing in Fig. 6 is number ...

in **quantum** optics, generalized quadrature squeezing is often investigated. Typically ...

of squeezing. For example, in **quantum** optics, generalized quadrature squeezing is often

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[Average thermal occupation ns of states of energy "s for bosons with \$=k_B T = 10^4\$ \(solid line\). The occupation of the lowest levels \(\$"s < k_B T\$ \) is strongly enhanced as compared to the classical \(...\)](#)

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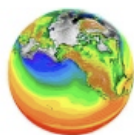
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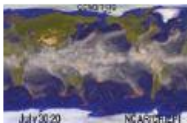
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Dai and Trenberth Global River Flow and Continental Discharge Dataset

SOURCE:

Dai, A., T. Qian, K. E. Trenberth, and J. D. Milliman, 2009: Changes in continental freshwater discharge from 1948-2004. *J. Climate*, **22**, 2773-2791 [pdf]

Dai, A., and K. E. Trenberth, 2002: Estimates of freshwater discharge from continents: Latitudinal and seasonal variations. *J. Hydrometeorol.*, **3**, 660-687. [pdf]

DATA DESCRIPTION: Time series of monthly river flow rates at the farthest downstream station for the world's largest 925 rivers, plus long-term river flow rates and continental discharge into the individual and global oceans.

PLEASE NOTE: For our own record, we would appreciate it very much if you could email Dr. A. Dai with a few lines to indicate your intended use of the data after you download. Thanks.

Files from Dai et. al (2009):

NOTE: The station annual flow rate "Vol" in `coastal-stns-byVol-updated-oct2007.txt` and "vol_stn" in `coastal-stns-Vol-monthly.updated-oct2007.nc` for Niger and other 19 U.S. rivers were in unit of m³/s, instead of km³/yr as stated in the files. This error was corrected on June 17, 2013. Other data were not affected by this error.

`coastal-stns-byVol-updated-oct2007.txt` : long-term mean flow rates for the 925 rivers: m2s_ratio = river mouth to station ratio of flow rate times 10,000; lonm and latm are the longitude and latitude for the river mouth (same as station ln/lat for small rivers); area and vol = drainage area and long-term mean flow rate at the station; nyr, yrb, and yre are the number of years with data, record beginning and ending years, respectively.

`coastal-stns-Vol-monthly.updated-oct2007.nc` : time series of monthly river flow from stations and station information, in netCDF format

`coastal-stns-Vol-monthly.Constructed.wateryr-v2-updated-oct2007.nc` : time series of observed and infilled monthly and annual flow, in netCDF

`readme-2d-monthly-discharge-timeSeries.f` : FORTRAN codes to read the following two binary files

`annual-dis-waterYr1949-2004-2d-scaled-con.bin` : 2-dim. annual coastal discharge from 1949-2004 for forcing OGCMs

`runoff2ocean-mon-fromStn-1deg-2d.bin` : 2-dim. long-term monthly coastal discharge

Files from Dai and Trenberth (2002)

Fitzroy-QX, 192 Guadalquivir use upstream/downstream stations with longer record to merge. Vstation = Vupstream*ratio, where the ratio is the monthly climatological streamflow ratio between the two stations within the common period)

stations for world's 925 ocean-reaching rivers. Created by Aiguo Dai/NCAR (adai@ucar.edu). Refs.: Dai, A., and K. E. Trenberth, 2002: Estimates of freshwater discharge from continents: Latitudinal and seasonal variations. J. Hydrometeorol., 3, 660-687; and Dai, A., T. Qian, K. E. Trenberth, and J. D. Milliman, 2008: Changes in continental freshwater discharge from 1949-2004. J. Climate, submitted.

history Tue Sep 2 10:17:08 2008: ncatted -O -a long_name,area_mou,o,c,drainage area at river mouth coastal-stns-Vol-monthly.updated-oct2007.ncwcd Jun 25 13:06:44 2008: ncatted -O -a title,global,o,c,Monthly streamflow from downstream stations for World's 925 ocean-reaching rivers. Created by Aiguo Dai/NCAR (adai@ucar.edu). Refs.: Dai, A., and K. E. Trenberth, 2002: Estimates of freshwater discharge from continents: Latitudinal and seasonal variations. J. Hydrometeorol., 3, 660-687; and Dai, A., T. Qian, K. E. Trenberth, and J. D. Milliman, 2008: Changes in continental freshwater discharge from 1949-2004. J. Climate, submitted. coastal-stns-Vol-monthly.updated-oct2007v2.nc

```

unitsless long_name time as YYYYMM _FillValue
long_name station index units unitless _FillValue
long_name station id long_name maximum characters
long_name station longitude units degrees_east
long_name station latitude units
degrees_north lon_mou long_name river mouth
longitude units degrees_east lat_mou
long_name river mouth latitude units degrees_north
area_stn long_name drainage areas at station units
km2 area_mou units km2 long_name drainage
area at river mouth vol_stn long_name annual
volume at station units km3/yr _FillValue
ratio_m2s long_name Ratio of volume between river mouth and station
_FillValue long_name total

```

The Dataverse Project

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General

We've only listed some of the most commonly used GIS links here. The library links to **many, many more U.S. and international resources** based on former CAST staff member Stephan Pollard's "*Starting the Hunt*" web site.

- **American FactFinder** 

A portal for U.S. Census data. Download data and join to spatial layers in a GIS for analysis. Now has a mapping tool for creating maps of data such as population, housing, economy, etc.

- **EarthExplorer** 

Find satellite and aerial photo imagery and radar remote sensing products, digital elevation models (DEMS), digital raster graphics (DRGs) and more at this USGS site.

- **FEMA Map Service Center** 

Find FEMA flood maps.

- **Geo.Data.gov** 

"The old Geospatial One Stop has been integrated into this new, enhanced official portal at the Data.gov domain. Find downloadable data, static maps, map services, applications, clearinghouses, and more for a variety of topics including environmental, biologic, business, military, transportation, and many other topics."

- **Mineral Resources On-Line Spatial Data** 

"Interactive maps and downloadable data for regional and global Geology, Geochemistry, Geophysics, and Mineral Resources"

- **National Atlas** 

The National Atlas of the United States brings together resources from over 20 federal agencies. Topics or "Chapters" include agricultural, biology, boundaries, climate, environment, geology, history (presidential election results and territorial acquisitions), map reference, people, transportation and water. An older-style web based map viewer is available for basic interactive map-making based on a variety of themes.

- **National Elevation Dataset** 

"National Elevation Dataset is the result of the maturation of the USGS effort to provide 1:24,000-scale digital elevation model data for the conterminous U.S. and 1:63,360-scale digital elevation model data for Alaska. The dataset provides seamless coverage of the United States, HI, AK, and the island territories."

- **National Geophysical Data Center Geoportal** 

Search or browse for NGDC data.

- **National Geospatial Digital Archive** 

A network for the archiving of geospatial images and data. Its Globetrotter portal will help you find valuable geospatial content. Content is limited to the United States, and is particularly strong for California. Themes include physical geography, human and

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National Stock Number Extract 2063 recent views

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Consumer Complaint Database 1091 recent views

Consumer Financial Protection Bureau — These are complaints we've received about financial products and services.



Ulrich Brose,^{1,22} Lara Cushing,¹⁰ Eric L. Berlow,² Tomas Jonsson,³ Carolin Banasek-Richter,¹ Louis-Felix Bersier,⁴ Julia L. Blamires,⁵ Stephen R. Carpenter,⁷ Marie-France Cattin Blandenier,⁸ Joel E. Cohen,⁹ Hassan Ali Dawah,¹¹ Tony Dell,¹² Francois Edwards,¹³ Jacob,⁶ Roland A. Knapp,¹⁵ Mark E. Ledger,¹³ Jane Memmott,¹⁶ Katja Mintenbeck,⁶ John K. Pinnegar,⁵ Björn C. Rall,¹ Tom Ray,¹⁷ Ulrich,¹⁸ Philip Warren,¹⁹ Rich J. Williams,¹⁰ Guy Woodward,²⁰ Peter Yodzis,^{21†} and Neo D. Martinez¹⁰. 2005. Body sizes of consumers in food webs. *Ecology* 86:2545.

Data Paper

Ecological Archives E086-135.

Data Paper Revision 1

Ecological Archives E086-135-R1.

Submitted 22 August 2008. Published 26 August 2008.

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† deceased

Data Files

Data file, original

Data file is ASCII text, tab delimited. No compression schemes were used. Data set consists of 16,863 records, not including header row.

[bodysizes.txt](#)




















Data file, revision 1

[bodysizes_2008.txt](#)

Updated body size data for the food webs of Mill Stream and Skipwih Pond. Three additional predator–prey links were added to the Skipwith Pond web data remain unchanged. The new database now contains 16,866 rows and the sum over the data in the column "Consumer/resource body mass" equals 2.47388×10^{20} .

Abstract

Trophic information – who eats whom – and species' body sizes are two of the most basic descriptions necessary to understand community structure.

Back to Term List		Tree View For: Data Collection Methods				
<input type="checkbox"/> Check box to view subheadings.		Click linked term for tree view.		Explode (+)	Major Concept	Scope
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<input type="checkbox"/>	<input type="checkbox"/> Content Analysis			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/> Data Analysis, Computer Assisted			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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<input type="checkbox"/>	<input type="checkbox"/> Multidimensional Scaling			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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<input type="checkbox"/>	<input type="checkbox"/> Root Cause Analysis			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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<input type="checkbox"/>	<input type="checkbox"/> Thematic Analysis			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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<input type="checkbox"/>	<input checked="" type="checkbox"/> Sampling Methods			<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input checked="" type="checkbox"/> Study Design			<input type="checkbox"/>	<input type="checkbox"/>	

Search

Check begin

Concerns

- Getting scooped (idea theft)
- Intellectual property (patent, copyright)
 - Data ownership (Institution? Author? Funder? Professor?)
- Confidentiality
 - Individual
 - Business records
- Capture and use of personal data by businesses, governments

Data Use Agreement

This Data Use Agreement (Agreement) is between the Colorado Department of Human Services (*insert program/division/data owner name*) and _____ located at _____, referred to as **Data User**.

Program Name Obligations:

Program Name will agree to provide the following information to the Data User in the format as indicated in the Application or alternatively: (list files, by source, with data elements, and the format data is to be delivered in, and note if paper files, computerized records, etc. if different than that requested in the Application.)

Data User Obligations:

- a. *Uses and disclosures as provided in this agreement.* Data User may use and disclose the confidential information provided by **Program Name** only for the activity described in the Application. Only the individuals or classes of individuals will have access to the data that need access to the confidential information to do the work as presented in the Application.
- b. *Nondisclosure Except as Provided in this Agreement.* Data User shall not use or further disclose the confidential data except as per this Agreement and applicable law.
- c. *Follow-Back.* Data User may not contact the subject of the information, next-of-kin, the physician, other provider, or any other relative or interested party except as follows (indicate Not applicable if no follow-back is proposed): _____

- d. *Safeguards.* Data User agrees to take appropriate administrative, technical and physical safeguards to protect the data from any unauthorized use or disclosure not provided for in this agreement. The Data Owner must ensure that no identifying information will be transmitted through unsecured telecommunications, including the unsecured Internet connections.
- e. *Confidentiality Agreements.* Data User will ensure that all persons who have access to the confidential information sign the confidentiality agreement, **Attachment B**. This includes, but is not limited to all interns, sub-contractors, staff, other workforce members, and consultants. A copy of the signed confidentiality agreements shall be maintained on file and be available for review by **Program Name** if requested.

Dai and Trenberth Global River Flow and Continental Discharge Dataset

SOURCE:

Dai, A., T. Qian, K. E. Trenberth, and J. D. Milliman, 2009: Changes in continental freshwater discharge from 1948-2004. *J. Climate*, **22**, 2773-2791 [pdf]

Dai, A., and K. E. Trenberth, 2002: Estimates of freshwater discharge from continents: Latitudinal and seasonal variations. *J. Hydrometeorol.*, **3**, 660-687. [pdf]

DATA DESCRIPTION: Time series of monthly river flow rates at the farthest downstream station for the world's largest 925 rivers, plus long-term river flow rates and continental discharge into the individual and global oceans.

PLEASE NOTE: For our own record, we would appreciate it very much if you could email Dr. A. Dai with a few lines to indicate your intended use of the data after you download. Thanks.

Files from Dai et. al (2009):

NOTE: The station annual flow rate "Vol" in `coastal-stns-byVol-updated-oct2007.txt` and "vol_stn" in `coastal-stns-Vol-monthly.updated-oct2007.nc` for Niger and other 19 U.S. rivers were in unit of m³/s, instead of km³/yr as stated in the files. This error was corrected on June 17, 2013. Other data were not affected by this error.

`coastal-stns-byVol-updated-oct2007.txt` : long-term mean flow rates for the 925 rivers: m2s_ratio = river mouth to station ratio of flow rate times 10,000; lonm and latm are the longitude and latitude for the river mouth (same as station ln/lat for small rivers); area and vol = drainage area and long-term mean flow rate at the station; nyr, yrb, and yre are the number of years with data, record beginning and ending years, respectively.

`coastal-stns-Vol-monthly.updated-oct2007.nc` : time series of monthly river flow from stations and station information, in netCDF format

`coastal-stns-Vol-monthly.Constructed.wateryr-v2-updated-oct2007.nc` : time series of observed and infilled monthly and annual flow, in netCDF

`readme-2d-monthly-discharge-timeSeries.f` : FORTRAN codes to read the following two binary files

`annual-dis-waterYr1949-2004-2d-scaled-con.bin` : 2-dim. annual coastal discharge from 1949-2004 for forcing OGCMs

`runoff2ocean-mon-fromStn-1deg-2d.bin` : 2-dim. long-term monthly coastal discharge

Files from Dai and Trenberth (2002)

WHY ARE PEOPLE SO COMFORTABLE
HANDING GOOGLE AND FACEBOOK
ALL THIS CONTROL OVER OUR LIVES?

I DUNNO.

OUR SPECIES BUILT THOUSANDS
OF NUCLEAR WEAPONS, SCATTERED
THEM AROUND THE PLANET, AND
THEN MOVED ON TO OTHER THINGS.

MAYBE IT'S BEST TO ACCEPT THAT
SOME OF THIS BIG-PICTURE PLANNING
IS JUST HAPPENING ON AUTOPILOT.



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<http://xkcd.com>

Data links

[Jim Grey's Fourth Paradigm book](#)

[DOSAR Project](#)

[ATLAS Experiment](#)

[Data Science Lab, Database Exploration Lab \(UT Arlington CSE dept.\)](#)

[MS in Business Analytics program](#)

[Brad's Libguide, including Zanran, Dataverse, data.gov](#)

[Community Data Portal](#)

[National Center for Atmospheric Research](#)

[University Corporation for Atmospheric Research](#)

[University of Arkansas GIS links](#)

[Data use agreement sample \(See p.2.\)](#)