Data management 101

General Guidelines for Effective Data Management

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General Guidelines / Best Practices

-Planning (DMP – Norton's presentation)

-Metadata

-Formatting

-Storing

-Security

-Copyright

-Sharing

Benefits of proper data management

-Data is evidence supporting/refuting models in science

-Efficient use of resources

-Effective protection

-Preservation and re-use through data sharing and collaboration

-High quality results

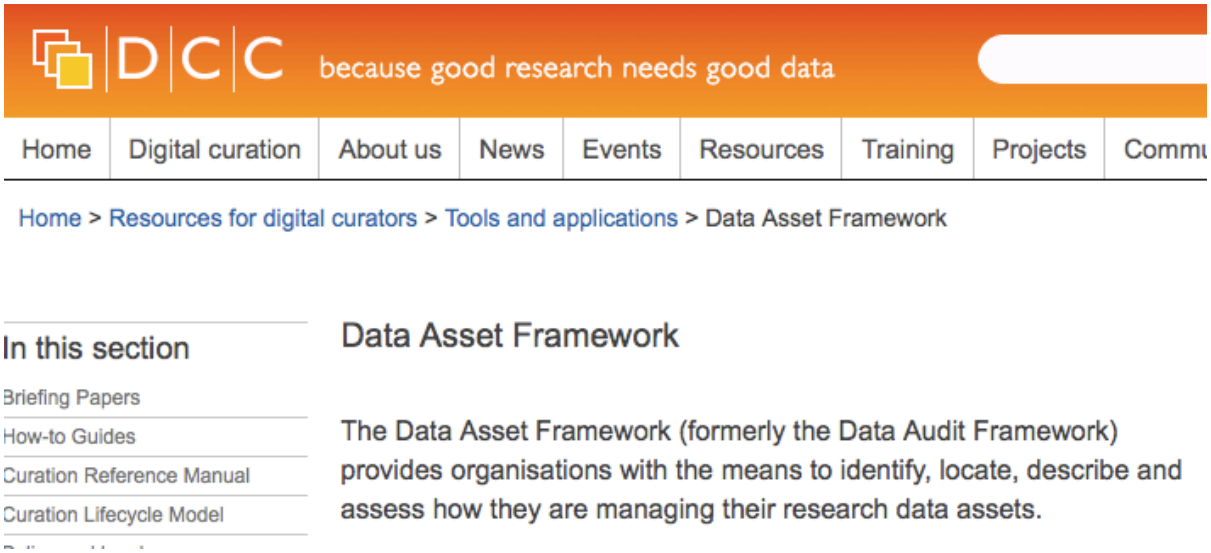
-Research excellence

-Advancing science

Challenges of data management

-Planning
-Organization
-Documenting
-Formatting
-Submitting
-Answer questions?
-Data errors/mistakes?
-Being scooped?
-Public resistance?

Tools for data management



Results of poor data management

Table 2. Data reporting problems in the scientific literature, according to Marco and Larkin (2000).

- Failing to include the number of eligible participants
- Reporting of missing data points inaccurately
- Failing to report all pertinent data
- Failing to report negative results
- Allowing research sponsors to influence reporting of results
- Labeling graphs inappropriately
- Reporting percentages rather than actual numbers
- Reporting results of inappropriately applied statistical tests
- Reporting differences when statistical significance is not reached
- Reporting no difference, when power is inadequate
- Performing multiple comparisons without correction
- Splitting data into multiple publications
- Using terminology without precise definitions
- Reporting conclusions not supported by the data
- Ignoring citations of prior work that challenge stated conclusions
- Inflating research results for the media

From: Horner J., and Minifie F.D. 2011 Research Ethics II: Mentoring, Collaboration, Peer Review, and Data. *Journal of Speech, Language, and Hearing Research* 54: S330–S345

Metadata
Annotation
Documenting

Metadata (Annotation/ Documenting)

Metadata
Information about data: the information required to understand data, context, quality, structure, and accessibility (Michener et al., 1997)

-Who, what, when, where, and how about every aspect of the data.

Metadata (Annotation/ Documenting)

Benefits of proper metadata

-Reuse and data sharing are facilitated

-Data discovery

-Expand the scale of study

-Addresses unanticipated questions

-Integrate data

http://www.flickr.com/photos/boojee/3743753784/in/photostream/

Metadata (Annotation/ Documenting)

Use standardized taxonomies and controlled vocabularies including domain, national, and international standards in the capture, management and archiving of data.

Metadata (Annotation/ Documenting)

Automatic addition of metadata

-Some is automatically added during the data collection or analysis process- i.e. date, time

-Some software (e.g. R statistical package, MATLAB, SAS, Galaxy) provide analysis scripts - records of the various steps involved in processing and analyzing data, and provide a form of "analytical metadata." always leave record of what you did with your data,

Metadata (Annotation/ Documenting)

User interface-driven analysis - changes to data are made by selecting steps from drop-down menus, followed by a “run” or “execute” or “ok” button
rarely leave a clear accounting of exactly what you have done

Metadata (Annotation/ Documenting)

Manually added metadata

About the project

-Title, people, key dates, funders and grants

About the data

-Title, key dates, creator(s), subjects, rights, included files, format(s), versions

-Interpretive aids: codebooks, data dictionaries, algorithms, code

Metadata (Annotation/ Documenting)

Keep a README file for each data file

-Plain text files

-Short description of what data it includes

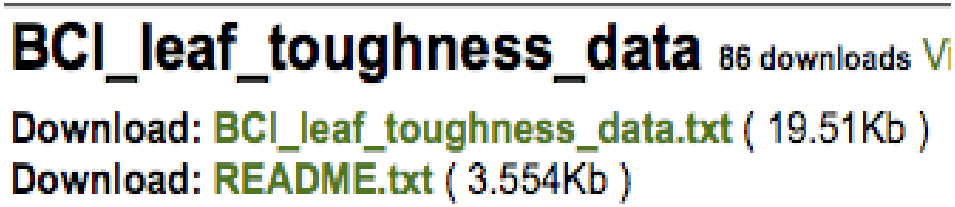
-Who collected the data and whom to contact with questions

-Column headings for any tabular data

-Units of measurement used

-Symbols used

-Specialized formats or abbreviations used



http://datadryad.org/handle/10255/dryad.8525

Formatting Your Data

http://www.ehow.co.uk/how_8510149_make-excel-spreadsheets-look-good.htm

Formatting Your Data

File formats in which data is created depend on:

-Software in which research data are created and digitized

-How researchers plan to analyze data

-Hardware used

-Availability of software

-Discipline-specific

Formatting Your Data

Organizing Files and Folders:

-Essential for accessibility

-Makes it easier to find and keep track of data files.

-Develop a system that works for your project

-<u>Be consistent</u>

http://jdorganizer.blogspot.com/2008/03/file-folders-declare-that-you-are.html

Formatting Your Data

File names:

-Use file names to classify broad types of files

-Create meaningful but brief names

“Year01” or “Fall03” vs “Corvallis_VegBiodiv_2007”

-Capitalize each word to differentiate it.

-Avoid using special characters in a file name.

\ / : * ? “ < > | [ ] & $

Formatting Your Data

File names:

-Use underscore or hyphen symbols instead of spaces

"_" or "-"

-Capture place, time, and theme – extremely useful, even if done in a highly abbreviated manner

-Reverse dates so they sort usefully YYYYMMDD e.g. filenaming_20080507

-Capture document version control

v01, v02, v03 instead of filenaming_lastestversion

Formatting Your Data for Storage

Store data in nonproprietary software formats (e.g., comma delimited text file, .csv); proprietary software (e.g., Excel, Access) may become unavailable, whereas text files can always be read

NOTE: When data are converted from one format to another, certain changes may occur to the data. After conversions, data should be checked for errors or changes that may be caused by this process

Formatting Your Data for Storage

Recommended File Formats for Preservation

Textual Formats	File Extensions
Acrobat PDF/A	.pdf
Comma-Separated Values	.csv
Open Office Formats	.odt, .ods, .odp
Plain Text (US-ASCII, UTF-8)	.txt
XML	.xml
Image/Graphic Formats	
JPEG	.jpg
JPEG2000	.jp2
PNG	.png
SVG 1.1 (no Java binding)	.svg
TIFF	.tif, .tiff
Audio Formats	
AIFF	.aif, .aiff
WAVE	.wav
Video Formats	
AVI (uncompressed)	.avi
Motion JPEG2000	.mj2, .mjp2

Recommended File Formats for Preservation. University of Texas http://repositories.lib.utexas.edu/recommended_file_formats

Storing Your Data

http://blog.brickhousesecurity.com/wp-content/uploads/mystica_usb_flash_drive.png

Storing Your Data

-Store data in nonproprietary hardware formats

Formats can rapidly become obsolete valuable data that are essentially lost because they are trapped on old formats, 5.25” floppy disks

CD/DVD experiential life expectancy is 2 to 5 years even though published life expectancies are often cited as 10 years, 25 years, or longer

Manufacturers claim that CD-R and DVD-R discs have a shelf life of 5 to 10 years before recording on them (U.S. National Archives)

Storing Your Data

Always store an uncorrected (the original data set) data file version or **master version**:

-Do not make any corrections to this file

-Make corrections using a scripted language.

-Consider making your original data file read-only

-Limit access to this file

Storing Your Data

-Whenever possible, use online storage (i.e. Dropbox) or institutional resources

http://www.hpc.ufl.edu/about/newStorage.php

Storing Your Data

Regular back-ups protect against accidental data loss:

-hardware failure

-software or media faults

-virus infection or malicious hacking

-power failure

-human errors

"Jim was told that he could back up his data by making an image of his computer."

http://www.mathworks.com/matlabcentral/fileexchange/25464-virtual-backup-using-matlab

Ensure that areas and rooms for data storage are structurally sound, and free from the risk of flood and fire

Data Security

http://www.icc-service.net/wp-content/uploads/2010/07/data-storage.jpg

Security

Unrestricted Data
If available to the public, will not harm an individual, group, or institution

Sensitive Data
If available to unauthorized users, may harm an individual, a group or institution

Restricted Data
Highest level of protection: i.e. Patient data, student data, security-related data such as passwords and risk assessments, and intellectual property

UF IT Data Security Standard
http://www.it.ufl.edu/policies/security/uf-it-sec-data.html

Security

DATA SECURITY AND ACCESS

-Physical security

-Network security

-Security of computer systems and files

http://www.icc-service.net/wp-content/uploads/2010/07/data-storage.jpg
http://mrcheckout.net/wp-content/uploads/2010/11/datasecurity.jpg

Security

When working with Restricted Data AVOID:

-Storing data on workstations, portable devices or removable media.

-Sending data in email or instant messages.

-Using data on unapproved web sites.

-Removing data from UF premises.

Modified from Bergsma K. UF restricted data required training
http://infosec.ufl.edu/restricted-data/data-security-slides.pdf

Security


Information Technology
Security
Kathy Bergsma, UF Information Security Manager
392-2061
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http://infosec.ufl.edu/
Job Description


About the HSC
Contact Information
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HSC Chief, Information Security
Phone: 352-273-5014
Mailing Address: P.O. Box 100152
Gainesville, FL 32610-0152
E-mail: cebel@ufl.edu
Web Site: security.health.ufl.edu
back to HSC Organization

Security

UF Privacy Office
Susan Blair,
Chief Privacy Officer
Office phone: 392-2094
Privacy Hotline: 866-876-4472
Email: privacy@ufl.edu
Web:
http://privacy.ufl.edu/

Information Privacy

The University of Florida values individuals' privacy and actively seeks to preserve the privacy rights of those who share information with us. Your trust is important to us and we believe you have the right to know how information submitted to the University of Florida is generally handled.

We are dedicated to preventing unauthorized access to information, maintaining the accuracy of information, and ensuring the appropriate use of information. We strive to put in place appropriate physical, electronic, and managerial safeguards to secure the information we collect in all formats: on paper, electronically, and verbally. These security practices are consistent with the policies of the university and with the laws and regulatory practices of the State of Florida and multiple federal agencies.

Privacy Incidents

University of Florida officials notify affected individuals in the case of a privacy breach.

- State of Florida's Unclaimed Property Website Breach
- College of Engineering Hard Drives Stolen
- Physics Department Server Breach
- Cardiothoracic Patient Research Breach
- Epidemiology and Health Policy Research Breach

Security

DATA DISPOSAL

For hard drives, simply deleting does not erase a file on most systems. Files need to be overwritten to ensure they are effectively scrambled

Shredders certified to an appropriate security level should be used for destroying paper and CD/DVD discs

External hard drives at the end of their life can be removed from their casings and disposed of securely through physical destruction

Contact your IT person

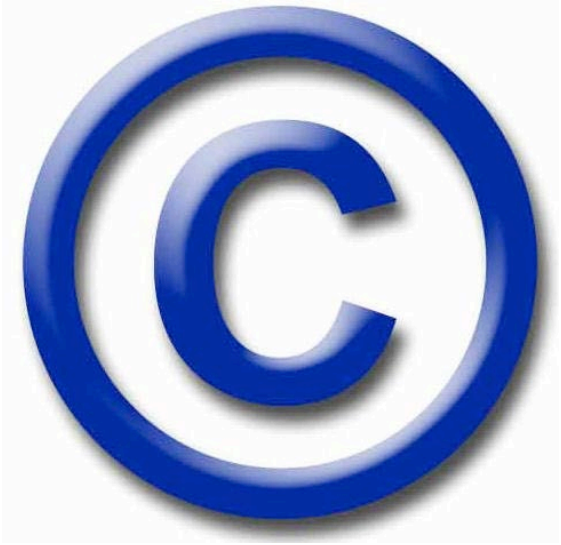
http://www.spectrumdatarecovery.com.au/content.aspx?cid=23&m=3

UF Restricted Data Required Training

Kathy Bergsma
UF Information Security Manager
ufirt@ufl.edu
http://infosec.ufl.edu

http://infosec.ufl.edu/restricted-data/data-security-slides.pdf

Copyright



http://blog.unl.edu/dixon/files/2012/01/copyright.jpg

Copyright

Give credit to the data source used, the data distributor and the copyright holder

In the case of collaborative research, copyright may be held jointly by various researchers or institutions.

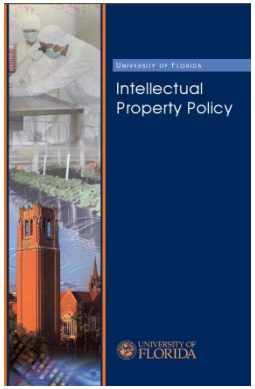
Secondary users of data must obtain copyright clearance from the rights holder before data can be reproduced

Data can be copied for non-commercial teaching or research purposes without infringing copyright, under the fair dealing concept, providing that the owner of the data is acknowledged

Copyright

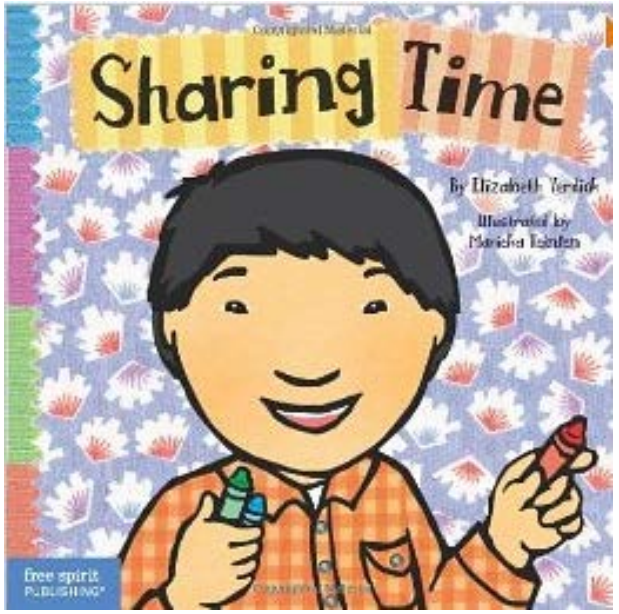
UF Office of Technology Licensing
http://www.research.ufl.edu/otl/index.html

UF Intellectual Property Policy
http://www.research.ufl.edu/otl/pdf/ipp.pdf



Christine Ross – Copyright on Campus
http://guides.uflib.ufl.edu/copyright

Sharing Your Data



http://www.amazon.com/Sharing-Toddler-Tools-Elizabeth-Verdick/dp/1575423146/ref=sr_1_1?s=books&ie=UTF8&qid=1335134736&sr=1-1

Sharing Your Data

WHY SHARE RESEARCH DATA

-Encourage scientific debate

-Promotes potential new uses of data

-New collaborations

-Improvement and validation of research methods

-Increases impact and visibility of research

-Promotes the research study and its outcomes

-Required by journals/funding agencies

-Provide direct credit to the researcher

Sharing Your Data

PLoS one

accelerating the publication of peer-reviewed science

Home Browse Articles About For Readers For Authors and Reviewers

RESEARCH ARTICLE

Sharing Detailed Research Data Is Associated with Increased Citation Rate

Article Metrics Related Content Comments: 5

Heather A. Piwowar*, Roger S. Day, Douglas B. Fridsma

Department of Biomedical Informatics, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, United States of America

To **add a note**, highlight some text. Hide notes

Make a general comment

http://www.amazon.com/Sharing-Toddler-Tools-Elizabeth-Verdick/dp/1575423146/ref=sr_1_1?s=books&ie=UTF8&qid=1335134736&sr=1-1

Sharing Your Data

HOW TO SHARE YOUR RESEARCH DATA

-Depositing with a specialist or discipline-specific data repository

-Submitting to a journal to support a publication

-Depositing in an institutional repository

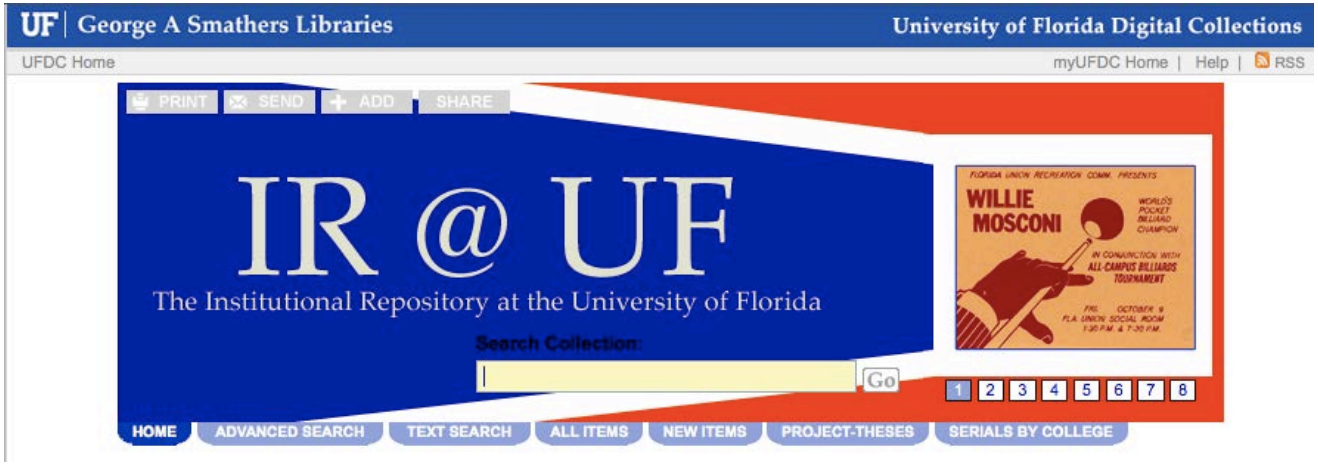
-Available online via a project or institutional website

-Available informally between researchers on a peer-to-peer basis

Sharing Your Data

A comprehensive list of data repositories by disciplines
http://oad.simmons.edu/oadwiki/Data_repositories

Sharing Your Data



Sharing Your Data

Advantages of depositing data with a data repository

- Assurance that data meet set quality standards

- Safe-keeping of data in a secure environment with the ability to control access where required

- Standardized citation mechanism to acknowledge data

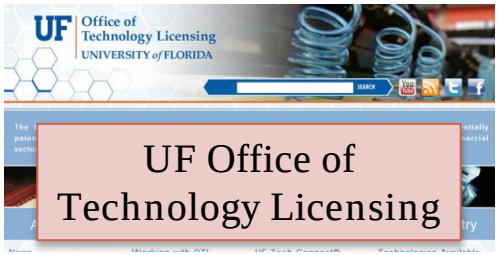
- Promotion of data to many users

- Online resource discovery of data through data catalogues

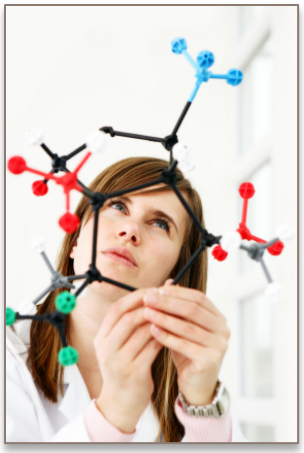
- Monitoring of the secondary usage of data

UF Health Sciences Center Library

UF High Performance Computing Center

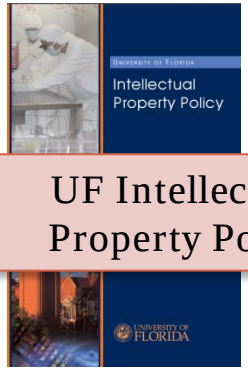


UF Office of Technology Licensing



UF Institutional Repository

UF Information Security Office



UF Intellectual Property Policy

http://www.ithenticate.com/Portals/92785/images/researcher-science-plagiarism.jpg

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Data Repositories. http://oad.simmons.edu/oadwiki/Data_repositories

Frequently Asked Questions (FAQs) about Optical Storage Media: Storing Temporary Records on CDs and DVDs. *Record managers. U.S. National Archives* http://www.archives.gov/records-mgmt/initiatives/temp-opmedia-faq.html

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UK - Joint. Info. Sys. Comm.- Choosing a file name www.jiscdigitalmedia.ac.uk/crossmedia/advice/choosing-a-file-name

University of Edinburgh Records Management Section, Standard Naming Conventions For Electronic Records: The Rules, www.recordsmanagement.ed.ac.uk/InfoStaff/RMstaff/RMprojects/PP/FileNameRules/Rules.htm

Van den Eynden V., Corti L., Woollard, M., Bishop, L., Horton L. 2011 Managing and sharing data. Best practice for researchers. University of Essex, U.K. http://www.data-archive.ac.uk/media/2894/managingsharing.pdf