- Please type into the chat your department and what you hope to get out of this workshop.

How to Manage Your Data

Lisa Spiro

June 2021, updated Oct. 2021

This workshop draws heavily on materials from the University of Minnesota Libraries, New England Collaborative Data Management Curriculum, MIT Libraries & DataOne.

- Forgotten what you called a file or where you put it
- Discovered unnecessary duplicates, then struggled over which to keep
- Been unsure about who has responsibility for managing files
- Lost data due to hardware failure, lost devices, etc.

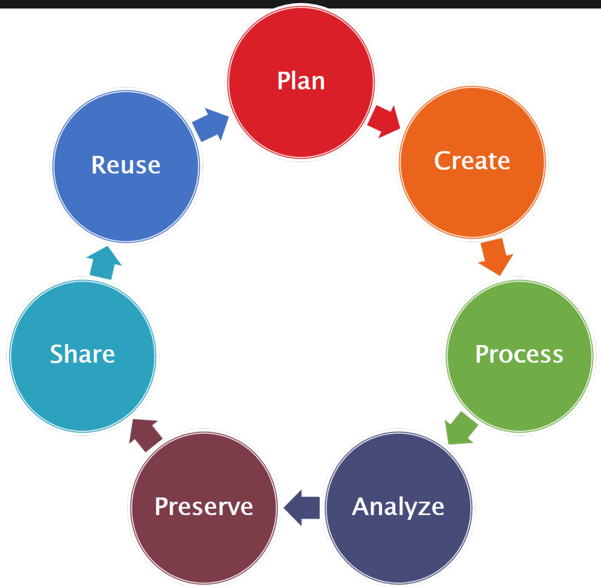
Objectives for This Session

1. Understand the importance of managing data.
2. Learn how to create a good data management plan.
3. Name and organize your files effectively.
4. Create tidy data.
5. Manage versions.
6. Document your data.
7. Know options for storing, backing up and archiving your data.

1. Why Managing Your Data Matters

What is data management?

The process of storing, organizing, describing, preserving, and sharing data so that research results can be validated, data can be understood, and future use is facilitated.



https://biblio.uottawa.ca/en/services/faculty/research-data-management/what-research-data-management

Why Is Managing Your Data Important?

- Keep track of your data, working more efficiently.
- Prevent data loss.
- Uphold standards of research integrity.
- Make it easier to share and re-use data.
- Meet funder, university & increasingly journal requirements.
- Be kind to Future You and your collaborators.

If the data you need still exists;
If you found the data you need;
If you understand the data you found;
If you trust the data you understand;
If you can use the data you trust;
Someone did a good job of data management.

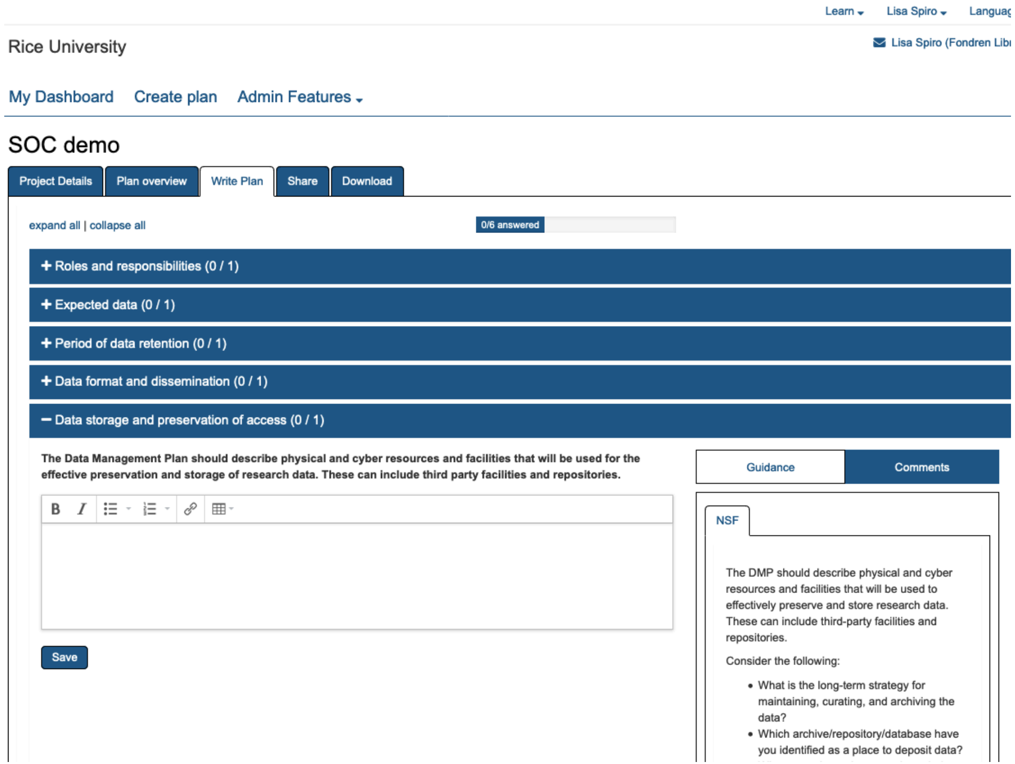
- *Rex Sanders, USGS*

2. Plan

Typical Components of Data Management Plan (NSF)

1. the **types of data** and other materials to be produced in the course of the project;
2. the **standards** to be used for data and metadata format and content;
3. policies for **access & sharing** including provisions for appropriate protection of privacy, security, IP, etc.;
4. policies and provisions for **re-use, re-distribution**, and the production of derivatives; and
5. plans for **archiving** data, samples, and other research products, and for **preservation** of access to them.

Create a Data Management Plan Using DMP Tool



SOC demo

+ Roles and responsibilities (0 / 1)

+ Expected data (0 / 1)

+ Period of data retention (0 / 1)

+ Data format and dissemination (0 / 1)

− Data storage and preservation of access (0 / 1)

The Data Management Plan should describe physical and cyber resources and facilities that will be used for the effective preservation and storage of research data. These can include third party facilities and repositories.

The DMP should describe physical and cyber resources and facilities that will be used to effectively preserve and store research data. These can include third-party facilities and repositories.

Consider the following:

- What is the long-term strategy for maintaining, curating, and archiving the data?
- Which archive/repository/database have you identified as a place to deposit data?

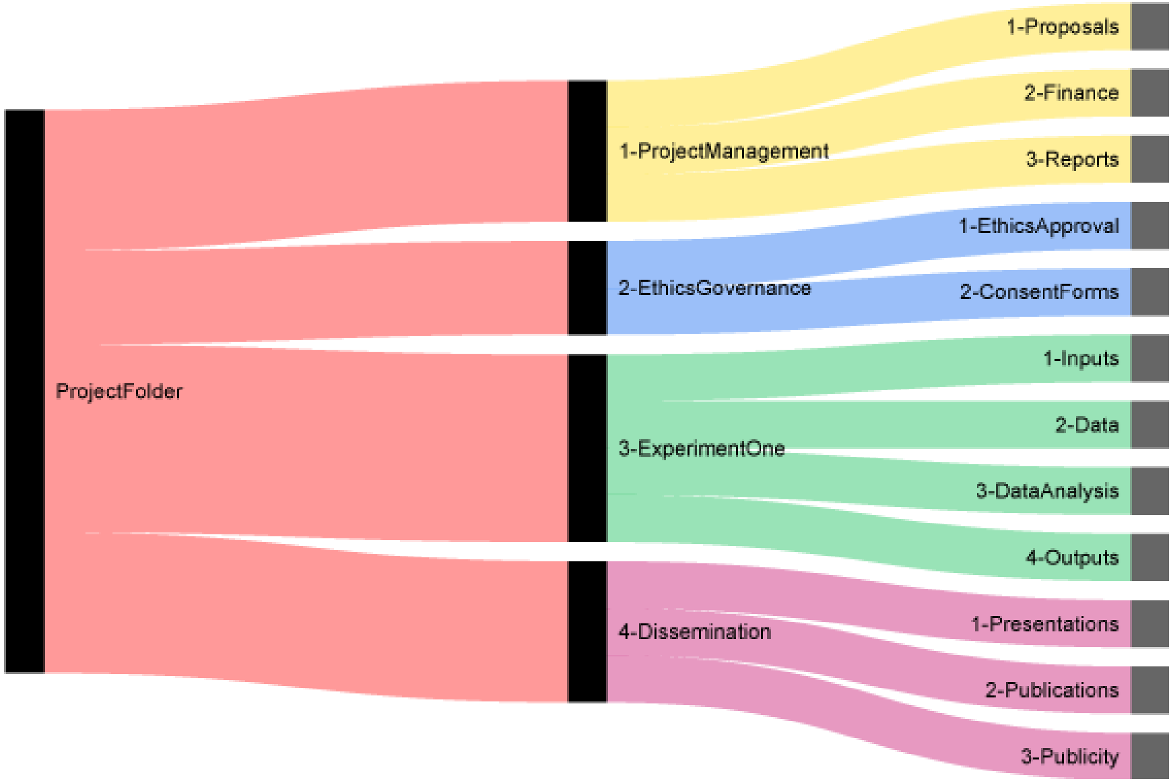
https://dmptool.org/

Key Principles for Data Management Planning

1. Investing time in organizing your data now will save you time later.
2. Be clear and consistent.
3. Document your procedures.
4. Work out your data management procedures with collaborators; define roles & responsibilities.
5. Understand that there is no one right way; it’s what works for you and your collaborators.

3. Organize Your Data

Example of a Directory Structure



Nikola Vukovic

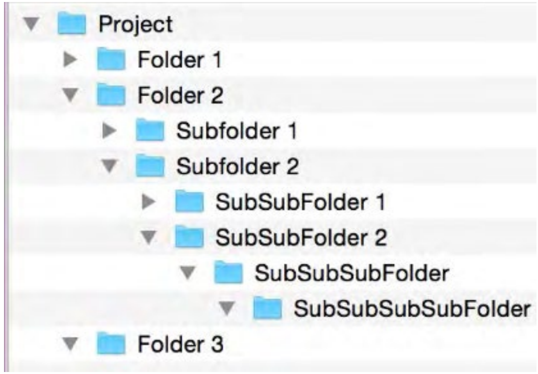
How to Create a Hierarchical File System

1. Organize your files in a predictable, easy-to-sort way.

2. Use relevant categories to organize folders, such as
   -Activity (e.g. interviews, experiments)
   -Stage (raw, active, completed)

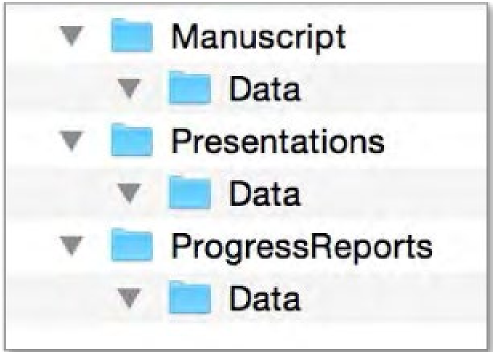
3. Select a meaningful naming convention for folders.

What to Avoid…



- Project
  - Folder 1
  - Folder 2
    - Subfolder 1
    - Subfolder 2
      - SubSubFolder 1
      - SubSubFolder 2
        - SubSubSubFolder
          - SubSubSubSubFolder
  - Folder 3

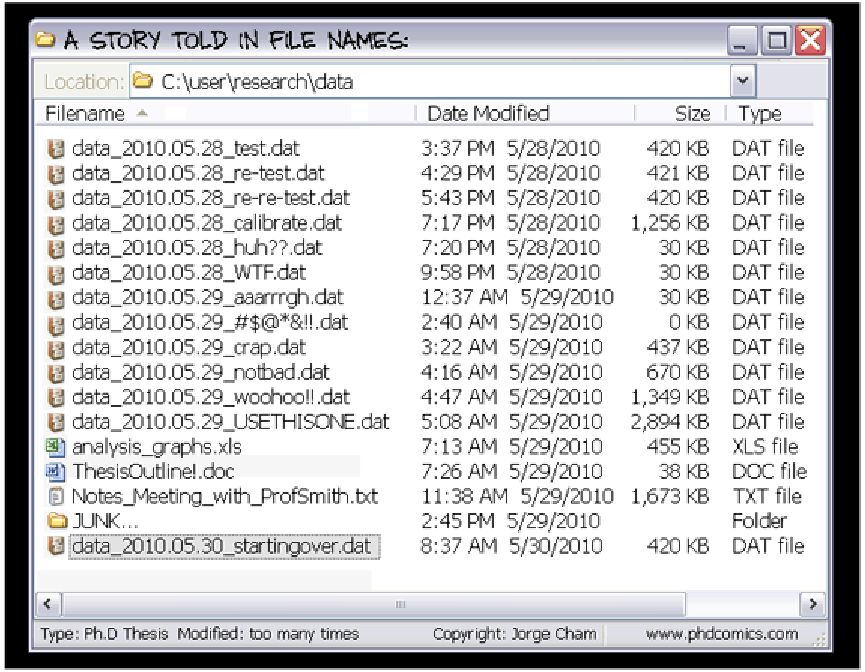
Too much depth



- Manuscript
  - Data
- Presentations
  - Data
- ProgressReports
  - Data

Overlapping categories

The Problem of File Names



A STORY TOLD IN FILE NAMES:

Location: C:\user\research\data

Filename	Date Modified	Size	Type
data_2010.05.28_test.dat	3:37 PM 5/28/2010	420 KB	DAT file
data_2010.05.28_re-test.dat	4:29 PM 5/28/2010	421 KB	DAT file
data_2010.05.28_re-re-test.dat	5:43 PM 5/28/2010	420 KB	DAT file
data_2010.05.28_calibrate.dat	7:17 PM 5/28/2010	1,256 KB	DAT file
data_2010.05.28_huh??.dat	7:20 PM 5/28/2010	30 KB	DAT file
data_2010.05.28_WTF.dat	9:58 PM 5/28/2010	30 KB	DAT file
data_2010.05.29_aaarrrgh.dat	12:37 AM 5/29/2010	30 KB	DAT file
data_2010.05.29_#$@*&!!.dat	2:40 AM 5/29/2010	0 KB	DAT file
data_2010.05.29_crap.dat	3:22 AM 5/29/2010	437 KB	DAT file
data_2010.05.29_notbad.dat	4:16 AM 5/29/2010	670 KB	DAT file
data_2010.05.29_woohoo!!.dat	4:47 AM 5/29/2010	1,349 KB	DAT file
data_2010.05.29_USETHISONE.dat	5:08 AM 5/29/2010	2,894 KB	DAT file
analysis_graphs.xls	7:13 AM 5/29/2010	455 KB	XLS file
ThesisOutline!.doc	7:26 AM 5/29/2010	38 KB	DOC file
Notes_Meeting_with_ProfSmith.txt	11:38 AM 5/29/2010	1,673 KB	TXT file
JUNK...	2:45 PM 5/29/2010		Folder
data_2010.05.30_startingover.dat	8:37 AM 5/30/2010	420 KB	DAT file

Type: Ph.D Thesis Modified: too many times Copyright: Jorge Cham www.phdcomics.com

http://phdcomics.com/comics.php?f=1323

Principles for Effective File Naming

- Files are **distinguishable** from each other within their containing folder.

- Files are easy to **locate, browse** and **sort.**

- If files are moved to another storage platform, their names will retain **useful context**.

(EDINA and Data Library, n.d.) | RDMRose

File Naming Best Practices

- **Be descriptive**: Use shared, meaningful terminology. Incorporate relevant terms such as project name, place, date, experiment, instrument, subject, etc.

  Example: AirQual_Lufkin_Sensor1_201709007

- **Be consistent:** Use the same structure and terms across projects so that files fall into a useful *order* (for sorting) and you can easily identify them.

  Example: AvSAT_Ric_2017
  AvSAT_Ric_2016
  AvSAT_UTx_2017

Guidelines for File Naming

Guideline	**Example**
Avoid special characters, like / , . # ?	Exp01a.xls, NOT Exp#1.a.xls
Don’t use blank spaces. Use CamelCharacters or _ to link together keywords.	Site01_Sensor002, NOT Site1 Sensor 2
Use yyyymmdd for **dates**	200180617, NOT 0617218
Use **leading zeroes**, e.g. 0001, 001, etc	Experiment002.xls, NOT Experiment2.xls

Which file naming scheme works the best?

A. bridgedata1
bridgedata2
bridgedata3

B. bridge1_sensor2_02142013
bridge1_sensor2_02152013
bridge1_sensor2_02162013

C. madisonavebridge_sensor2_20130214
madisonavebridge_sensor2_20130215
madisonavebridge_sensor2_20130216

D. madisonavebridge_sensor2_feb142013
madisonavebridge_sensor2_02152013
madbridge_s2_feb162013

University of Minnesota Libraries

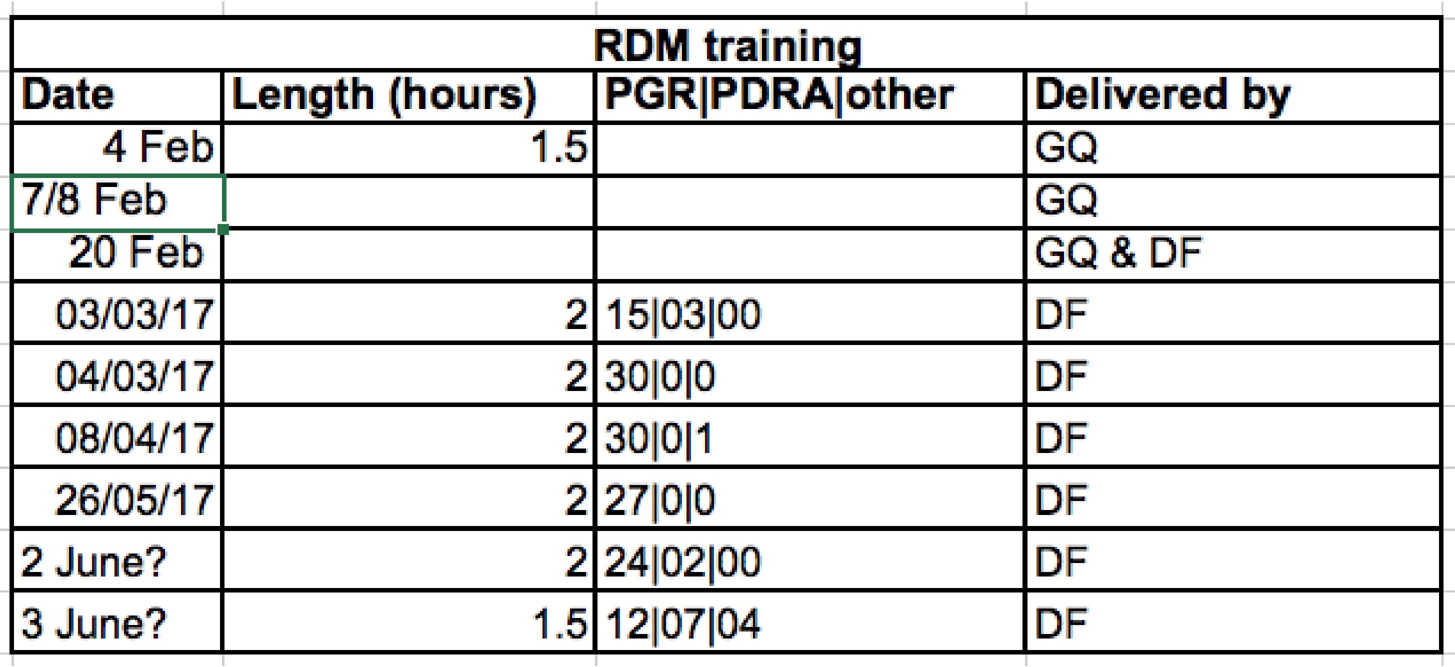
Exercise: File Naming Scheme

Look at the handout at
https://tinyurl.com/FIleNamingExercise

What file naming scheme would you create to make it easy to find, sort, and understand files? Discuss in your breakout room. (approx. 5 minutes)

4. Create tidy data.

Example of Messy Data



RDM training			
Date	Length (hours)	PGR|PDRA|other	Delivered by
4 Feb	1.5		GQ
7/8 Feb			GQ
20 Feb			GQ & DF
03/03/17	2	15|03|00	DF
04/03/17	2	30|0|0	DF
08/04/17	2	30|0|1	DF
26/05/17	2	27|0|0	DF
2 June?	2	24|02|00	DF
3 June?	1.5	12|07|04	DF

post-graduate researcher (PGR)' post-doctoral research associate (PDRA),

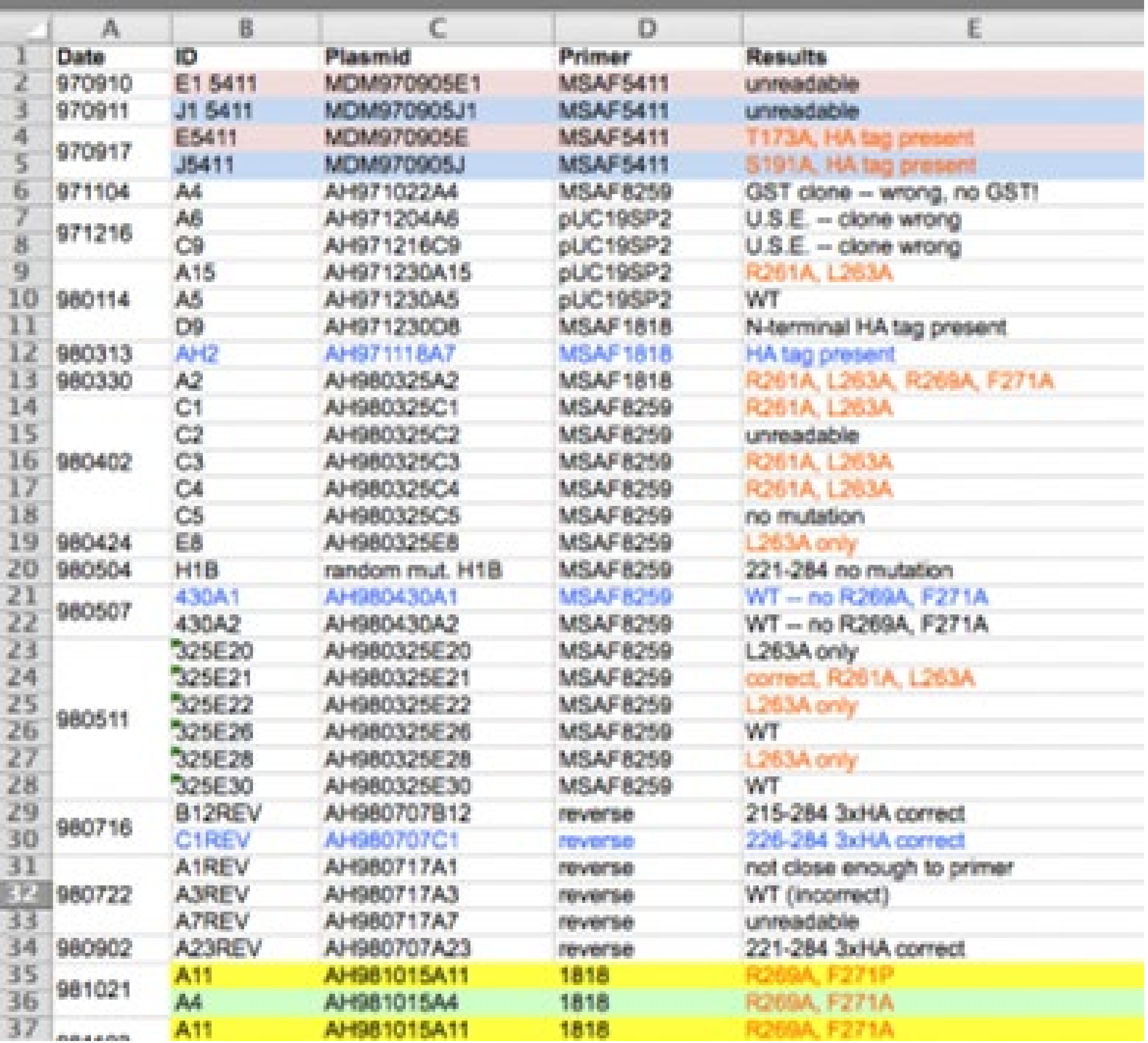
https://librarycarpentry.org/lc-spreadsheets/01-format-data/index.html

The Problems with Messy Data

- Difficult to analyze
- Requires time to clean
- Confusing to other users– and to Future You
- Raises questions about your credibility

Keep Your Data Tidy

- Make each variable a column & each observation a row
- Make column headers variable names
- Atomize your data; put only a single piece of information in each cell (e.g. city, state, country)
- Be consistent in how you will handle empty values (e.g. NULL, leave blank)



	A	B	C	D	E
1	Date	ID	Plasmid	Primer	Results
2	970910	E1 5411	MDM970905E1	MSAF5411	unreadable
3	970911	J1 5411	MDM970905J1	MSAF5411	unreadable
4	970917	E5411	MDM970905E	MSAF5411	T173A, HA tag present
5		J5411	MDM970905J	MSAF5411	S191A, HA tag present
6	971104	A4	AH971022A4	MSAF8259	GST clone -- wrong, no GST!
7	971216	A6	AH971204A6	pUC19SP2	U.S.E. -- clone wrong
8		C9	AH971216C9	pUC19SP2	U.S.E. -- clone wrong
9	980114	A15	AH971230A15	pUC19SP2	R261A, L263A
10		A5	AH971230A5	pUC19SP2	WT
11		D9	AH971230D8	MSAF1818	N-terminal HA tag present
12	980313	AH2	AH971118A7	MSAF1818	HA tag present
13	980330	A2	AH980325A2	MSAF1818	R261A, L263A, R269A, F271A
14	980402	C1	AH980325C1	MSAF8259	R261A, L263A
15		C2	AH980325C2	MSAF8259	unreadable
16		C3	AH980325C3	MSAF8259	R261A, L263A
17		C4	AH980325C4	MSAF8259	R261A, L263A
18		C5	AH980325C5	MSAF8259	no mutation
19	980424	E8	AH980325E8	MSAF8259	L263A only
20	980504	H1B	random mut. H1B	MSAF8259	221-284 no mutation
21	980507	430A1	AH980430A1	MSAF8259	WT -- no R269A, F271A
22		430A2	AH980430A2	MSAF8259	WT -- no R269A, F271A
23	980511	325E20	AH980325E20	MSAF8259	L263A only
24		325E21	AH980325E21	MSAF8259	correct, R261A, L263A
25		325E22	AH980325E22	MSAF8259	L263A only
26		325E26	AH980325E26	MSAF8259	WT
27		325E28	AH980325E28	MSAF8259	L263A only
28		325E30	AH980325E30	MSAF8259	WT
29	980716	B12REV	AH980707B12	reverse	215-284 3xHA correct
30		C1REV	AH980707C1	reverse	226-284 3xHA correct
31	980722	A1REV	AH980717A1	reverse	not close enough to primer
32		A3REV	AH980717A3	reverse	WT (incorrect)
33		A7REV	AH980717A7	reverse	unreadable
34	980902	A23REV	AH980707A23	reverse	221-284 3xHA correct
35	981021	A11	AH981015A11	1818	R269A, F271P
36		A4	AH981015A4	1818	R269A, F271A
37		A11	AH981015A11	1818	R269A, F271A

What issues do you see with this spreadsheet?

Stanford U Libraries

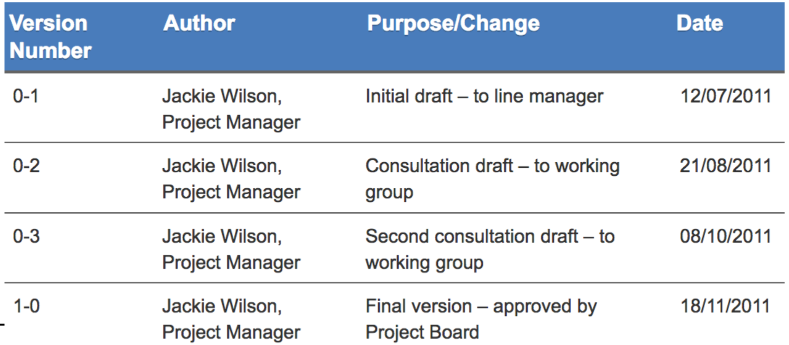
5. Manage versions

Versioning: Which one is authoritative?

DataAnalysis.xls
DataAnalysis2.xls
DataAnalysisSept2017.xls
DataAnalysisFinal.xls
DataAnalysisFinalFINAL.xls

Manual Options for Managing Versions

- Retain original, raw files and significant iterations.
- Use careful file naming: record major changes via whole numbers (v01), minor via an additional number (v02_01)
- Put older versions in an archive folder.
- Create a version control table:



Version Number	Author	Purpose/Change	Date
0-1	Jackie Wilson, Project Manager	Initial draft – to line manager	12/07/2011
0-2	Jackie Wilson, Project Manager	Consultation draft – to working group	21/08/2011
0-3	Jackie Wilson, Project Manager	Second consultation draft – to working group	08/10/2011
1-0	Jackie Wilson, Project Manager	Final version – approved by Project Board	18/11/2011

Software for Managing Versions

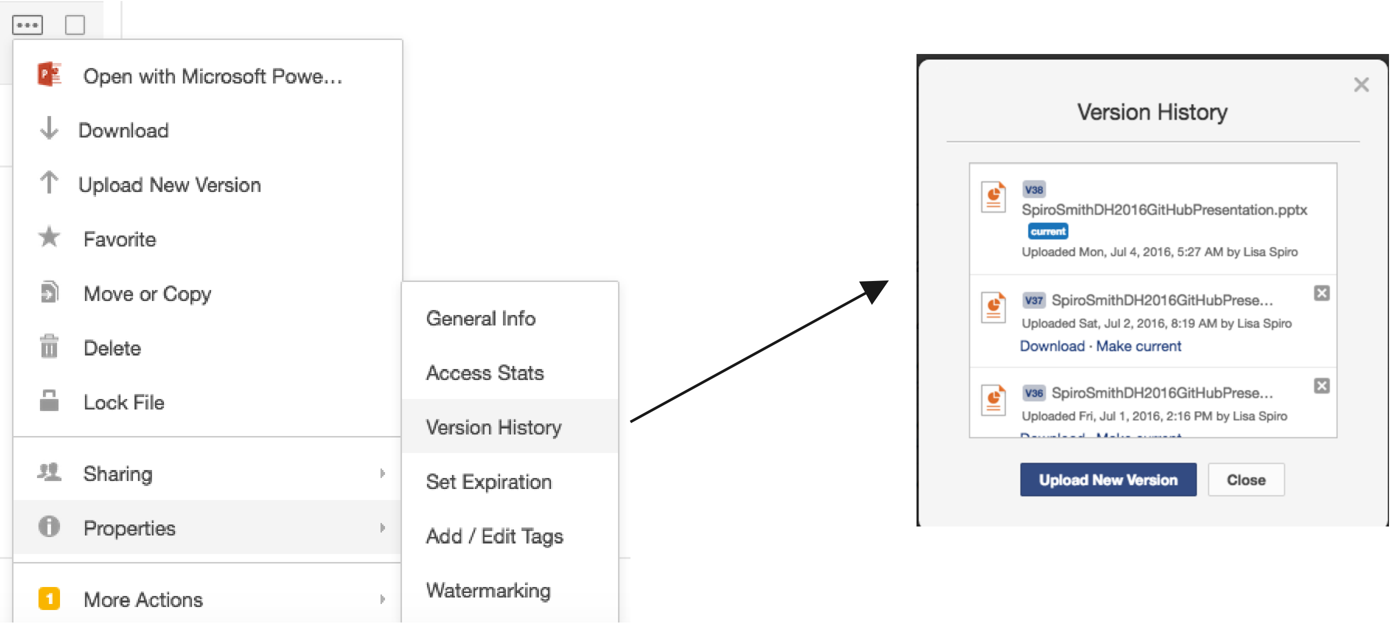
Accessing multiple versions:

- Box, Google Drive & other storage services

Version control software:

- GitHub: Researchers and educators can receive GitHub Team (unlimited repositories) for free.

Accessing Version History on Box.com



SpiroSmithDH2016GitHubPresentation.pptx

Uploaded Mon, Jul 4, 2016, 5:27 AM by Lisa Spiro

SpiroSmithDH2016GitHubPrese…

Uploaded Sat, Jul 2, 2016, 8:19 AM by Lisa Spiro

SpiroSmithDH2016GitHubPrese…

Uploaded Fri, Jul 1, 2016, 2:16 PM by Lisa Spiro

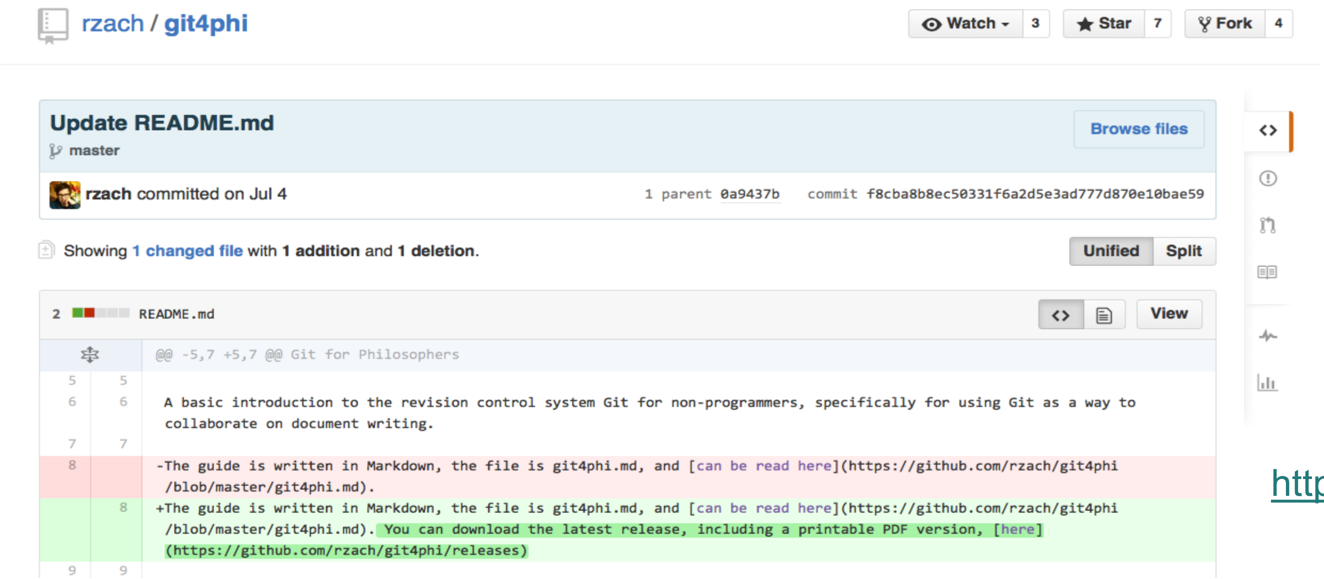
https://community.box.com/t5/Organizing-and-Tracking-Content/Accessing-Version-History/ta-p/50452

Version Control Software

“Version control is a system that records changes to a file or set of files over time so that you can recall specific versions later.” (Pro Git)

- See who does what.
- Access any version of file.
- Roll back changes.
- Enable new branches of project.

Manage and Access Versions of Files with Git(Hub)



Update README.md

master

rzach committed on Jul 4 — 1 parent 0a9437b — commit f8cba8b8ec50331f6a2d5e3ad777d870e10bae59

Showing **1 changed file** with **1 addition** and **1 deletion**.

2 README.md

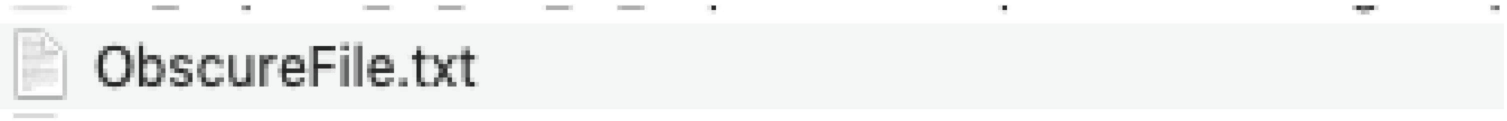
```
@@ -5,7 +5,7 @@ Git for Philosophers

 A basic introduction to the revision control system Git for non-programmers, specifically for using Git as a way to
 collaborate on document writing.

-The guide is written in Markdown, the file is git4phi.md, and [can be read here](https://github.com/rzach/git4phi
 /blob/master/git4phi.md).
+The guide is written in Markdown, the file is git4phi.md, and [can be read here](https://github.com/rzach/git4phi
 /blob/master/git4phi.md). You can download the latest release, including a printable PDF version, [here]
 (https://github.com/rzach/git4phi/releases)
```

https://github.com/rzach/git4phi

Researchers and educators can receive GitHub Team (unlimited repositories) for free.

6. Document your data.

What information would you want to know about this file?



ObscureFile.txt

Enter questions into the chat. (For example, “who created the file?”)

Why Document Data?

- Makes it easier for you and your colleagues to interpret your data
- Facilitates collaboration, sharing, and reuse
- Promotes successful long-term preservation of data

New England Collaborative Data Management Curriculum

Create a Readme File to Document a File or Directory

Typical contents:

- **What:** title & description
- **When:** date of data collection
- **Who:** name & contact info of creator
- **Where:** location where data was captured
- **How:**
  - Method of data collection, creation or processing
  - Restrictions on accessing files

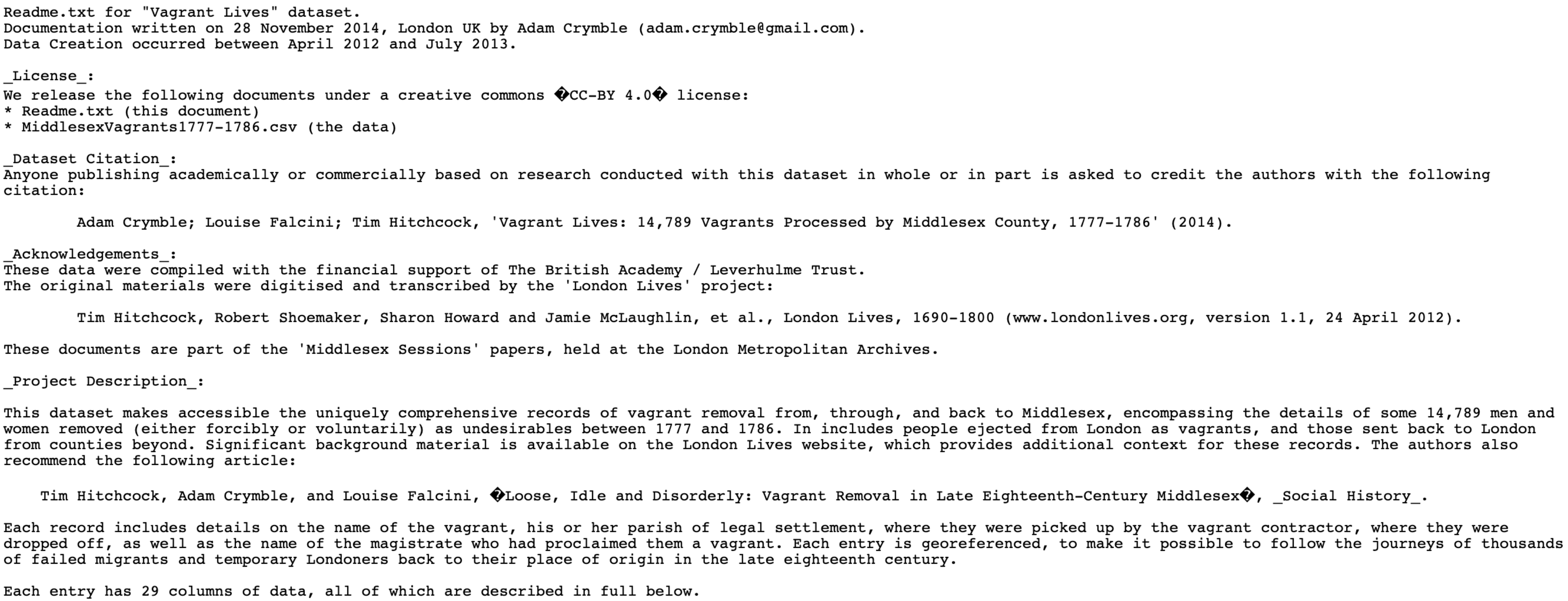
https://data.research.cornell.edu/content/readme

Simple Example of a ReadMe File

Files to replicate Sean Bolks and Richard J. Stoll, “The Arms Acquisition Process: The Effect of Internal and External Constraints on Arms Race Dynamics,” *The Journal of Conflict Resolution* 44, no. 5 (October 1, 2000): 580–603.

File	Content
table1.dta	Stata data file with data for Table 1
table1.do	Stata .do file with commands to replicate Table 1
table2.dta	Stata data file with data for Table 2
table2.do	Stata .do file with commands to replicate Table

More Detailed ReadMe file



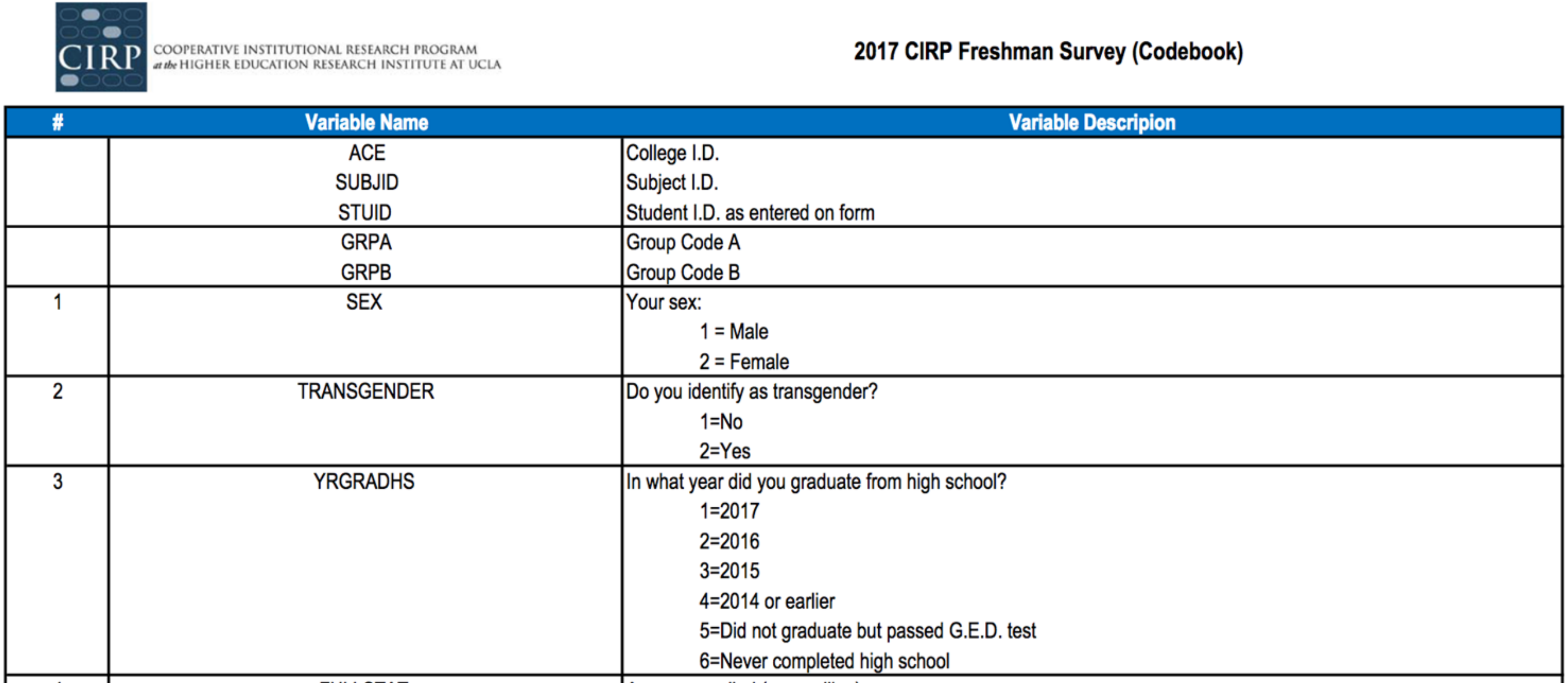
```
Readme.txt for "Vagrant Lives" dataset.
Documentation written on 28 November 2014, London UK by Adam Crymble (adam.crymble@gmail.com).
Data Creation occurred between April 2012 and July 2013.

_License_:
We release the following documents under a creative commons �CC-BY 4.0� license:
* Readme.txt (this document)
* MiddlesexVagrants1777-1786.csv (the data)

_Dataset Citation_:
Anyone publishing academically or commercially based on research conducted with this dataset in whole or in part is asked to credit the authors with the following
citation:

        Adam Crymble; Louise Falcini; Tim Hitchcock, 'Vagrant Lives: 14,789 Vagrants Processed by Middlesex County, 1777-1786' (2014).

_Acknowledgements_:
These data were compiled with the financial support of The British Academy / Leverhulme Trust.
The original materials were digitised and transcribed by the 'London Lives' project:

        Tim Hitchcock, Robert Shoemaker, Sharon Howard and Jamie McLaughlin, et al., London Lives, 1690-1800 (www.londonlives.org, version 1.1, 24 April 2012).

These documents are part of the 'Middlesex Sessions' papers, held at the London Metropolitan Archives.

_Project Description_:

This dataset makes accessible the uniquely comprehensive records of vagrant removal from, through, and back to Middlesex, encompassing the details of some 14,789 men and
women removed (either forcibly or voluntarily) as undesirables between 1777 and 1786. In includes people ejected from London as vagrants, and those sent back to London
from counties beyond. Significant background material is available on the London Lives website, which provides additional context for these records. The authors also
recommend the following article:

    Tim Hitchcock, Adam Crymble, and Louise Falcini, �Loose, Idle and Disorderly: Vagrant Removal in Late Eighteenth-Century Middlesex�, _Social History_.

Each record includes details on the name of the vagrant, his or her parish of legal settlement, where they were picked up by the vagrant contractor, where they were
dropped off, as well as the name of the magistrate who had proclaimed them a vagrant. Each entry is georeferenced, to make it possible to follow the journeys of thousands
of failed migrants and temporary Londoners back to their place of origin in the late eighteenth century.

Each entry has 29 columns of data, all of which are described in full below.
```

https://zenodo.org/record/13103/files/Readme.txt

Create a Codebook to Describe the Contents of Data Files

“A codebook is an essential document that informs the data user about the **study, data file(s), variables, categories**, etc., that make up a complete dataset. The codebook may include a dataset’s record layout, list of **variable names and labels**, concepts, categories, cases, missing value codes, frequency counts, notes, universe statements, and so on.”
http://www.ddialliance.org/training/getting-started-new-content/create-a-codebook

Codebook Example

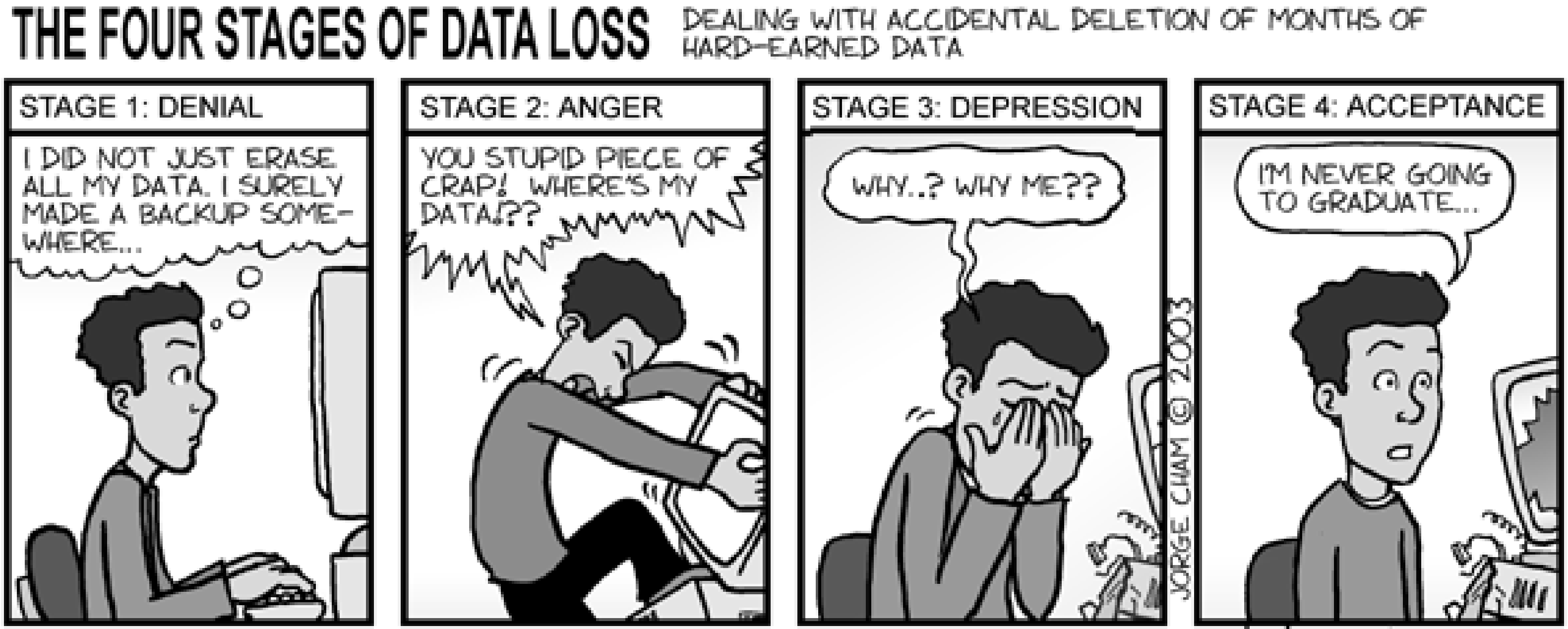


CIRP COOPERATIVE INSTITUTIONAL RESEARCH PROGRAM
at the HIGHER EDUCATION RESEARCH INSTITUTE AT UCLA

2017 CIRP Freshman Survey (Codebook)

#	Variable Name	Variable Descripion
	ACE SUBJID STUID	College I.D. Subject I.D. Student I.D. as entered on form
	GRPA GRPB	Group Code A Group Code B
1	SEX	Your sex: 1 = Male 2 = Female
2	TRANSGENDER	Do you identify as transgender? 1=No 2=Yes
3	YRGRADHS	In what year did you graduate from high school? 1=2017 2=2016 3=2015 4=2014 or earlier 5=Did not graduate but passed G.E.D. test 6=Never completed high school

7. Store, Share and Archive Data


THE FOUR STAGES OF DATA LOSS
DEALING WITH ACCIDENTAL DELETION OF MONTHS OF HARD-EARNED DATA
STAGE 1: DENIAL
I DID NOT JUST ERASE ALL MY DATA. I SURELY MADE A BACKUP SOMEWHERE...
STAGE 2: ANGER
YOU STUPID PIECE OF CRAP! WHERE'S MY DATA!??
STAGE 3: DEPRESSION
WHY..? WHY ME??
STAGE 4: ACCEPTANCE
I'M NEVER GOING TO GRADUATE...
JORGE CHAM © 2003
www.phdcomics.com

http://phdcomics.com/comics/archive.php?comicid=382

3-2-1 Backup Rule

3 Save 3 copies of your data.

2 Use 2 types of storage.

1 Keep 1 remote copy.

Overview of Data Storage, Backup and Sharing Options at Rice

Network or Cloud Storage

- **storage.rice.edu** - U: drive, departmental shares
- **Research Data Facility (RDF)** - larger scale storage for research
- **Rice Box:** cloud storage; 1 TB limit for faculty & staff, 500 GB for grad students

Backup Options

- **storage.rice.edu** backups/snapshots
- **Crash Plan** for Rice workstations

Data Sharing- Globus Connect

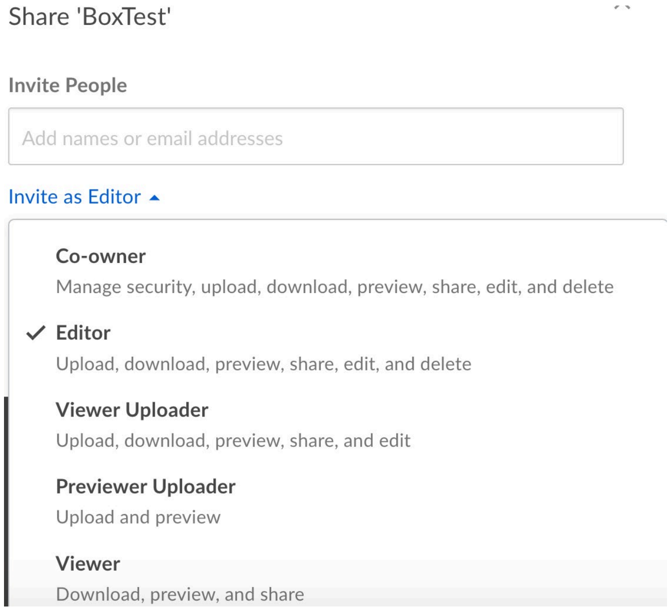
Options for faculty/ staff: https://kb.rice.edu/page.php?id=70762

Options for students: https://kb.rice.edu/page.php?id=65636

Features of Rice Box

"enterprise cloud-based storage and collaboration service"

- Access prior versions (up to 100)
- Sync files and download for offline use
- Files automatically backed up at multiple data centers
- Control file/folder permissions



Share 'BoxTest'

Invite People

Add names or email addresses

Invite as Editor ▲

Co-owner
Manage security, upload, download, preview, share, edit, and delete

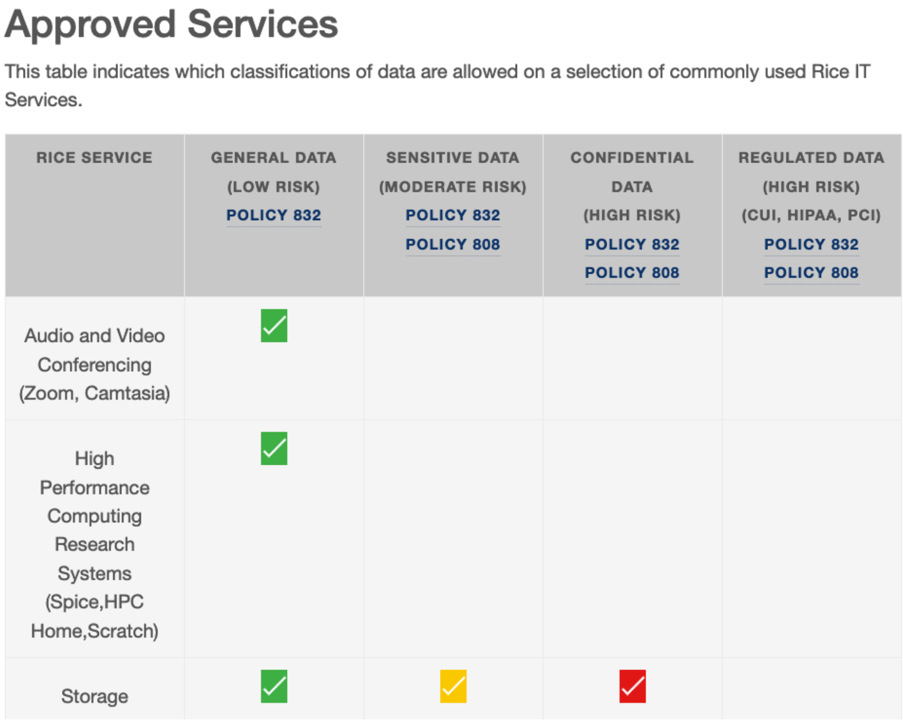
✓ Editor
Upload, download, preview, share, edit, and delete

Viewer Uploader
Upload, download, preview, share, and edit

Previewer Uploader
Upload and preview

Viewer
Download, preview, and share

Consult IT regarding data security



Approved Services

This table indicates which classifications of data are allowed on a selection of commonly used Rice IT Services.

RICE SERVICE	GENERAL DATA (LOW RISK) POLICY 832	SENSITIVE DATA (MODERATE RISK) POLICY 832 POLICY 808	CONFIDENTIAL DATA (HIGH RISK) POLICY 832 POLICY 808	REGULATED DATA (HIGH RISK) (CUI, HIPAA, PCI) POLICY 832 POLICY 808
Audio and Video Conferencing (Zoom, Camtasia)	✓			
High Performance Computing Research Systems (Spice,HPC Home,Scratch)	✓			
Storage	✓	✓	✓	

https://vpit.rice.edu/it-security/resources/risk-classifications/approved-services

Data Archiving Options

Public Repositories:

- Discipline based repository (e.g. GenBank or PANGEA)
- General data repository (e.g. FigShare or Dataverse)
- Institutional repository (e.g. Rice Digital Scholarship Archive)

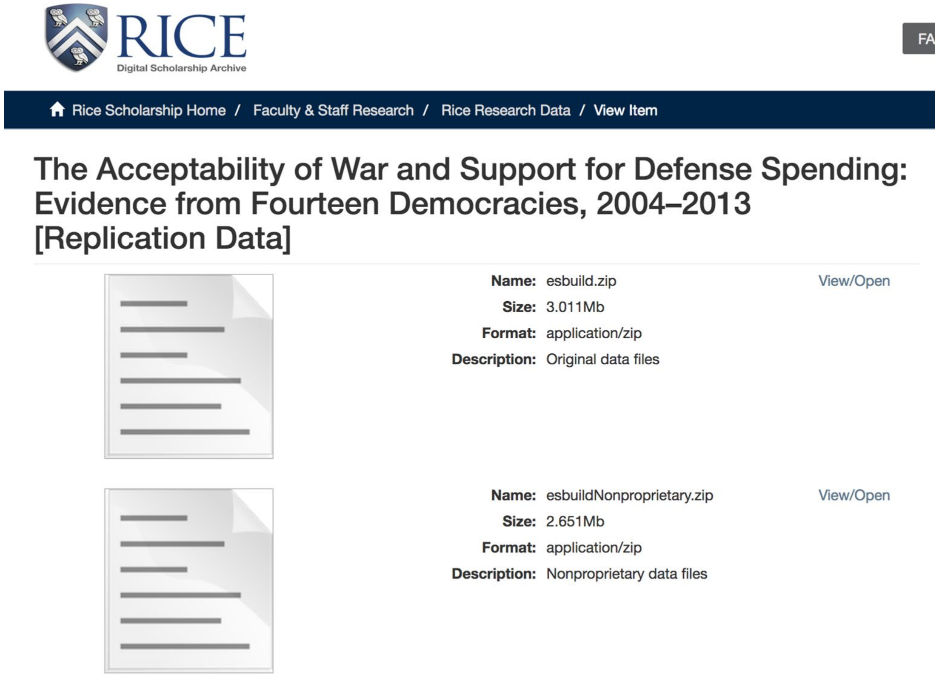
Private Approaches:

- Long-term storage

Why Archive Your Research Data with a Data Repository?

- Conform to publisher or funder requirements
- Get cited
    - “studies that made [gene expression microarray] data available in a public repository received 9% … more citations than similar studies for which the data was not made available.” (Piowowar & Vision, 2013)
- Promote future research by making data available publicly for the long term

Rice Data Sharing Option: Rice Digital Scholarship Archive


RICE
Digital Scholarship Archive
FA
Rice Scholarship Home / Faculty & Staff Research / Rice Research Data / View Item
View/Open
View/Open

The Acceptability of War and Support for Defense Spending: Evidence from Fourteen Democracies, 2004–2013 [Replication Data]

Name: esbuild.zip
Size: 3.011Mb
Format: application/zip
Description: Original data files

Name: esbuildNonproprietary.zip
Size: 2.651Mb
Format: application/zip
Description: Nonproprietary data files

https://scholarship.rice.edu/

Data Archiving Caveats

- Do not share confidential data (unless it has been completely de-identified and approved through IRB).
- Consult with your collaborators before publishing data.
- It may be possible to embargo data so that it is not available until the related publication is released.

What Does Research Data Services Offer?

https://library.rice.edu/research-data-services

- Workshops on R, Python, Excel, etc.
- Consulting on finding, analyzing, managing, and visualizing data, including during office hours
- Publishing and preserving data through the Rice Digital Scholarship Archive; providing DOIs
- Reviewing data management plans

Please contact researchdata@rice.edu with any questions.

Visit us online at http://researchdata.rice.edu/.

- Help us shape future workshops! Please complete this evaluation:
- **https://tinyurl.com/FondrenEval**

Resources

Borer, Elizabeth T., et al "Some Simple Guidelines for Effective Data Management." *Bulletin of the Ecological Society of America* (2009): 205–14.

DataOne Primer on Data Management, https://www.dataone.org/sites/all/documents/DataONE_BP_Primer_020212.pdf

Dataverse, *Data Management Plans*, http://best-practices.dataverse.org/data-management/

ICPSR *Guide to Social Science Data Preparation and Archiving,* http://www.icpsr.umich.edu/icpsrweb/content/deposit/guide/

Svend Juul et al, "Take good care of your data," http://www.epidata.dk/downloads/takecare.pdf

UK Data Archive, *Managing and Sharing Data: Best Practices for Researchers*, http://www.data-archive.ac.uk/media/2894/managingsharing.pdf