

# The Scholar's Backpack: Using virtual environments to support modern research practice.

Bret Davidson | Eka Grguric

NCSU Libraries

[bretdavidson.github.io/cni-2016](https://bretdavidson.github.io/cni-2016)

# Agenda

- Open science as problem space
- Open science as modern research practice
- Open science at NC State
- Scholar's Backpack

# Open Science: what is it?

- Open Access
- Open Data
- Open Notebooks
- Open Source

Open Science is a return to first principles of scientific practice.

PHILOSOPHICAL  
TRANSACTIONS:  
GIVING SOME  
ACCOMPT  
OF THE PRESENT  
Undertakings, Studies, and Labours  
OF THE  
INGENIOUS  
IN MANY  
CONSIDERABLE PARTS  
OF THE  
WORLD.

*Vol I.*

For *Anno 1665, and 1666.*

In the SAVOY,  
Printed by T. N. for John Martyn at the Bell, a little with-  
out Temple-Bar, and James Allestry in Duck-Lane,  
Printers to the Royal Society.

# Nullius in Verba

"Take nobody's word for it."

Open Science can  
increase reproducibility.

# Five Schools of Thought

by Sönke Bartling & Sascha Friesike

Editors, <http://book.openingscience.org/>

- Infrastructure
- Public
- Measurement
- Democratic
- Pragmatic

# Why Libraries?



# Aligns with core library values

- information access
- open peer review
- community-based knowledge creation
- the preservation and dissemination of research
- libraries are champions of open (open source; open data)

Libraries

are about

supporting their users

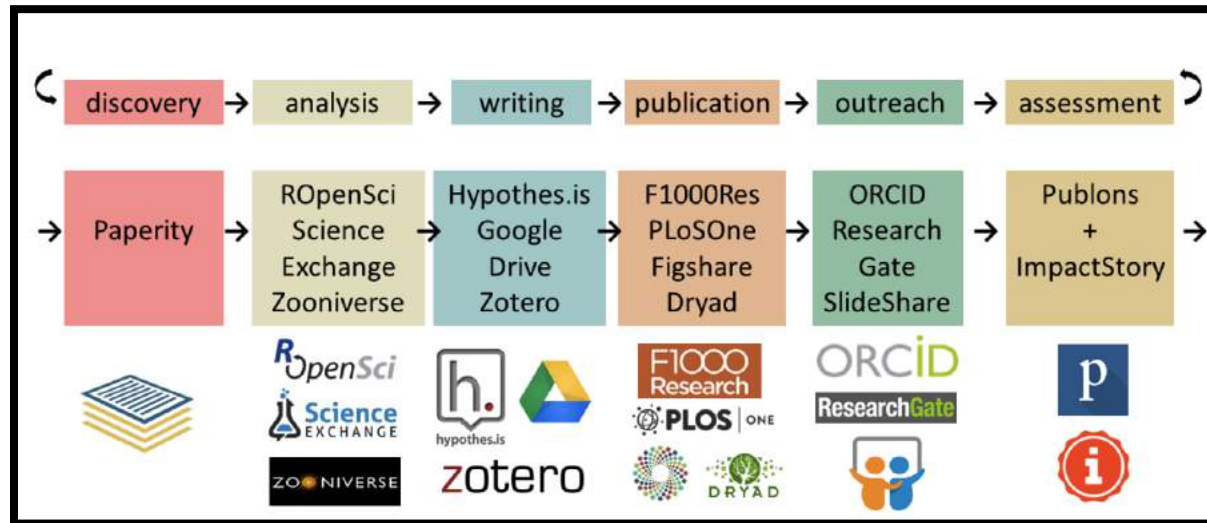
Academic Libraries

are about

supporting research practice

Ongoing disruption by digital  
technologies in modern research  
practice

# Hypothetical Open Science Workflow



101 Innovations in Scholarly Communication,  
<https://innoscholcomm.silk.co/>

# Policy Shifts in support of open

OECDpublishing

Please cite this paper as:

OECD (2015), "Making Open Science a Reality", *OECD Science, Technology and Industry Policy Papers*, No. 25, OECD Publishing, Paris.  
<http://dx.doi.org/10.1787/5jrs2f963zs1-en>



OECD Science, Technology and Industry  
Policy Papers No. 25

**Making Open Science a  
Reality**

OECD

Ecosystem of Support for  
Modern Research Practice at  
NCSU Libraries

# Research Support



## COLLECTIONS

Tripsaver, Special Collections, Digital Repository



## CITATION MANAGEMENT

RefWorks, Zotero, Mendeley, EndNote



## DATA AND GIS

Finding geospatial and numeric data, GIS software assistance



## DATA MANAGEMENT

DMP review, sharing & discovery, best practices



Need Help?



## GRANTS AND FUNDING

Opportunities, proposal writing, sponsored research compliance



## MEASURING RESEARCH IMPACT

Citation analysis, author networks and metrics, benchmarking



## PUBLISHING AND COPYRIGHT

Copyright agreements, Open Access, fair use



## VISUALIZATION

High-tech spaces, video walls, data visualization

## CHANCELLOR'S FACULTY EXCELLENCE PROGRAM

Libraries' support for faculty cluster programs

## SUBJECT SPECIALISTS



Jeff Essic



Karen DeWitt



Danica Lewis



Mira Waller



## TEXT AND DATA MINING

Datasets, tools and tutorials

All subject specialists >



## WORKSHOPS

All Workshops

Digital Media Workshops

Makerspace Workshops

Ready. Set. Go!

Research Workshops

Visualization Workshops

View other Library events. →

« NOVEMBER »

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micar

# Visualization Workshops

NOV

18

## Infographics: Visualizing Information

November 18  
10:00 AM to 12:00 PM

AT THE  
ITTC Lab 2, D. H. Hill Library

DEC

2

## Getting Started with Data Visualization: Tools for Research!

December 2  
11:00 AM to 12:00 PM

AT THE  
ITTC Lab 2, D. H. Hill Library

DEC

2

## Getting Started with Data Visualization II: Elements of Design

December 2  
12:00 PM to 1:00 PM

AT THE  
ITTC Lab 2, D. H. Hill Library

DEC

5

## R for Absolute Beginners

December 5  
1:00 PM to 3:00 PM

AT THE

# Makerspace

## D. H. HILL LIBRARY

A D-I-Y creation and collaboration space



## JAMES B. HUNT JR. LIBRARY

3D Printing services and more





**WOLFPACK  
CITIZEN  
SCIENCE  
CHALLENGE**

The NCSU Libraries'  
**Open Science Initiative**

# Goals

- explore open science practice at NCSU
- better understand researcher needs in context

Take a non-prescriptive  
**user-centered** approach.

Create opportunities for  
communication.

# Open Science Unconference

[NC State Home](#) RESOURCES

**NCSU LIBRARIES** [FIND](#) [GET HELP](#) [SERVICES](#) [LIBRARIES](#) [ABOUT](#)

[ASK US](#) [MY ACCOUNT](#) [HOURS](#) [FAQ](#) [LOG OUT](#) [CHAT NOW](#)

## Open Science Unconference 2016

**When**  
Tuesday, March 22, 9:00 a.m - 5:00 p.m

**Where**  
Duke Energy Hall 2nd Floor, James B. Hunt Jr. Library


**About**  
NCSU Libraries will be hosting an Open Science Unconference in the Duke Energy Hall at the James B. Hunt Jr. Library on March 22nd, 2016. The unconference will be an informal, participant-driven, event for researchers across NCSU who are interested in open science to meet, discuss, and discover opportunities for collaboration. The unconference structure is loose and collaborative; participants are welcome to help set the agenda, define the outcomes, and develop the deliverables. Hosted by the NCSU Libraries, the unconference will feature breakout sessions and a keynote presentation by Dr. Marcus Hanwell.

Attendance is free but space is limited. To register please fill out this form: [go.ncsu.edu/opensci2016\\_registration](http://go.ncsu.edu/opensci2016_registration)

To keep in touch and hear about future events, please join our google group: [group-openscience@ncsu.edu](mailto:group-openscience@ncsu.edu)

**SCHEDULE**

- 9:00 - 10:00 Coffee and Mingling
- 10:00 - 11:00 Keynote
- 11:00 - 1:15 Breakout Planning, Lunch, and Voting
- 1:15 - 4:00 Two Rounds of Breakout Sessions



open science

Open Science Logo, Greg Emmerich, CC-BY-SA-2.0

# Follow-up Informal Interviews

- Modern Research Skills Gap
- Insufficient Incentives

NCSU LIBRARIES  
**SUMMER**



**OPEN SCIENCE**

EVENTS

- All Events & Exhibits
- All Workshops
- Events Calendar
- Exhibits

EVENT SERIES

- Coffee & Viz
- Summer of Open Science
- Fabulous Faculty
- Amazing Alumni
- Stellar Students
- AV Geeks at the Hunt Library
- Read Smart
- Making Space

WORKSHOPS

- All Workshops
- Visualization Workshops
- Makerspace Workshops
- Research Workshops
- Digital Media Workshops

* MAY *						
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29	30	31				

## Summer of Open Science Event Series

The NCSU Libraries Summer of Open Science is a series of workshops and meetups that support modern research practice through hands on skill building.

Researchers are increasingly using digital tools in a complex, increasingly open, scholarly ecosystem. This has created a technical skills gap for experienced and novice researchers alike. The Summer of Open Science is designed to address this skills gap.



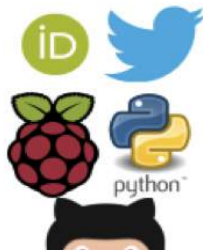
### INTRODUCTION TO THE COMMAND LINE INTERFACE

May 19, 2016  
2:00 PM to 4:00 PM  
At the D.H. Hill Makerspace, D. H. Hill Library



### WEB SCRAPING WITH PYTHON

May 25, 2016  
2:00 PM to 5:00 PM  
At the D.H. Hill Makerspace, D. H. Hill Library



### UNDERSTAND AND BUILD YOUR SCHOLARLY IDENTITY

Jun 2, 2016  
10:00 AM to 12:00 PM  
At the Multimedia Seminar Center, D. H. Hill Library

### SCIENTIFIC COMPUTING WITH PYTHON AND RASPBERRY PI

Jun 7, 2016  
2:00 PM to 5:00 PM  
At the D.H. Hill Makerspace, D. H. Hill Library

### BUILD YOUR SCHOLARLY WEBSITE THE EASY WAY

Jun 10, 2016  
10:00 AM to 12:00 PM

# Goals

- Hands on skill building
- Provide networking opportunities
- Increase visibility of library spaces & services

# Skills

- Scholarly identity creation
- Scientific computing
- Building a website
- Data harvesting
- Code collaboration

# The Planning Team

Representation from both technical  
and non-technical departments.

**Ekatarina [Eka] Grguric (Project Lead)**

NCSU Libraries Fellow, Digital Libraries Initiatives / User Experience

**Lauren Di Monte (Project Manager)**

NCSU Libraries Fellow, User Experience / Administration

**Alison Blaine (Content Development)**

NCSU Libraries Fellow, Digital Libraries Initiatives / Research & Information Services

**Bret Davidson (Technical Lead)**

Digital Technologies Development Librarian, Digital Libraries Initiatives

**Jennifer Garrett (Community Development)**

Research Librarian for Mgmt, Education, and Social Sciences, Research & Information Services

# Summer of Open Science

- Workshops
  - Intro to the Command Line Interface
  - Web Scraping with Python
  - Understand and Build Your Scholarly Identity
  - Scientific Computing with Python & Raspberry Pi
  - Build Your Scholarly Website the Easy Way
- Events
  - Meetups
  - End-of-Summer Showcase

# Instructors



Brittany Johnson



Eka Grguric



Lauren DiMonte



Alison Blaine



Madison Sullivan



Will Cross



Todd Stoffer



Scientific Computing with Python & Raspberry Pi

**40 person waiting list**



Interdisciplinary Need:  
over 40 departments across ~16 colleges

# Takeaways

- Libraries are well positioned to fill gaps in the curriculum
- "Open Science" attracted a range of disciplines
- High demand for introductory skill training, particularly coding skills (Python)
- Interest in interdisciplinary research sharing
- Summer presents interesting opportunities and challenges

# Virtual Environments for Reproducible Computing

Technical workshops are  
ripe for disaster.

# What could go wrong?

- Images reset overnight
- Improper permissions
- Network connectivity issues
- Language Versions
- Missing packages

# Instructor Challenges

- Consistency across user environments
- Consistency of course materials
- Time to provision computing environments
- Ease of collaboration

# Student Challenges

- Basic data types and structures
- Module system
- Retrieve a web page with Requests
- Parse content with BeautifulSoup
- Generate a word cloud with matplotlib
- Control Structures
- Exception Handling
- Working with file system

Computing Tasks

vs.

Computing Environments

# Many Options

- Custom Operating System Images
- Custom Distributions, e.g. Anaconda
- Interactive Environments, e.g. Jupyter

# Our Approach

- Vagrant for managing operating system
- Ansible for provisioning and configuration
- Course or lab specific packages and resources

# Easy!

1. Install Vagrant
2. Install VirtualBox
3. Clone project repo
4. ``vagrant up``
5. ``vagrant ssh``
6. Execute code!

This is reproducible computing!

# Benefits

- Consistent environment user to user
- Single target for course materials
- Faster provisioning for new workshops
- Repeatable course to course

# Rise of Scholarly Code

# Researcher Challenges

- Consistency across lab environments
- Ability to see results of code
- Consistency across time
- Ease of collaboration

github.com/NCSU-Libraries/scholars-backpack

NCSU-Libraries / scholars-backpack

Unwatch 7 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Pulse Graphs Settings

No description or website provided. — Edit

1 commit 1 branch 0 releases 1 contributor MIT

Branch: master New pull request

Create new file Upload files Find file Clone or download

bretdavidson initial commit		Latest commit 2bb566f 23 seconds ago
ansible	initial commit	23 seconds ago
code	initial commit	23 seconds ago
.gitignore	initial commit	23 seconds ago
LICENSE	initial commit	23 seconds ago
README.md	initial commit	23 seconds ago
Vagrantfile	initial commit	23 seconds ago

README.md

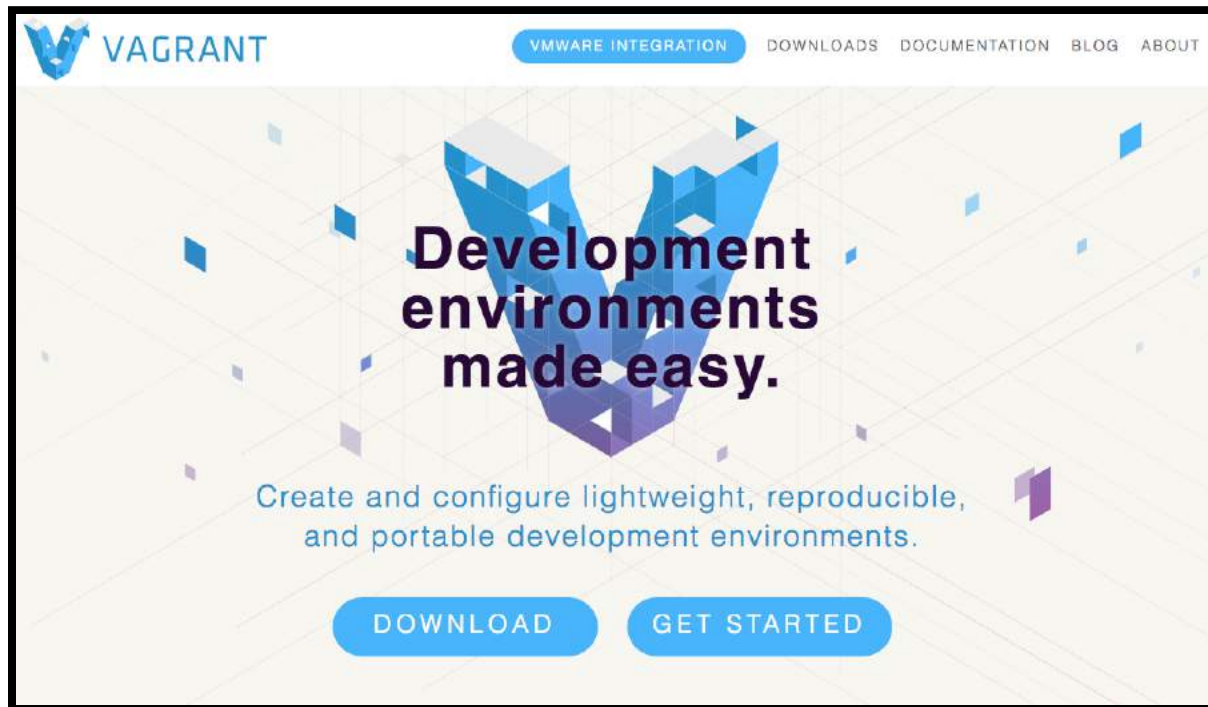
## Scholar's Backpack

Modern research practice asks researchers to engage with information in new ways through the use of a rapidly changing array of digital technologies. The Scholar's Backpack will bring together a sampler of commonly used digital tools that support the research lifecycle in one virtual machine, both decreasing the overhead of locating, installing, and learning how to use new tools and improving the reproducibility of scientific computing environments.

# Features

- Python
- R and R Studio
- Jupyter Notebook Server
- Example Notebooks

# Vagrant

The image shows the Vagrant website landing page. At the top left is the Vagrant logo, a blue stylized 'V' with a crown-like top, followed by the word 'VAGRANT' in blue. To the right of the logo is a navigation menu with links: 'VMWARE INTEGRATION' (highlighted in a blue pill), 'DOWNLOADS', 'DOCUMENTATION', 'BLOG', and 'ABOUT'. The main content area features a large, 3D-style blue 'V' logo in the center. Overlaid on this logo is the text 'Development environments made easy.' in a bold, dark font. Below this, a smaller line of text reads 'Create and configure lightweight, reproducible, and portable development environments.' At the bottom of the main content area are two blue pill-shaped buttons: 'DOWNLOAD' and 'GET STARTED'. The background of the main content area is a light beige color with a subtle grid pattern and scattered blue and purple geometric shapes.

Create and configure lightweight,  
**reproducible**, and portable  
development environments.

# Usage

- Easy installation through binary package
- Flexible configuration via **text-based configuration file**
- Single command: ``vagrant up``

# Ansible

"Automation engine" for provisioning  
and configuration management.

# Provisioning

"To make something available."

**Installation!**

# Configuration Management

"Establish and maintain **consistency** of an environment."

# Provisioning

- Text editor
- Python & R
- Git
- Web Browser
- etc.

# Configuration

- Start Jupyter notebook server
- Set environment variables
- Set default login directory

# Benefits

- Improved consistency
- Ability to see results of code
- Ease of collaboration

# Future Work

# Richer Environment

- Broader scientific computing
- Improved adherence to best practices
- Docker containers for portability

# Embedded Use

- Curricular use
- Laboratory use

# Summary

Open Science represents a new framework for research and provides an opportunity for libraries to engage researchers in new ways.

NCSU Libraries has done workshops and outreach around this framework and there is evidence of strong interest across disciplines.

We are redeploying existing technical resources and cutting edge technology in ways that used to be difficult or impossible.

This approach has helped us  
identify a new leadership role for  
libraries in open research  
support.

# Thanks!

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eka\_grguric@ncsu.edu | @egrguric

[github.com/NCSSU-Libraries/scholars-backpack](https://github.com/NCSSU-Libraries/scholars-backpack)

[bretdavidson.github.io/cni-2016](https://bretdavidson.github.io/cni-2016)