

Python intro of 2 hours, for MSGSO

(the **conda-juPy-GitHub** ferment)

This presentation is at

[https://github.com/MPOcanes/
MPO624-2018/tree/master/presentations](https://github.com/MPOcanes/MPO624-2018/tree/master/presentations)

python@lists.rsmas.miami.edu

after

python-subscribe@lists.rsmas.miami.edu

Brian Mapes, UM-RSMAS

March 22, 2018

2 hours is so short...

If you want to build a ship, don't drum up people together to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea. – Antoine de Saint Exupery

The 2 hours we have

- First hour: philosophical ramblings of interest (I hope) to a wide range of backgrounds, and launch together onscreen
- Break: (easy) troubleshooting of install/launch?
- Second hour: example **juPy** .ipynb notebooks
 - elementary ones for newbies
 - advanced users can chew on others
 - some last words
 - dissipating into chaos as the clock runs out

General Ramblings

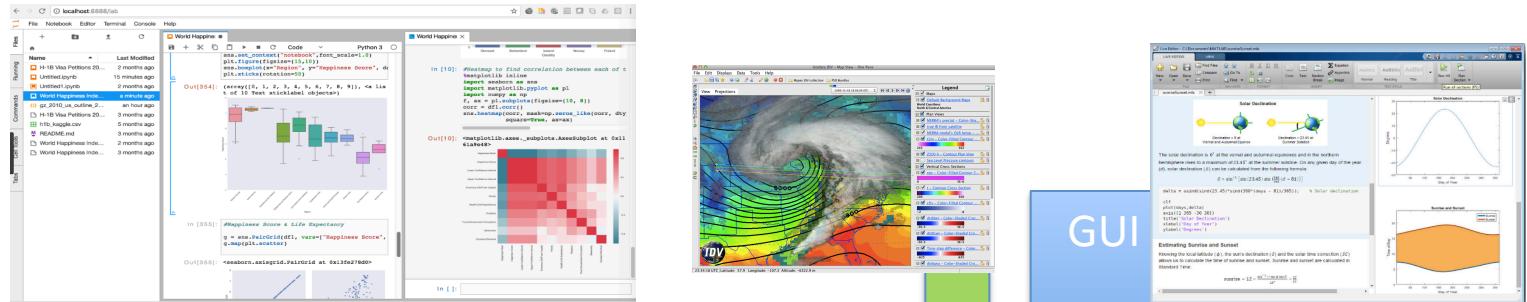
- Bottom up: computers, our age's power tool
 - the stack: from chips to screen,pointer,keyboard
 - languages, compiled vs. interpreted
 - *what layer is that error coming from?*
- Top down: Packages, companies, communities
 - ecosystems, proprietary vs. open-source
- The juicy middle: why the Python buzz?
 - programming, procedural vs. object-oriented
 - packages packages packages of packages

Bottom up: computers and IT

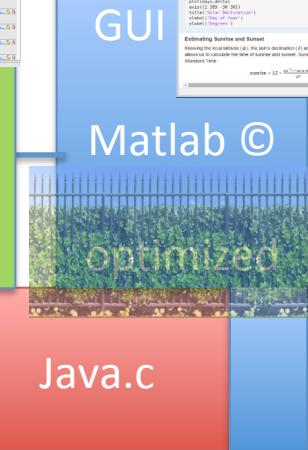
- Hardware, software: a **technology stack**
- Bits to bytes to all other “Digital Objects”
- Machine language to compilers to scripts
- 4th generation: scripting (interpreted), with integrated graphics for debugging, yet still fast & efficient
- Your machine vs. centralized servers & Cloud

Leveling a rugged IT landscape so science can do science

Graphical
Interfaces



Interpreted
(scripting)
compilers

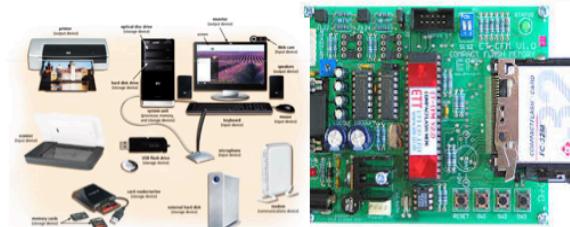


OS

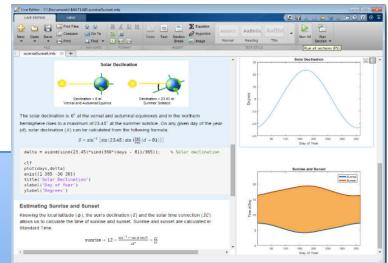


Hardware

- Front end:
- * Screen, speakers
 - Pointing device
 - Keyboard



- Back end:
- * CPU & graphics card
 - RAM
 - disk space



Top down: packages and companies

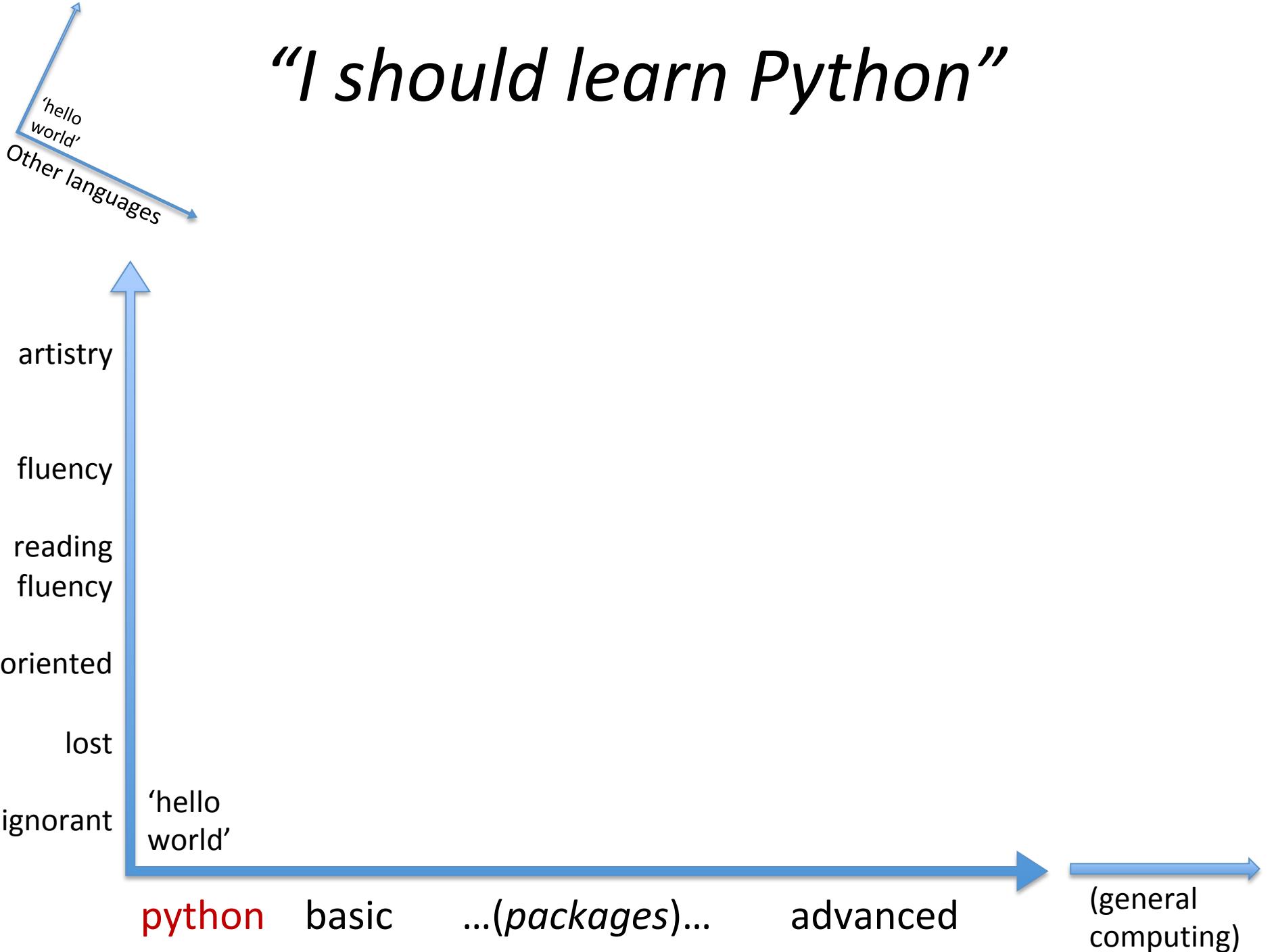
- Proprietary (for science): Matlab, IDL, ...
 - community shares on company-hosted sites
- Open source: Python, R, Octave, Ferret, NCL, GrADS, ... (Linux, Gnu gcc at root?)
 - community shares on **GitHub**, Bitbucket, ...
 - ***It's all about the community contributions***
 - ***Packages, and galleries of examples***
- Supported open source: a company sells *solutions & support*; the package is free
 - Python (Canopy, **Anaconda**, PyCharm comm. edition)
 - following Linux model (Red Hat, etc.)

The juicy middle: the Python buzz

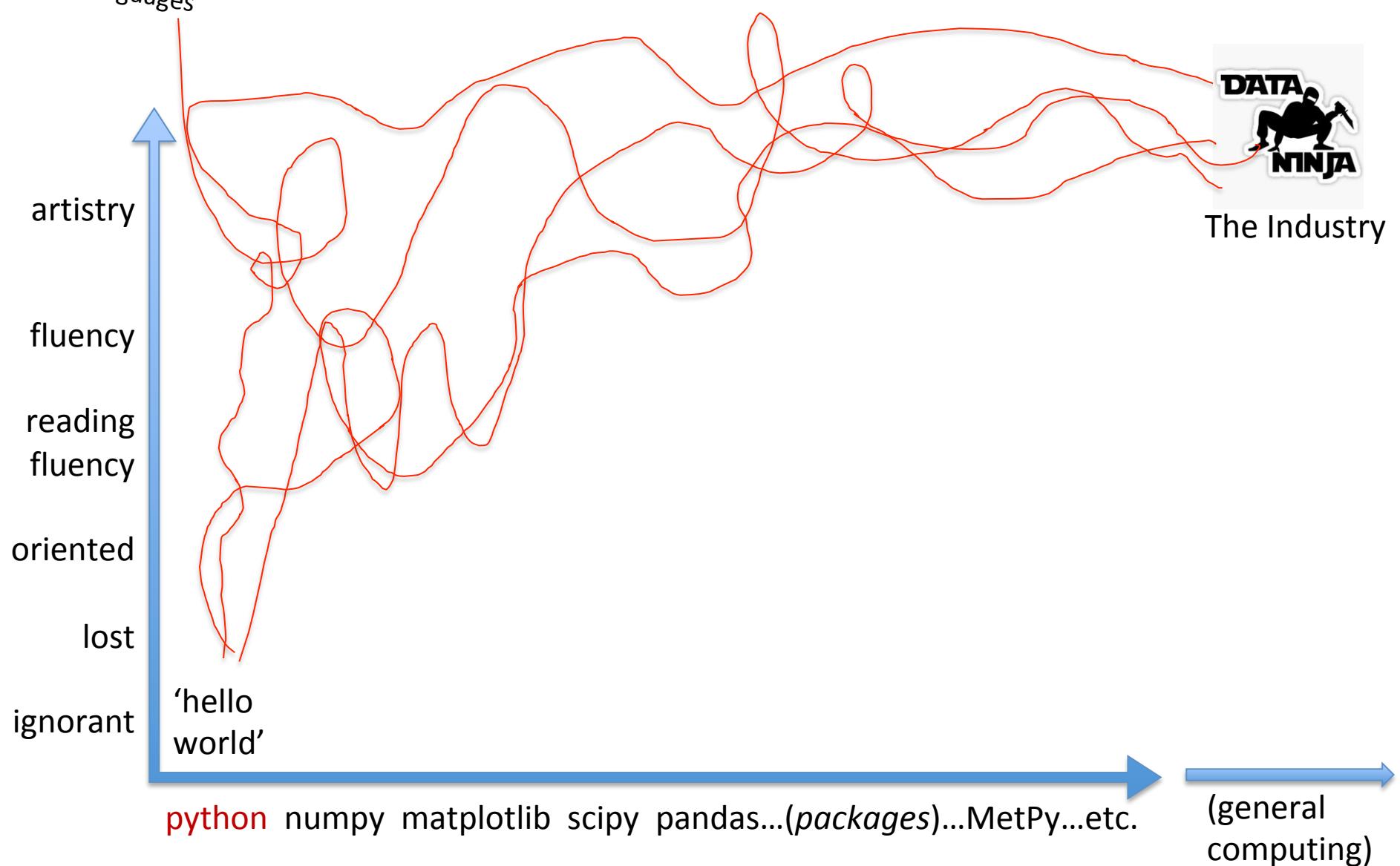
- Why do people like it so much?
 - Syntax is very well thought out & readable
 - Can “wrap” other languages (OS, compiled, ...)
 - giving Python-friendly syntax to uglier languages
 - Procedural AND object-oriented
 - Super-power command: **import**
 - packages packages packages of packages
 - try “**import antigravity**”

Community (part of an *ecosystem*)

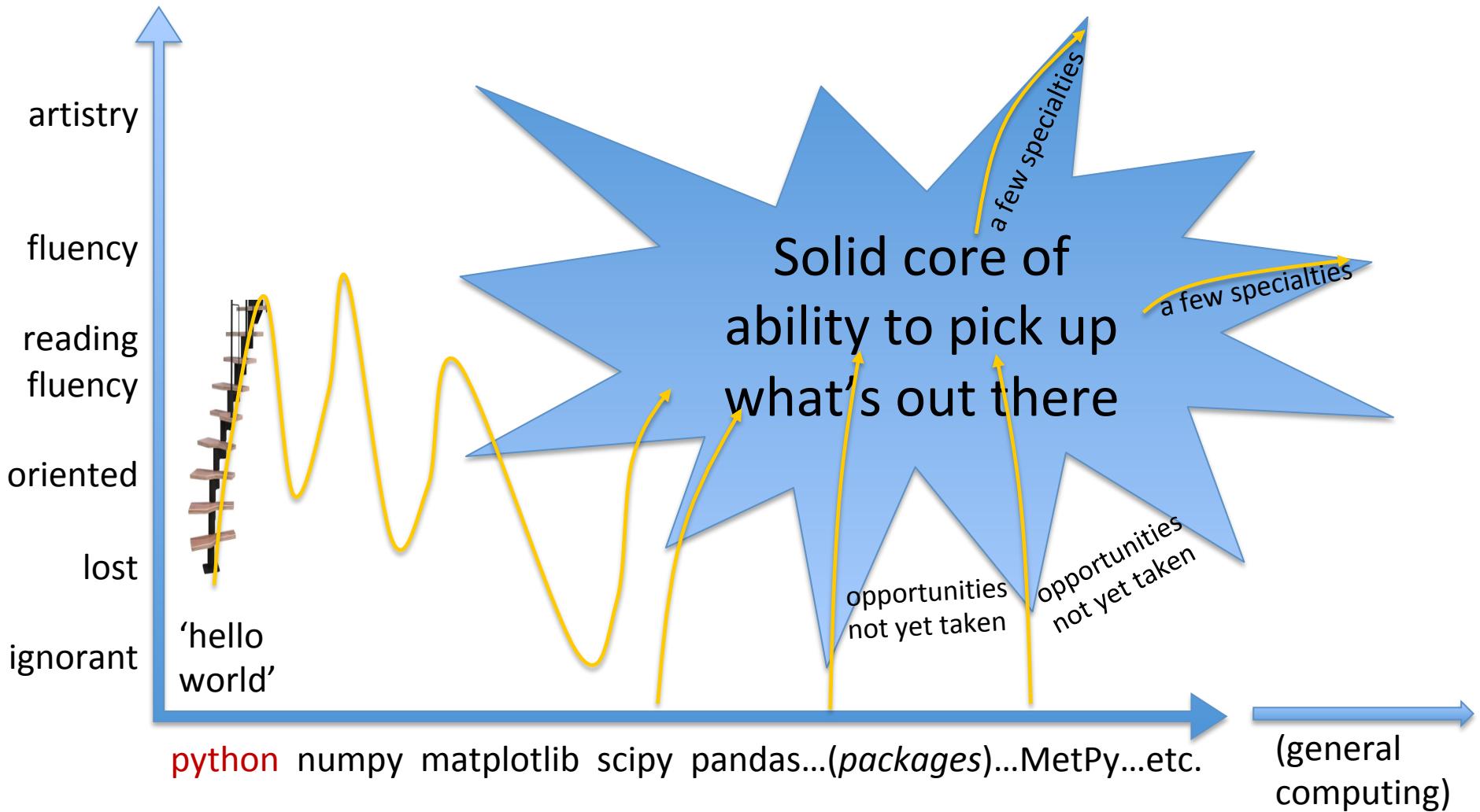
- There is lots of free stuff!
- *Too much...lots from semi-alien user cultures, hard to parse or evaluate*
 - google “python cheat sheet”
- *Find mavens in your area -- and then don't annoy them too much or too early with learned-helplessness (passive-minded whining)*



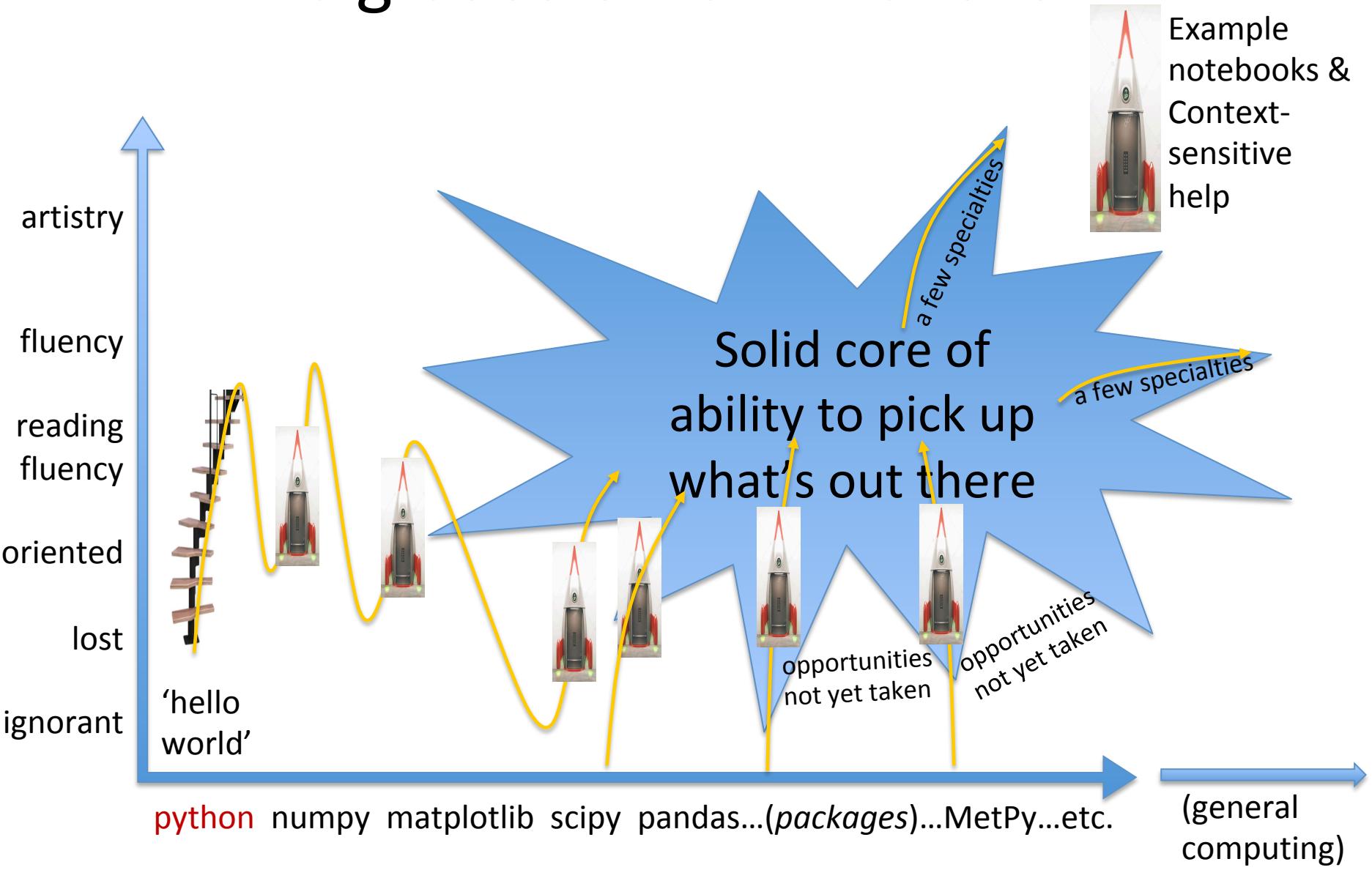
“Data science” path: *populous*, so *it’s where web search tends to drop you*



Scientist path: a career-making skill set



After that first staircase, can get big boosts from mavens!

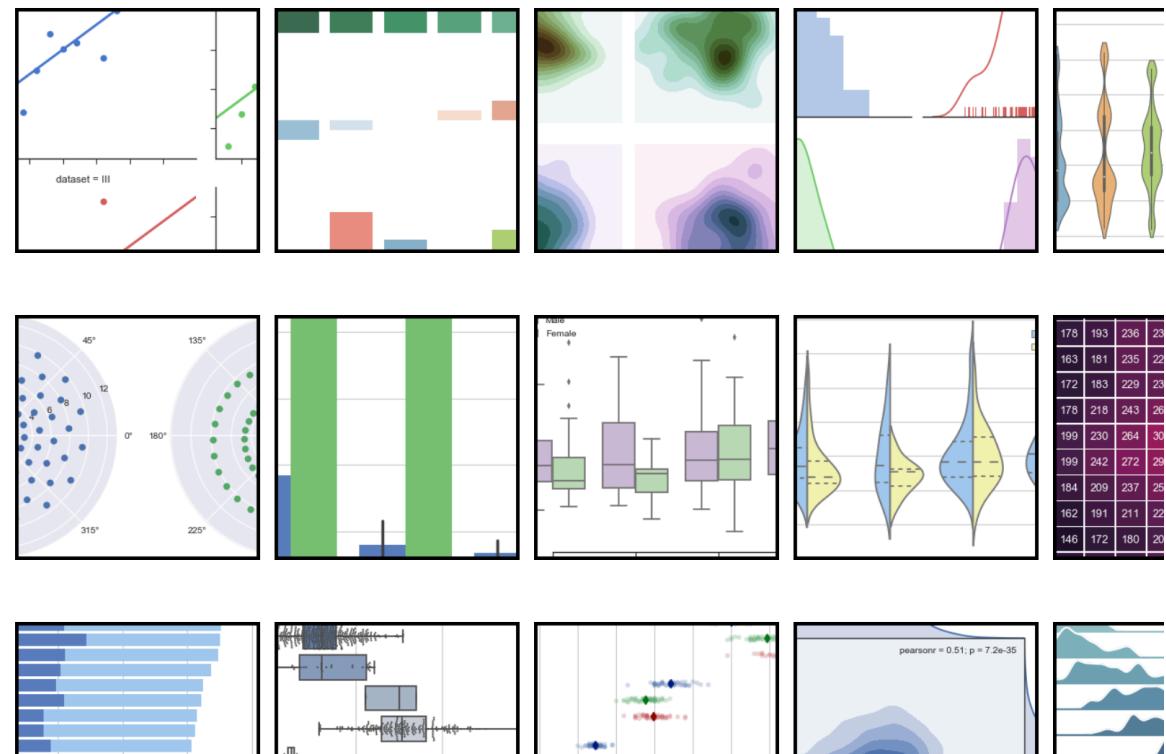


conda-ju Py-GitHub

- Packages are where the power lives!
- “galleries” let you work backward from a result-shaped container

seaborn 0.8.1 [Gallery](#) [Tutorial](#) [API](#) [Site](#) ▾ [Page](#) ▾

Example gallery



That first staircase

<https://unidata.github.io/online-python-training/>

// Basic Python Syntax

Here are some good sources for learning the basics of Python's Syntax:

- [Codecademy](#) has some free lessons on learning Python
- [learnpython.org](#) also has some free, interactive materials
- The [official](#) Python tutorial is pretty good as well

// Beginning Python Concepts

What follows is a series of Jupyter notebooks on learning Python with geoscience objectives. You can either peruse this material with the nbviewer links below or [run the Jupyter notebooks interactively](#).

- [Control Flow](#)
 - [Conditional Statements](#)
 - [Loops](#)
 - [Functions](#)
- [Basic Data Structures](#)
- [Basic Input and Output](#)
- [Times and Dates](#)

That first staircase

- <https://docs.python.org>
- As first programming learning:
 - <http://pyintro.org/tutorial.html>
 - <https://software-carpentry.org/lessons/>
 - <http://www.learnpython.org/>
- Python for programmers
 - <http://nbviewer.jupyter.org/github/jakevdp/WhirlwindTourOfPython/blob/master/Index.ipynb>

Beyond the staircase

- Learning packages, from working examples
- A big advantage of Jupyter rather than more complex Python “development environments”
 - Spyder (comes with Anaconda)
 - PyCharm (the serious programmer’s choice)

Finding your community

- Search: Jupyter galleries
 - <https://github.com/jupyter/jupyter/wiki/A-gallery-of-interesting-Jupyter-Notebooks>
 - Coherent books, for free
 - https://github.com/koldunovn/python_for_geosciences
 - <http://www.johnny-lin.com/pyintro/> (free chapters: I like 3 & 7)
- Browse agenda & YouTubes of SciPy, PyCon

ma·ven

/'māvən/ ⓘ

noun NORTH AMERICAN *informal*
noun: **maven**; plural noun: **mavens**

an expert or connoisseur.
"fashion mavens"

Origin

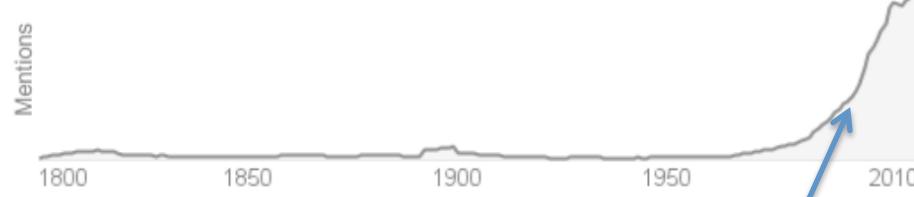
YIDDISH

→ maven
1960s

1960s: Yiddish.

Translate maven to

Use over time for: maven



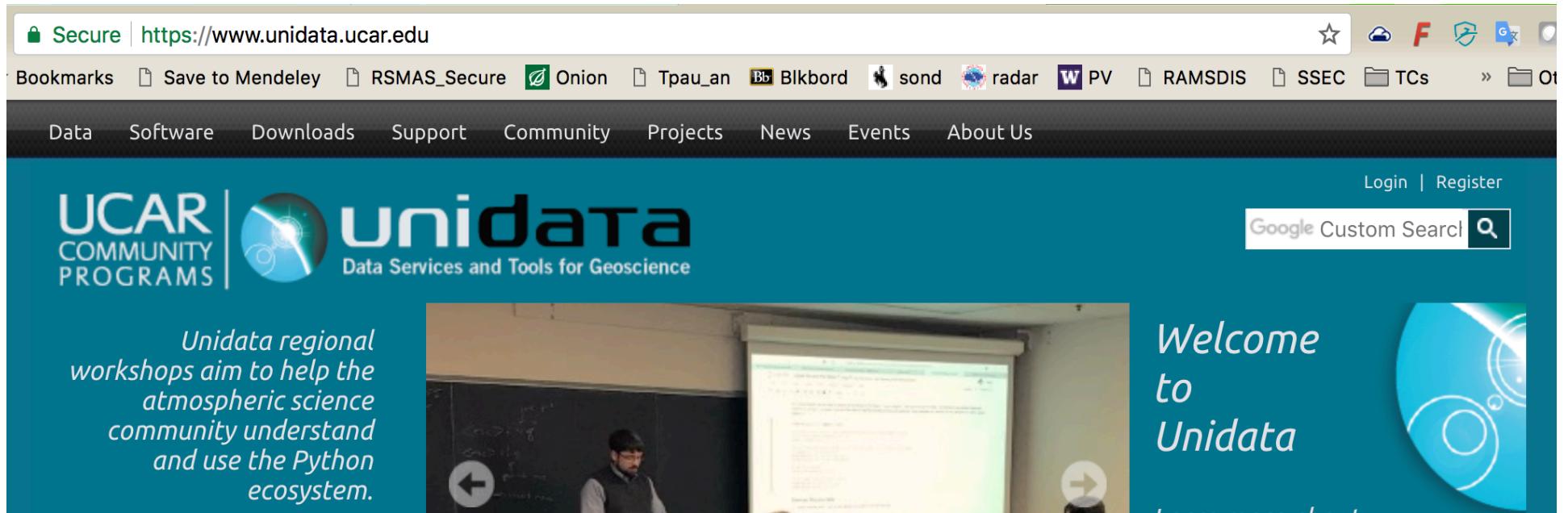
Malcolm Gladwell popularised the term more widely in his book *The Tipping Point* (Little Brown, 2000). Gladwell described those who are intense gatherers of information and also impressions, and so are often the first to become aware of new or nascent trends. The word has since become widely used in particular

History [edit]

The word itself is a borrowing from the [Yiddish](#) *meyvn* 'an expert, connoisseur', derived from the [Hebrew](#) מְבִין *mēvīn* 'person with understanding, teacher', a participle of the verb הָבֵין *hēvīn* 'to understand'^[1], from the [West Semitic root](#) *byn* 'to be separate, distinguish'^[2].

It was first recorded (spelled *mayvin*) in [English](#) in 1950 (in the *Jewish Standard* of [Toronto, Ontario, Canada](#)) and popularized in the United States in the 1960s by a series of commercials created

My (ATM-OCE) mavens: Unidata, and <http://pyaos.johnny-lin.com>



- But RSMAS has local mavens too... enriched in
 - Brazilians! Leo, Tiago, & earlier
 - » before I (and maybe the technology) were quite ready...
 - Europeans! Milan, Ray Bell, ...
 - python@lists.rsmas.miami.edu
 - New list, culture not yet set... delicate times!
 - Don't annoy, but somebody has to break the ice...

General python science mavens

- Jake VanderPlas
 - <http://vanderplas.com/>
 - <http://jakevdp.github.io/pages/about.html>
 - <https://github.com/jakevdp>
- <https://github.com/jrjohansson/scientific-python-lectures>
- [https://github.com/koldunovn/python for geosciences](https://github.com/koldunovn/python_for_geosciences)

conda-juPy-GitHub

- As of April 2017, GitHub reports having almost 20 million users and 57 million repositories, making it the largest host of source code in the world. (Wikipedia)
- GitHub has a mascot, an "Octocat" called Mona, a cat with five tentacles and a human-like face.



conda-juPy-GitHub

- **Big selling point: GitHub.com renders .ipynb files as static viewable pages**
 - *For a better rendering:* install nbviewer.jupyter.org browser extension
 - or paste github URL into nbviewer.jupyter.org



conda-juPy-GitHub: tiers of commitment

1. Scavenger: know how to operate the Web site

This screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The page displays a single Jupyter Notebook file, 'Jupyter Notebook Users Manual.ipynb'. The GitHub interface includes a navigation bar with 'This repository', 'Search', and links for 'Pull requests', 'Issues', 'Marketplace', and 'Explore'. Below the navigation bar, there are buttons for 'Unwatch', 'Star', and 'Fork'. The main content area shows the notebook's details: 'Branch: master', 'Author: brianmapes', 'Add some notebooks', '1 contributor', '2409 lines (2408 sloc)', and '85.2 KB'. A pink callout bubble with the text 'Learn to see this! (one file)' points to the download options ('Raw', 'Binary', 'History') at the bottom of the notebook's preview. To the right of the page, a blue bracket groups several annotations: '7 layers of apparatus!!', 'Unwelcoming at first blush', and a GitHub logo.



conda-jupyter-GitHub: tiers of commitment

1. Scavenger: know how to operate the Web site

This repository Search Pull requests Issues Marketplace Explore

MPOcanes / MPO624-2018 Unwatch 3 Star 2 Fork 13

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

MPO 624 CLASS FOR SPRING 2018

atmospheric science idv notebook jupyter-notebook jupyter atmospheric-science oceanography unidata Map

378 commits 2 branches 0 releases

Branch: master New pull request Create new file Upload files Find file Clone or download

brianmapes Update README.md Latest commit 1327307 20 hours ago

assignments Update README.md
classnotes Create 2018-02-08.md
exams update from MPO624
lessonplans Update 5thTuesday.md
notebooks Add some notebooks

Learn to see this!
(whole repo)



conda-jupyter-GitHub: tiers of commitment

1. Scavenger: know how to operate the Web site

The screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The page includes a navigation bar with links to 'This repository', 'Search', 'Pull requests', 'Issues', 'Marketplace', and 'Explore'. Below the navigation bar, there's a header with a bell icon, a '+' button, and a profile picture. The main content area displays repository details: 'MPO 624-2018' (private), 'Code', 'Issues 0', 'Projects 0', 'Wiki', 'Insights', 'Settings', 'Unwatch', '3', 'Star 2', 'Fork 13', and an 'Edit' button. A large green starburst annotation points to the 'Star 2' and 'Fork 13' counts with the text 'popular?'. Another pink starburst annotation points to the 'jupyter-notebook', 'atmospheric-science', 'oceanography', and 'griddata' topics with the text 'Don't miss these tags, to discover like-minded repositories'. At the bottom, there's a commit history showing a recent update by 'brianmapes' and a list of files like 'assignments', 'classnotes', 'exams', etc., with their last update times. A pink starburst annotation points to the commit history with the text 'is project dead or alive?'.

MPOcanes / MPO624-2018

Code Issues 0 Projects 0 Wiki Insights Settings

Unwatch 3 Star 2 Fork 13

Don't miss these tags, to discover like-minded repositories

jupyter-notebook atmospheric-science oceanography griddata Manage topics

2 branches 0 releases 13 contributors

Branch: master New pull request Create new file Upload files Find file Clone or download

brianmapes Update README.md

Latest commit 1327307 20 hours ago

assignments Update README.md 20 hours ago

classnotes Create 2018-02-08.md 3 days ago

exams update from MPO624 25 days ago

lessonplans Update 5thTuesday.md 21 hours ago

notebooks Add some notebooks 6 days ago

is project dead or alive?

conda-jupyter GitHub: tiers of commitment

2. Sign up, and create your own *repositories*

Free! If open to whole world

The screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The repository has 0 issues, 0 pull requests, 0 projects, and 0 wiki pages. The README.md file contains 22 lines (14 sloc) and is 1.29 KB. A context menu is open over the '+' icon in the top right corner, listing options: New repository, Import repository, New gist, New organization, This repository, and New issue. A pink hand-drawn style arrow points from the text 'Create your own repositories' to this menu. The GitHub logo is visible in the top left.

MPOcanes / MPO624-2018

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Branch: master MPO624-2018 / README.md

brianmapes Update README.md 3 days ago

1 contributor

22 lines (14 sloc) | 1.29 KB Raw Blame History

MPO 624 CLASS FOR SPRING 2018

Welcome!

The course is all here. Fork it so you can contribute back!



conda-jupyter-GitHub: tiers of commitment

2. Sign up, and create your own *repositories*

Free! If open to whole world

The screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The repository has 0 issues, 0 pull requests, and 0 projects. It is currently on the 'master' branch. A commit by 'brianmapes' updated the README.md file 22 days ago. The README.md file contains the following text:

```
MPO 624 CLASS FOR SPRING 2018

Welcome!

The course is all here. Fork it so you can contribute back!
```

A pink callout box highlights the text ".md is ‘markdown’ easy to edit, nice looking formatting!".

A GitHub cat icon is in the bottom right corner.

conda-jupyter GitHub: tiers of commitment

2. Sign up, and create your own *repositories*

Free! If open to whole world

MPOcanes / MPO624-2018

Code Issues Pull requests Projects Wiki Insights Settings

MPO624-2018 / README.md or cancel

Edit file Preview changes

```
1 # MPO 624 CLASS FOR SPRING 2018
2 ## Welcome!
3 The course is all here. Fork it so you can contribute back!
4
5
6 ### Software accounts and installs:
7
8 1. https://github.com/MPO624/MPO624-2018/blob/master/INSTALL\_JUPYTER\_UNIDATA.md
9 1. https://github.com/MPO624/MPO624-2018/blob/master/GITHUB\_QUICKSTART.md
10 1. Install the IDV
11 * Install the IDV nightly build from Undidata. https://www.unidata.ucar.edu/downloads/idv/nightly/index.jsp You will need to light sign-in, just so they know who's using it. Great free software, my group (and Xingchen in class) are involved with integrating it into Jupyter notebooks.
```

.md is “markdown”
edits like email, with ****emphasis****
- and bullets
- and stuff



conda-juPy-

GitHub: tiers of commitment

2. Sign up, and create your own *repositories*

Free! If open to whole world

GitPrint – Easily print GitHub markdown [Tweet](#)

Change github to gitprint for a fine looking document! →

Secure <https://gitprint.com/MPO624-2018/blob/master/README.md>

Apps Save to Mendeley NSFC NNC TC tide ClimRean radar DuPage RAP_wx Unisys INFO AMSj modis CPC Library deGe

MPO 624 CLASS FOR SPRING 2018

Welcome!

The course is all here. Fork it so you can contribute back!

Software accounts and installs:

1. https://github.com/MPO624/MPO624-2018/blob/master/INSTALL_JUPYTER_UNIDATA.md (https://github.com/MPO624/MPO624-2018/blob/master/INSTALL_JUPYTER_UNIDATA.md)
2. https://github.com/MPO624/MPO624-2018/blob/master/GITHUB_QUICKSTART.md (https://github.com/MPO624/MPO624-2018/blob/master/GITHUB_QUICKSTART.md)

conda-jupyter-GitHub: tiers of commitment

2. Sign up, and create your own *repositories*

Free! If open to whole world

The screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The page includes a navigation bar with links for 'This repository', 'Search', 'Pull requests', 'Issues', 'Marketplace', and 'Explore'. Below the navigation bar, there's a header with the repository name 'MPOcanes / MPO624-2018' and a 'Unwatch' button. The main content area displays the repository details: '378 commits', '2 branches', '0 releases', and '13 contributors'. A pink starburst highlights the 'Create new file', 'Upload files', and 'Find file' buttons in the top right corner. The repository description is 'MPO 624 CLASS FOR SPRING 2018'. The tags listed are 'atmospheric', 'science', 'idv', 'notebook', 'jupyter-notebook', 'jupyter', 'atmospheric-science', and 'oceanograp'. The commit history shows a recent update by 'brianmapes' to 'README.md'. The GitHub logo, a black cat, is visible in the bottom right corner.

Add files by drag and drop to browser!

378 commits 2 branches 0 releases 13 contributors

Create new file Upload files Find file Clone or download

brianmapes Update README.md

assignments Update README.md

classnotes Create 2018-02-08.md

exams update from MPO624

lessonplans Update 5thTuesday.md

notebooks Add some notebooks

Latest commit 1327307 20 hours ago

6 days ago

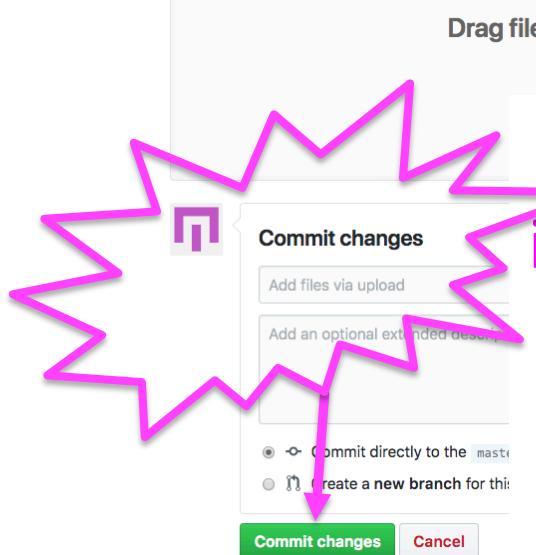
conda-jupyter-GitHub: tiers of commitment

2. Sign up, and create your own *repositories*

Free! If open to whole world

This screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The top navigation bar includes links for 'This repository', 'Search', 'Pull requests', 'Issues', 'Marketplace', and 'Explore'. Below the bar, the repository name 'MPOcanes / MPO624-2018' is displayed, along with statistics: 3 unwatched, 2 stars, and 13 forks. A pink arrow points from the text 'Add files by drag and drop to browser!' to the 'Drag files here to add them to your repository' area.

Add files by
drag and drop
to browser!



But understand: a *repository*
is more than a dump for files!
every **commit** requires a
commit message...
it's all logged, that's good



conda-juPy-GitHub: tiers of commitment

It's why there are 7 layers: acts as a *quality filter*

This screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The page includes a navigation bar with links for 'This repository', 'Search', 'Pull requests', 'Issues', 'Marketplace', and 'Explore'. Below the navigation bar, there are buttons for 'Unwatch' (3), 'Star' (2), and 'Fork' (13). The main content area displays the repository structure: 'MPO624-2018 / notebooks / Jupyter Notebook Users Manual.ipynb'. A commit by 'brianmaps' is shown, adding some notebooks 6 days ago. The commit details show 1 contributor and file statistics: 2409 lines (2408 sloc) and 85.2 KB. At the bottom, there are buttons for 'Raw', 'Blame', 'History', and file operations.



Jupyter Notebook Users Manual

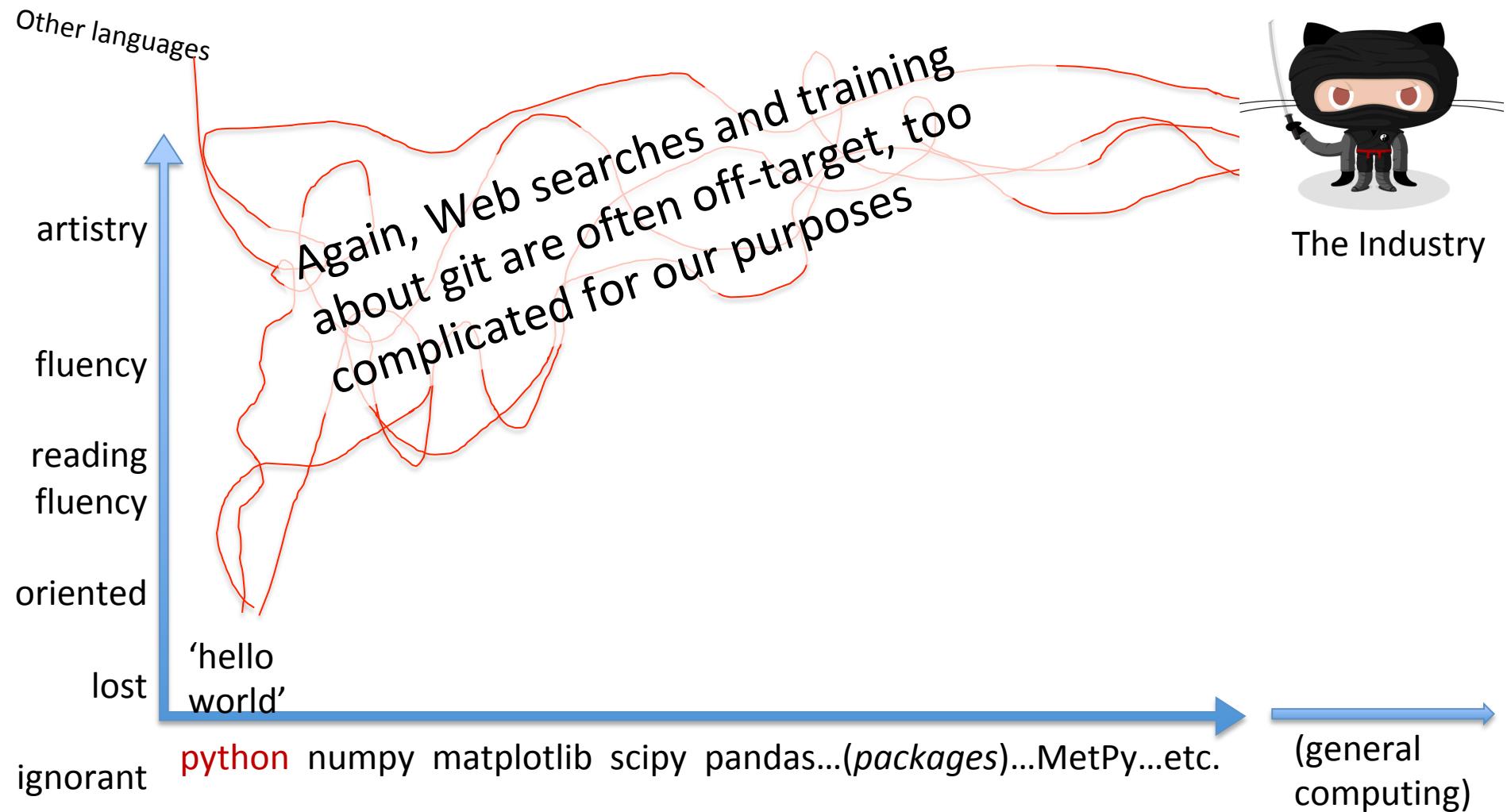
This page describes the functionality of the [Jupyter](#) electronic document system. Jupyter documents are called "notebooks" and can be seen as many things at once. For example, notebooks allow:

- creation in a **standard web browser**
- direct **sharing**
- using **text with styles** (such as italics and titles) to be explicitly marked using a [wikitext language](#)
- easy creation and display of beautiful **equations**
- creation and execution of interactive embedded **computer programs**
- easy creation and display of **interactive visualizations**

Jupyter notebooks (previously called "IPython notebooks") are thus interesting and useful to different groups of people:

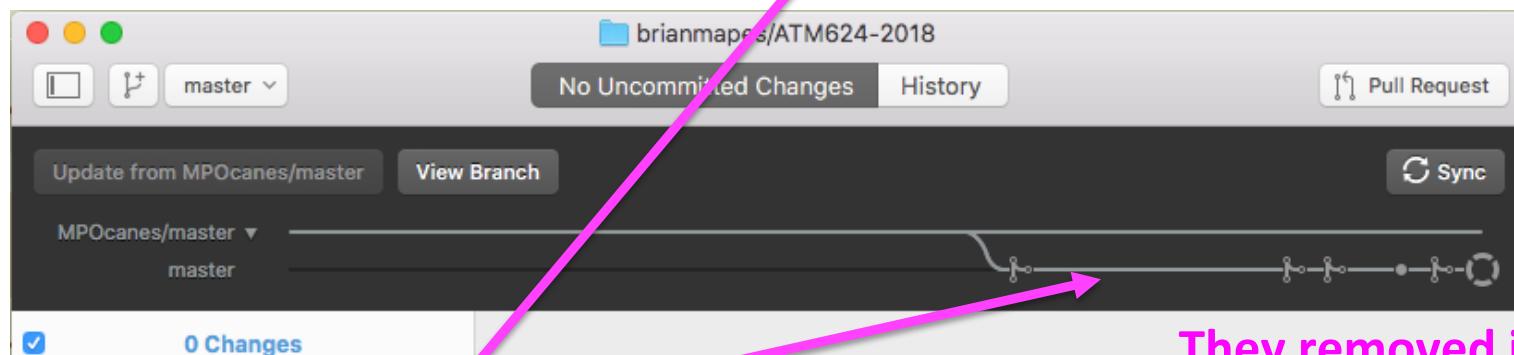
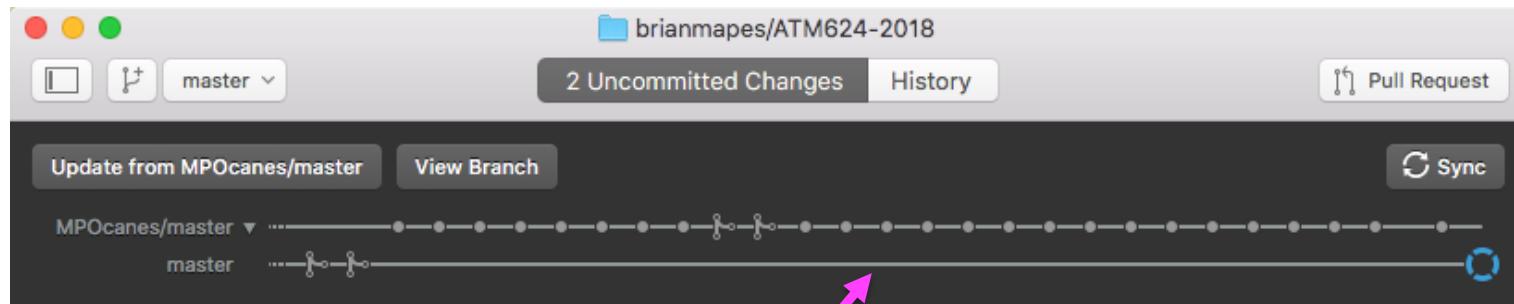


git and github are mainly designed for
teams of software engineers, not for
occasional-collaborators like us...



conda-jupyter GitHub: tiers of commitment

3. Version Control (local and github.com backup)



"subway plot" shows great timeline of all the updates, commits, merges!

They removed it from latest version!

Grrr!

Get old "223" version!



* Desktop MUUCH nicer than memorizing git commands!
"sync" and "update" are not git commands!

conda-jupyter GitHub: tiers of commitment

4. Collaborate!

The screenshot shows a GitHub repository page for 'MPOcanes / MPO624-2018'. The page includes a navigation bar with links for 'This repository', 'Search', 'Pull requests', 'Issues', 'Marketplace', and 'Explore'. On the right side of the header are icons for a bell (Unwatch), a plus sign (New pull request), and a fork (Fork). Below the header, the repository name 'MPOcanes / MPO624-2018' is displayed, along with statistics: 379 commits, 2 branches, 0 releases, and 13 contributors. A green button labeled 'Clone or download' is visible. The main content area shows tabs for 'Code', 'Issues 0', 'Pull requests 0', 'Projects 0', 'Wiki', 'Insights', and 'Settings'. Below these tabs, there are topic labels: 'atmospheric', 'science', 'idv', 'notebook', 'jupyter-notebook', 'jupyter', 'atmospheric-science', 'oceanography', 'unidata', and 'Manage topics'. A pink arrow points from the text 'Improved your fork in some generalized way?' to the 'New pull request' button. Another pink arrow points from the text 'Send a pull request to the owner!' to the 'Clone or download' button. A third pink arrow points from the text 'more than just' to the 'FORK ME!' button, which is highlighted with a pink starburst.

conda-jupyter GitHub: tiers of commitment

4. Collaborate!

MPOcanes / MPO624-2018

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

atmospheric science idv notebook jupyter-notebook jupyter atmospheric-science oceanography unidata Manage topics

379 commits 2 branches 0 releases 13 contributors

Branch: master New pull request

Create new file Upload files Find file Clone or download

Unwatch 3 Star 2 Fork 13

FORK ME!

more than just

Improved your fork in some generalized way?

Send a pull request to the owner!

DOWNLOAD

GitHub

Unidata / unidata-python-workshop

Code Issues Pull requests Projects

Branch: master unidata-python-workshop / notebooks /

dopplershift Remove use of "lIs" (Fixes #264) ...

..

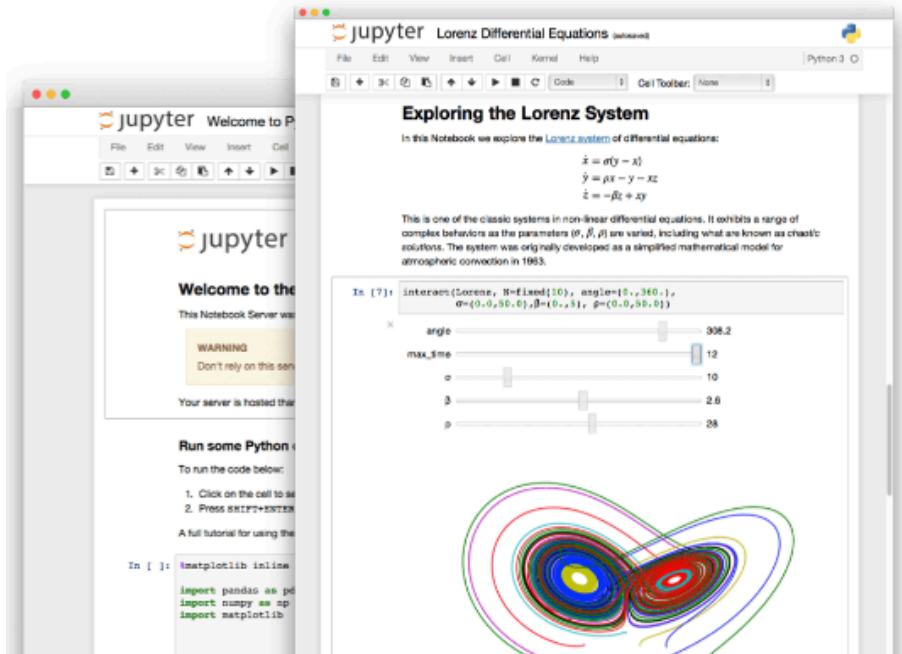
Animation	Remove solutions from i
Bonus	Move wms sample to fa
CartoPy	Remove solutions from i
Command_Line_Tools	Modify header image ac
GOES_RGB_Demo	MNT: Fix notebooks on
Jupyter_Notebooks	Modify header image ac
Matplotlib	Break up Primer notebo
MetPy_Advanced	Remove unused import
MetPy_Case_Study	Remove use of depreca
Metpy_Introduction	Add stand alone MetPy
Model_Output	Rename model data to r
NumPy	Break up Primer notebo
Primer	Plot mangitude of temp
Pythonic_Data_Analysis	← I showed this one earlier Change buoy data date
Satellite_Data	Fix spelling errors in sat
Siphon	Remove use of "lIs" (Fix
Skew_T	Add solution to bulk she
Surface_Data	Fix surface notebook
Time_Series	Change dates to 9/6-9/
netCDF	Remove use of "lIs" (Fix

Notebook Troves

- Unidata's educational (training) “boosters”:
 - <https://github.com/Unidata/unidata-python-workshop/tree/master/notebooks>



conda-jupyter-GitHub



The Jupyter Notebook

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more.

[Try it in your browser](#)[Install the Notebook](#)

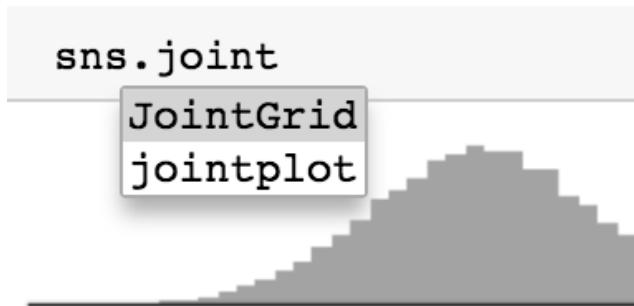
- **jupyter notebook** process manages OS-level resources
 - streams its I/O to port 8888, in browser-ese
- **Your browser** manages the human- screen- keyboard- mouse interactions
 - *stable, free infrastructure* -- *Firefox has problems sometimes*



- Formerly “iPython notebook”
 - file suffix remains .ipynb
 - & many services start with nb (nbconvert, etc.)
- Jupyter generalization: 2014
 - Ju refers to Julia (a python-like language -- faster)
 - the R is for that statistics-oriented language (formerly S, S+)
- Now very general: has kernels (interpreters) for dozens of languages (e.g. octave, & matlab’s python engine)

conda-jupyter-GitHub

- A light Development Environment, with inline help
 - TAB shows *methods and attributes* available for any *object*



- SHIFT+TAB shows the *docstring* for any object

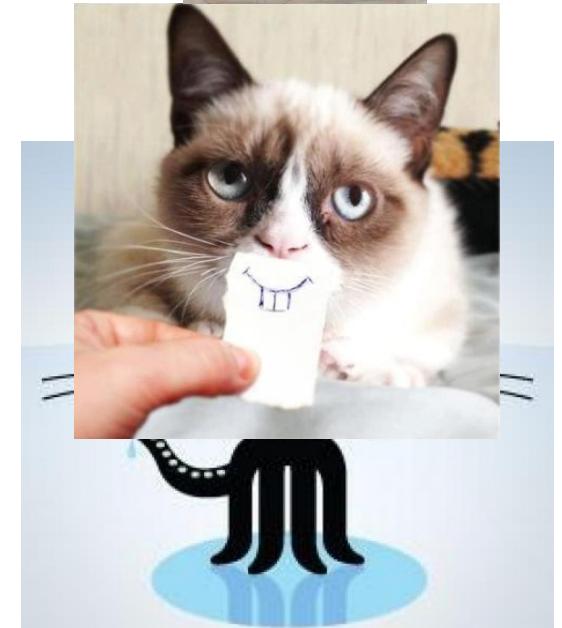
A screenshot of a Jupyter Notebook cell showing the docstring for 'sns.jointplot'. The text is as follows:

```
Signature: sns.jointplot(x, y, data=None, kind='scatter', stat_func=<function pearsonr at 0x11b12a9d8>, color=None, size=6, ratio=5, space=0.2, dropna=True, xlim=None, ylim=None, joint_kws=None, marginal_kws=None, annot_kws=None, **kwargs)
Docstring:
Draw a plot of two variables with bivariate and univariate graphs.

This function provides a convenient interface to the :class:`JointGrid` class, with several canned plot kinds. This is intended to be a fairly lightweight wrapper; if you need more flexibility, you should use :class:`JointGrid` directly.
```

Conclusion: conda-juPy-GitHub is tolerable to learn, to unlock...

- ...so much free goodness!
 - unification of computing, results, & communication
 - work from troves of examples
 - #NeverAgainStartFromScratch
 - true collaboration
 - with discoverable strangers
- But, know your mavens
 - Search is an ally – not quite friend
 - works for industry, mostly



Let's do examples in hour 2

- Launch jupyter notebook
- Download some notebooks
- Let's step through one, to learn Jupyter use