

That's not [data] science!

Mara Averick ([@dataandme](https://twitter.com/@dataandme))

Tidyverse Developer Advocate, RStudio



Mara Averick

TIDYVERSE DEV ADVOCATE, RSTUDIO

Not a Real Data Scientist™



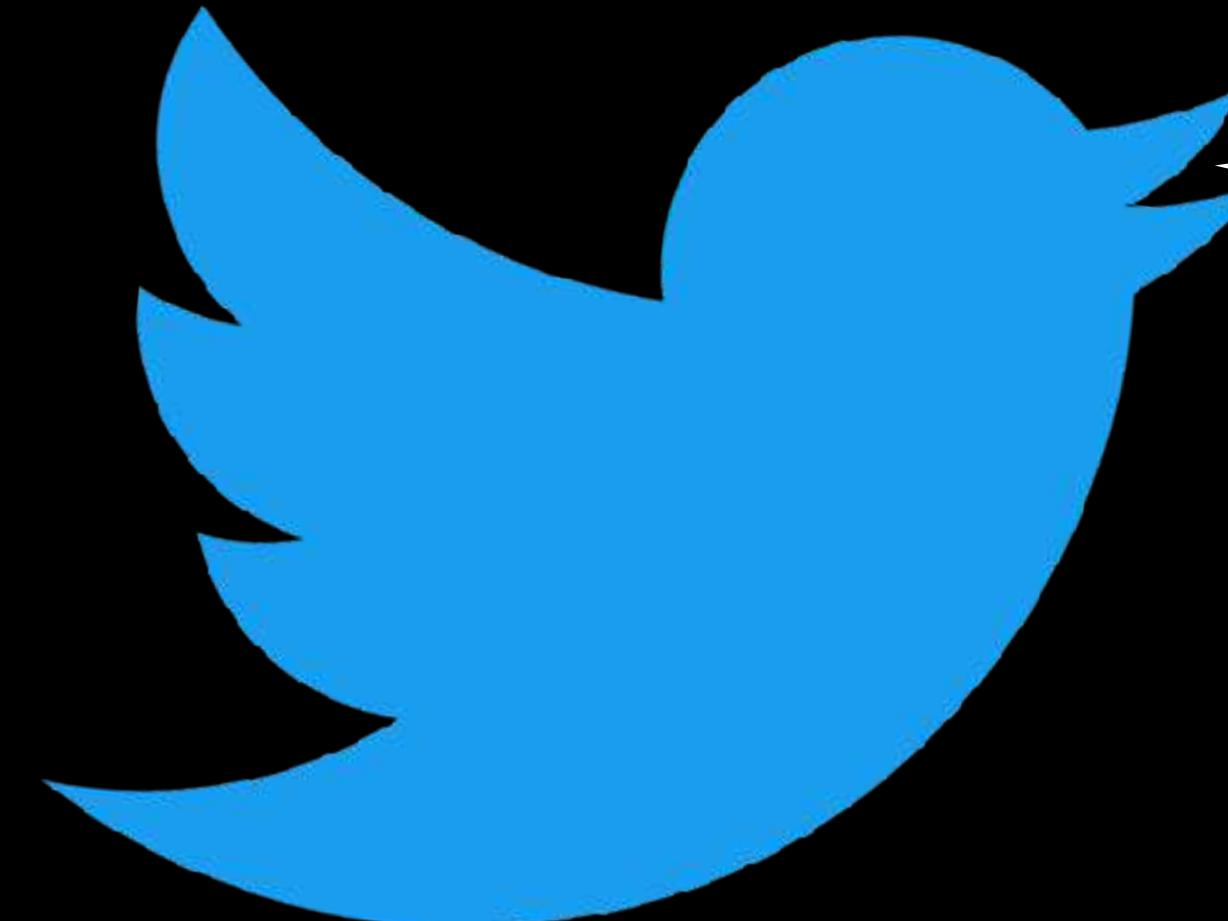


Mara Averick

TIDYVERSE DEV ADVOCATE, RSTUDIO



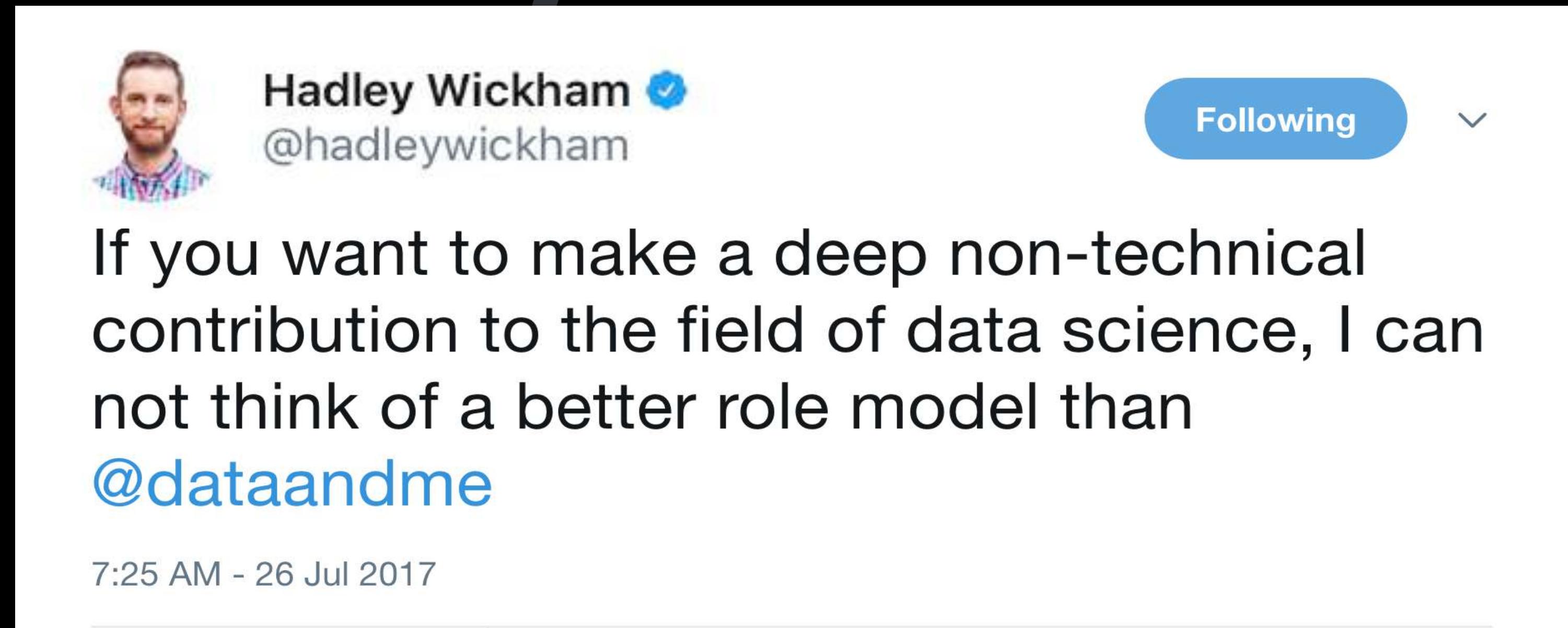
leaRn out loud



OMG I just learned a thing!!

100% selfish

but...



Hadley Wickham 
@hadleywickham

Following ▾

If you want to make a deep non-technical contribution to the field of data science, I can not think of a better role model than
[@dataandme](#)

7:25 AM - 26 Jul 2017

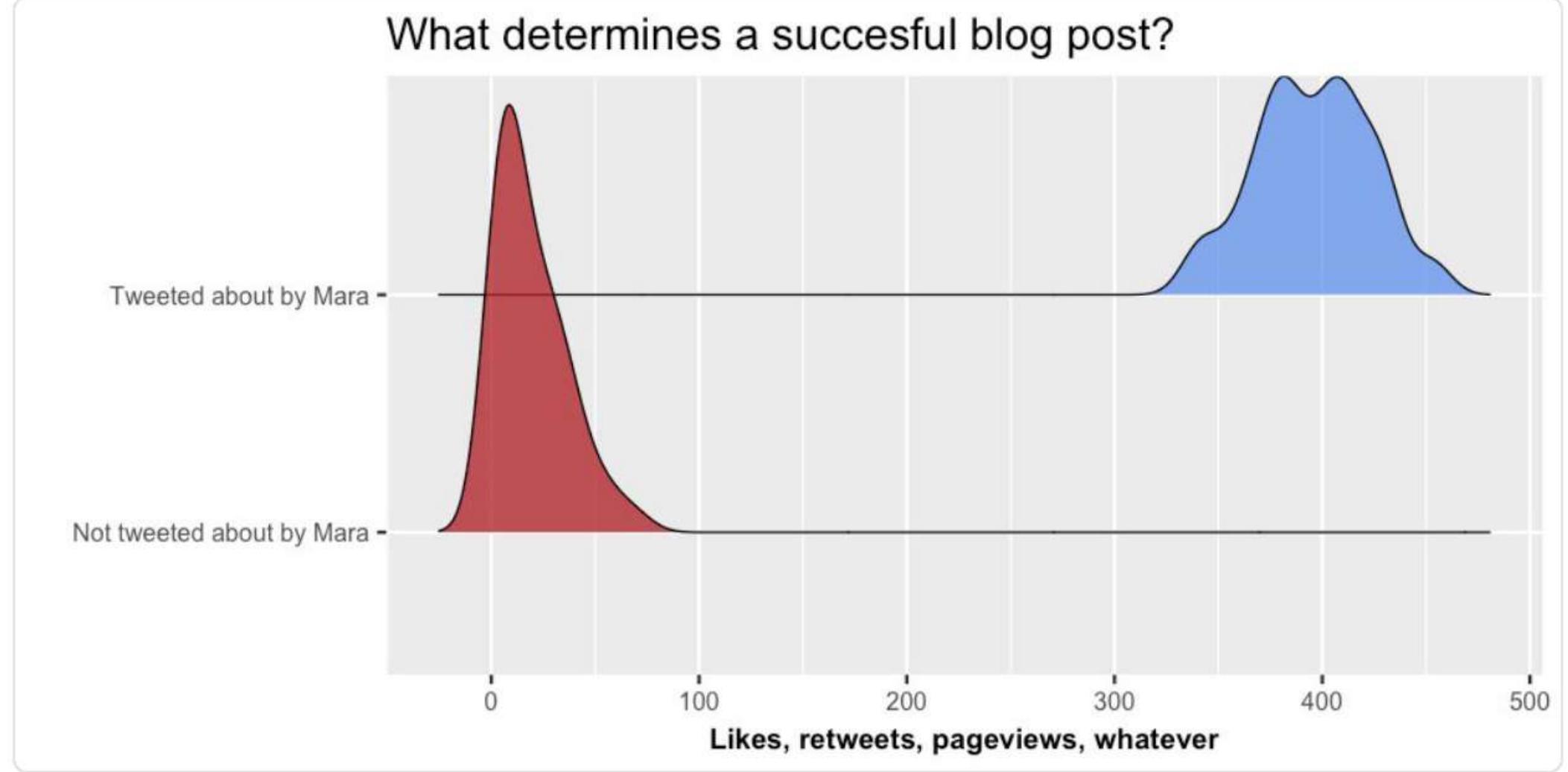
but...

 **Edwin Thoen**
@edwin_thoen

Following ▾

After 9 months as an R blogger I discovered
the key to writing a successfull blog: please
[@dataandme!](#)

What determines a succesful blog post?



Tweeted about by Mara

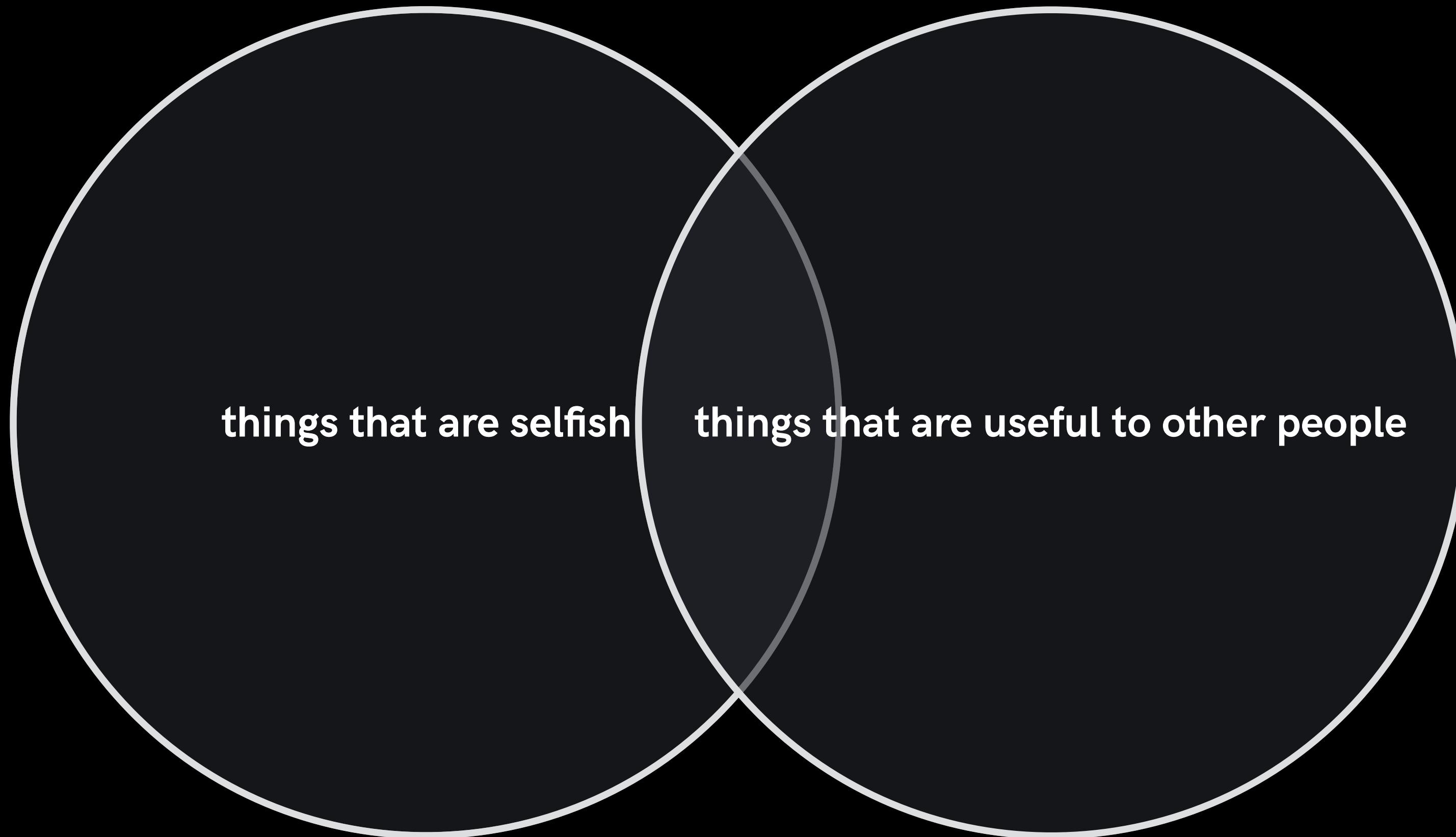
Not tweeted about by Mara

0 100 200 300 400 500

Likes, retweets, pageviews, whatever

5:36 AM - 27 Aug 2017

but...





Hadley Wickham
@hadleywickham

Follow



Replying to @juliasilge @arnicas @dataandme

I really didn't want to imply that Mara doesn't have awesome technical skills 😞 She does!

8:32 AM - 26 Jul 2017

8:32 AM - 26 Jul 2017



Lucy
@LucyStats

Follow



Replying to @hadleywickham @juliasilge and 2 others

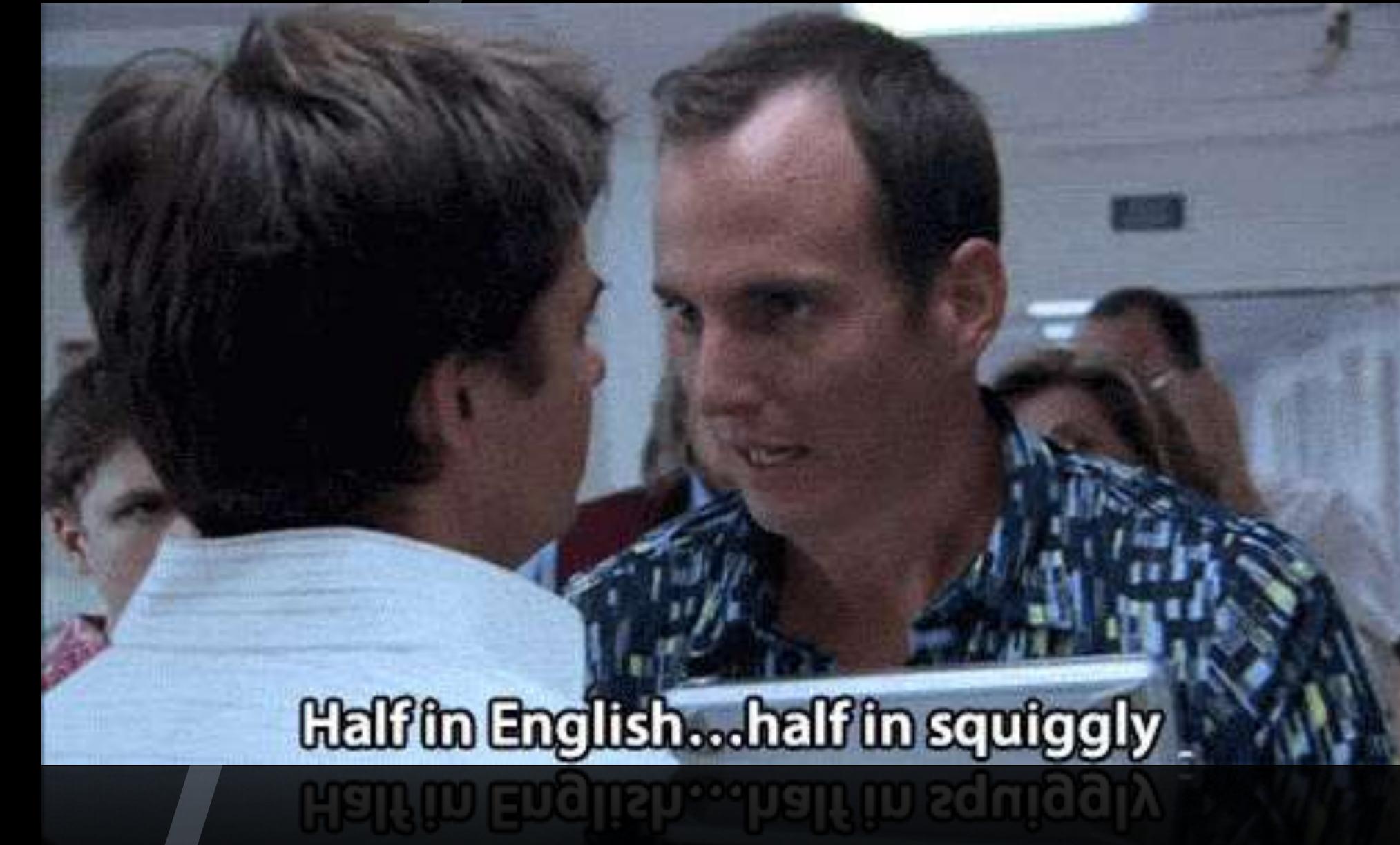
I read as @dataandme has the ability to translate quite technical material to a non-tech audience, so if you're non-tech she's a 🔥 go to! 🚀🏆

8:37 AM - 26 Jul 2017

ex•o•ter•ic

adj. *understandable by outsiders*

or the general public







Dean Oliver

@DeanO_Lytics

Following

To make the case to draft Draymond, though, you want to be more EXplicit in your discussions. Saying "the model says he's good" not enough.

twitter.com/KaiserLindeman ...

This Tweet is unavailable.

11:16 AM - 30 Jun 2017



Mara Averick @dataandme · 30 Jun 2017

Replies to @DeanO_Lytics @RodneyFort

Reminds me of a paper I read the other day re. visual decision models w/
explanatory NLG arxiv.org/abs/1612.04757

Computer Science > Computer Vision and Pattern Recognition

Attentive Explanations: Justifying Decisions and Pointing to the Evidence

Dong Huk Park, Lisa Anne Hendricks, Zeynep Akata, Bernt Schiele, Trevor Darrell, Marcus Rohrbach

(Submitted on 14 Dec 2016)

Deep models are the defacto standard in visual decision models due to their impressive performance on a wide array of visual tasks. However, they are frequently seen as opaque and are unable to explain their decisions. In contrast, humans can justify their decisions with natural language and point to the evidence in the visual world which led to their decisions. We postulate that deep models can do this as well and propose our Pointing and Justification (PJ-X) model which can justify its decision with a sentence and point to the evidence by introspecting its decision and explanation process using an attention mechanism. Unfortunately there is no dataset available with reference explanations for visual decision making. We thus collect two datasets in two domains where it is interesting and challenging to explain decisions. First, we extend the visual question answering task to not only provide an answer but also a natural language explanation for the answer. Second, we focus on explaining human activities which is traditionally more challenging than object classification. We extensively evaluate our PJ-X model, both on the justification and pointing tasks, by comparing it to prior models and ablations using both automatic and human evaluations.

Dean Oliver @DeanO_Lytics

I love relating sports back to high end science. It shows kids answer to, "What is this math good for?" This relates Draymond to deep models

Mara Averick @dataandme

Replying to @DeanO_Lytics @RodneyFort

Reminds me of a paper I read the other day re. visual decision models w/ explanatory NLG arxiv.org/abs/1612.04757

arXiv > Computer Vision and Pattern Recognition
Explanations: Justifying Decisions and Pointing to the Evidence
K. Park, Lisa Anne Hendricks, Zeynep Akata, Bernt Schiele, Trevor Darrell, Marcus Rohrbach
on 14 Dec 2016



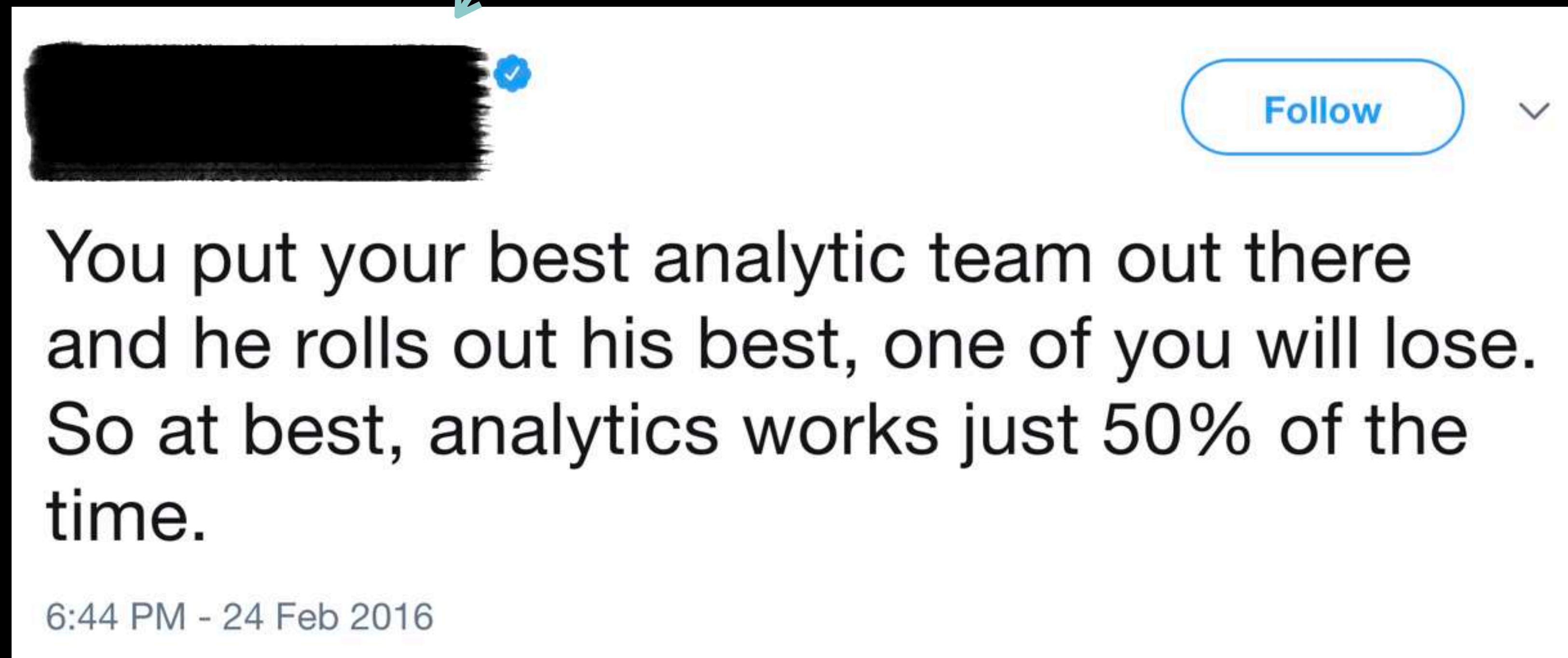
Follow



If u have great players, you're going 2 win games. If u have bad players, you're going 2 lose games. What does analytics have 2 do with it?

5:44 PM - 23 Feb 2016

real, verified sportsball reporter
who told me I could use this



About that abstract...

9



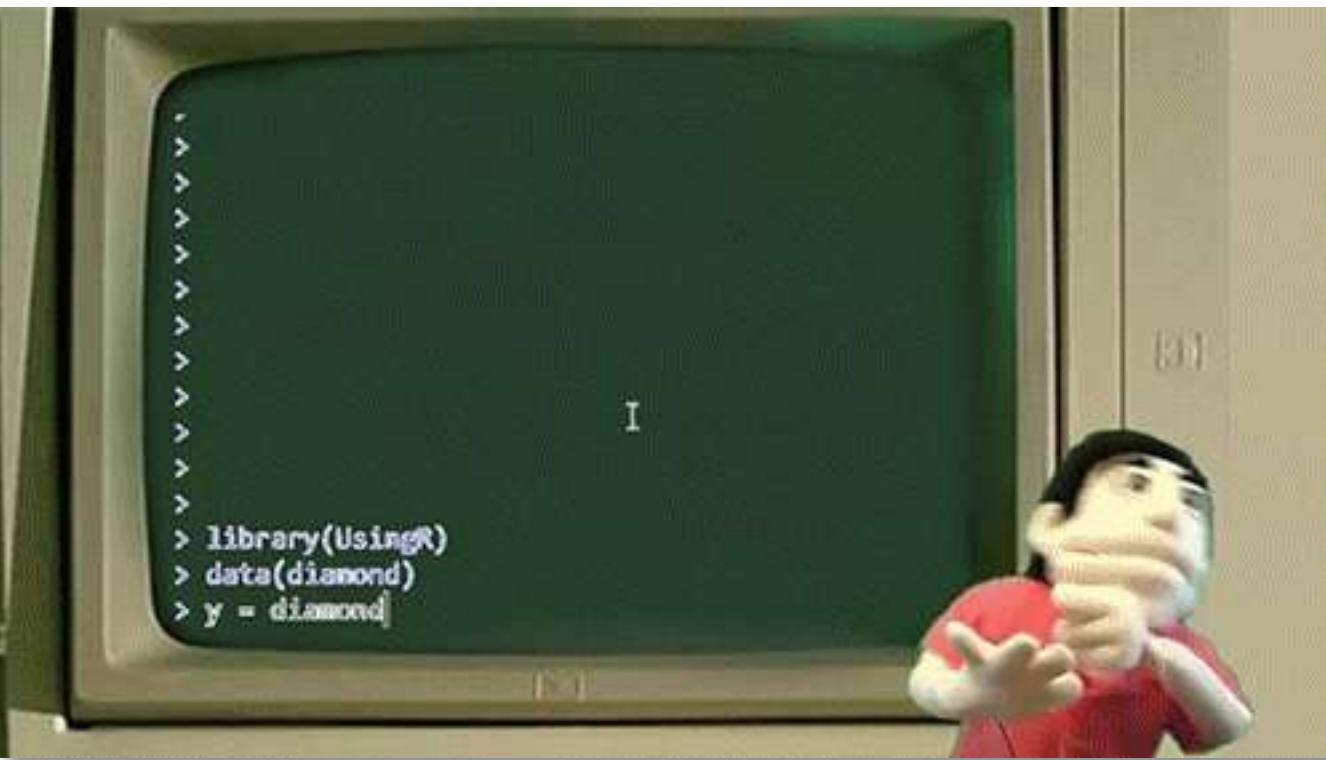
About that abstract...

9



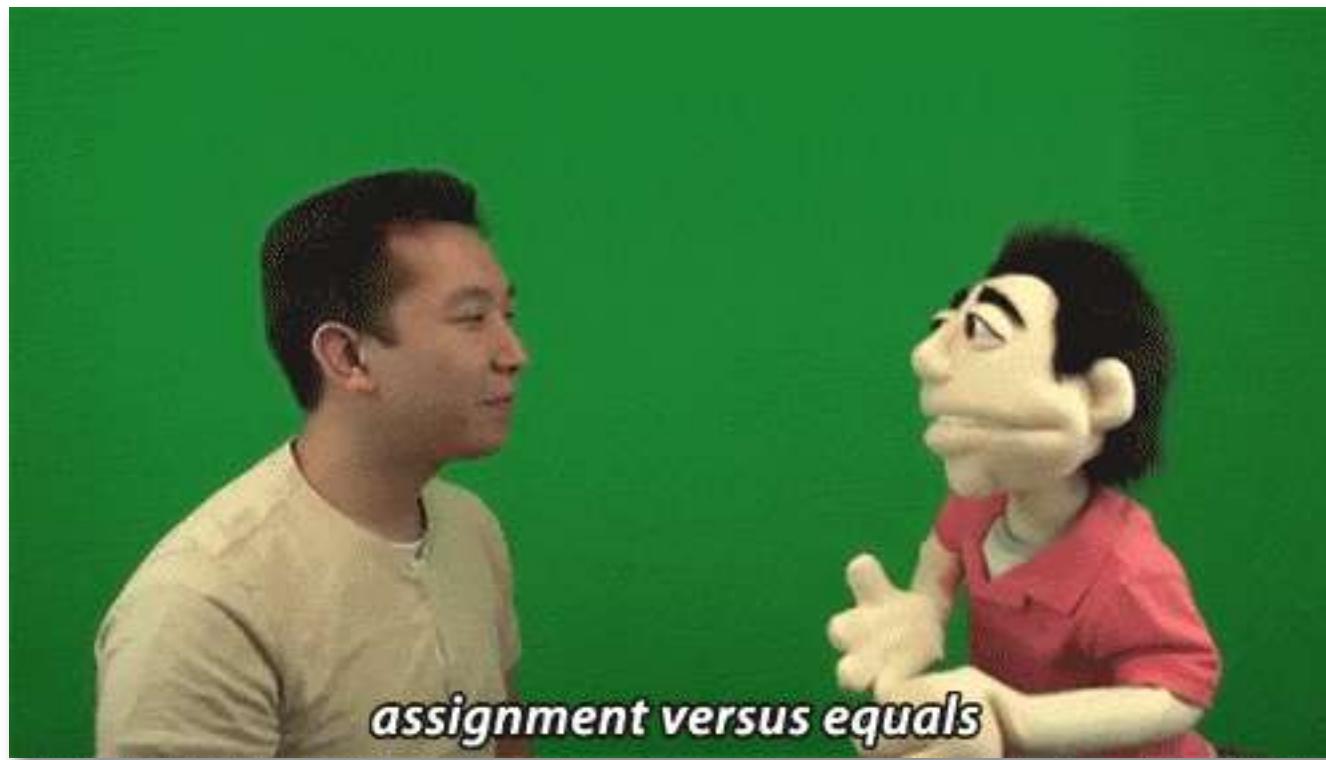
How'd she get in here?

BLAME THE PUPPET...



How'd she get in here?

BLAME THE PUPPET...



How'd she get in here?

BLAME THE PUPPET...



ROGER
PENG



PUPPET
ROGER
PENG



Don't worry, I know about some things...



and
BRIAN CAFFO



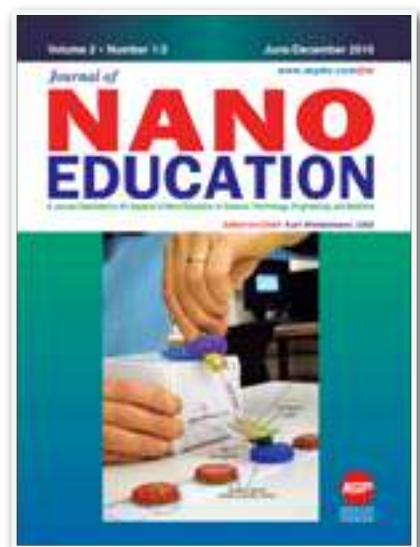
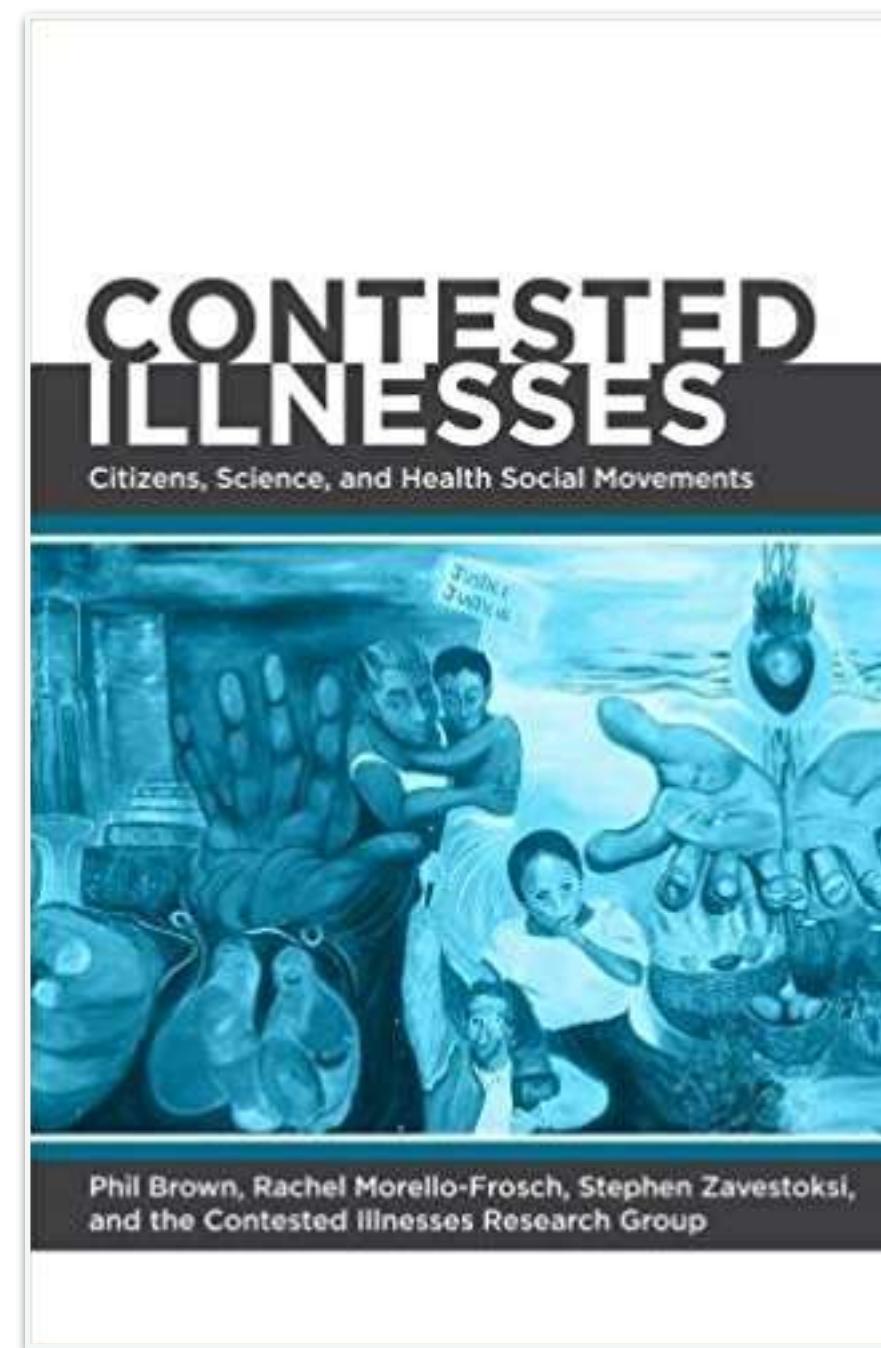
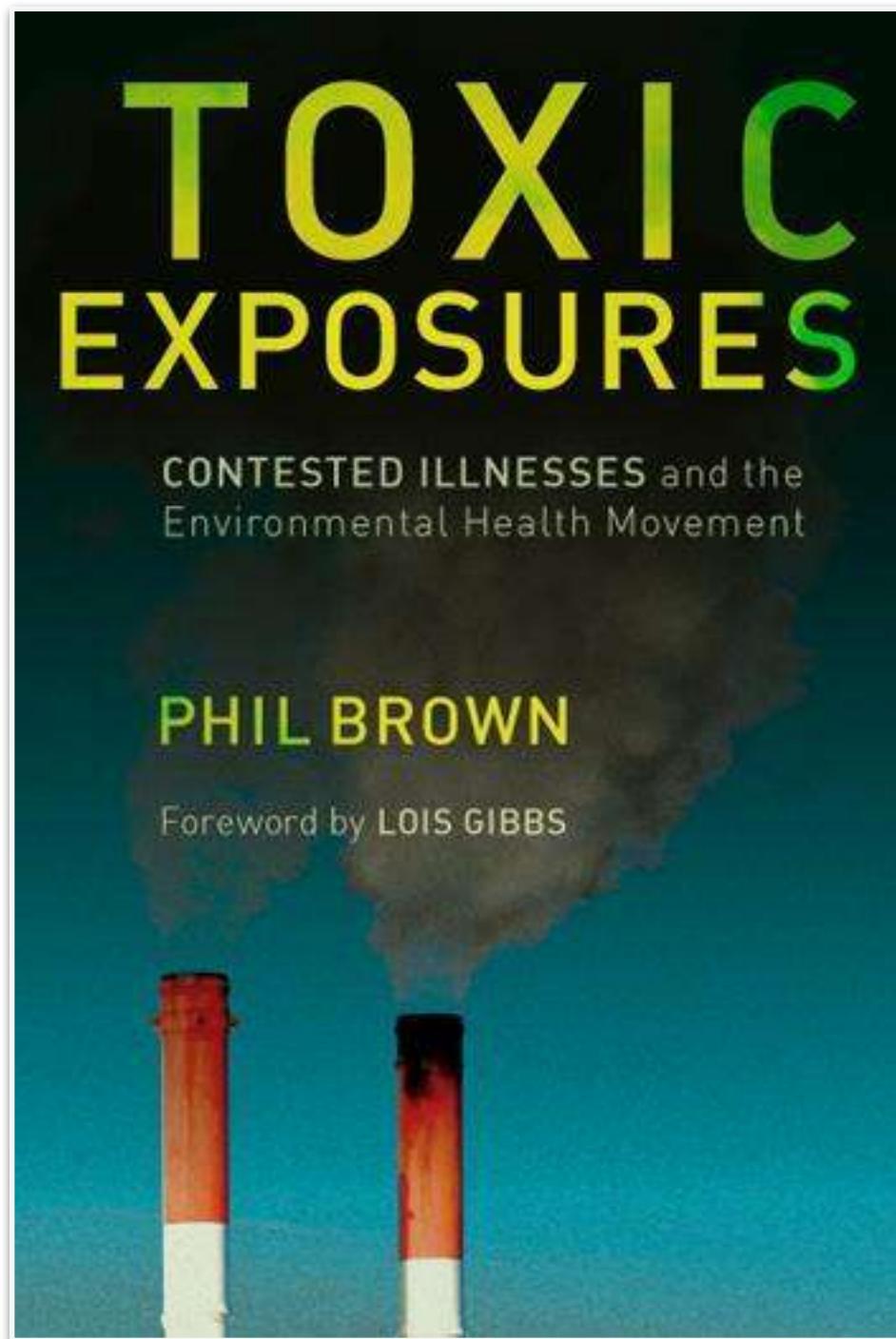
SCIENCE & SOCIETY

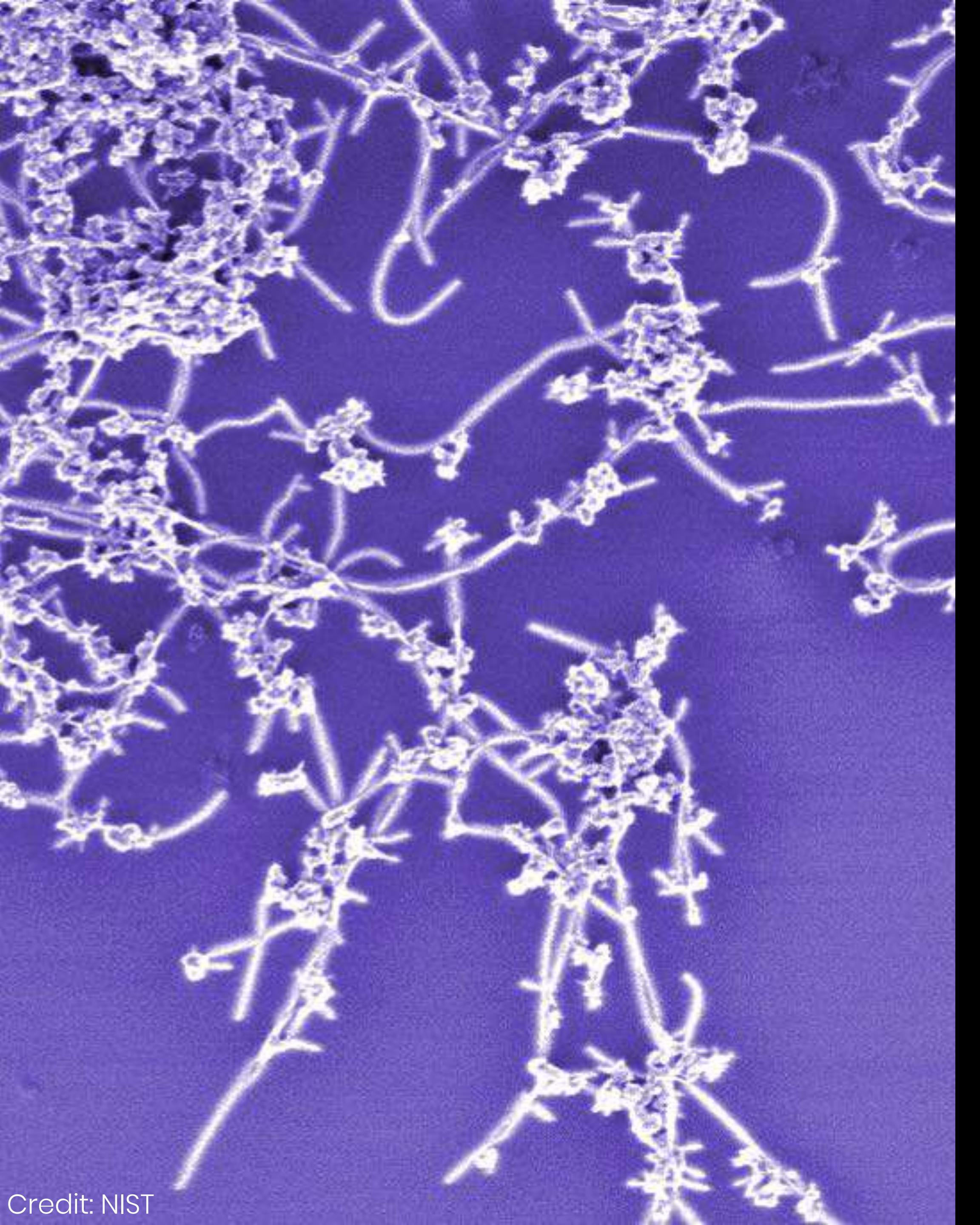
Studying scientists...

“Like many social groups that do not reproduce themselves biologically, the experimental particle physics community renews itself by training novices.”

— Sharon Traweek, *Pilgrim's Progress: Male Tales Told During a Life in Physics*, 1988

academic origins...





Ethical, Legal & Social Implications of Nanotechnology

Nanotechnology Interdisciplinary Research Team

Who cares about boundaries?

“Nonstop categorization is every bit as indispensable to our survival in the world as is the nonstop beating of our hearts.”

- Hofstadter and Sanders 2013, p.15

Who cares about boundaries?

"Similitude is still an indispensable border of knowledge. For no equality or relation of order can be established between two things unless their resemblance has at least occasioned their comparison."

- Foucault 1973, p.67

Who cares about boundaries?

“Teaching in these new [data science] programs has significant overlap in curricular subject matter with traditional statistics courses; yet many academic statisticians perceive the new programs as *‘cultural appropriation.’*”

- Donoho 2017, p.745

science

science



natural
philosophy
science

natural
philosophy

science

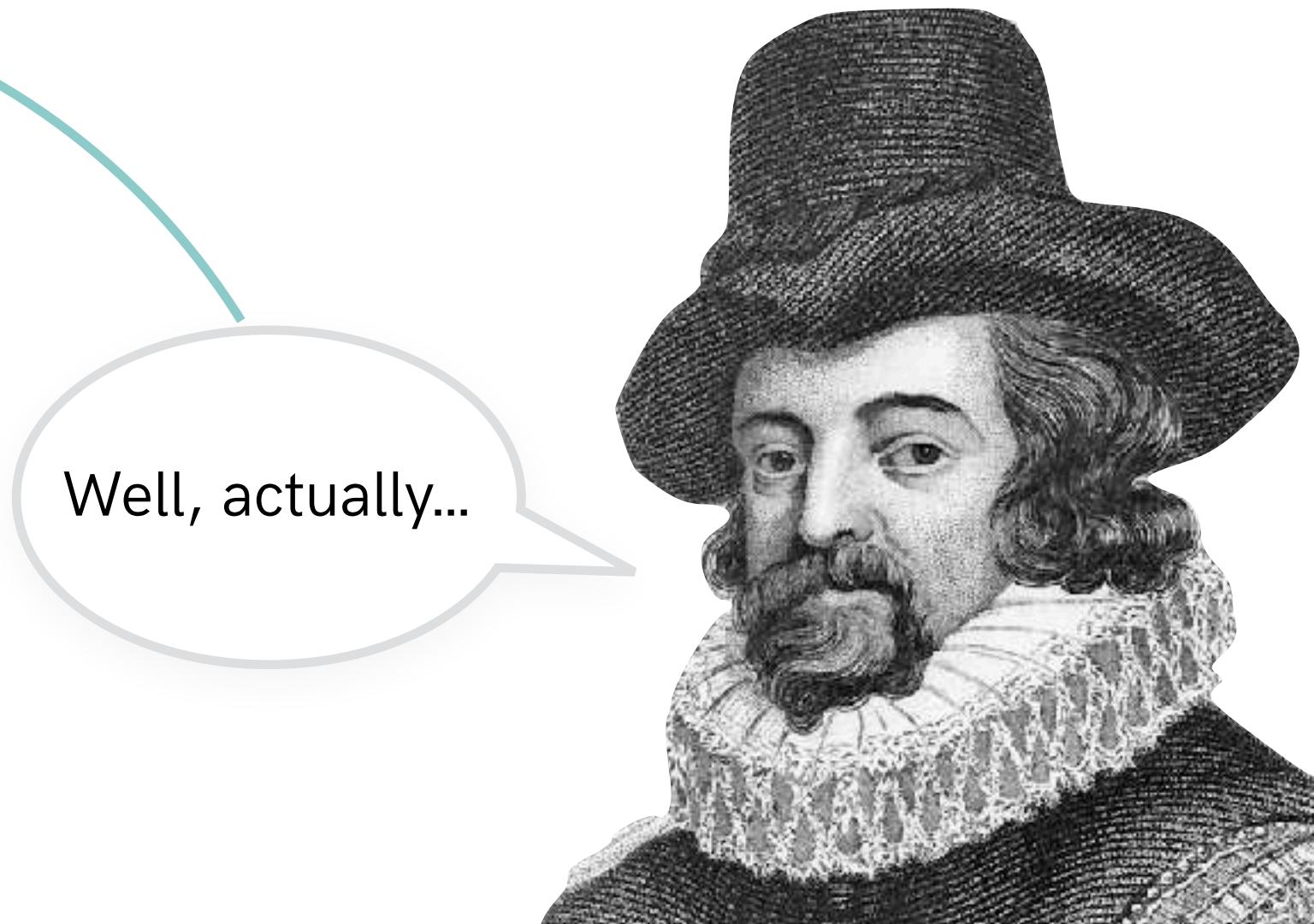




NOVUM ORGANON

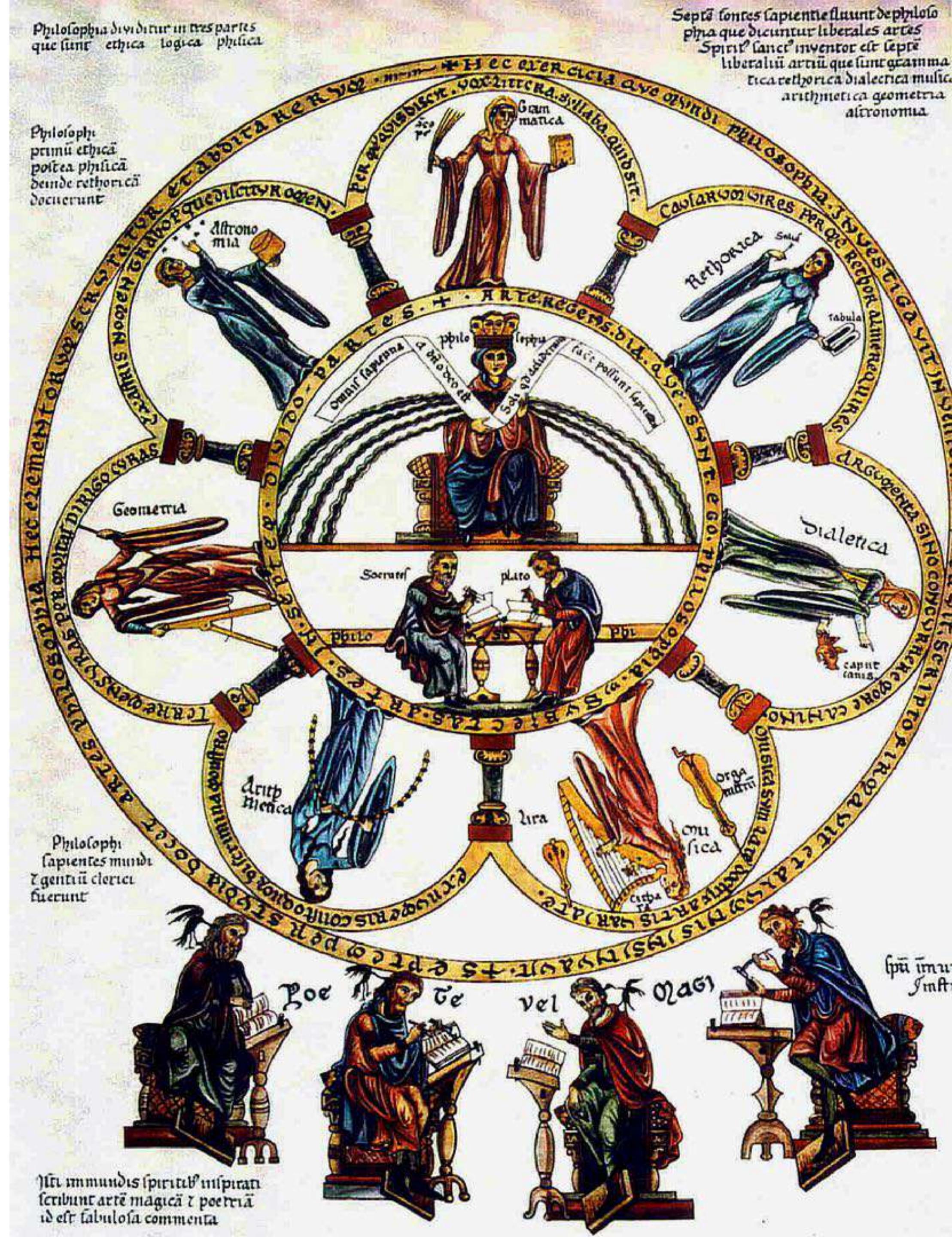


Well, actually...



Medieval map of knowledge

Philosophy seated between the seven **liberal arts** –
Picture from the [Hortus deliciarum](#) of Herrad von Landsberg (12th century)



Aristotle Sciences

22



Practical Philosophy

Ethics

Political science



Productive Philosophy

Rhetoric

Aesthetics

Literary criticism



Theoretical or Speculative Philosophy

Theological

Physical and Metaphysical

Biopsychological

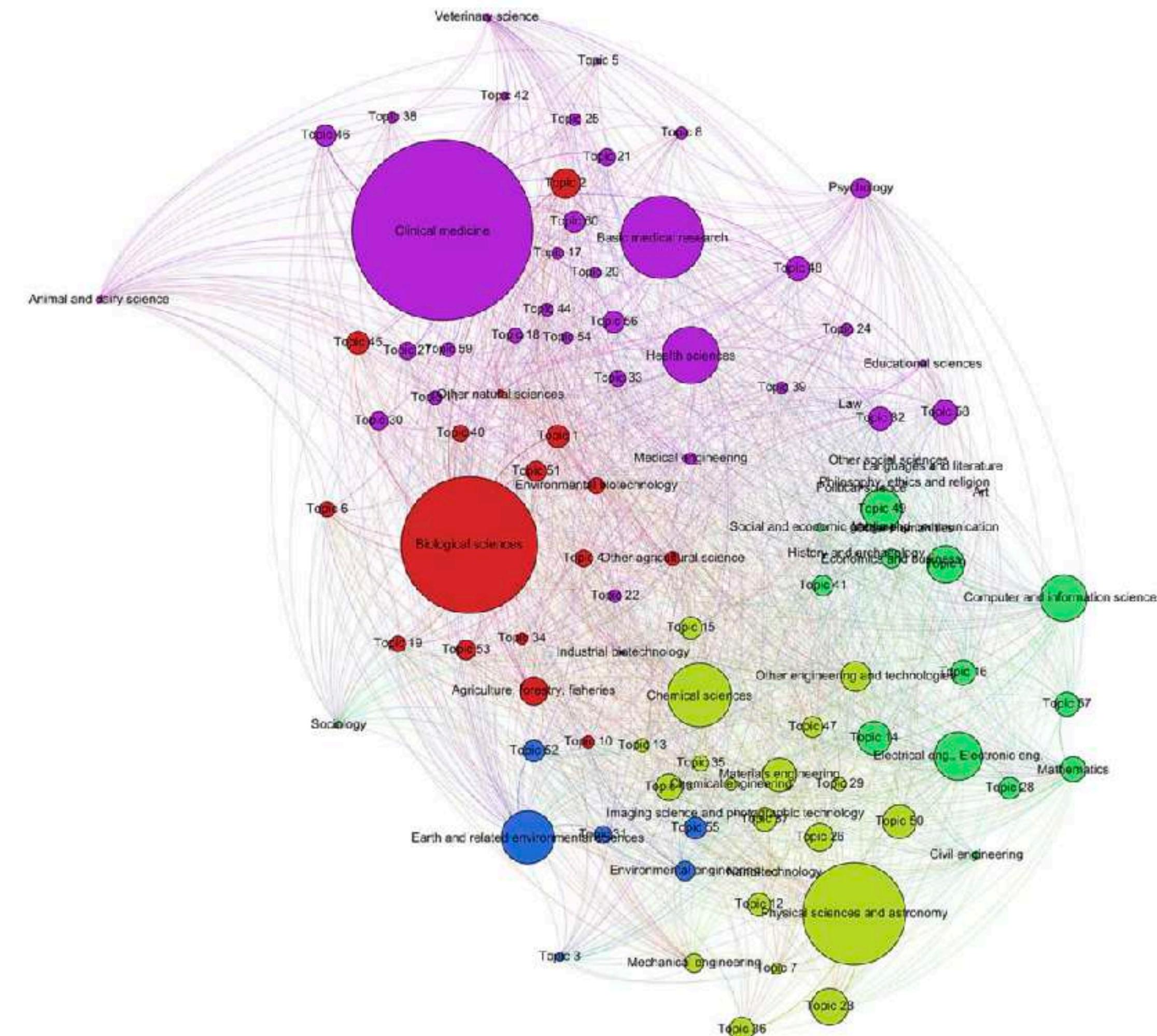


FIG. 2. Network visualization of topics and OECD major classifications assigned to publications. Node weight is based on the count of publications assigned to a given node. Edge weight is based on the co-occurrence of links between a topic and OECD major classification. Node and edge colors are based on a modularity algorithm in which each community is assigned a specific color. Source: ISI-WoS; Authors. Full sized picture in Appendix S2. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

MAP of the SYSTEM of HUMAN KNOWLEDGE

UNDERSTANDING

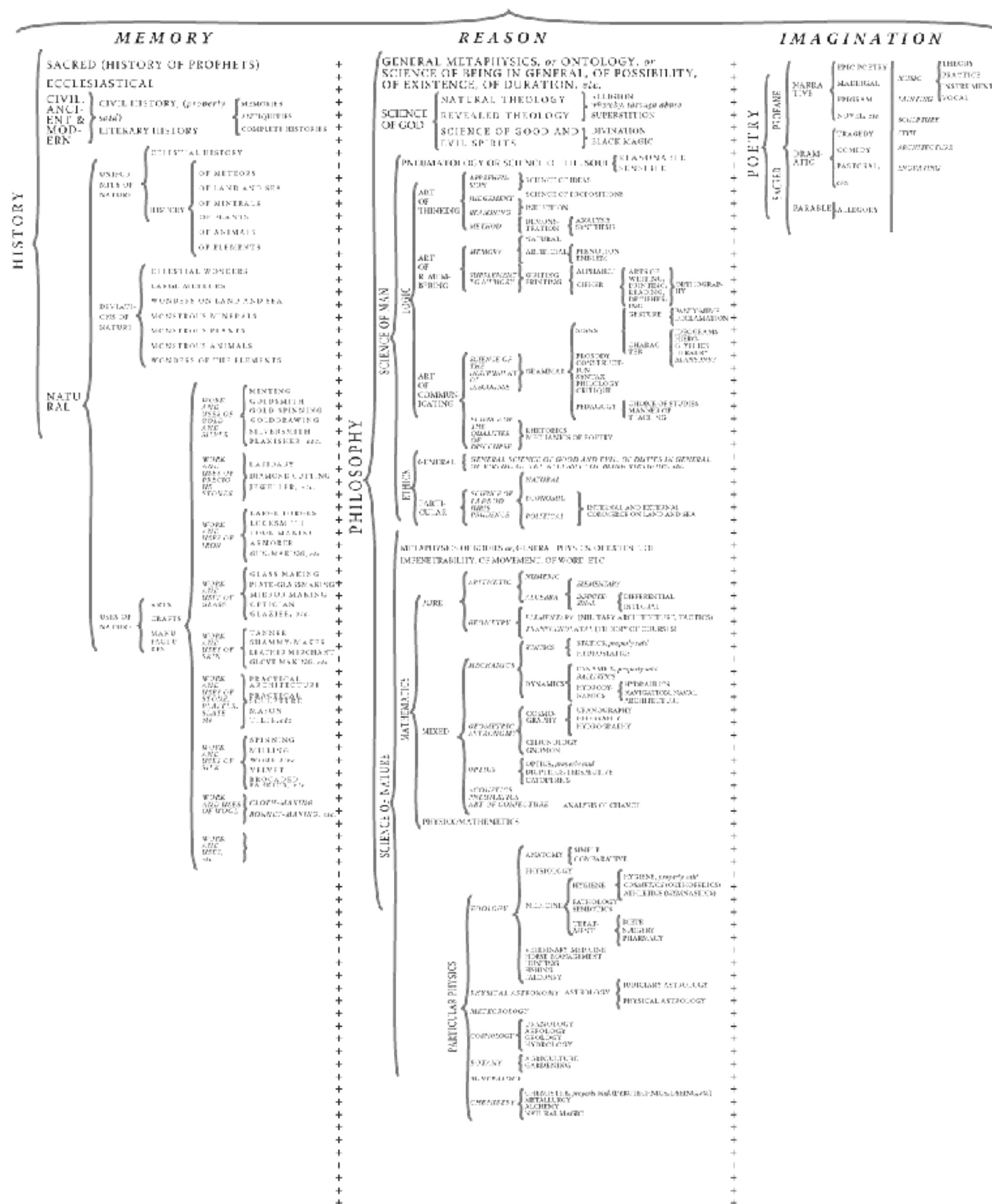


Diagram translated by Benjamin Heller of the University of Michigan and designed by Marketa Kubacakova.(6 Nov. 2013.). The Encyclopedia of Diderot & d'Alembert Collaborative Translation Project. *Quod.lib.umich.edu*. Retrieved from <https://quod.lib.umich.edu/d/did/tree.html>

denis diderot

“This is a work that cannot be completed except by a society of men of letters and skilled workmen, each working separately on his own part, but all bound together solely by their zeal for the best interests of the human race and a feeling of mutual good will.”



(1713-1784)

On L'Encyclopédie, as quoted on The Encyclopedia of Diderot & d'Alembert Collaborative Translation Project. Quod.lib.umich.edu.

ENCYCLOPEDIE,
OU
DICTIONNAIRE RAISONNÉ
DES SCIENCES,
DES ARTS ET DES MÉTIERS,
PAR UNE SOCIÉTÉ DE GENS DE LETTRES.

Mis en ordre & publié par M. DIDEROT, de l'Académie Royale des Sciences & des Belles-Lettres de Prusse, & quant à la PARTIE MATHÉMATIQUE, par M. D'ALEMBERT, de l'Académie Royale des Sciences de Paris, de celle de Prusse, & de la Société Royale de Londres.

*Tanum ferri janthinique polli.
Tanum de medio sumptis accedi honoris!* HORAT.

TOME PREMIER.



A PARIS.

Chez { BRIASSON, rue Saint-Jacques, à la Scieuse.
DAVID Fils, rue Saint-Jacques, à la Plume, Enr.
LE BRETON, Imprimeur ordinaire du Roi, rue de la Harpe.
DURAND, rue Saint-Jacques, à Saint-Lazare, Rue Grillon.

M. DCC. LI

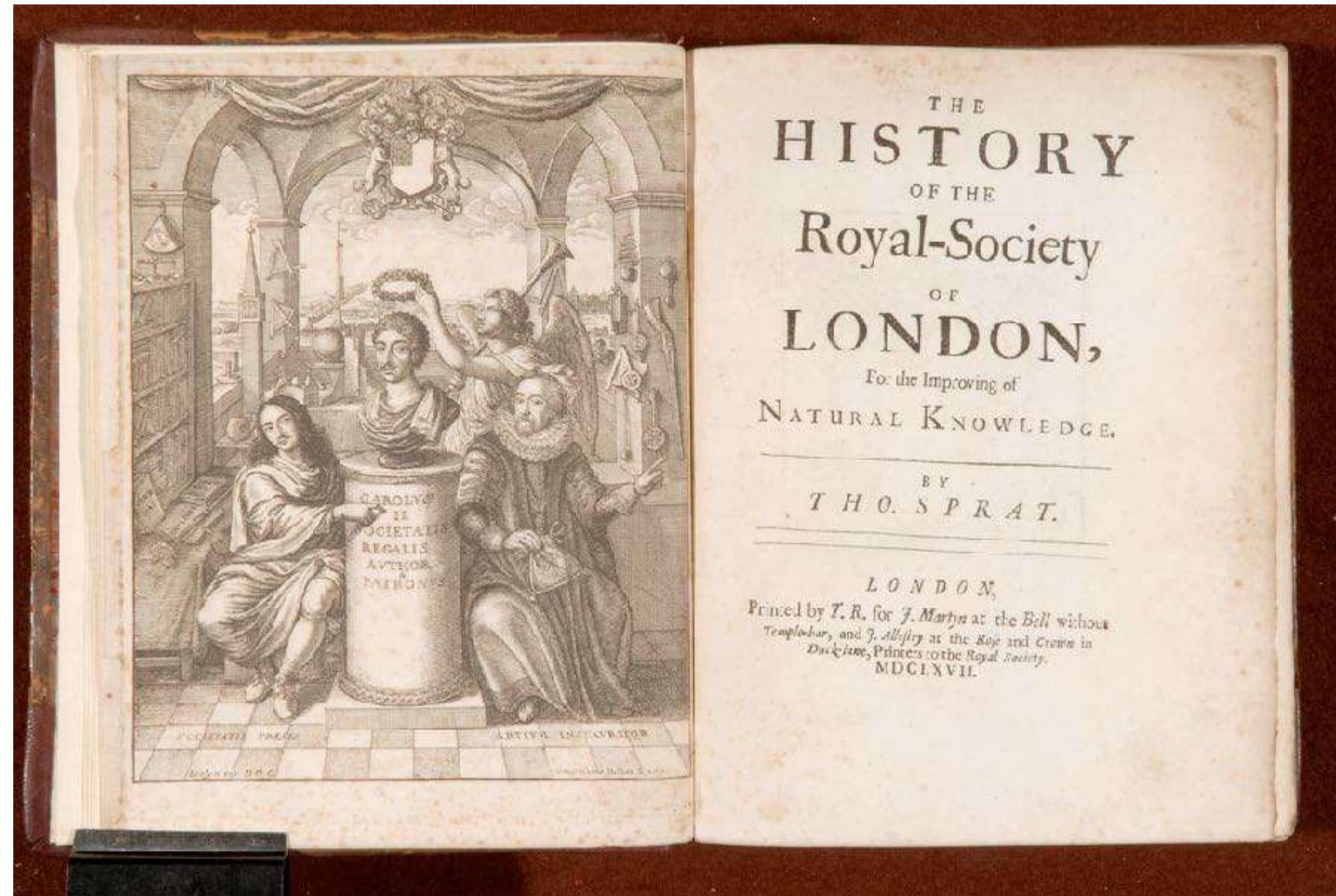
AVEC APPROBATION ET PRIVILEGE DU R. O.



🇫🇷 “*science*” != 🇬🇧 science



🇫🇷 “science” != 🇬🇧 science



🇫🇷 “science” != 🇬🇧 science

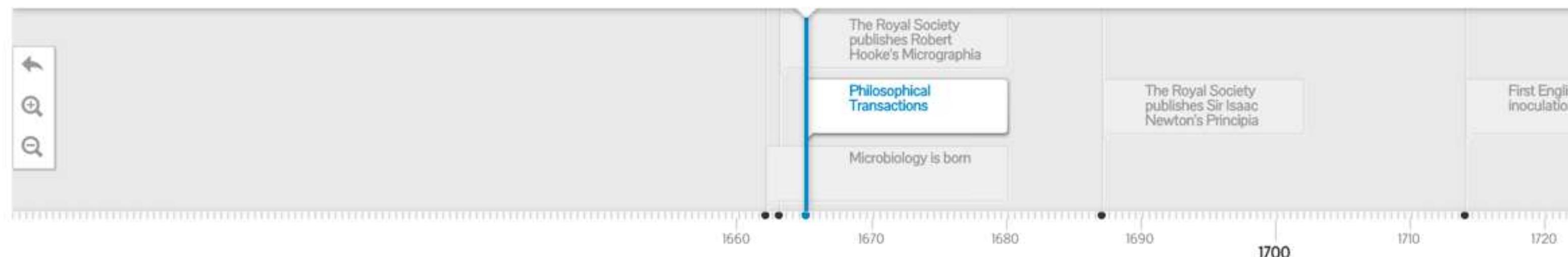


1663
Beginning of
modern
archaeology

1665 Philosophical Transactions

Philosophical Transactions of the Royal Society begins publication under the editorial guidance of Henry Oldenburg, Secretary of the Royal Society. This journal is now the oldest scientific journal in continuous publication in the world and established the concepts of scientific priority and peer review.

1665
Microbiology is born



Portrait of Henry Oldenburg (left) by Jan van Cleve, 1668; and contents page of Philosophical Transactions of the Royal Society, Volume 6 (right).

Royal Society comms: squad goals

- ...separate *Knowledge of Nature* from:
 - *Colours of Rhetoric*
 - *Devices of Fancy*
 - *Deceits of Fables*
- Ditch the language of “*Wits and Scholars*”
- Return to...*primitive purity, and shortness*
- Get as near the *Mathematical plainness* as possible

— Thomas Sprat, 1667. *History of the Royal Society of London*

“Mertonian” norms of science

1. Universalism
2. Communism (“Communalism”)
3. Disinterestedness
4. Organized skepticism



scientist

Scientist : The Story of a Word

“The appellation ***scientist*** is considered a title of honour, hotly contended for by economists, engineers, physicians, psychologists, and others.”

— Sydney Ross, 1962. *Annals of Science*

data

"The appellation **'scientist'** is considered a **sexy** title ~~of honour~~, hotly contended for by ~~economists, engineers, physicians,~~ ~~psychologists, and others.~~" *i dunno, but it makes me mad!*

william whewell

"...by analogy with *artist*, they might form ***scientist***...there could be no scruple in making free with this termination when we have such words as ***sciolist***, *economist*, and *atheist*"



(1794-1866)

W. Whewell. (*anonymously*) 1834. *The Quarterly Review*, 51, 58-61.

sci.o.list

n • a superficial pretender to knowledge

Scientist : The Story of a Word

"When an appellation is accepted or rejected as the designation of a group of people...the motives, which are not usually admitted consciously, are dictated by...the image that the word provokes."

— Ross 1962, continued

Scientist

"The designation *scientist*... was not in accord with the persona... To them the word scientist implied making a business of science; it degraded their **labours of love** to a **drudgery for profits** or salary."

— Ross 1962, p.66

Data Scientist

“The now-contemplated field of data science...is motivated by **commercial** rather than **intellectual developments**. Choosing in this way is likely to miss out on the really important intellectual event of the next 50 years.”

— Donoho 2017, p.745

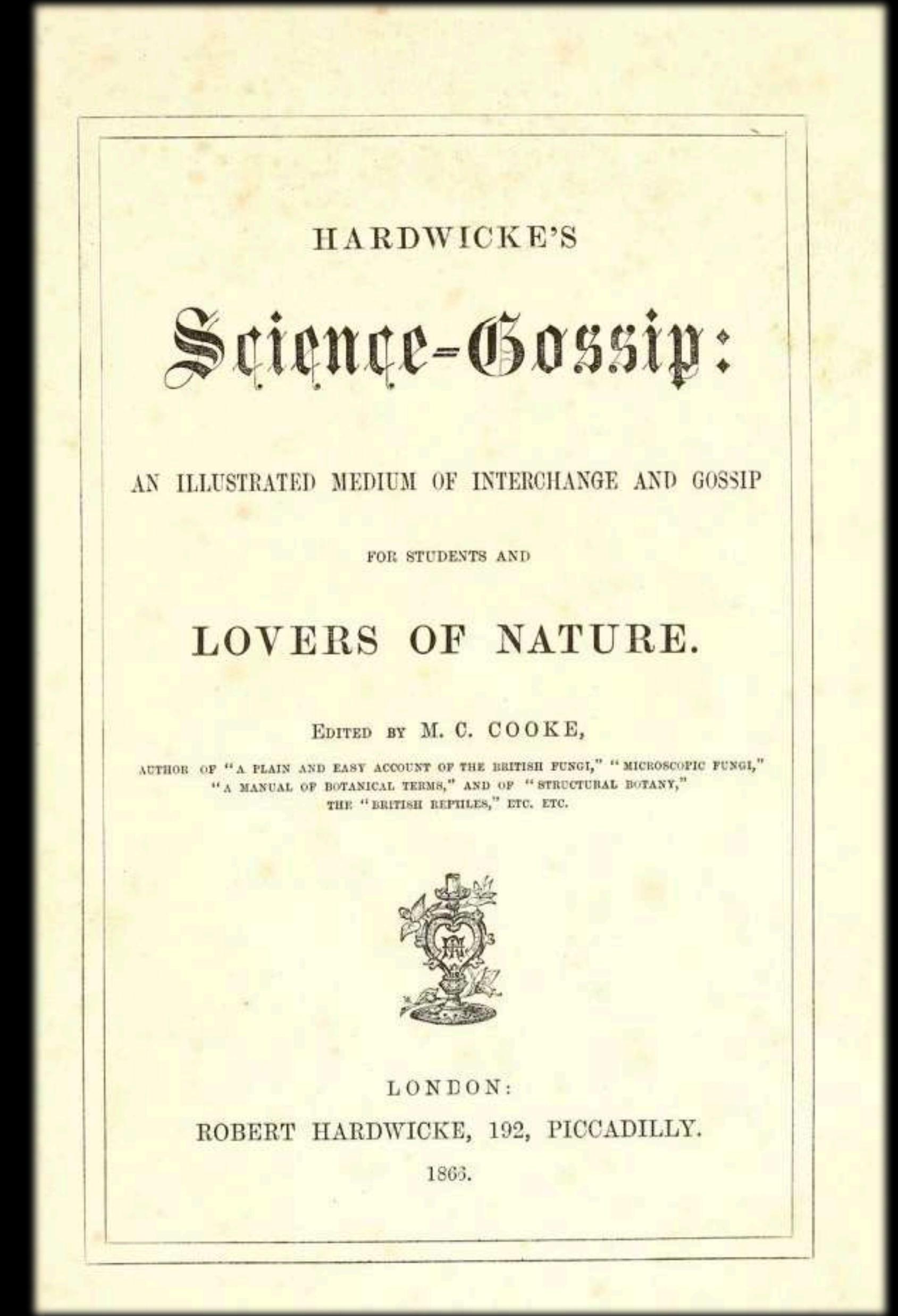
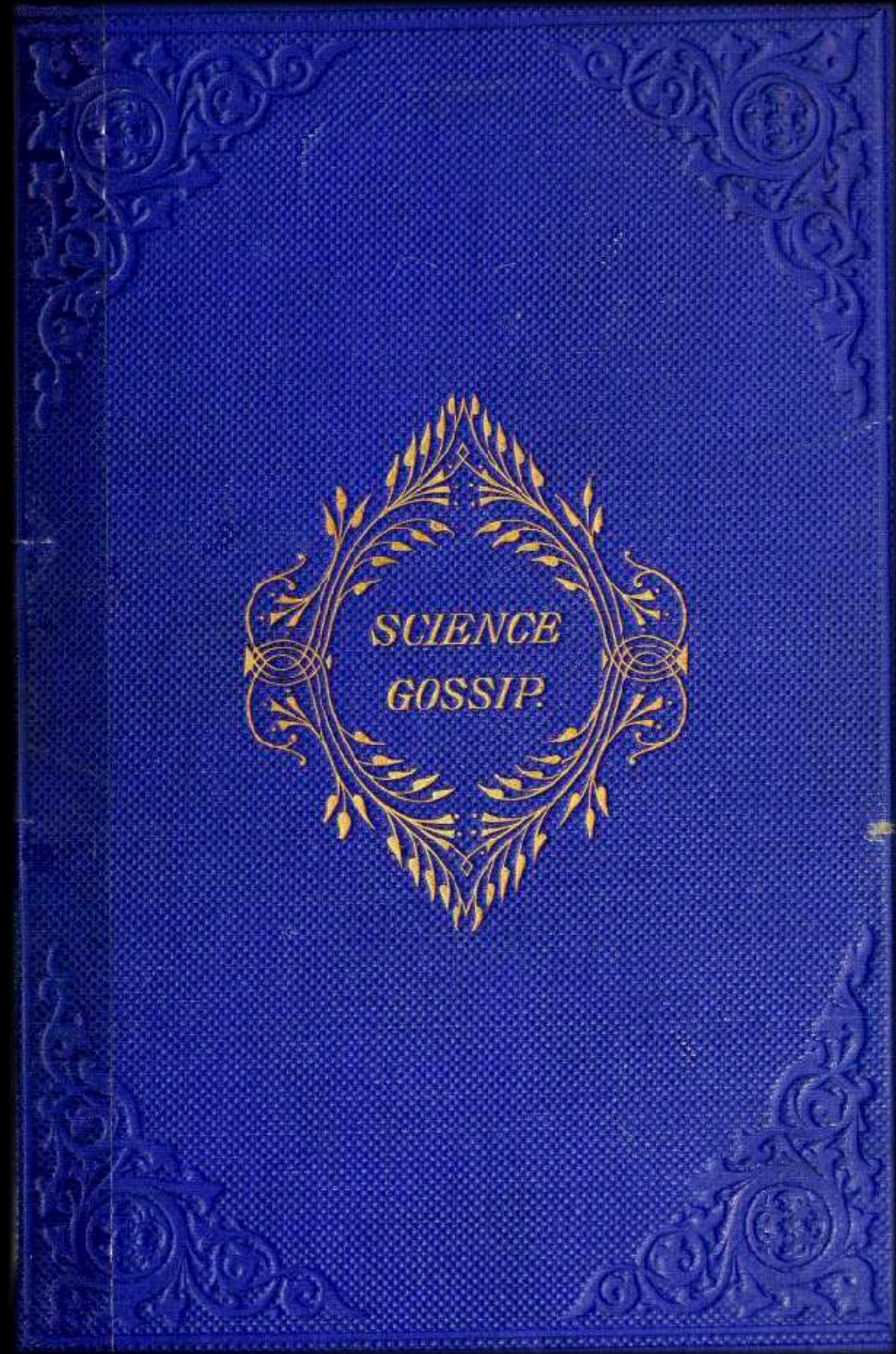
thomas h. huxley

“To any one who respects the English language, I think '**Scientist**' must be about as pleasing a word as 'Electrocution.' I sincerely trust you will not allow the pages of **Science-Gossip** to be defiled by it.”



(1825-1895)

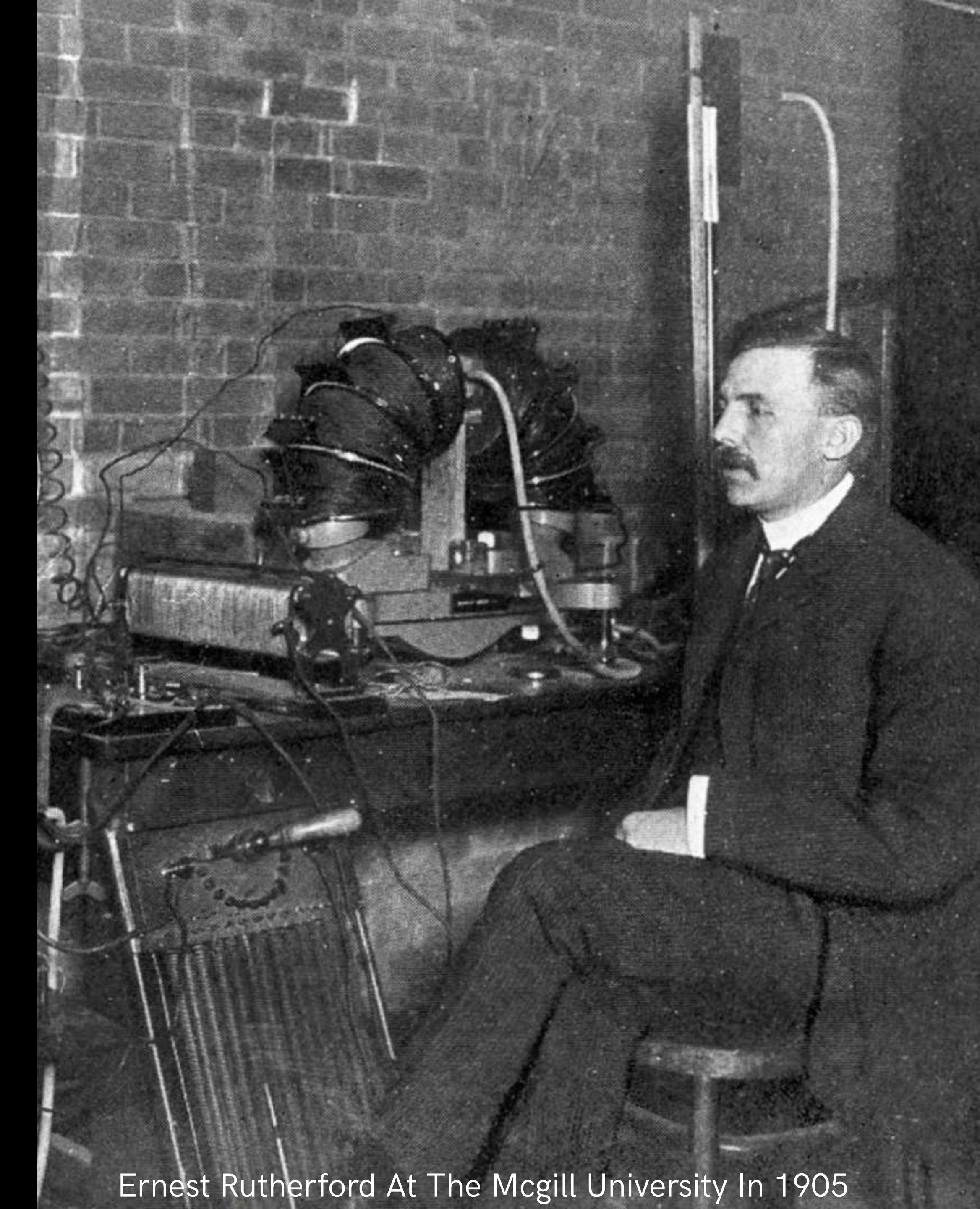
Thos. H. Huxley 1894. Letter to J.T. Carrington, editor of *Science-Gossip*, in Ross 1962.



Ernest Rutherford

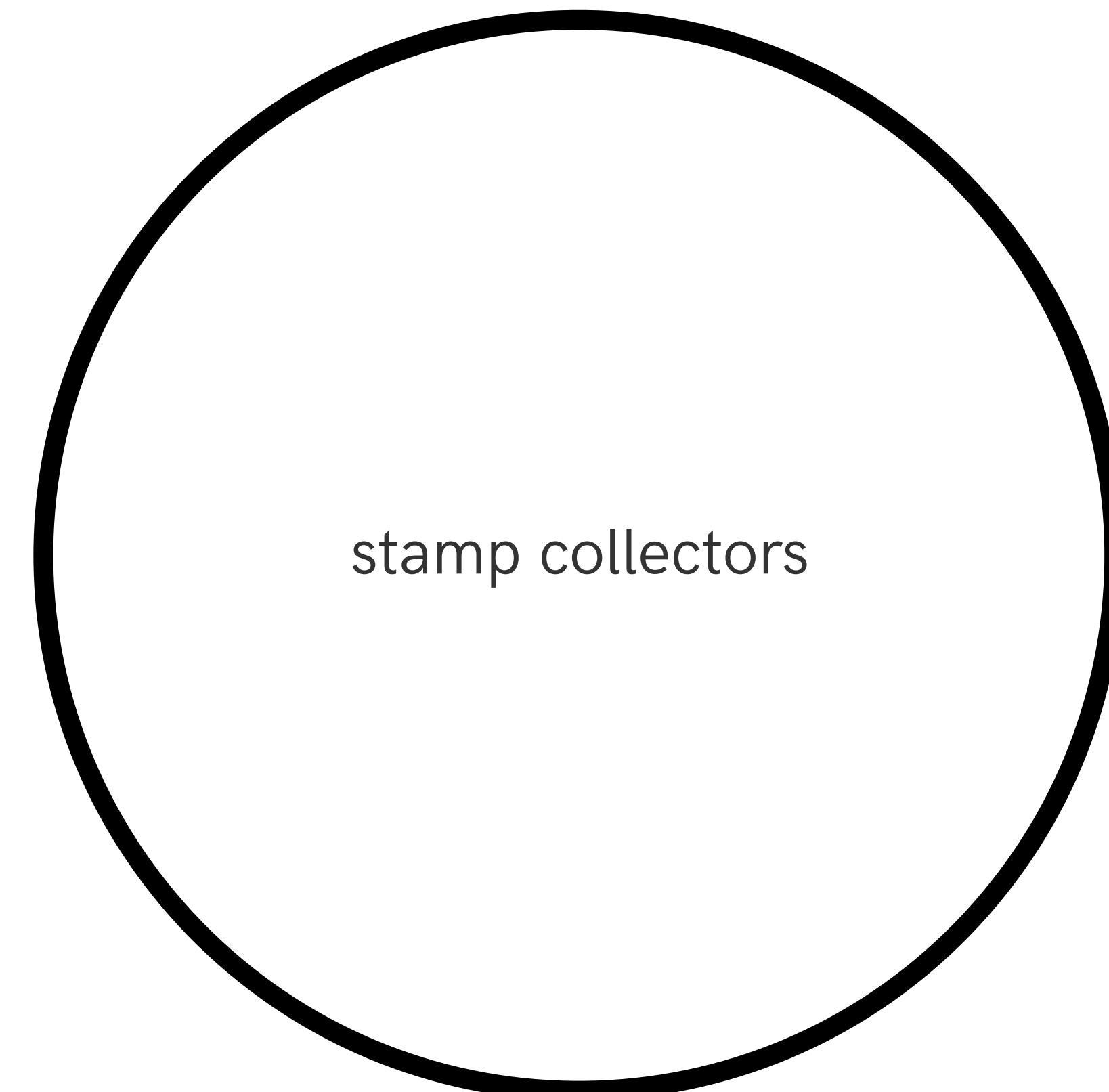
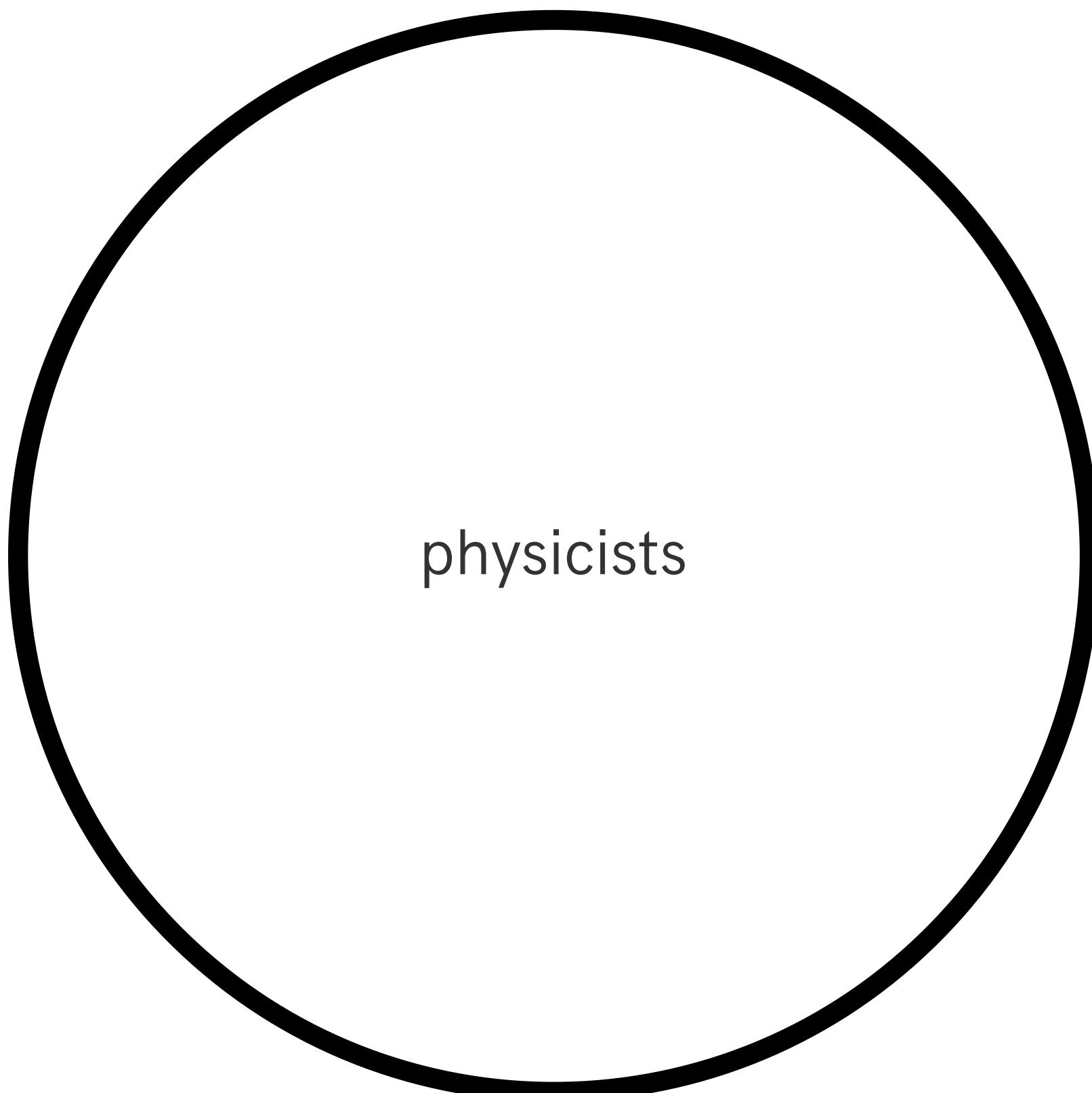
“...said that scientists were divided into two categories—physicists and stamp collectors”

– Daniel Lang, The New Yorker, 1963.

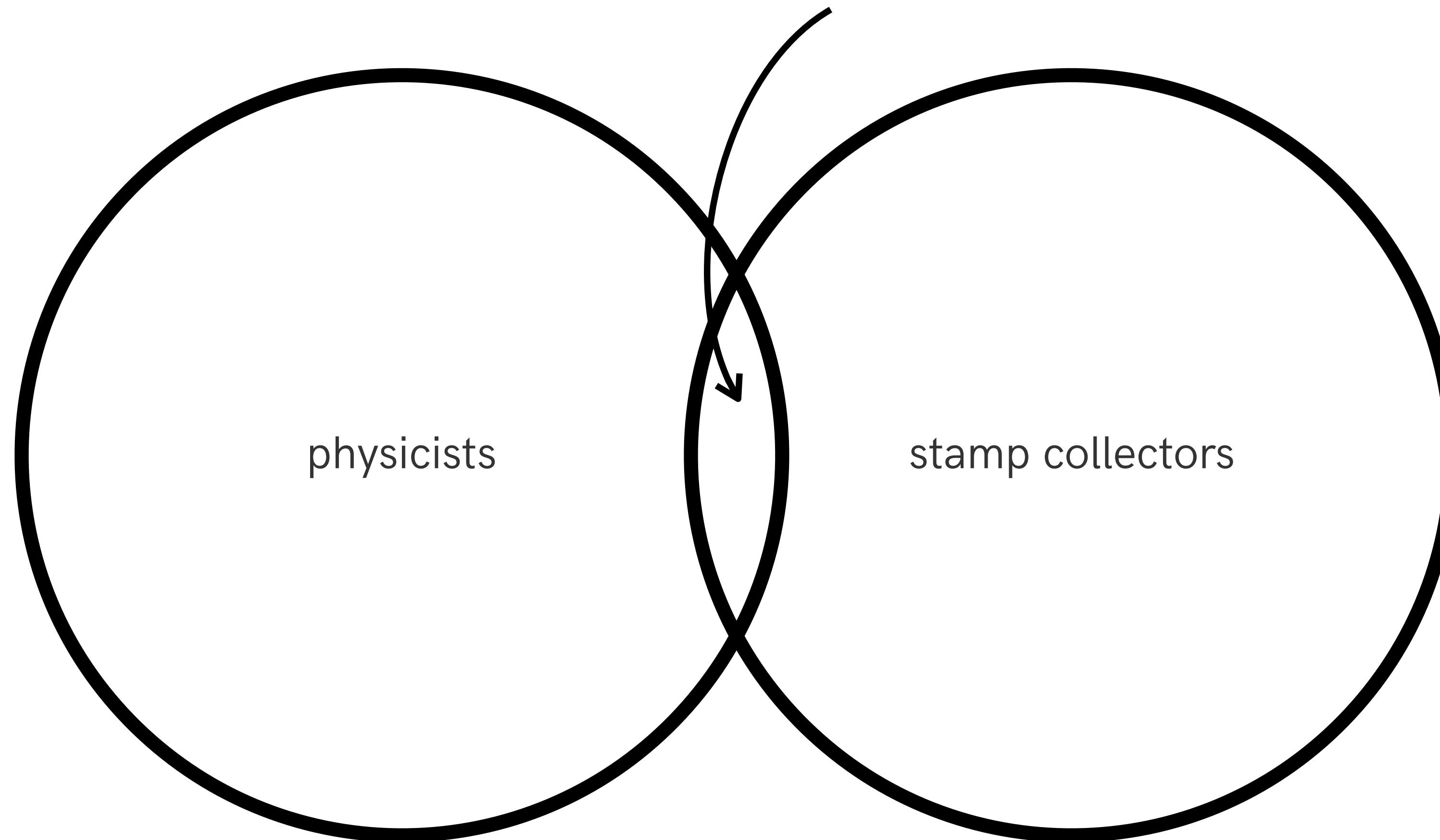


Ernest Rutherford At The McGill University In 1905

all scientists



physilatelists



pan.chres.ton

n · an explanation or theory which can fit all cases, being used in such a variety of ways as to become meaningless

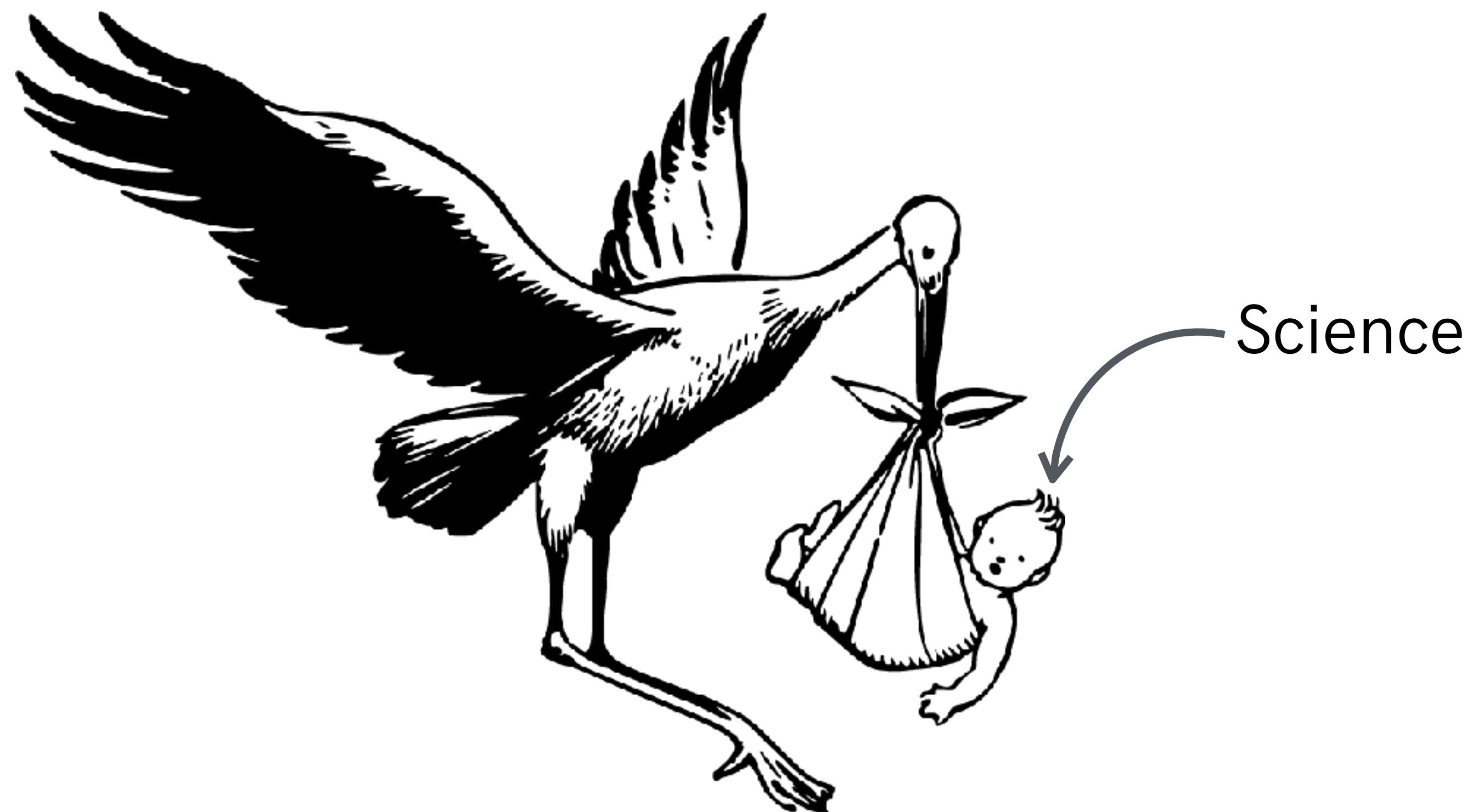
data science-ing

44

```
library(tidyverse)  
data <- read_csv(data.csv)  
model <- fancy_algo(data)  
model
```



Mom, where do data come from?



**“Is not science a
dispassionate recording of
facts, uncontaminated by
value judgements?”**

(Ross 1962)

**science
in context**



CONTEXT

CONTEXT



What does
doing science
look like?



What does
doing science
look like?



What does
doing science
look like?



What does
doing science
look like?



OH, THAT'S WHAT YOU mean BY context

socio-technical systems

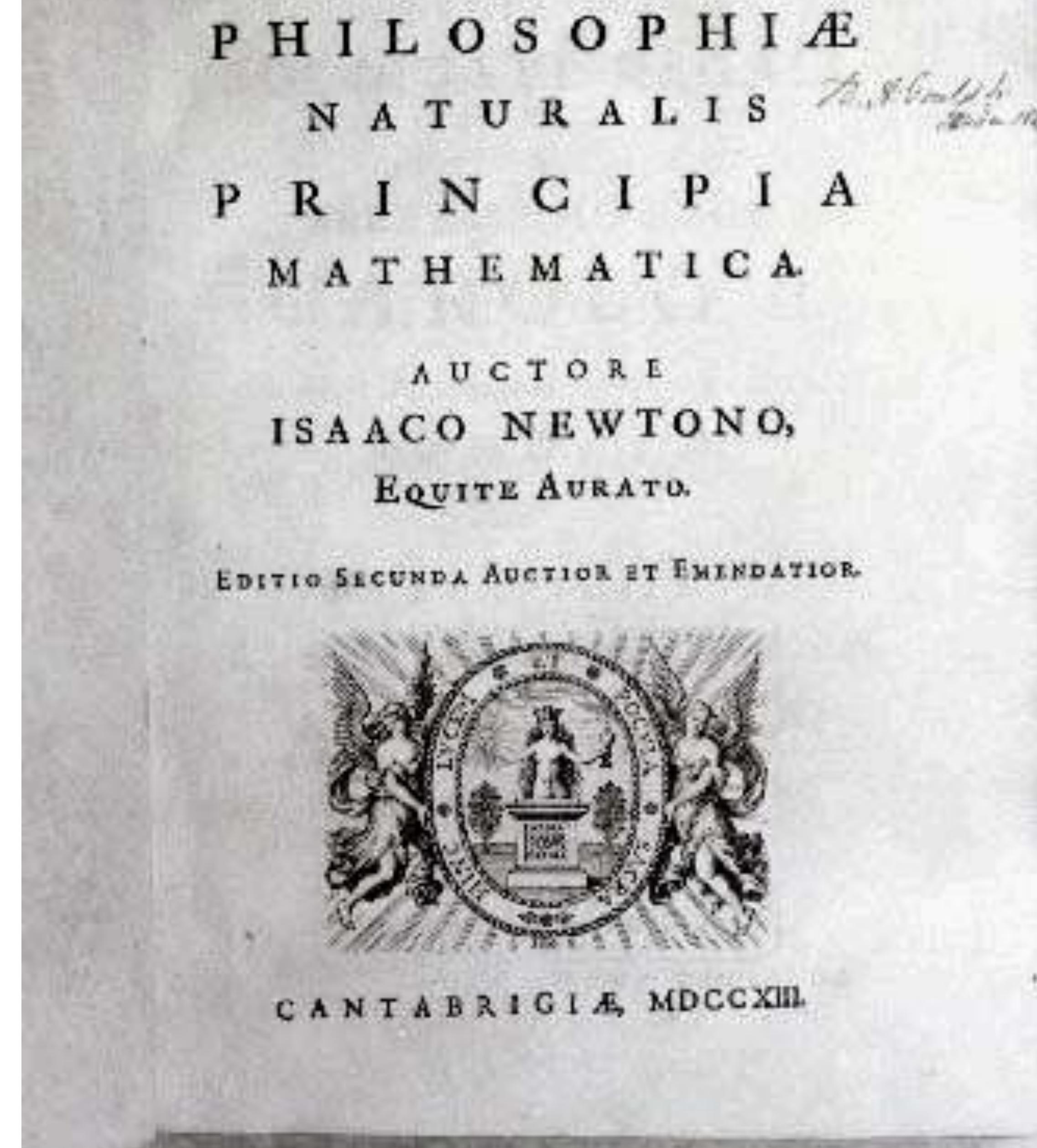
complex socio-technical systems

(Norman & Stappers 2015)



What of “*hypotheses non fingo*”

54



The view from nowhere...

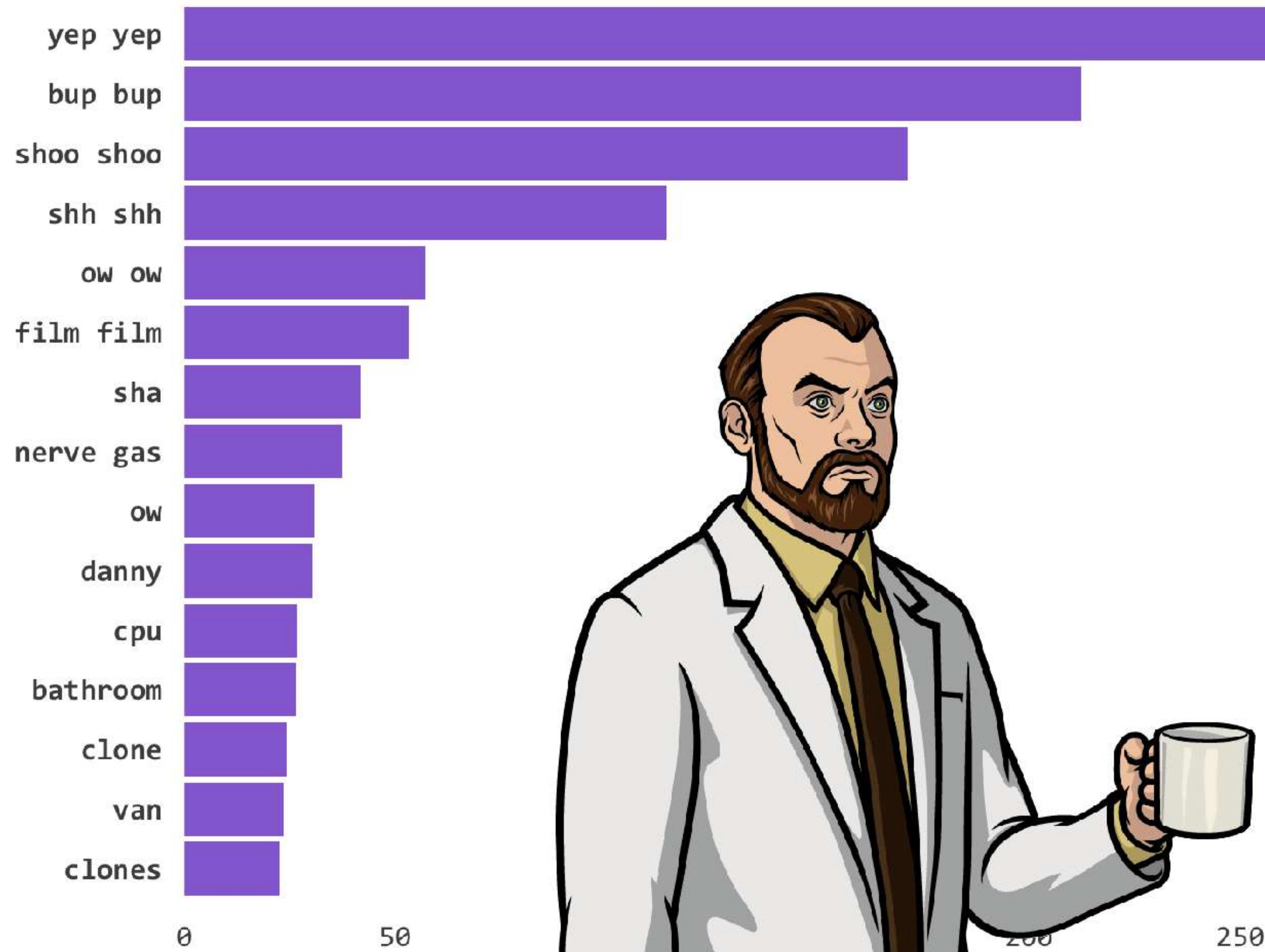
"We have to remember that the view from nowhere is always a view from somewhere, and it's usually the view from the body that's regarded as the default."

– Catherine D'Ignazio, *What can data visualization learn from feminism?*, 2018.

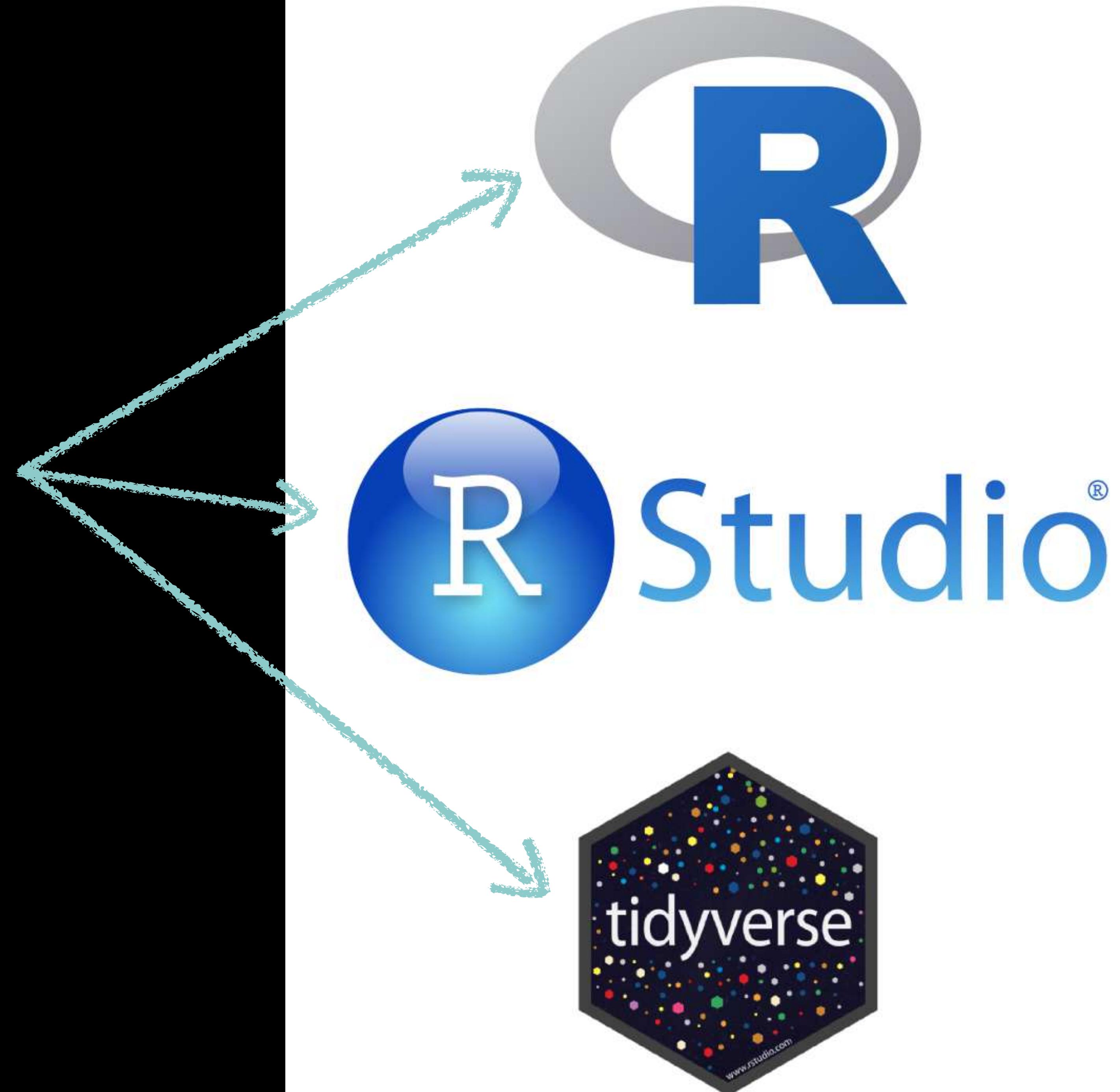
What About R?

Oh, I'm super into it!

KRIEGER'S MOST DISTINCTIVE TERMS



my favourite
tools



data wrangling



We gotta find a way to make this fit into the hole for this

Rectangling data wrangling



Idea

Rectangling

~~data wrangling~~



We gotta find a way to make this fit into the hole for this



with visualization we want to be sure that we communicate the right thing, and that we don't inadvertently communicate the wrong thing. In order to do so, we need to take into account the audience(s) and contexts in which these visualizations are used — we also need to account for the application/use of the visualization, esp. when being used as a "decision-support" mechanism. for example, what our adverse outcome is might inform the way in which we depict uncertainty. we have to ask ourselves what information is being removed in our rendering — are these conversations being eliminated?

information fidelity is crucial, and/but we use visualization to help maximize our ability to communicate quite a lot of information. the user/viewer inherently brings his or her own experience to bear on the interpretation of the knowledge being conveyed (if it is in fact knowledge at that point in time). so, what is to be done? do we attempt to measure efficacy, and, if so, how? visualization, in fact, can also be a medium through which we consider new information; we're able to visualize information about our data before we actually know its contents sometimes this is a matter of good, efficient procedures. so, what tools do we even trust to help us w/ such an endeavor. how do we bring more of the tools in a way that helps us augment our strengths as humans?

comment your life

what do you do when you have an idea but don't, at that moment, know how to "make"

you consider your audience. if it's you, you capture the idea in a way that's different from how you would do so for a second-party or an audience

a thing I actually have done/will likely continue to do in order to avoid things taking forever in life always

and also b/c it allows a different kind of thinking

note: below I started to write as though someone else would actually read that (note the spacing)

at times we don't calibrate correctly for the audience, ourselves included

sometimes, your mental model/calculations for this are "off." I, for one have left myself a bunch of notes which, when later found by their author (me) could not be properly parsed/interpreted. However, in trying to get back to what it was that I meant to convey, I am able to make use of clues/signals which, if asked to do so, I would likely be unable to "formalize" or make explicit. even when I do "get" it, I, as reader, bring things to the table that weren't there at the time of their writing. to find the common ground

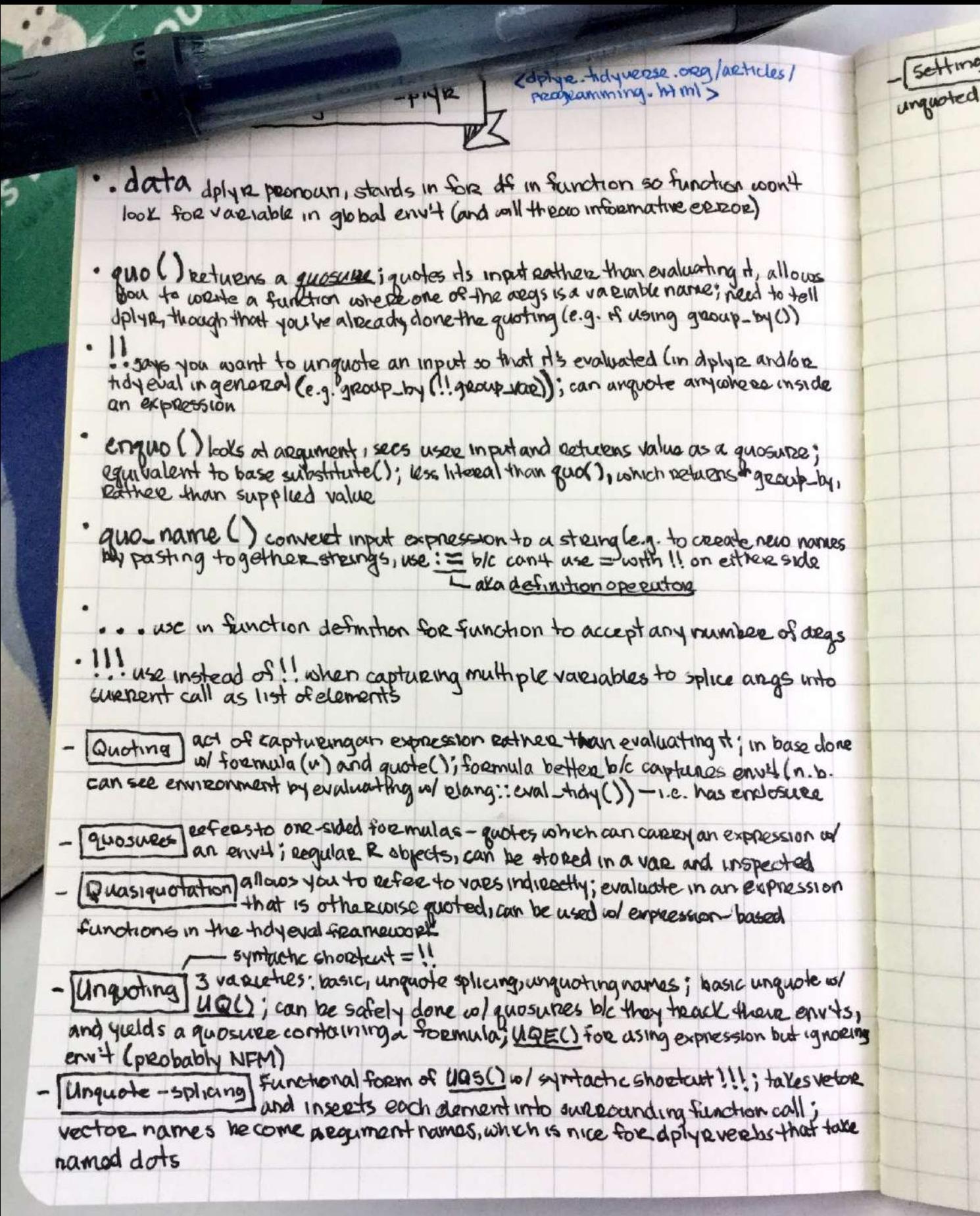
Not Very Tidy



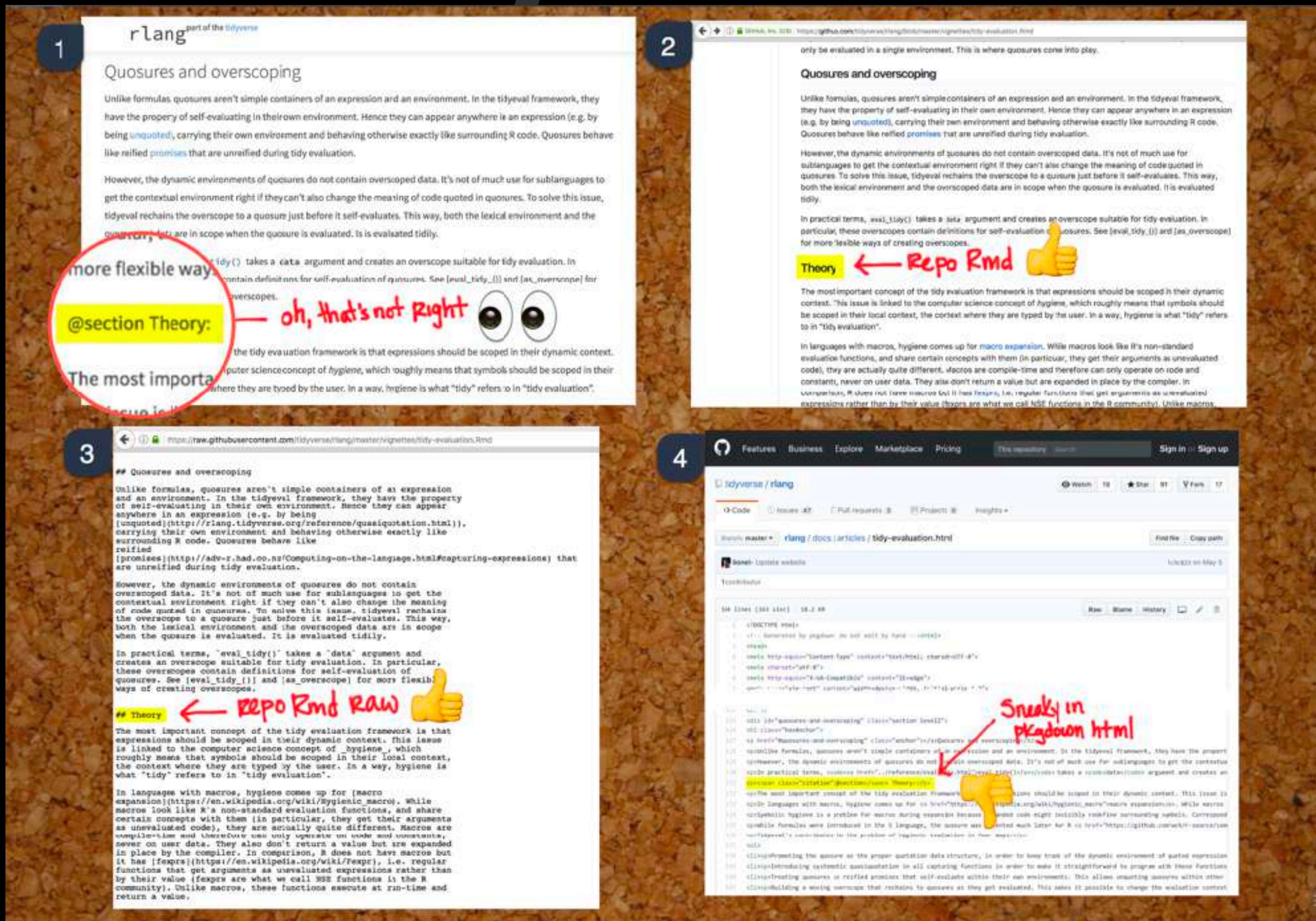
Not Very Tidy



sharing untidy efforts...



sharing untidy efforts...





tradecraft

other people's content...

63



other people's content...

↑
not necessarily new

Mara Averick
@dataandme

Follow

ICYMI, it's not breaking news, but @hspter's R-📦-✍️ing guide = 🔥: "Writing an R package from scratch" buff.ly/2wuSwg0 #rstats

Step 0: Packages you will need

You packages you will need to create a package are devtools and roxygen2. I am having you download the development version of the roxygen2 package.

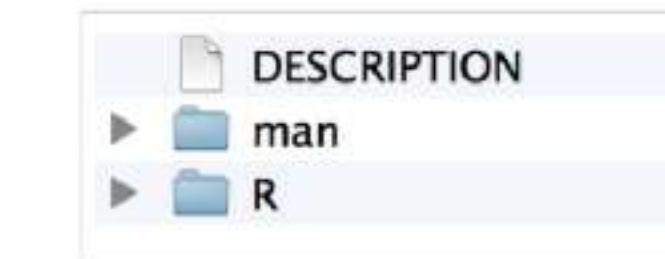
```
1 install.packages("devtools")
2 library("devtools")
3 devtools::install_github("klutometis/roxygen")
4 library(roxygen2)
```

Step 1: Create your package directory

You are going to create a directory with the bare minimum folders of R packages. I am going to make a cat-themed package as an illustration.

```
1 setwd("parent_directory")
2 create("cats")
```

If you look in your parent directory, you will now have a folder called cats, and in it you will have two folders and one file called DESCRIPTION.



You should edit the DESCRIPTION file to include all of your contact information, etc.

The screenshot shows three versions of the 'DESCRIPTION' file:

- Initial 'DESCRIPTION'**: Contains fields like 'Name: cats', 'Version: 1.0', 'Title: cats', 'Authors: Mara Averick', 'Description: A cat-themed package', 'Encoding: UTF-8', and 'LazyData: TRUE'.
- After adding 'man'**: Shows the addition of a 'man' folder under 'DESCRIPTION'.
- After adding 'R'**: Shows the addition of an 'R' folder under 'DESCRIPTION'.

tweet anatomy



Your Name

@yourhandle

Cool tutorial using {**package-name**}:
"Title of the tutorial" by **@author_handle**
www.thelinktoit.com via **@sitename**
#relevanthash **#maybeanother**

but with pretty pictures

tweet anatomy

Mara Averick
@dataandme

Follow

Another 🌟 chart resource: "ggplot2 extensions" (w/ more than shown) maintained by @Emaasit buff.ly/2eJI4HA
#rstats #ggplot2 #dataviz

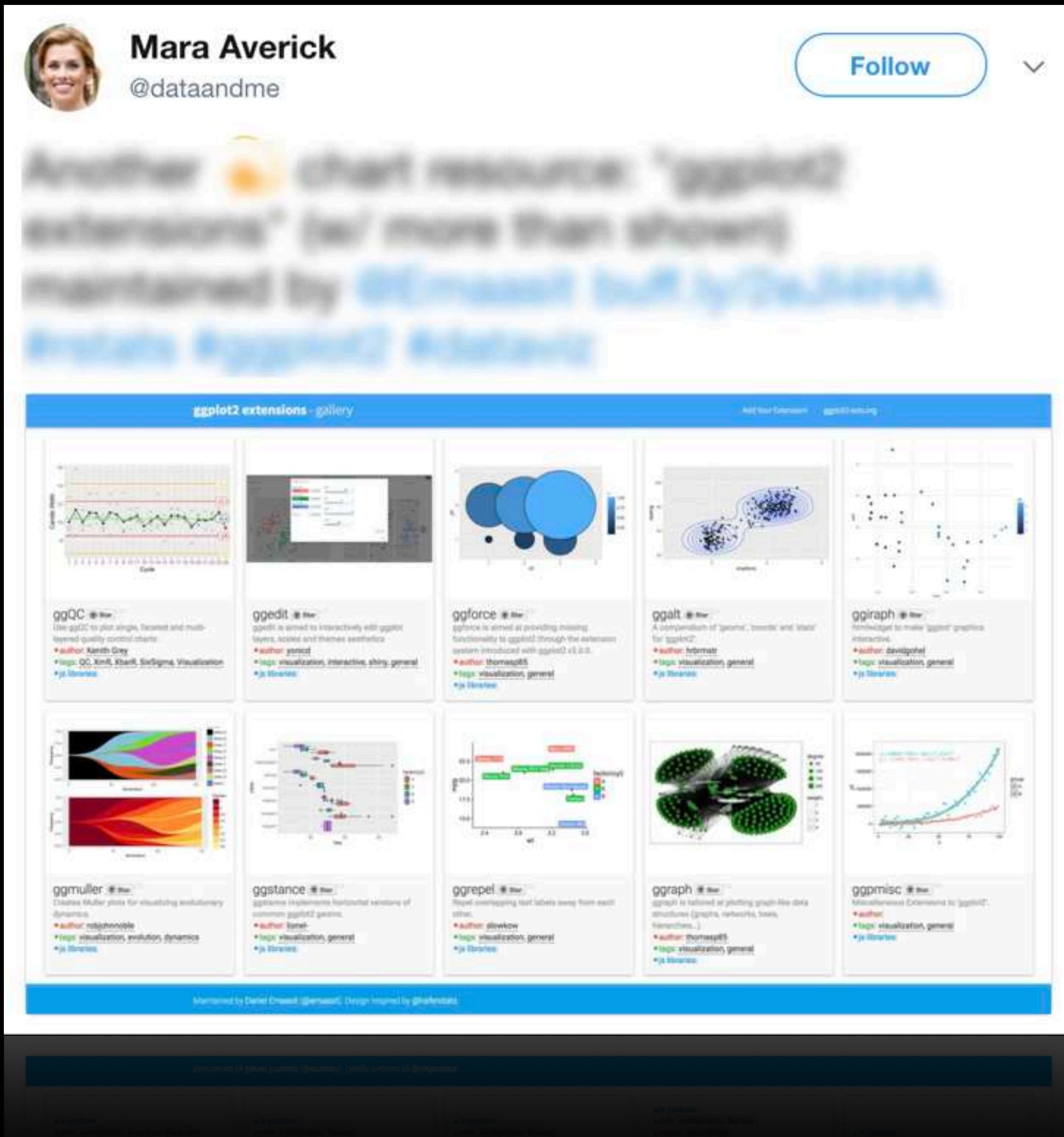
ggplot2 extensions - gallery

The gallery shows 10 examples of ggplot2 extensions:

- ggQC: Provides quality control plots.
- ggridit: Allows for interactive ggplot2 layers.
- ggforce: Adds functionality to ggplot2 through the tidyverse system.
- ggalt: Provides additional themes and scales.
- gggraph: Focuses on creating graph-based graphics.
- ggmcmc: Visualizes MCMC chains.

Maintained by Daniel Emrich (Emaasit). Design inspired by @hrbrmstr.

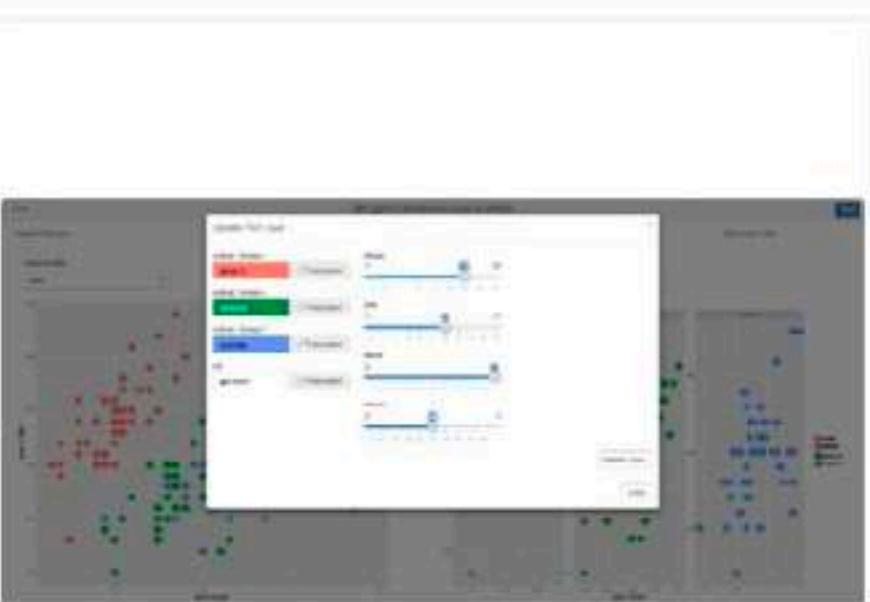
tweet anatomy



**ggQC**

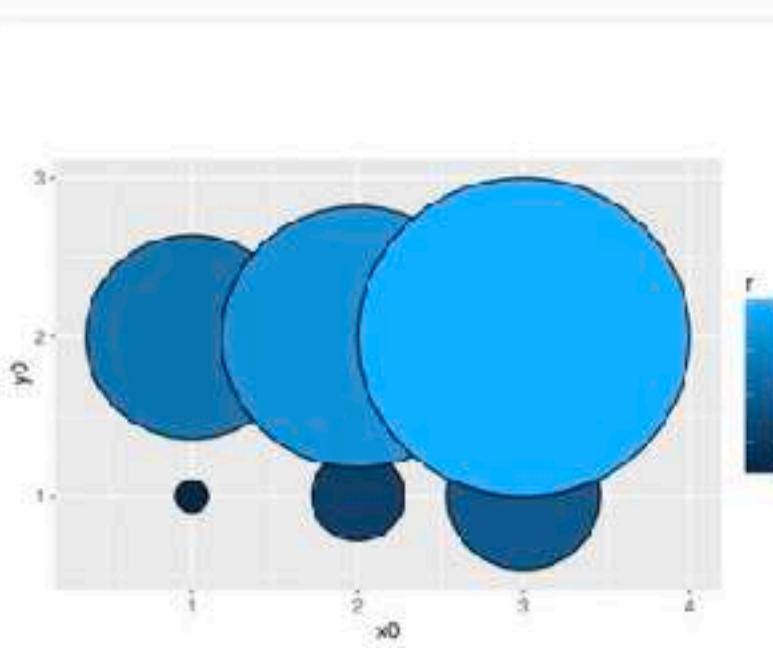
Use ggQC to plot single, faceted and multi-layered quality control charts .

- **author:** Kenneth Grey
- **tags:** QC, XmR, XbarR, SixSigma, Visualization
- **js libraries:**

**ggedit**

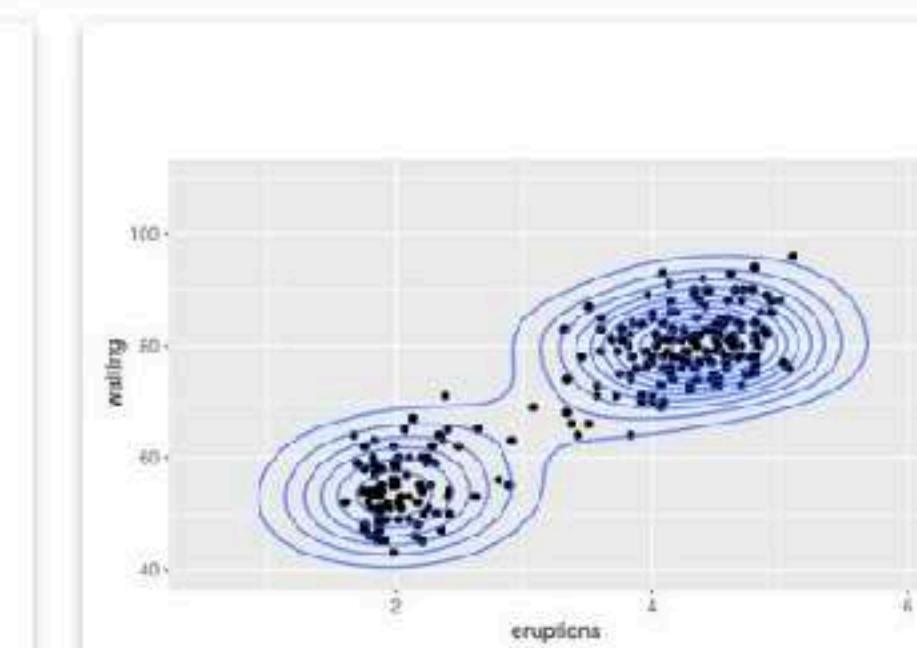
ggedit is aimed to interactively edit ggplot layers, scales and themes aesthetics

- **author:** yonied
- **tags:** visualization, interactive, shiny, general
- **js libraries:**

**ggforce**

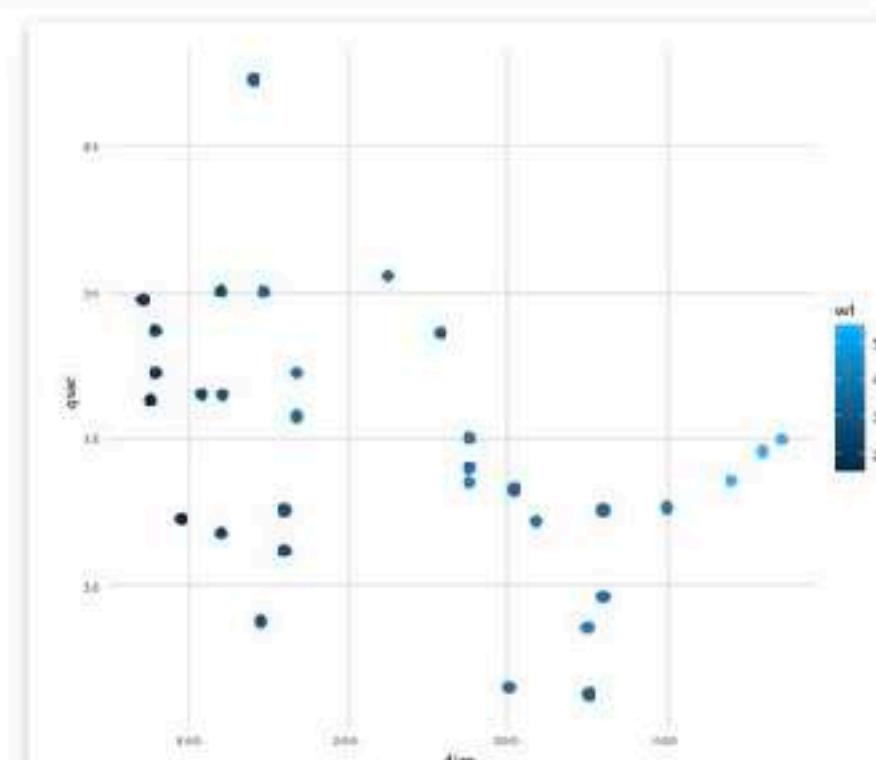
ggforce is aimed at providing missing functionality to ggplot2 through the extension system introduced with ggplot2 v2.0.0.

- **author:** thomasp85
- **tags:** visualization, general
- **js libraries:**

**ggalt**

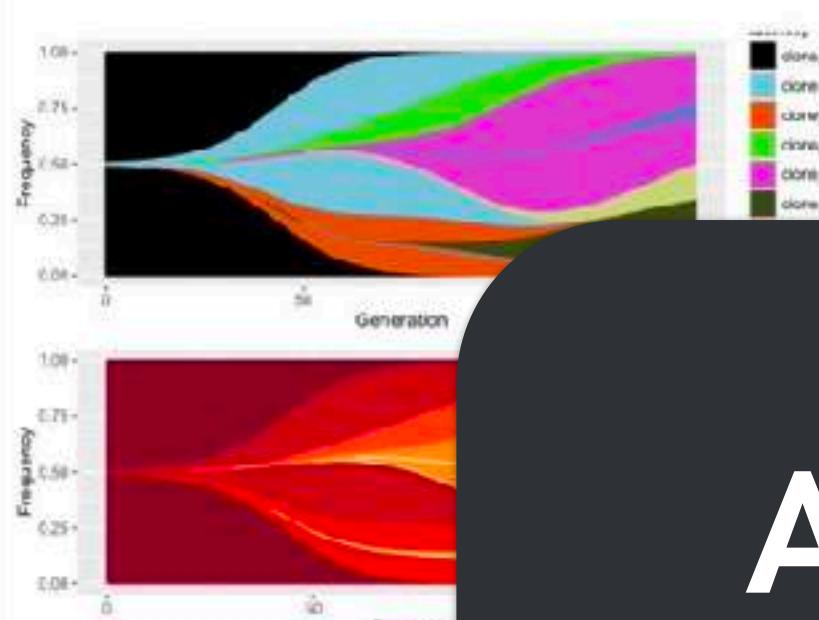
A compendium of 'geoms', 'coords' and 'stats' for ggplot2.

- **author:** hrbrmstr
- **tags:** visualization, general
- **js libraries:**

**ggiraph**

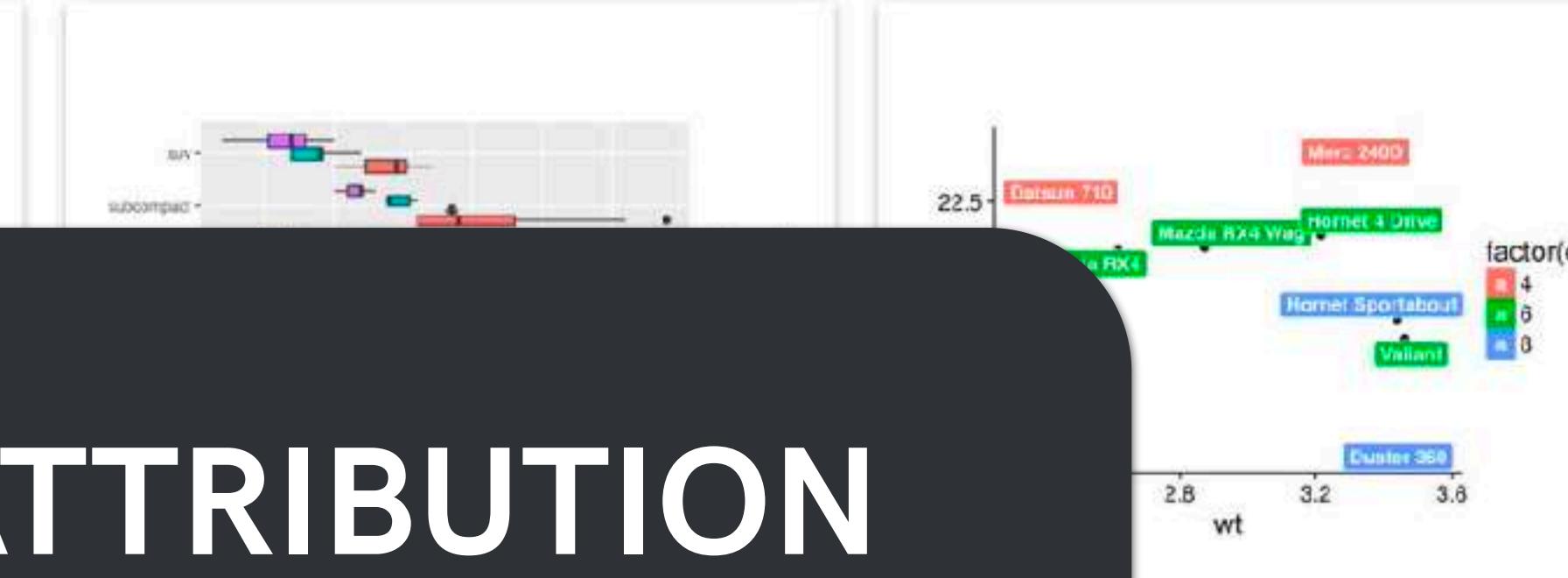
htmlwidget to make 'ggplot' graphics interactive.

- **author:** davidgohel
- **tags:** visualization, general
- **js libraries:**



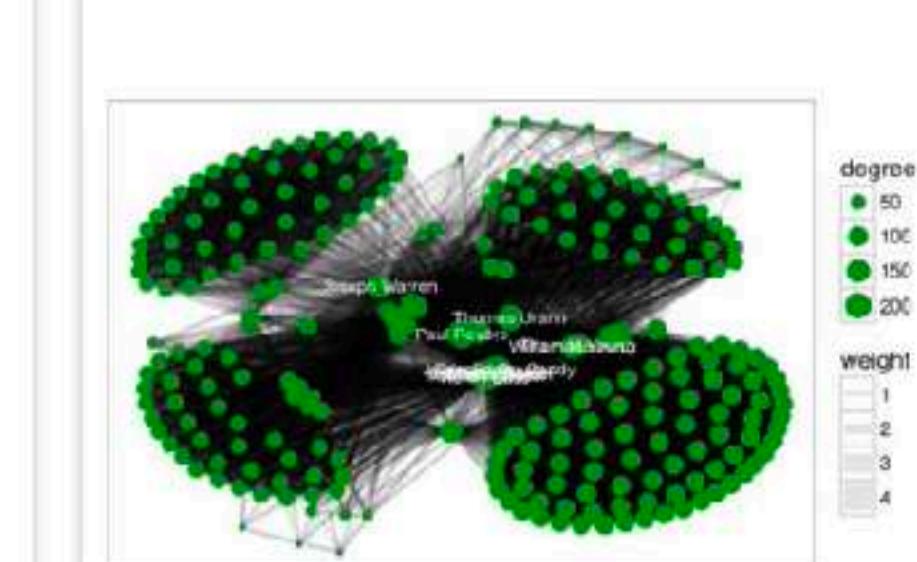
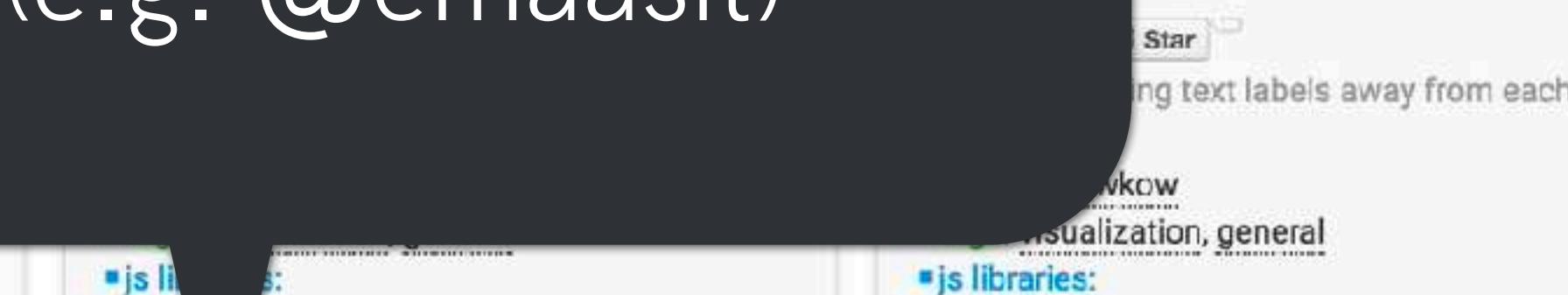
ATTRIBUTION

(e.g. @emaasit)

**ggmuller**

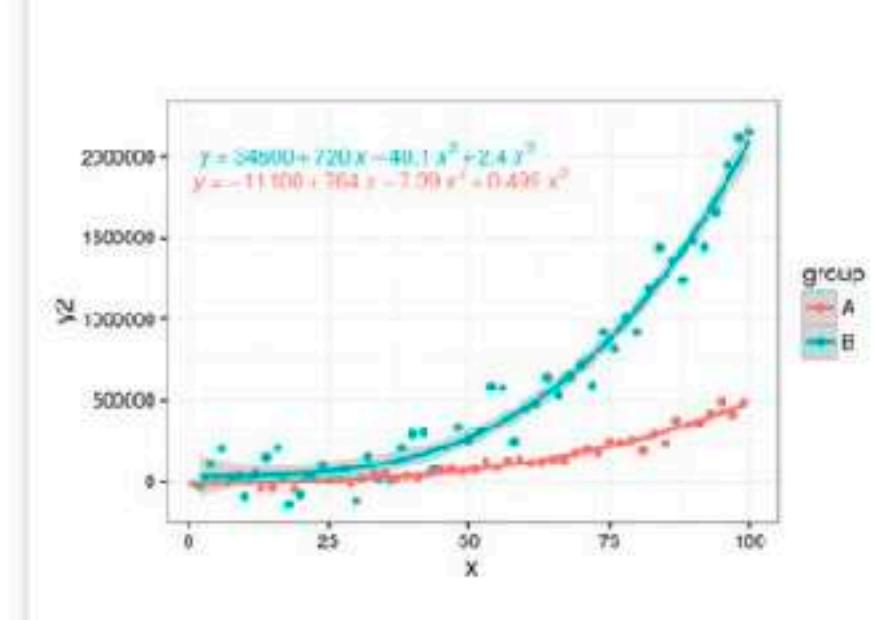
Creates Muller plots for visualizing dynamics.

- **author:** robjohnnoble
- **tags:** visualization, evolution, dynamics
- **js libraries:**

**ggraph**

ggraph is tailored at plotting graph-like data structures (graphs, networks, trees, hierarchies...).

- **author:** thomasp85
- **tags:** visualization, general
- **js libraries:**

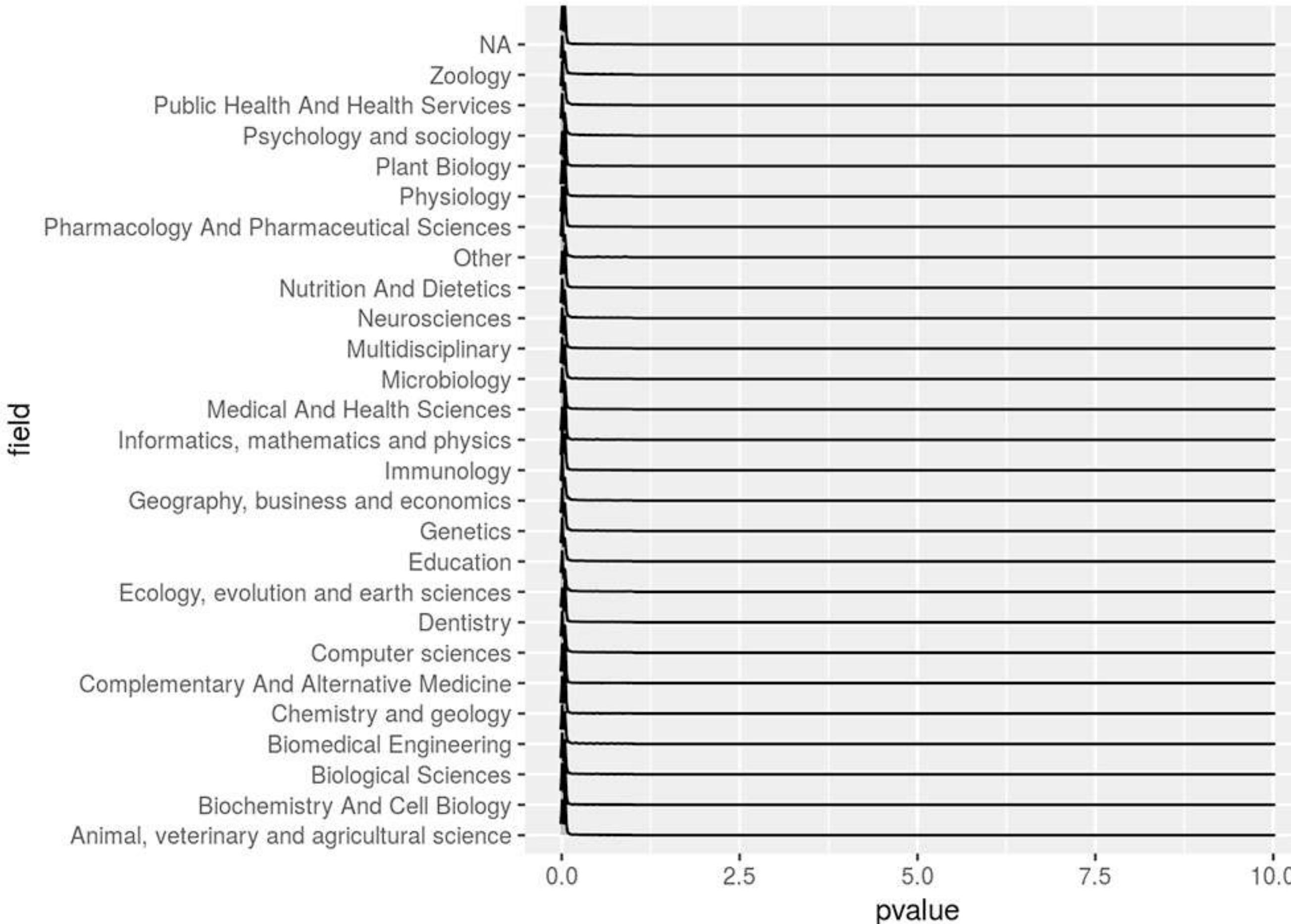
**ggpmisc**

Miscellaneous Extensions to 'ggplot2'.

- **author:**
- **tags:** visualization, general
- **js libraries:**

Creating an expository graph for a talk

👤 Jeff Leek 📅 2017/10/02



src: @jtleek <<https://simplystatistics.org/2017/10/02/creating-an-expository-graph-for-a-talk>>

the tweet != the content



the tweet != the content



tweet Rs

- Read (or run)
- Relatable
- Retrievable
- Relevant
- Real

you do you 

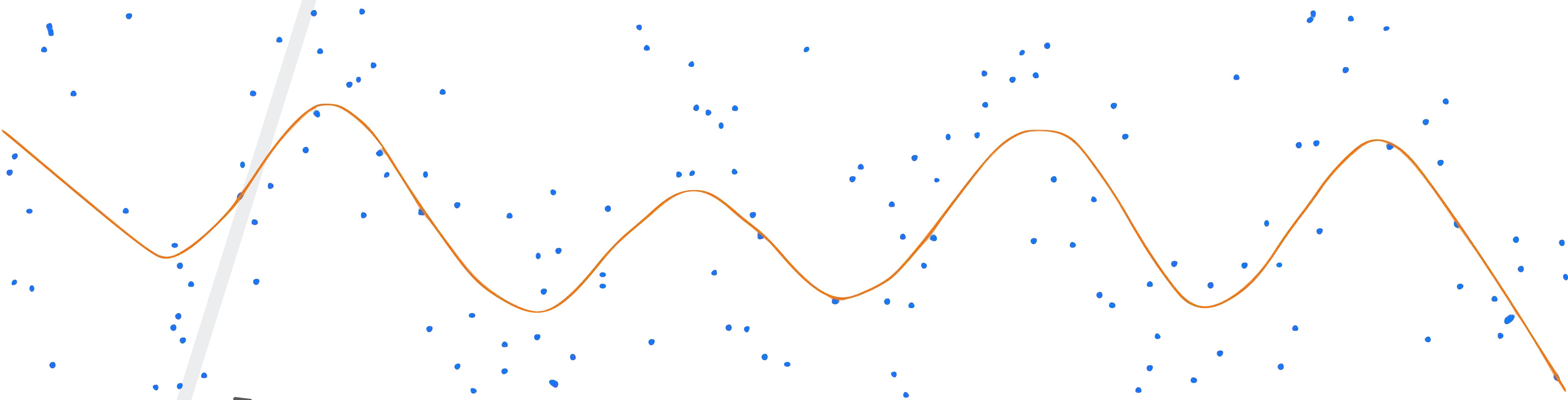
* completely arbitrary rules I made up

leaRning out loud



OMG, I just learned a thing!

leaRning out loud



dialogue is totally back...

Roger Peng and Hilary Parker are the new Boethius and Lady Philosophy

Ingelfinger no more?

Mara Averick
@dataandme

Hey paper-publishing tweeps, have you ever heard of "The Ingelfinger Rule"?
nejm.org/doi/full/10.10...
archive.is/20121228213429...

90% No.

6% Yes, and it's legit.

4% Yes, and it's passé.

biased sample ! → 131 votes • Final results
1:34 PM - 25 Apr 2018

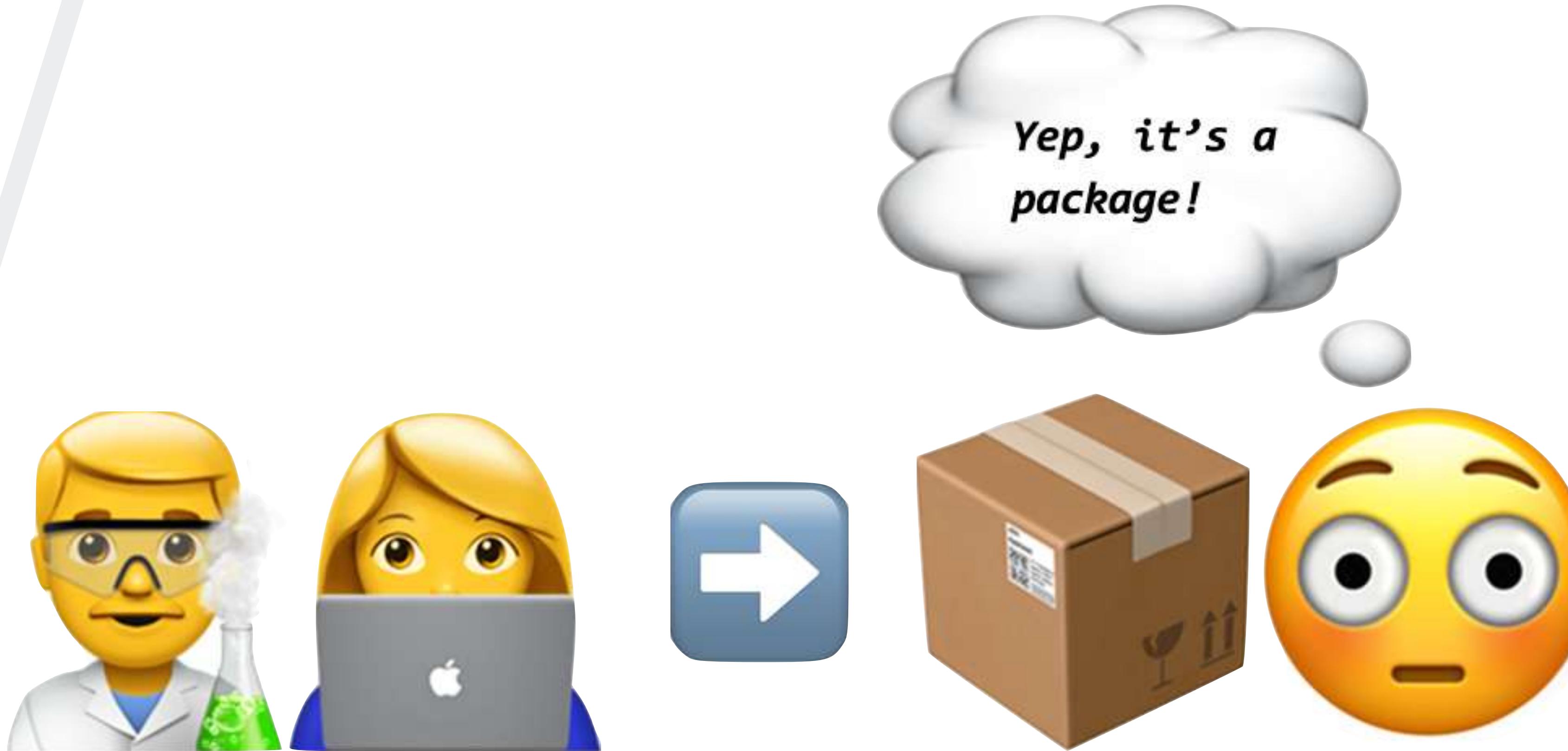
The newcomer's paradox...



When you ask for help, some friendly soul will no doubt tell you that "it's easy, just do foo, bar and baz." Except for you, it is not easy, there may be no documentation for foo, bar is not doing what it is supposed to be doing and what is this baz thing anyway with its eight disambiguation entries on Wikipedia?

— Leslie Hawthorne

require(n00bs)



require(n00bs)

When assigning reviewers to a submission, we aim to pair experienced reviewers with new ones, or reviewers with expertise on a package's programming methods with those experienced in its field of application.

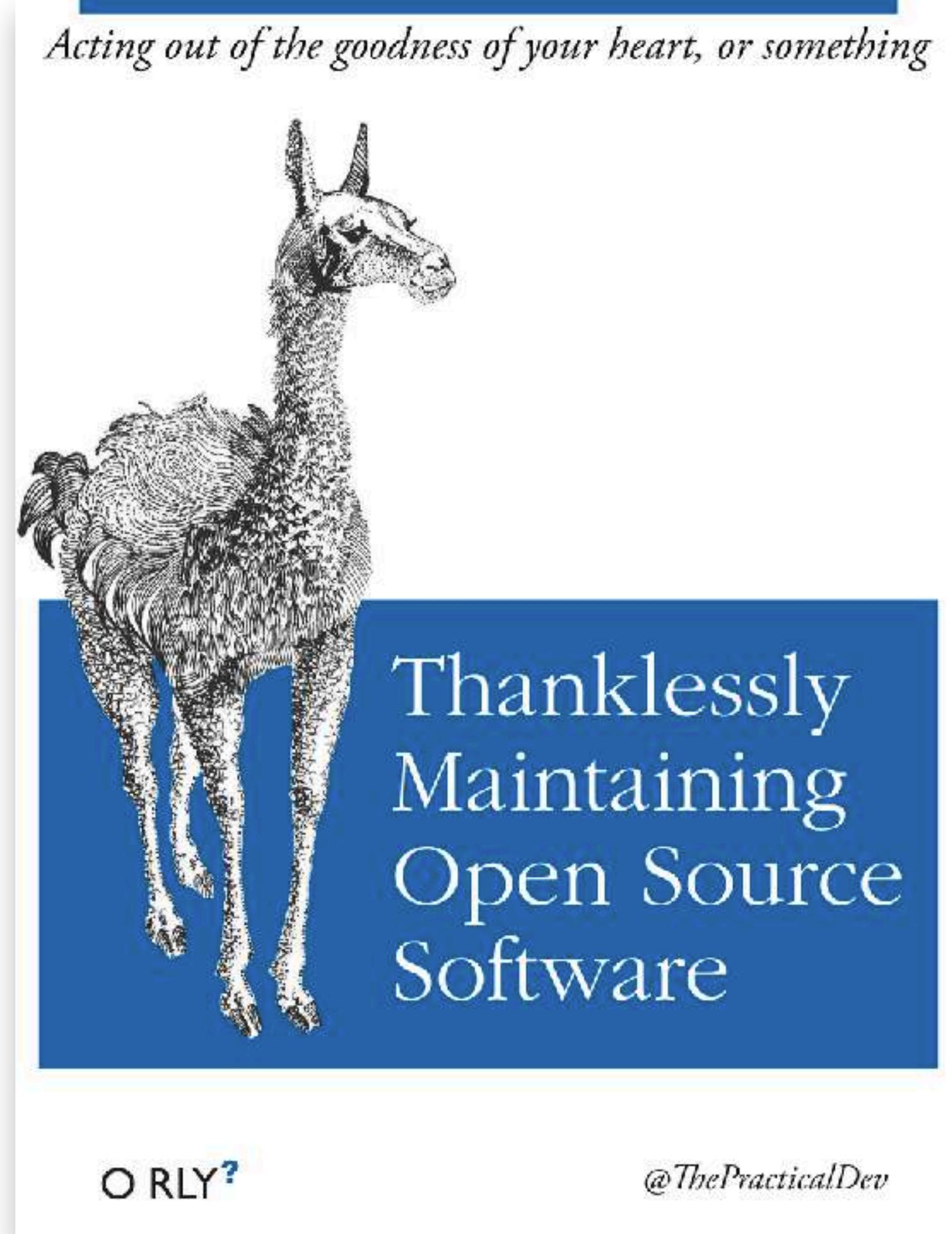


How rOpenSci uses Code Review to Promote Reproducible Science

ropensci.org highlighted with Highly

giving back

74



Thank You

<http://bit.ly/not-science>



Thank You

<http://bit.ly/not-science>



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