

An overview of open-science practices, and how to adopt (some of) them in your work

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 @tgrootswagers

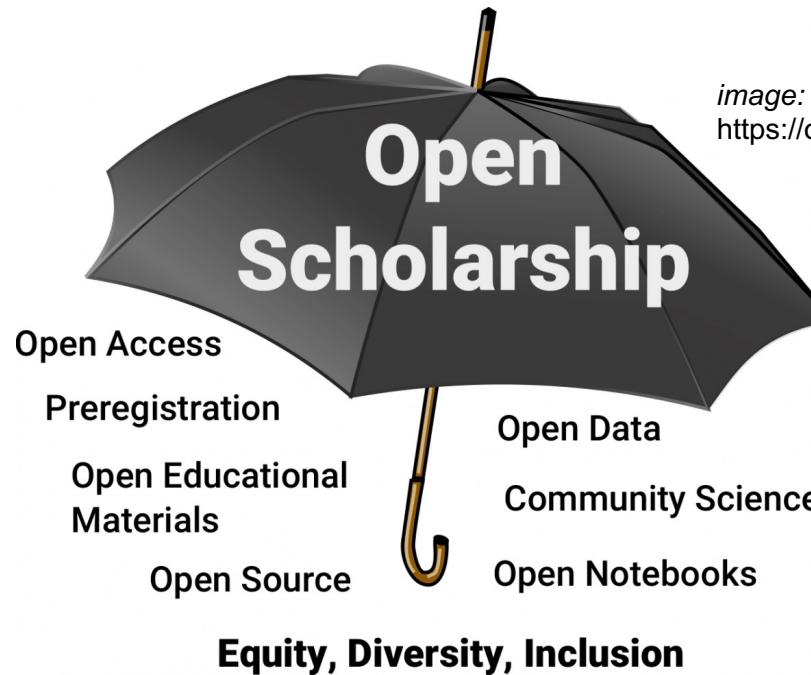


Conclusion

- Open science can be beneficial
- Many ways to engage
- Many tools available
- Lots of resources!
- Helpful community*

- BUT
 - Not all-or-nothing
 - Not everyone has the time
 - Not everyone has the resources
 - Not required to do good science

image: Robinson et al, 2018
<https://osaos.codeforscience.org/what-is-open/>



replicability

rigor

transparency

openness

reproducibility

knowledge^accumulation

How to “open science”

- Preregistration and Registered Reports
- Sharing code
- Sharing data
- Open access publishing and preprints

Preregistration & Registered Reports

Rationale

False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant

Joseph P. Simmons, Leif D. Nelson, Uri Simonsohn

First Published October 17, 2011 | Research Article | [Find in PubMed](#)

<https://doi.org/10.1177/0956797611417632>



[Article information](#) ▾



- “Garden of forking paths”
- Specify a-priori hypothesis and analysis plans
- Designed to counter p-hacking or HARK-ing
- Exploration still possible
 - Just needs to be clear

Easy: Preregistration

- Write down hypotheses and analysis plans in advance, or based on a pilot dataset
- Any level of detail
 - Upload experiment and analysis scripts
 - ‘Time-stamp’ decisions
 - Full report, with blanks for the actual results

The screenshot shows the OSFHOME interface. At the top, there is a navigation bar with links for My Quick Files, My Projects, Search, Support, Donate, and a user profile for Tijl Grootswagers. Below the navigation bar, there is a search bar with placeholder text "Click on a storage provider or drag and drop to upload". Underneath the search bar is a table displaying a list of files. The columns are labeled Name, Size, Version, Download, and Modified. The table contains the following data:

Name	Size	Version	Download	Modified
Rotation Invariance				
- OSF Storage (Australia - Sydney)				
preprocessing_invariance.m	4.8 kB	1	0	2020-03-16 02:08 PM
rotation-invariance_design_and_analysis.pdf	331.8 kB	1	0	2020-03-16 02:08 PM
rotation_invariance_decoding.m	3.9 kB	1	0	2020-03-16 02:08 PM

A red box highlights the "Modified" column, and a red box at the bottom right corner contains the text "Time-stamp".

Easy: Preregistration

OSF REGISTRIES ▾ Add New My Registrations Help Donate 

Predictions of Object Location and Identity in Time-Resolved EEG

Public registration ▾

Overview

Files

Wiki

Components 0

Links 0

Analytics

Comments 0

<

Study Information

Title
Predictions and Violations of Object Location and Identity in Time-Resolved EEG

Research Questions
The aim of the present project is use MVPA (Carlson et al, 2013; Cichy et al, 2014; Grootswagers, Wardle & Carlson, 2017; Hogendoorn & Burkitt, 2018) to decode the neural responses associated with predictions about an object's identity and predictions about an object's location from the responses associated with violations of these predictions using time-resolved EEG decoding analysis.

Hypotheses
PP predicts that when expectations are violated error will propagate through the cortical hierarchy until it is quashed by top-down predictions (Friston, 2005). In light of this, we expect to be able to decode a prediction error signal across violation trials. Further, due to the retinotopic organisation of visual cortex and the hierarchical nature of object selective processing we expect that decoding of predictions and violations of an object's spatial location will be independent of the object's identity and vice versa. Lastly, previous work has shown that the magnocellular pathway in the dorsal stream projects low spatial frequency information to orbitofrontal cortex ~50ms before lateral occipital cortex becomes active (Bar et al, 2006). Thus, we expect to be able to distinguish trials that violate predictions about spatial location from trials where the predictions are confirmed before object identity becomes decodable. Specifically, decoding of position and violations of position should be evident earlier in time than decoding of object identity and violations of object identity. Finally, we plan to do an exploratory analysis using a multivariate extension of Granger causal analysis (Goddard et al, 2016; Seth, 2010) to investigate the feed-forward and feedback informational dynamics between peri-frontal and peri-occipital regions contrasting predicted trials versus violation trials.

Sampling Plan

Contributors
Christopher Whyte, Tijl Grootswagers, Amanda Robinson, Hinze Hogendoorn, and Thomas A. Carlson

Description
No description

Registration type
Prereg Challenge

Date registered
December 17, 2018

Date created
December 17, 2018

Registered from
osf.io/u9awm

Internet Archive link
<https://archive.org/details/osf-registrations-hkedz-v1>

Category
Project

Registration DOI
[10.17605/OSF.IO/HKEDZ](https://doi.org/10.17605/OSF.IO/HKEDZ)

Publication DOI
No publication DOI

Subjects

Advanced: Registered Reports

- Write intro & methods
- Peer review
- In-principle acceptance
- Collect data
- Add results and discussion
- Paper is accepted regardless of result outcome
- No file-drawer effect*

- Obstacles:
 - Takes long (thus often not suitable for students)
 - Only few journals accept RR



Cortex
Volume 106, September 2018, Pages 132-150



Registered Report

Representing the location of manipulable objects in shape-selective occipitotemporal cortex: Beyond retinotopic reference frames?

Regine Zopf^{a, b} , Marina Butko^{a, b}, Alexandra Woolgar^{a, b}, Mark A. Williams^{a, b, c}, Anina N. Rich^{a, b, c}

Show more

+ Add to Mendeley Share Cite

<https://doi.org/10.1016/j.cortex.2018.05.009>

Get rights and content

Sharing code

Rationale

- Many analysis decisions are not captured in methods, or can be interpreted in different ways
- Public code allows to see exactly what was done
- Easy for others to replicate or build on your study

Code availability

The code that supports the findings of this study is available from the corresponding authors upon reasonable request.

Minimal: Public code

- Dump everything on the internet
- Not very useful, but better than nothing

Minimal: Public code

The screenshot shows a GitHub repository page for `Tijl/Grootswagers_etal_degraded_objects`. The repository has 1 pull request, 0 stars, and 0 forks. The `Code` tab is selected, showing a list of files: `LICENSE.md`, `README.md`, `averagetrials.m`, `decoding.m` (highlighted with a red box), `predictingrt.m`, and `timeseriesdecoding.m`. The `decoding.m` file was created on April 17, 2017. The `README.md` file contains a note about decoding degraded objects and a warning that the code is for reference purposes only. The repository has no releases or packages published.

`Tijl / Grootswagers_etal_degraded_objects`

Code Issues Pull requests Actions Projects Wiki Security ...

23970096f1 Go to file Code

Tijl Update README.md ... on 17 Apr 2017 4

📄	LICENSE.md	Create LICENSE.md
📄	README.md	Update README.md
📄	averagetrials.m	Create repository
📄	decoding.m	Create repository
📄	predictingrt.m	Create repository
📄	timeseriesdecoding.m	Create repository

About

No description, website, or topics provided.

Readme MIT License

Releases

No releases published Create a new release

Packages

No packages published Publish your first package

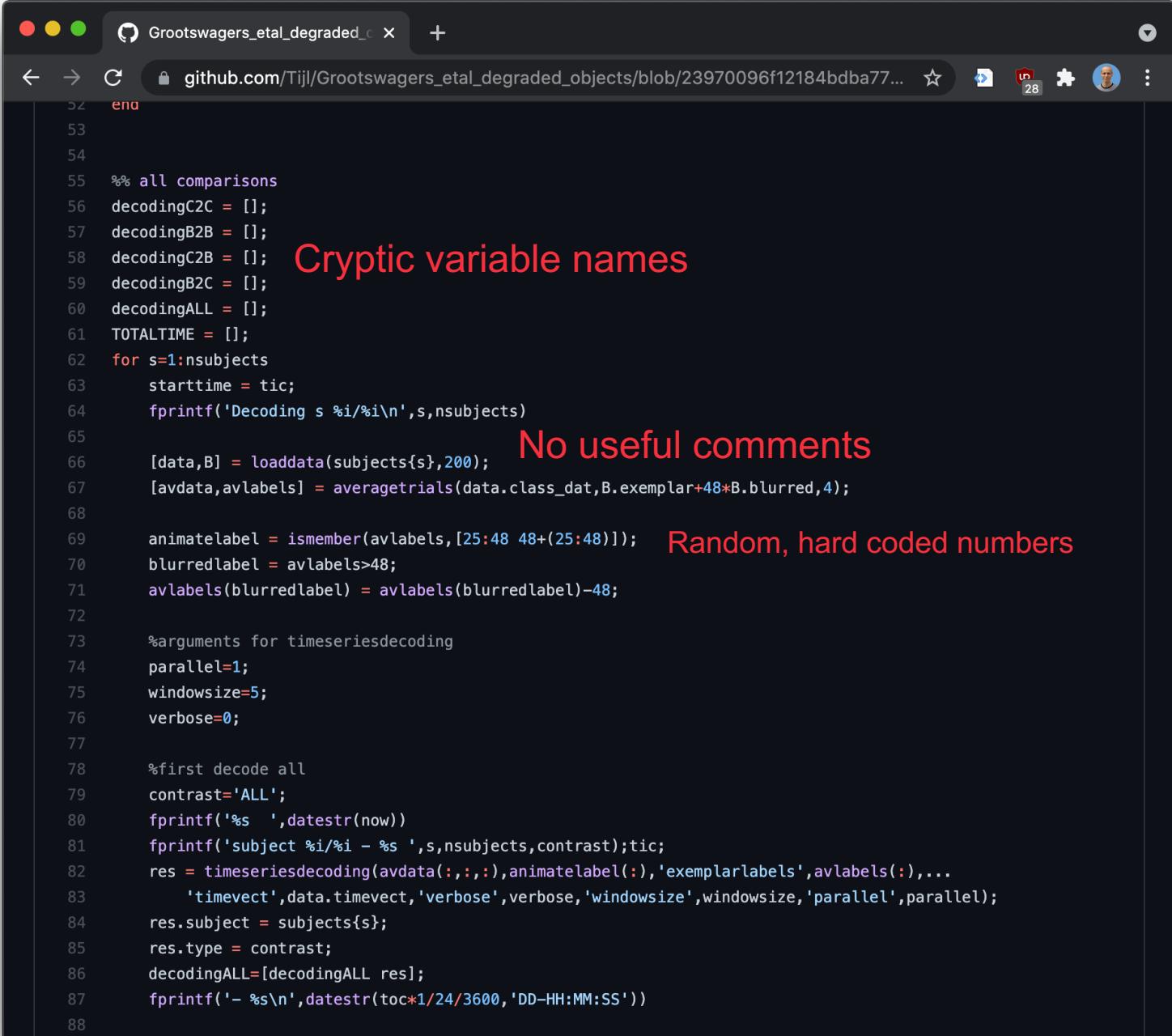
Languages

MATLAB 100.0%

Code for decoding degraded objects, and correlating distance to classifier boundary to behaviour.

For reference purposes only.

Minimal: Public code



The screenshot shows a GitHub browser window with the URL github.com/Tijl/Grootswagers_etal_degraded_objects/blob/23970096f12184bdb77.... The script is named `eno` and contains the following code:

```
52 eno
53
54
55 %% all comparisons
56 decodingC2C = [];
57 decodingB2B = [];
58 decodingC2B = [];
59 decodingB2C = [];
60 decodingALL = [];
61 TOTALTIME = [];
62 for s=1:nsubjects
63     starttime = tic;
64     fprintf('Decoding s %i/%i\n',s,nsubjects)
65
66 [data,B] = loaddata(subjects{s},200);
67 [avdata,avlabels] = averagetrials(data.class_dat,B.exemplar+48*B.blurred,4);
68
69 animatelabel = ismember(avlabels,[25:48 48+(25:48)]);
70 blurredlabel = avlabels>48;
71 avlabels(blurredlabel) = avlabels(blurredlabel)-48;
72
73 %arguments for timeseriesdecoding
74 parallel=1;
75 windowsize=5;
76 verbose=0;
77
78 %first decode all
79 contrast='ALL';
80 fprintf('%s ',datestr(now))
81 fprintf('subject %i/%i - %s ',s,nsubjects,contrast);tic;
82 res = timeseriesdecoding(avdata(:,:,1),animatelabel(:,:,1),'exemplarlabels',avlabels(:,:,1),...
83     'timevect',data.timevect,'verbose',verbose,'windowsize',windowsize,'parallel',parallel);
84 res.subject = subjects{s};
85 res.type = contrast;
86 decodingALL=[decodingALL res];
87 fprintf('- %s\n',datestr(toc*1/24/3600,'DD-HH:MM:SS'))
```

Annotations in red text are overlaid on the code:

- Cryptic variable names**: Points to the variable names like `ENO`, `decodingC2C`, `decodingB2B`, etc.
- No useful comments**: Points to the lack of descriptive comments in the code.
- Random, hard coded numbers**: Points to the hard-coded values like `200`, `48`, and the range `[25:48 48+(25:48)]`.

Good: Readable code

- Add comments and instructions
- Organised folder structure

Good: Readable code

The screenshot shows a web browser window displaying a project page on the Open Science Framework (OSF). The title of the project is "The representational dynamics of visual...". The page includes a navigation bar with links for My Quick Files, My Projects, Search, Support, Donate, and user profile. Below the title, there are tabs for Files, Wiki, Analytics, Registrations, Contributors, Add-ons, and Settings. A large text area displays the project's title and a brief description: "Rapid image presentations and time-resolved decoding of EEG data offers enormous potential to investigate the representational dynamics of a large object set." The page also lists contributors, creation date, identifier, category, and description.

The page has a clean, modern design with a blue header bar and a white background. The text is clearly legible and organized into sections. The overall impression is one of a well-maintained and professional scientific project page.

The project page for "The representational dynamics of visual..." on OSF features a blue header bar with the OSF logo and navigation links. The main content area displays the project title, a brief description, and various metadata fields. The page is well-organized and visually appealing, reflecting good readability and organization.

Contributors: Tijl Grootswagers, Amanda Robinson, Thomas A. Carlson
Date created: 2018-09-27 04:24 PM | Last Updated: 2019-01-04 03:03 PM
Identifier: DOI 10.17605/OSF.IO/A7KNV
Category: Project
Description:
Rapid image presentations and time-resolved decoding of EEG data offers enormous potential to investigate the representational dynamics of a large object set.

Content description

Contents:

- main directory: figures from the paper, movies, poster
- data_bids: BIDS-formatted EEG data
- Stimuli: images of the 200 stimuli + 16 target (source: www.pngimg.com; for rights, see <http://pngimg.com/license>)
- data: behavioural and EEG data as used in the analysis
- code: analysis code, results (Matlab files), and code for recreating the figures

License: Add a license

Wiki

Article: <https://doi.org/10.1016/j.neuroimage.2018.12.046>
Biorxiv preprint: <https://doi.org/10.1101/394148>

Citation

Components

Add Component Link Projects

Add components to organize your project.

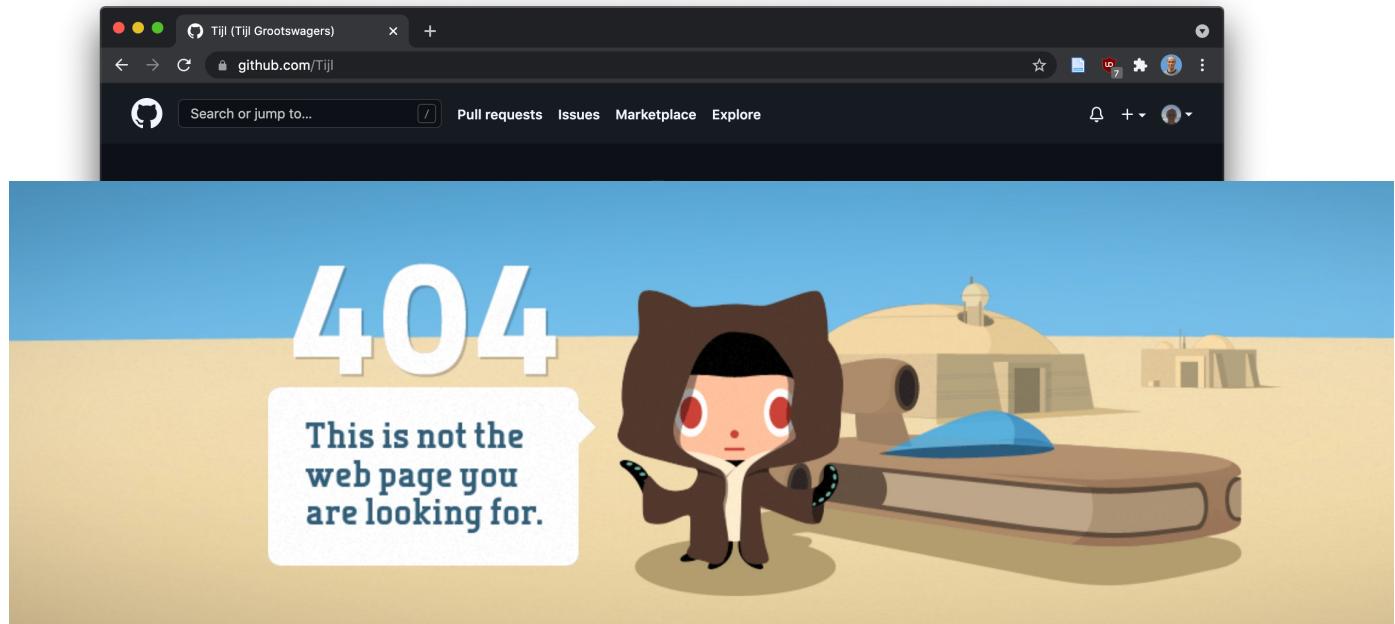
Good: Readable code

The screenshot shows the Open Science Framework (OSF) interface. At the top, there's a navigation bar with links for 'My Quick Files', 'My Projects', 'Search', 'Support', 'Donate', and a user profile for 'Tijl Grootswagers'. Below the navigation bar is a search bar and a menu with options like 'Files', 'Wiki', 'Analytics', 'Registrations', 'Contributors', 'Add-ons', and 'Settings'. A message 'Click on a storage provider or drag and drop to upload' is displayed above the file list. The main area contains a table with columns for 'Name', 'Size', 'Version', 'Downloads', and 'Modified'. The 'Name' column lists files and folders: 'code', 'get_target_and_dist_epochs.m', 'plot_behavioural_accuracies.m', 'plot_combined_targetnontarget.m', 'plot_decoding_combined.m', 'plot_rsa_glm.m', 'plot_timegenresults.m', 'preprocessing_200objs.m', '+ results_decoding_pairwise', '+ results_decoding_target_nontarget', '+ results_rsa_decoding', '+ results_timegen_multiclass', '+ results_timegen_target_nontarget', 'run_decoding_pairwise.m', 'run_decoding_target_variablenontarget.m', 'run_rsa_decoding.m', 'run_timegen_multiclass.m', and 'run_timegen_target_variablenontarget.m'. The '+ results...' items are collapsed. A red annotation box highlights the 'code' folder and its contents, with the text '- 'Organised' folder structure' and '- subfolders for data, results, and code' overlaid.

Name	Size	Version	Downloads	Modified
- code				
get_target_and_dist_epochs.m	3.7 kB	1	25	2018-09-27 04:35 PM
plot_behavioural_accuracies.m	2.5 kB	2	14	2018-12-17 02:39 PM
plot_combined_targetnontarget.m	6.0 kB	1	10	2018-12-17 02:39 PM
plot_decoding_combined.m	7.6 kB	2	31	2018-12-17 02:39 PM
plot_rsa_glm.m	25.8 kB	2	14	2018-12-17 02:39 PM
plot_timegenresults.m	5.7 kB	1	12	2018-12-17 02:39 PM
preprocessing_200objs.m	2.5 kB	1	25	2018-09-27 04:30 PM
+ results_decoding_pairwise				
+ results_decoding_target_nontarget				
+ results_rsa_decoding				
+ results_timegen_multiclass				
+ results_timegen_target_nontarget				
run_decoding_pairwise.m	4.5 kB	1	17	2018-09-27 04:37 PM
run_decoding_target_variablenontarget.m	3.4 kB	1	8	2018-09-27 04:37 PM
run_rsa_decoding.m	3.0 kB	1	9	2018-12-17 02:40 PM
run_timegen_multiclass.m	5.1 kB	1	8	2018-09-27 04:37 PM
run_timegen_target_variablenontarget.m	4.4 kB	1	11	2018-09-27 04:37 PM
+ data				

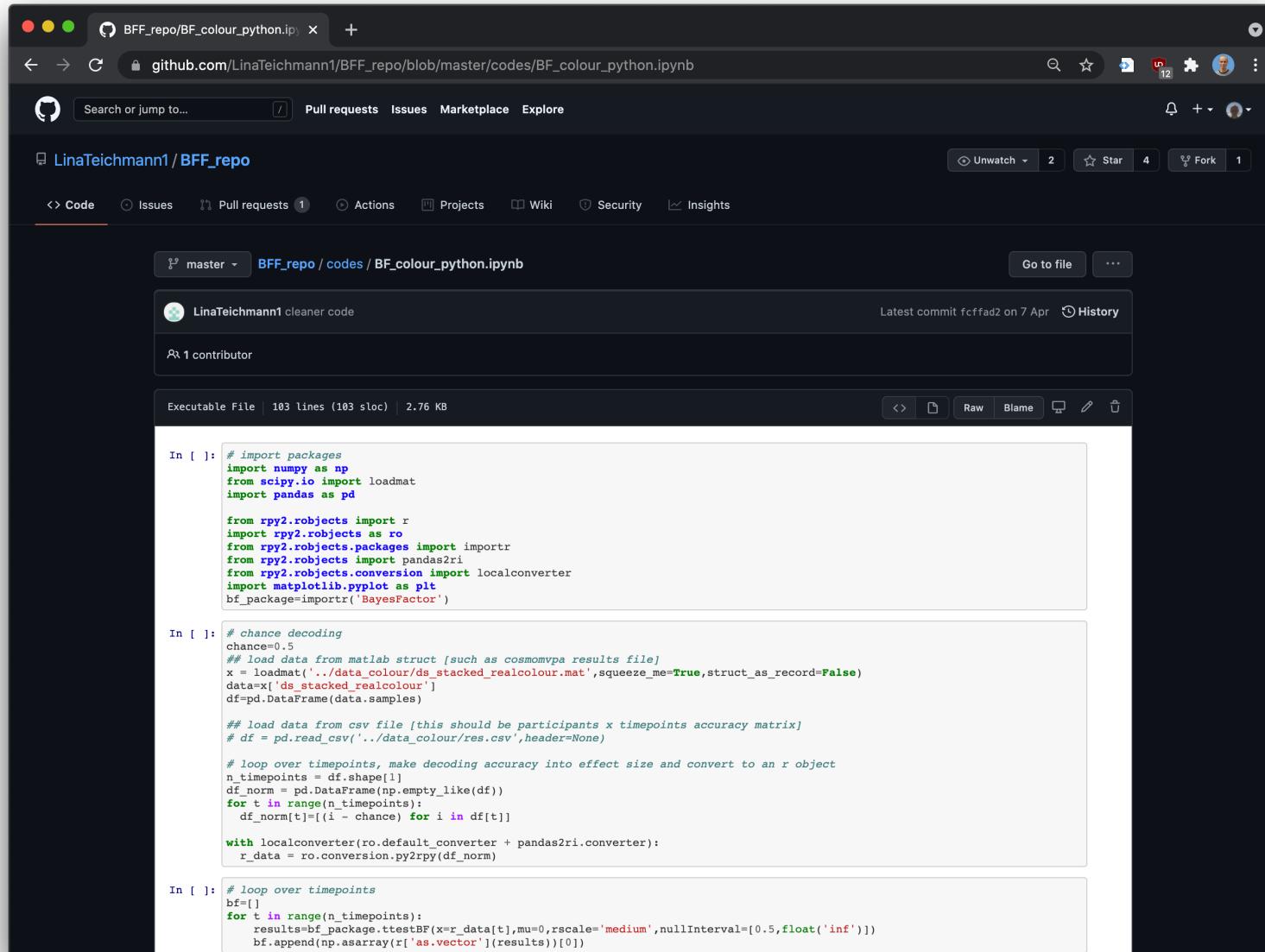
Better: Reproducible code

- Instructions on how to use the code
- Clear which parts of the code generate what result



Better: Reproducible code

- Python notebooks



The screenshot shows a GitHub repository page for 'LinaTeichmann1/BFF_repo'. The repository has 2 stars, 4 forks, and 1 issue. The 'Code' tab is selected, showing the file 'BF_colour_python.ipynb' in the 'master' branch. The notebook contains three code cells:

```
In [ ]: # import packages
import numpy as np
from scipy.io import loadmat
import pandas as pd

from rpy2.robjects import r
import rpy2.robjects as ro
from rpy2.robjects.packages import importr
from rpy2.robjects import pandas2ri
from rpy2.robjects.conversion import localconverter
import matplotlib.pyplot as plt
bf_package=importr('BayesFactor')

In [ ]: # chance decoding
chance=0.5
## load data from matlab struct [such as cosmomvpa results file]
x = loadmat('../data_colour/ds_stacked_realcolour.mat',squeeze_me=True,struct_as_record=False)
data=x['ds_stacked_realcolour']
df=pd.DataFrame(data.samples)

## load data from csv file [this should be participants x timepoints accuracy matrix]
# df = pd.read_csv('../data_colour/res.csv',header=None)

# loop over timepoints, make decoding accuracy into effect size and convert to an r object
n_timepoints = df.shape[1]
df_norm = pd.DataFrame(np.empty_like(df))
for t in range(n_timepoints):
    df_norm[t]=[(i - chance) for i in df[t]]

with localconverter(ro.default_converter + pandas2ri.converter):
    r_data = ro.conversion.py2rpy(df_norm)
    r_data = ro.conversion.rpy2py(r_data)

In [ ]: # loop over timepoints
bf=[]
for t in range(n_timepoints):
    results=bf_package.ttestBF(x=r_data[t],mu=0,rscale='medium',nullInterval=[0.5,float('inf')])
    bf.append(np.asarray(r['as.vector'](results))[0])
```

Example from: Teichmann, et al 2021 bioRxiv

Better: Reproducible code

- Code containers

The screenshot shows a web browser window for the Ecoset capsule on Code Ocean. The left sidebar displays the file tree:

- Core Files (1.06 KB): metadata, environment, code (extract_activations_comput..., extract_activations_comput..., LICENSE, main.py, matplotlibrc, README_license_ecoset_pas..., README.md, run).
- data (18.89 GB): Manage Datasets, ecoset, input_image_sets, models, LICENSE, .gitignore.
- results (65.58 MB): .codeoceandatasets (7 B).

The main content area shows the README.md file:

How to obtain ecoset and extract activations from pre-trained deep neural networks

This capsule entails 1) ecoset, a large-scale image set (>1.5 mio. images from 565 basic level categories; please find [ecoset license and password](#) [here](#)), 2) deep neural network models (vNet architecture) trained on ecoset and ILSVRC2012 at (/data/models/vNET), and 3) [code to extract activations from these networks in response to arbitrary sets of images](#) ([and to compute representational dissimilarity matrices \(RDMs\)](#)).

How to obtain ecoset

- Study the file README_license_ecoset_password.md which contains the terms and conditions and ecoset password.
- A direct download of ecoset is available via "aws s3 cp --no-sign-request s3://codeocean-datasets/0ab003f4-ff2d-4de3-b4f8-b6e349c0e5e5/ecoset.zip".
- Alternatively, ecoset can be downloaded from the drop-down menu to the left (data, ecoset, ecoset.zip)

How to use the capsule to extract deep neural network activations

This capsule is structured into code, data and results.

How do these elements map to the file system?

```
/ [root]
└── code
    ├── extract_activations_compute_RDMs_AlexNet.py
    ├── extract_activations_compute_RDMs_vNet.py
    ├── LICENSE
    ├── main.py
    ├── matplotlibrc
    ├── README_license_ecoset_password.md
    └── README.md
    └── run
    └── data
        └── ecoset
            ├── ecoset_categories_overview.pdf
            ├── NSFW_cleaned_ecoset.zip
            ├── readme_license_ecoset_password.md
            └── unzip_ecoset_categories.sh
        └── input_image_sets
            ├── cichy_92
            └── cichy_92_only_4_stimuli_debugging
            └── horikawa_1200_training
        └── models
```

Example from: Mehrer, J., et al 2021. PNAS

Sharing data

Sharing data

Data availability

- Reproducing findings
- Build on your work
- Meta analyses
- Obstacles:
 - Reformatting can take a lot of time!
 - Best to do it right from the start of a project
 - Ethics
 - Raw data requires unspecified consent

The data that support the findings of this study are available from the corresponding authors upon reasonable request.

Minimal: data dump

- With code, of course

Minimal: data dump

A screenshot of a GitHub repository page titled "Tijl / Grootswagers_eta_l_degraded_objects". The repository has 1 unwatched pull request, 0 stars, and 0 forks. The "Code" tab is selected, showing the "master" branch. The "data_behavioural" directory contains two files: "datatable.csv" and "datatable_description.json", both added 3 years ago by Tijl. The GitHub interface includes a search bar, navigation links like Pull requests, Issues, Marketplace, Explore, and a header with user icons.

Tijl / Grootswagers_eta_l_degraded_objects

Unwatch 1 Star 0 Fork 0

Code Issues Pull requests Actions Projects Wiki Security Insights Settings

master Grootswagers_eta_l_degraded_objects / data_behavioural / Go to file Add file ...

Tijl Add: data 282b423 on 12 Dec 2018 History

..

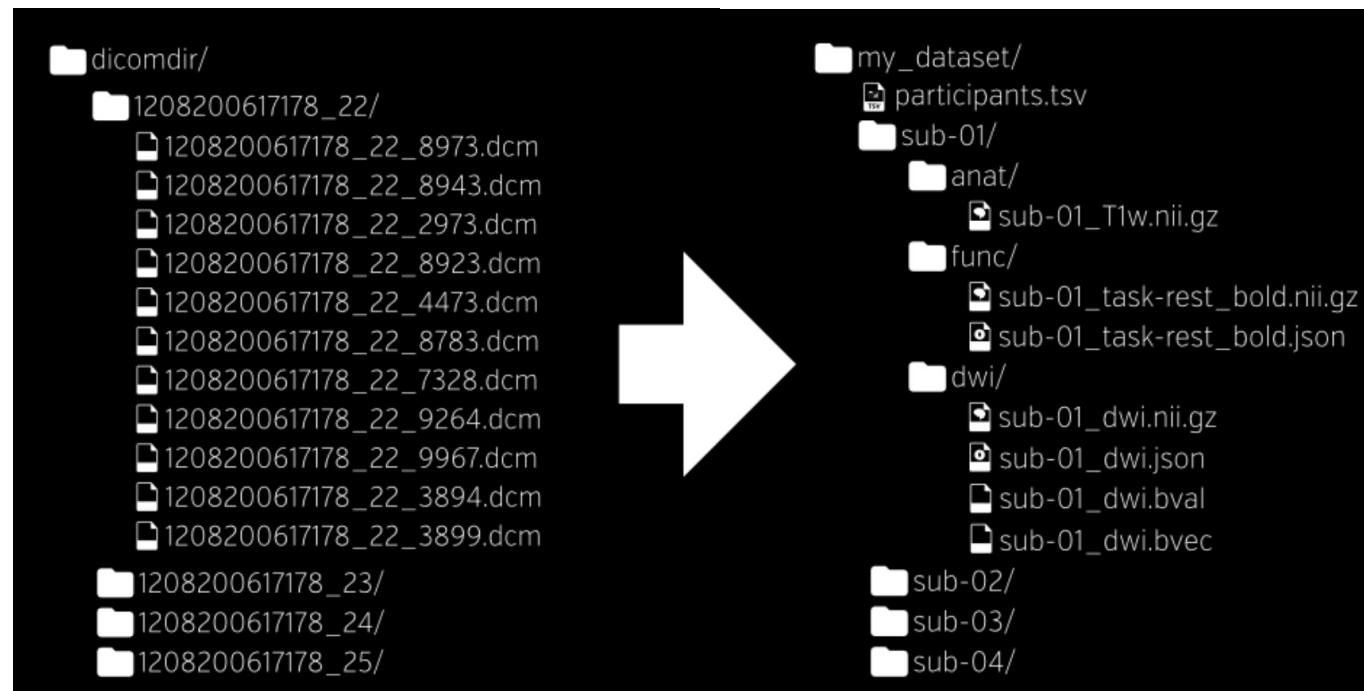
datatable.csv Add: data 3 years ago

datatable_description.json Add: data 3 years ago

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Better: data with usage guidelines

- Of course with code
- With a usage guide
- In a standard format
 - BIDS (Brain Imaging Data Structure)



Better: data with usage guidelines

The screenshot shows a dataset page for 'THINGS-EEG' on figshare.com. The page includes sections for dataset details, usage metrics, categories, keywords, license, and exports.

Dataset Details:

- Version 17** posted on 15.06.2021, 16:30 by [Tijl Grootswagers](#)
- EEG data for 1854 object concepts presented in RSVP streams. Data from 50 participants. For the other materials (code and figures), see <https://doi.org/10.17605/OSF.IO/HD6ZK>
- Compressed using 7zip (www.7-zip.org/)
- Contents:**
 - data_general.7z - main BIDS folder (including the data descriptors)
 - results_general.7z - grand mean RDMs
 - sub-XX.7z - single-subject raw data, preprocessed data, and RDMs (50 total subjects)
- HISTORY**
 - 03.06.2021 - First online date
 - 15.06.2021 - Posted date
 - 16.06.2021 - Revision date

Usage Metrics:

157	views	146	downloads	0	citations
-----	-------	-----	-----------	---	-----------

CATEGORIES:

- Cognitive Science not elsewhere classified
- Neuroscience

KEYWORDS:

- EEG data
- RSVP stream
- object concepts
- visual processing
- human visual system

LICENCE: CC BY 4.0

EXPORTS: Select an option ▾

Bottom Navigation:

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- COPE
- DATA CITATION INDEX
- OPEN ACCESS

Open Access Publishing

Rationale

- Traditional subscription publishing model: “Reader pays”
 - Remnant of printed journals
 - Commercial journals can charge as much as they want
 - Costly for institutions to maintain subscriptions
 - Costly for others to access knowledge (policy-makers, journalists, etc)
- Anyone should be able to participate, regardless of institutional affiliation or country

'Solution': Open access

- Author pays APC (article processing charge) to publish
- No limit or standards on processing charge
- Obstacle: Who should pay?
 - Author pays from competitive grant funding, or otherwise out of pocket
 - Problematic
 - Institute pays for every paper or 'APC-deals'
 - Problematic
 - Funders and institutions directly fund journals

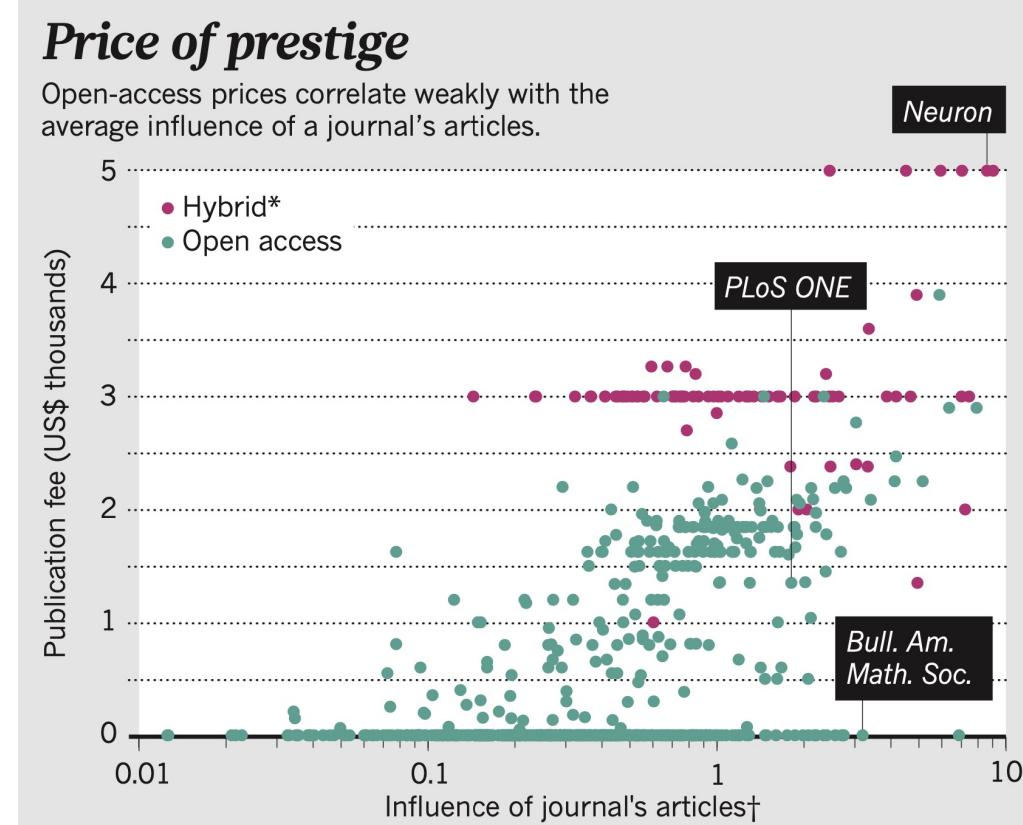


Figure: Van Noorden, R., 2013. *Nature*

Open access ‘loopholes’

- Keep accepted manuscript!!
 - Author owns copyright, and can publicly archive this version
- Check journal self-archiving policies:
 - <https://v2.sherpa.ac.uk/romeo/>
- Post a ‘preprint’

Preprints

- Open access
- Early awareness
- Establishing precedence
- Catching errors
- Fast dissemination
- Risks:
 - Not peer-reviewed
 - Anyone can post a preprint
 - “Scooping”

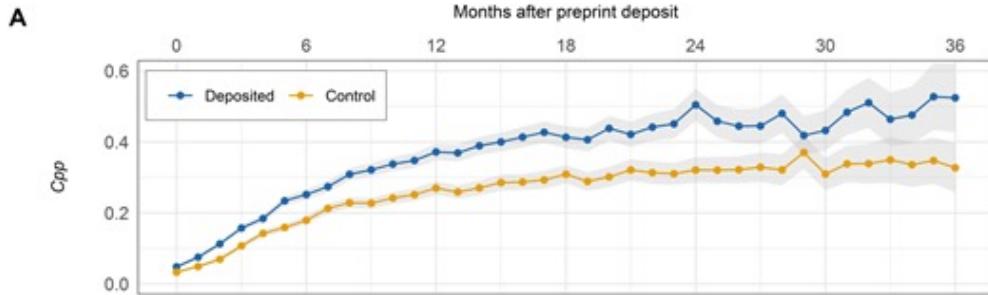


Figure: Fraser, N., et al 2020. Quantitative Science Studies

Where to post preprints?

- arXiv
 - Original flavour, very basic interface (since 1991)
 - No doi option
- bioRxiv
 - Fancy interface, full-text html generation
 - Automatic linking of published journal version
 - Only for preprints of empirical works (no reviews or accepted papers)
- Psyarxiv
 - Simple upload & go
 - Easy to link to OSF project



Where to post preprints?



bioRxiv
THE PREPRINT SERVER FOR BIOLOGY

bioRxiv posts many COVID19-related papers. A reminder: they have not been formally peer-reviewed and should not guide health-related behavior or be reported in the press as conclusive.

New Results

Follow this preprint

Finding decodable information that can be read out in behaviour

Tijl Grootswagers, Radoslaw M. Cichy, Thomas A. Carlson

doi: <https://doi.org/10.1101/248583>

Now published in *NeuroImage* doi: [10.1016/j.neuroimage.2018.06.022](https://doi.org/10.1016/j.neuroimage.2018.06.022)



Abstract Full Text Info/History Metrics

Preview PDF

ARTICLE USAGE

Article lifetime Last 6 months This month

Article usage: January 2018 to September 2021

Show by month	Abstract	Full-text HTML	PDF
Total	3,282	689	1,194



Tweeted by 59

26 readers on Mendeley

See more details

Quantitative Biology > Neurons and Cognition

(Submitted on 2 Feb 2021 [\(v1\)](#), last revised 19 Feb 2021 (this version, v2))

The neural dynamics underlying prioritisation of task-relevant information

Tijl Grootswagers, Amanda K. Robinson, Sophia M. Shatek, Thomas A. Carlson

The human brain prioritises relevant sensory information to perform different tasks. Enhancement of task-relevant information requires flexible allocation of attentional resources, but it is still a mystery how this is operationalised in the brain. We investigated how attentional mechanisms operate in situations where multiple stimuli are presented in the same location and at the same time. In two experiments, participants performed a challenging two-back task on different types of visual stimuli that were presented simultaneously and superimposed over each other. Using electroencephalography and multivariate decoding, we analysed the effect of attention on the neural responses to each individual stimulus. Whole brain neural responses contained considerable information about both the attended and unattended stimuli, even though they were presented simultaneously and represented in overlapping receptive fields. As expected, attention increased the decodability of stimulus-related information contained in the neural responses, but this effect was evident earlier for stimuli that were presented at smaller sizes. Our results show that early neural responses to stimuli in fast-changing displays contain remarkable information about the sensory environment but are also modulated by attention in a manner dependent on perceptual characteristics of the relevant stimuli. Stimuli, code, and data for this study can be found at [this https URL](#).

Comments: Published in *Neurons, Behavior, Data analysis, and Theory (NBDT)*

Subjects: **Neurons and Cognition (q-bio.NC)**

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Accepted manuscript to appear in *Behavior Research Methods*

1 A primer on running human behavioural experiments online
2
3 Tijl Grootswagers*
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5
6 Abstract
7 Moving from the lab to an online environment opens up enormous potential to collect behavioural data
8 from thousands of participants with the click of a button. However, getting the first online experiment
9 running requires familiarisation with a number of new tools and terminologies. There exist a number of
10 tutorials and hands-on guides that can facilitate this process, but these are often tailored to one specific
11 online platform. The aim of this paper is to give a broad introduction to the world of online testing. This
12 will provide a high-level understanding of the infrastructure before diving into specific details with more
13 in-depth tutorials. Becoming familiar with these tools allows moving from hypothesis to experimental
14 data within hours.
15

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Abstract
Moving from the lab to an online environment opens up enormous potential to collect behavioural data from thousands of participants with the click of a button. However, getting the first online experiment running requires familiarisation with a number of new tools and terminologies. There exist a number of new tools and terminologies. There exist a number of tutorials and hands-on guides that can ...
See more

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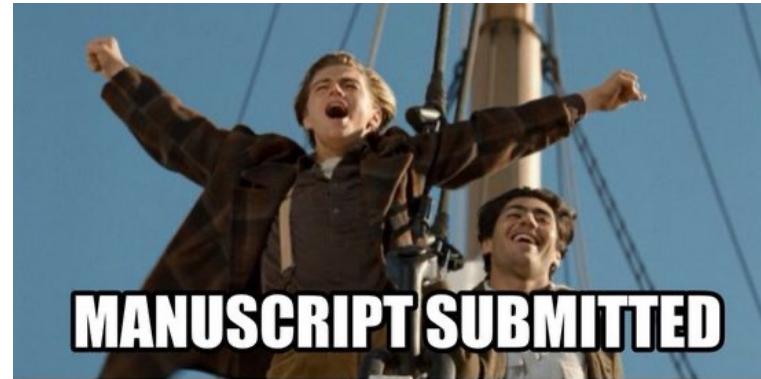
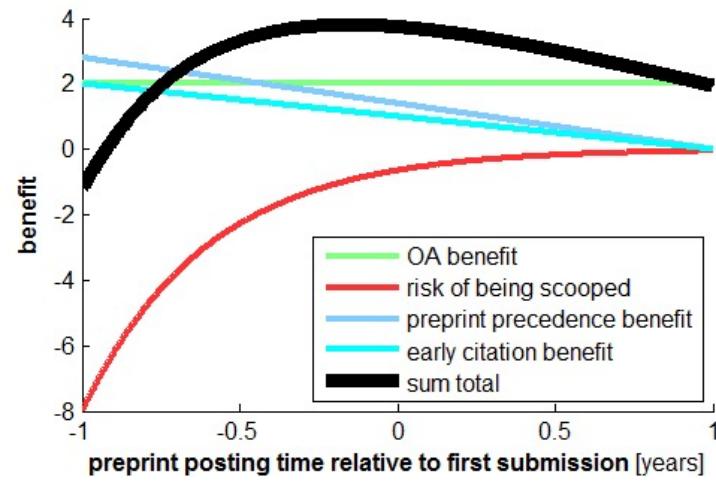
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Conclusion



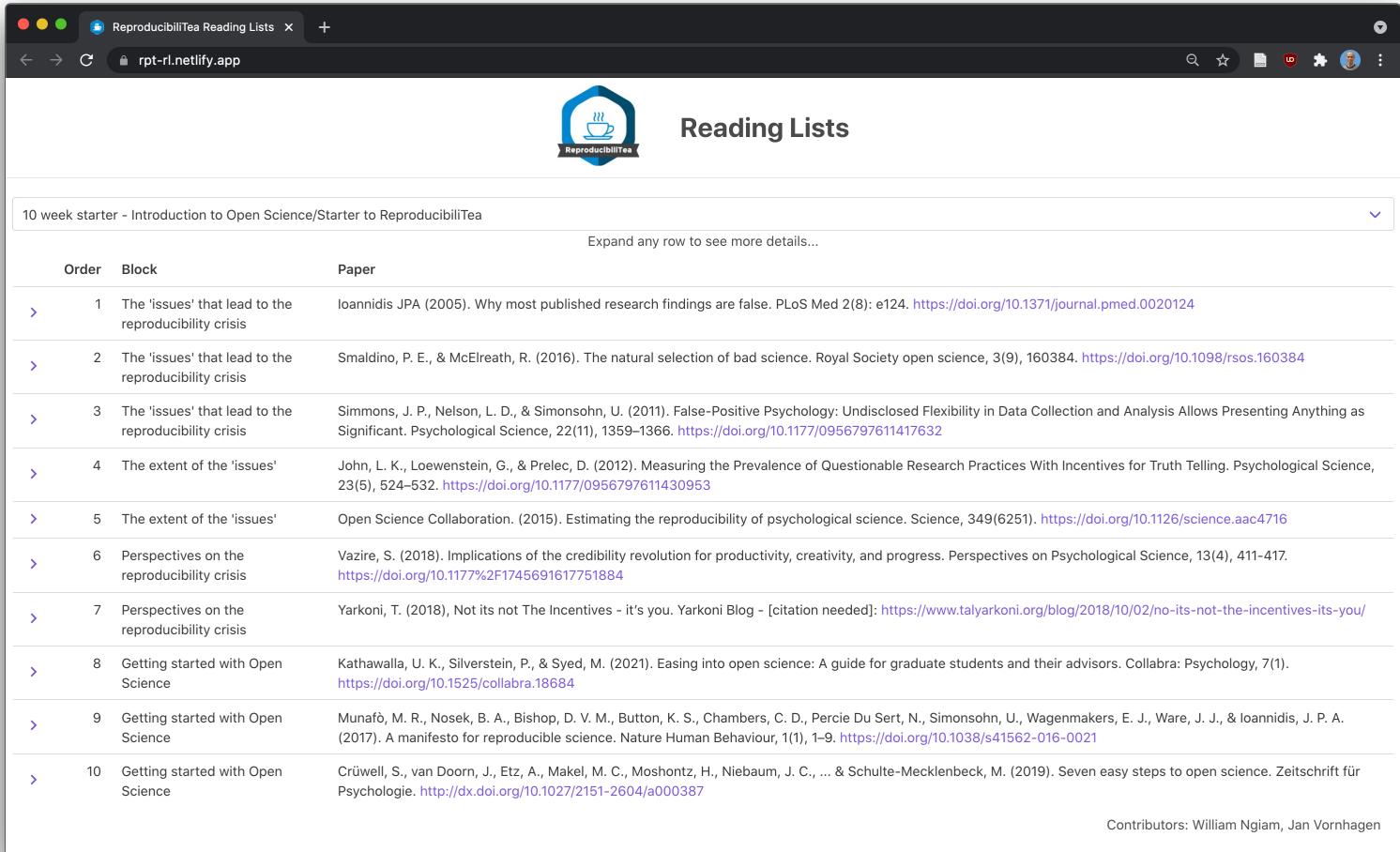
Conclusion

- Open science can be beneficial
- Many ways to engage
- Many tools available
- Lots of resources!
- Helpful community*

- BUT
 - Not all-or-nothing
 - Not everyone has the time
 - Not everyone has the resources
 - Not required to do good science

Resources & references

- osf.io (full projects), github.com (code), figshare (big data)
- Example reading list: <https://rpt-rl.netlify.app/>



The screenshot shows a web browser window with a dark theme. The title bar reads "ReproducibiliTea Reading Lists". The main content area displays a reading list titled "10 week starter - Introduction to Open Science/Starter to ReproducibiliTea". At the top right is a "Reading Lists" button. Below it is a logo featuring a blue hexagon with a white teacup icon and the text "ReproducibiliTea". A sub-header "Expand any row to see more details..." is visible. The reading list is presented in a table format:

Order	Block	Paper
>	1	The 'issues' that lead to the reproducibility crisis Ioannidis JPA (2005). Why most published research findings are false. <i>PLoS Med</i> 2(8): e124. https://doi.org/10.1371/journal.pmed.0020124
>	2	The 'issues' that lead to the reproducibility crisis Smaldino, P. E., & McElreath, R. (2016). The natural selection of bad science. <i>Royal Society open science</i> , 3(9), 160384. https://doi.org/10.1098/rsos.160384
>	3	The 'issues' that lead to the reproducibility crisis Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant. <i>Psychological Science</i> , 22(11), 1359–1366. https://doi.org/10.1177/0956797611417632
>	4	The extent of the 'issues' John, L. K., Loewenstein, G., & Prelec, D. (2012). Measuring the Prevalence of Questionable Research Practices With Incentives for Truth Telling. <i>Psychological Science</i> , 23(5), 524–532. https://doi.org/10.1177/0956797611430953
>	5	The extent of the 'issues' Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. <i>Science</i> , 349(6251). https://doi.org/10.1126/science.aac4716
>	6	Perspectives on the reproducibility crisis Vazire, S. (2018). Implications of the credibility revolution for productivity, creativity, and progress. <i>Perspectives on Psychological Science</i> , 13(4), 411–417. https://doi.org/10.1177%2F1745691617751884
>	7	Perspectives on the reproducibility crisis Yarkoni, T. (2018). Not its not The Incentives - it's you. Yarkoni Blog - [citation needed]: https://www.talyarkoni.org/blog/2018/10/02/no-its-not-the-incentives-its-you/
>	8	Getting started with Open Science Kathawalla, U. K., Silverstein, P., & Syed, M. (2021). Easing into open science: A guide for graduate students and their advisors. <i>Collabra: Psychology</i> , 7(1). https://doi.org/10.1525/collabra.18684
>	9	Getting started with Open Science Munafò, M. R., Nosek, B. A., Bishop, D. V. M., Button, K. S., Chambers, C. D., Percie Du Sert, N., Simonsohn, U., Wagenmakers, E. J., Ware, J. J., & Ioannidis, J. P. A. (2017). A manifesto for reproducible science. <i>Nature Human Behaviour</i> , 1(1), 1–9. https://doi.org/10.1038/s41562-016-0021
>	10	Getting started with Open Science Crüwell, S., van Doorn, J., Etz, A., Makel, M. C., Moshontz, H., Niebaum, J. C., ... & Schulte-Mecklenbeck, M. (2019). Seven easy steps to open science. <i>Zeitschrift für Psychologie</i> . http://dx.doi.org/10.1027/2151-2604/a00387

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