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You can download the sources of this presentation here:  
<https://github.com/mxochicale/riots-sth-20200225>

# Fully Open Access PhD Thesis

RIOTS Club @ St Thomas

25th February 2020 for 13h00m  
at Maisey Seminar Room

**Miguel Xochicale, PhD**

✉ @\_mxochicale 📧@mxochicale

School of Biomedical Engineering and Imaging Sciences  
King's College London

# Outline

1. My journey into Open-Access (OA) science
2. Who to follow?
3. What tools I use?
4. How to do an OA thesis?
5. Takeaways

# INTRODUCTION

# My journey as ...

... open-source enthusiast and open-access scientist:

- **(2004-2006)** MSc in Signal Processing  
Arduino is an open-source hardware and software company
- **(2013-2014)** Research Assistant in Robotics at INAOE  
Discovered R and GitHub [[github.com/jwf-zz/tdetools](https://github.com/jwf-zz/tdetools)]
- **(2014-2019)** PhD student in Robotics at Uni of Bham  
Open-access scientist [[twitter.com/o\\_guest](https://twitter.com/o_guest)]  
& open-source enthusiast [[github.com/severin-lemaignan](https://github.com/severin-lemaignan)]
- **(2019-present)** Research Associate in Ultrasound-Guidance Intervention at KCL  
Continuously-integrated Open-source Reproducible TeX  
[[github.com/rodluger/corTeX](https://github.com/rodluger/corTeX)]

PEOPLE

# Olivia Guest (pro-#openscience)



**Olivia Guest | Ολίβια Γκεστ**  
@o\_guest

goth • computational cognitive modeling • geek & techish Cypriot • queer • she/they  
• pro-#openscience • anti-#properscience • [neuroplausible.com](#)

📍 Cyprus 🌐 [oliviaguest.com](http://oliviaguest.com) 📅 Joined October 2015

4,734 Following 7,149 Followers

**neuroplausible** About

I Hate Matlab: How an IDE, a Language, and a Mentality Harm

Olivia Guest March 17, 2017 77 Comments

Share Tweet

I dislike Matlab not only because it's closed source and not free software, but primarily because limiting education to just Matlab goes on to limit students' and scientists' skills.

## Closed Source Means Closed Science

Secondly, Matlab is closed source, proprietary, and prohibitively expensive if you have to buy it yourself. They obfuscate their source code in many cases, meaning bugs are much harder to spot and impossible to edit ourselves without risking court action. Moreover, using Matlab for science results in paywalling our code. We are by definition making our computational science closed.

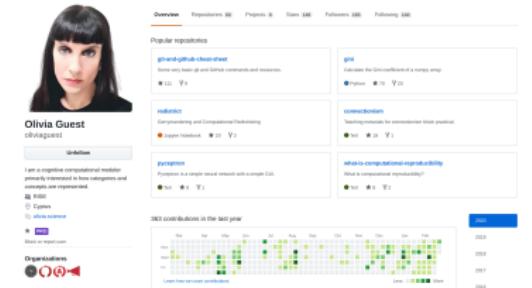
Many people in the mutually inclusive open science and open software movements hope to see Matlab surpassed sooner rather than later and some even think it is inevitable. By extension, people in these movements tend to think freely deciding to use Matlab (and indeed any closed source software) in science is at least questionable and at most unethical. I believe in free and open software and science, so I am in principle opposed to Matlab's grip on science.



The principles of open science, by Andrey E. Neustadt



[https://twitter.com/o\\_guest](https://twitter.com/o_guest)



**Olivia Guest**  
oliviaguest

bio I am a cognitive computational modeler primarily interested in how categories and concepts are represented.

Projects

repositories

Contributing and Computational Thinking

pygraph

383 contributions in the last year

**ReScience organization**

Reproducible Science is good. Replicated Science is better.

Bordeaux https://rescience.github.io

Repositories 11 Packages People 25 Projects



**rescience.github.io**  
Indiscipline website solutions

Top languages

People

**https://github.com/oliviaguest**

Severin Lemaignan (open-source enthusiast)



<https://twitter.com/skadge>



<https://github.com/severin-lemaignan>

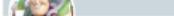
Who to follow?, What to read? & what to heard?

# Open Science Advocates



**Dr. Rachael Ainsworth**  
@rachaelainsworth

Community Manager & #OpenScience advocate @OfficeofScience | India Astrophysics | @TheAstronomer | Organics | B10x speaker | she/her | Manchester, England | [rachael@rhainsworth.uk](mailto:rachael@rhainsworth.uk) | Joined April 2010  
1,084 Following | 1,087 Followers



**Ulrich Diniagi**  
@drdiniagi

entomology/603-603-0755.. | Berlin, Germany | [diniagi@zoo.kit.edu](mailto:diniagi@zoo.kit.edu) | Joined December 2009  
56 Following | 1,308 Followers



**Corin J. Logan**  
@LoganCorine

Aren granules invasive because they're being targeted? @TheLoganInstitute | Senior Researcher | ZKZ, Leipzig, Germany | [Corine.Logan@ZKZ.LUH.de](mailto:Corine.Logan@ZKZ.LUH.de) | Joined September 2012  
1,373 Following | 1,915 Followers



**Björn Brems**  
@brems

Professional student of Neurogenetics | #neurobiology | Neuroscience | #OpenScience | brems.björn@med.uni.lub.freiburg.de

99 Following | 0,073 Followers



**Jon Tennant** 

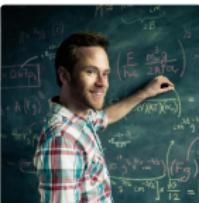
@jontennantphd

Northeast nogope scientist. Latest book: [lit.ly/epigeneticre...@jontennantphd.com](#) | Joined August 2011  
842 Following | 17,227 Followers



**Rebecca Willén**  
@rwillen

Scientist & Psychologist, Founding Director @ICGMIInstitute. Fan of science, scientists, independence and freedom.  
swedes | [rwillen.info](mailto:rwillen.info) | Joined July 2017  
681 Following | 1,113 Followers



**Rodrigo Luger**  
rodluger

Astronomer at the Center for Computational Astrophysics

 Flatiron Institute

 New York, NY

<https://www.w3.org/>

[View more posts by this author](#)

## Podcasts

The image shows the homepage of the Science for Progress website on the left, featuring a yellow banner with the text "SCIENCE FOR PROGRESS Because Science is Fundamental in the 21st Century" and a stylized brain icon. Below the banner is the URL "scienceforprogress.net" and a "support us on Facebook" button. To the right is a screenshot of a Facebook page for "Open Science Talk" with a post about the launch of Open Access Week. The page has 84 posts, 1 likes, and 30 shares. It includes links to the website and a video thumbnail.

TOOLS

“Free software” means that the users have the freedom to run, copy, distribute, study, change and improve the software



# Open Source Software

"The promise of open source is higher quality, better reliability, greater flexibility, lower cost, and an end to predatory vendor lock-in."



# My Collection of Scientific Tools

Screenshot of a GitHub repository titled "My Collection Of Scientific Tools". The repository has 12 forks, 1 branch, 8 packages, and 1 issue. The README.md file is present.

**My Collection Of Scientific Tools**

This repository presents various tools that I have been using in my journey of becoming a scientist. *The tools we use have profound (and devious!) influence on our thinking habits, and therefore, on our thinking abilities*

- Edger W.Dijkstra. 1975. How do we tell truths that might hurt?

**These are other tools that I am also familiar with:**

- R is a language and environment for statistical computing and graphics.
- python is powerful... and fast, plays well with others; runs everywhere; is friendly & easy to learn; is Open.
- LaTeX (L<sup>A</sup>T<sub>E</sub>X) is a document preparation system for high-quality typesetting.
- openCV Open Source Computer Vision Library
- hik The Hidden Markov Model Toolkit (HTK)
- Foam3, the name produced from the two words FORMula TRANslator
- inkscape free and open source software to create realistic 3D humans
- TensorFlow Open source library for learning and data visualization for novice and expert
- rustacean Create Acoustic Models
- glib The Gesture and Activity Recognition Toolkit
- grt Gesture Recognition Toolkit
- julia Open Source Large Vocabulary CSR Engine Julia
- julia is a high-level, high-performance dynamic programming language for numerical computing
- superCollider is a platform for audio synthesis and algorithmic composition.
- elan Annotations on video and audio resources.

**Contact**

If you have specific questions about the content of this repository, you can contact [Miguel Xochicale](#). If your question might be relevant to other people, please instead [open an issue](#).



 <https://github.com/mxochicale/tools>

*The tools we use have profound (and devious!) influence on our thinking habits, and therefore, on our thinking abilities.*

PHD THESIS

# LATEX and vector files

# LATEX

This screenshot shows a GitHub repository interface for a LaTeX document. The repository name is 'mxochicale-phd / thesis'. The 'Code' tab is selected. A file named 'abstract.tex' is shown, which contains the LaTeX code for the abstract section of a thesis. The code includes sections for 'Abstract', 'Background', 'Objectives', 'Methods', 'Results', and 'Conclusion'. The file size is 1.44 KB and has 31 lines of code.

```
\begin{abstract}
    This abstract ...
\end{abstract}
```

The 'abstract.tex' file content:

```
\begin{abstract}
    This abstract ...
\end{abstract}

\begin{abstract}
    Nonlinear analysis can be applied to investigate
    the dynamics of time-ordered data.
    Such analysis is useful to understand
    variability in the context of human-robot interaction.
    Hence, this dissertation not only explores questions such as
    How to quantify movement variability
    and what movement variability measures are appropriate
    to quantify movement variability
    but also how methods of nonlinear analysis are affected
    by real-world movement data (e.g., non-stationary, data length size,
    sampling frequency or noise).
    Methods are explored to determine embedding parameters,
    reconstruct state spaces, recurrence plots and
    recurrence quantification analysis.
    Additionally, this thesis presents three dimensional surface plots of
    recurrence quantification analysis with which to consider
    the verticality of movement variability and recurrence thresholds.
    These show that three dimensional
    surface plots of Shanon entropy might be a suitable approach
    to understand the dynamics of real world time series data.
    This dissertation also presents a novel approach to implement nonlinear
    analysis in the context of human-robot interaction
    where humanoid robots can be pre-programmed with nonlinear analysis algorithms
    to evaluate. For instance, the improvement of movement performances.
\end{abstract}
```



This screenshot shows a GitHub repository interface for a vector file. The repository name is 'mxochicale-phd / thesis'. The 'Code' tab is selected. A file named 'thesis-figs/chapter1/thesis-structure.v05.svg' is shown, which is a version of a vector structure diagram. The file was last committed on 7 May 2019. The commit message is 'Latest commit: 8079569 on 7 May 2019'. The commit details show several commits from 'Inkscape [final-version] alpha-version' over the past 18 months.

| Commit                   | Date                          |
|--------------------------|-------------------------------|
| pre-submission           | 18 months ago                 |
| sources                  | 18 months ago                 |
| README.md                | 18 months ago                 |
| thesis-structure-v05.svg | first draft                   |
| thesis-structure-v05.svg | first draft                   |
| thesis-structure-v05.svg | thesis draft 1.5              |
| thesis-structure-v05.svg | thesis draft v1.75            |
| thesis-structure-v05.svg | thesis draft v2.00            |
| thesis-structure-v05.svg | pre-submission                |
| thesis-structure-v05.svg | pre-submission                |
| thesis-structure-v05.svg | [final-version] alpha-version |



# github

# Embedded code in Figures

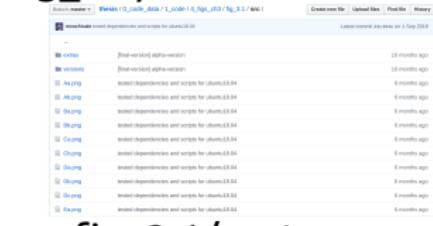
## fig\_3.1



## fig\_3.1/code



## fig\_3.1/src



## fig\_3.1/vector



## Nonlinear Analysis

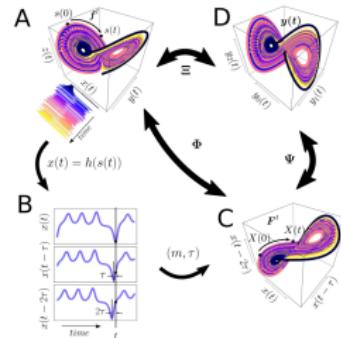


Fig. 3.1 State space reconstruction methodology. State space reconstruction is based on  $x(t) = h[s(t)] = h[f^t[s(0)]]$ , where  $h[\cdot]$  is a function  $h: M \rightarrow \mathbb{R}$ , defined on the trajectory  $s(t)$ .  $f$  is the true dynamical system,  $f: M \rightarrow M$ , defined as evolution function and  $f^t$ , with time evolution  $t \in \mathbb{N}$  that corresponds to an initial position  $s(0) \in M$ . The time-delay embedding represented as  $\Phi$ , maps the original  $d$ -dimensional state space  $M$  into a  $(d, \tau)$ -uniform time-delay embedding  $\{m_i\}_{i=1}^{\infty}$ .  $\Psi$  is the delay embedding map, which maps the  $(d, \tau)$ -uniform time-delay embedding  $\{m_i\}_{i=1}^{\infty}$  into a  $p$ -dimensional reconstructed state space  $X(t)$ .  $\Phi^{-1}$  is the delay embedding inverse map, which maps the  $p$ -dimensional reconstructed state space  $X(t)$  into a  $(d, \tau)$ -uniform time-delay embedding  $\{m_i\}_{i=1}^{\infty}$ .  $\Psi^{-1}$  is the delay embedding inverse map, which maps the  $(d, \tau)$ -uniform time-delay embedding  $\{m_i\}_{i=1}^{\infty}$  into a  $p$ -dimensional reconstructed state space  $X(t)$ .  $\Phi$  and  $\Psi$  are called transformation maps. This figure is from Quintana-Dosse (2012); Uzal et al. (1991); available at [DOI](#).

transformations  
Quintana-Dosse  
at [DOI](#).

## More with GitHub



The figure displays a variety of academic outputs from a PhD thesis:

- Magistri Invenit:** University of Birmingham, UK (2024/2025)
- Abstract:** Nonlinear analysis to quantify movement variability in human-humanoid interaction.
- PhD Thesis:** A blue book cover with the title "Nonlinear Analysis to Quantify Movement Variability in Human-Humanoid Interaction".
- Github Repositories:** A screenshot of a GitHub profile showing repositories like "PhD Thesis", "Data", "Code", "GitHub Classroom", "GitHub Code & Data", and "Slides 2022-2023".
- Video Presentation:** A screenshot of a video player showing a presentation slide with the title "Nonlinear Analysis to Quantify Movement Variability in Human-Humanoid Interaction" and a subtitle "A Thesis by Dr. [redacted] for the Degree of Doctor of Philosophy, submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy".
- Citation:** A template citation for the thesis, including the author's name, title, university, year, and a digital object identifier (DOI).

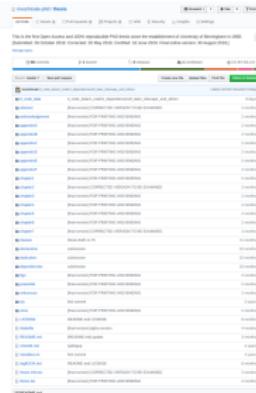


A screenshot of a web browser showing the "Open Access PhD Thesis Logo" page. The URL in the address bar is "https://openaccessphdthesis.org/logo". The page has a light blue header with the title "Open Access PhD Thesis Logo". Below the header is a search bar with placeholder text "Search for a logo or logo template". A sidebar on the left lists categories: "Logo templates" (selected), "Logos", "Logos by subject", "Logos by author", and "Logos by year". The main content area features a large green circular logo with a white center. Inside the green circle are several icons: a blue graduation cap, a black open padlock, a white flask with blue liquid, and a brown book with a yellow ribbon. Below the green circle, the text "Open Access PhD Thesis" is written in large, bold, blue letters. At the bottom of the page, there's a "Usage" section with a "Not" link, a "What's included" section with a "View details" link, and a "Download" section with a "Download" button.

# FIRST Open Access PhD Thesis at UoB (since 1900)



<https://github.com/mxochicale-phd/thesis>



Nonlinear Analysis to Quantify Movement Variability in Human-Humano



## Abstract

Quantitative analysis of movement variability is a key element of movement research interest. This dissertation aims to understand how movement variability can be measured and analyzed in different contexts. Specifically, this work focuses on the quantification of movement variability in three-dimensional space, and its application to humanoid robotics. Additionally, this work presents three-dimensional surface of movement variability analysis, and its application to humanoid robotics. Furthermore, this work presents three-dimensional surface of movement variability analysis, and its application to humanoid robotics.



## OA PhD Thesis

- \* LaTeX project
- \* Vector files

## OA SOFTWARE

- \* R version 3.4.4 (2018-03-15)
- \* R packages:
  - data.table
  - ggplot2
  - tseriesChaos
  - nonlinearTseries
  - RccArmadillo
- \* GNU Octave 4.0.2



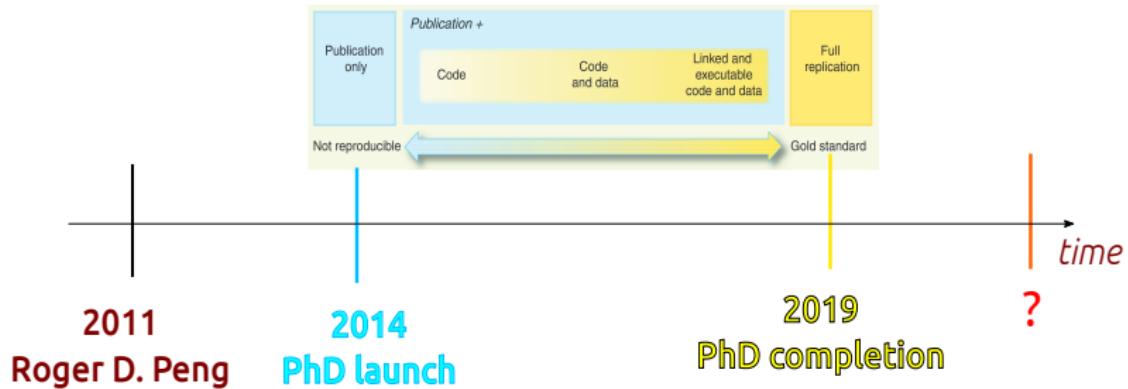
<https://doi.org/10.5281/zenodo.1473140>

Submitted: 26 October 2018/Corrected: 20 May 2019.

Certified: 18 June 2019/Final online version: 30 August 2019.

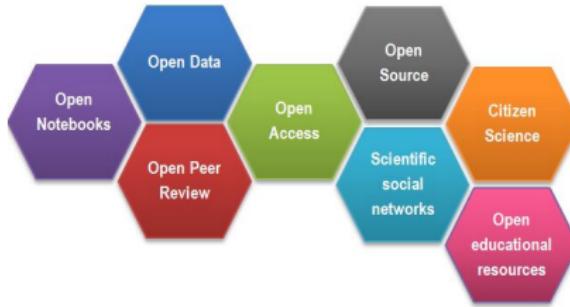
# TAKEAWAYS

# My journey in OA according to the Reproducibility Spectrum



## Takeaways

1. Learn from other open access scientists and open source enthusiasts (there are quite amazing human beings in Twitter and GitHub)
2. Use, perhaps also contribute to, free and open source software as much as you can (happy to help!)
3. How to start?: Reproduce a paper in ReScience
4. Read, replicate, learn, fail, share and do not stop exploring the exciting world of open access science!



## References

-  Xochicale Miguel  
» Nonlinear Analysis to Quantify Movement Variability in  
Human-Humanoid Interaction «  
Open Access Ph.D. Thesis (2019)  
<https://github.com/mxochicale-phd/thesis>



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<https://github.com/mxochicale/riots-sth-20200225>