TEWA 1: Advanced Data Analysis

Lecture 01

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https://github.com/lei-zhang/tewa1_univie

Conduct at the University

- Read the current information provided on u:find and u:space. Information at short notice is sent via e-mail.
- Register for courses and exams.
- Always maintain a distance of 1-metre from other persons.
- Wear a face mask during courses and if the minimum distance of 1 metre cannot be kept.
- Wash your hands regularly and thoroughly and sanitise work areas.
- Please do not use lifts, if possible.
- Do not come to the University when sick. In case of a suspected COVID-19 infection, call the hotline 1450 immediately.
- For further information, please go to studying.univie.ac.at/info.

Taking care of each other

- Please only use labelled seats in lecture halls:
- Please do not change the labels and/or move furniture.
- If you don't get a labelled seat, please use a student space for hybrid learning.
- Recommended: keep a seat number record:
  - available online at studying.univie.ac.at/info
  - Additionally you can use the Stopp-Corona-App by Red Cross.
- For further information, please go to studying.univie.ac.at/info.

Lehrveranstaltungen/lectures: 

Prüfungen / exams: 

Goal of this course

- Practical R programming, with DataCamp

- Practical model-building in Stan, model diagnostics

- (Enough) theory to ground you

- Be comfortable to use R/Stan for your own work + very basic knowledge of GitHub

What comes to your mind when talking about Statistics?

A clear goal depends on knowledge & expectations

Pre-course survey

- sent to 20 (+5) registered students
- received 22
- 88% return rate, many thanks!

spontaneous feedback are still welcome at any time!

What is your experience with…

- Statistics?
- R? (and / or Python, Matlab?)
- Cognitive Modeling?

You would like to…

- learn about regression models?
- gain knowledge of Bayesian stats?
- be able to read "computational modeling" section in papers?
- write your own model?

Your knowledge of stats

Your knowledge of programming

Your expectations

Schedule of Lectures

06.10	L01	Introduction and overview
14.10	L02	Introduction to R/Python/Matlab
21.10	L03	Probability; Bayes' Theorem
28.10	L04	Linking data and parameter & model
04.11	L05	Binomial model with Grid approximation
11.11	L06	Binomial model with MCMC in Stan
18.11	L07	Simple linear model in Stan
25.11	L08	Cognitive Modeling; Rescorla-Wagner model
02.12	L09	Implementing Rescorla-Wagner model
09.12	L10	Hierarchical modeling + Optimizing Stan codes
16.12	L11	PRL task & model comparison
13.01	L12	Stan style tip & debugging + HPC demo
20.01	L13	Summary + Exam
27.01	L14	(optional, in case we are behind schedule)

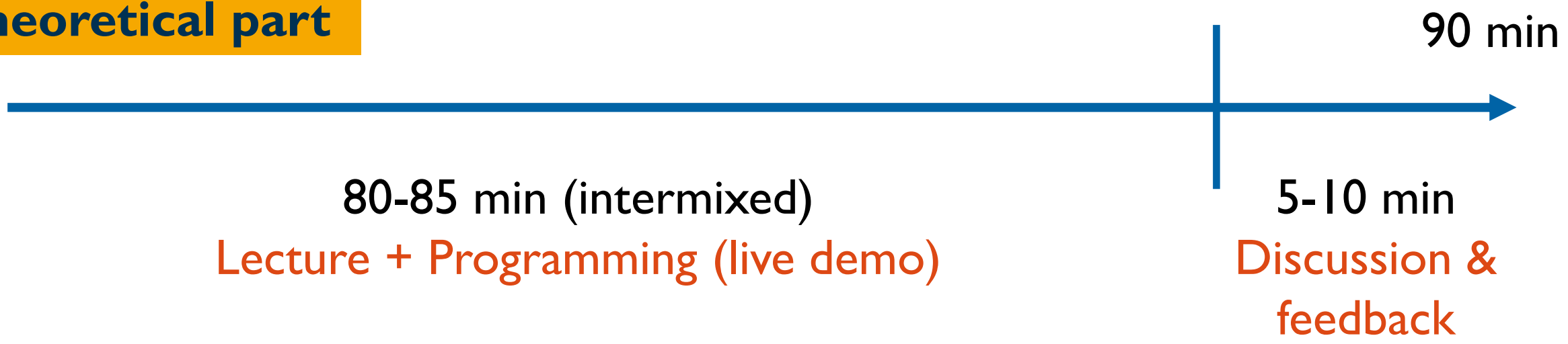
On-going R tutorials & Group programming

Exam

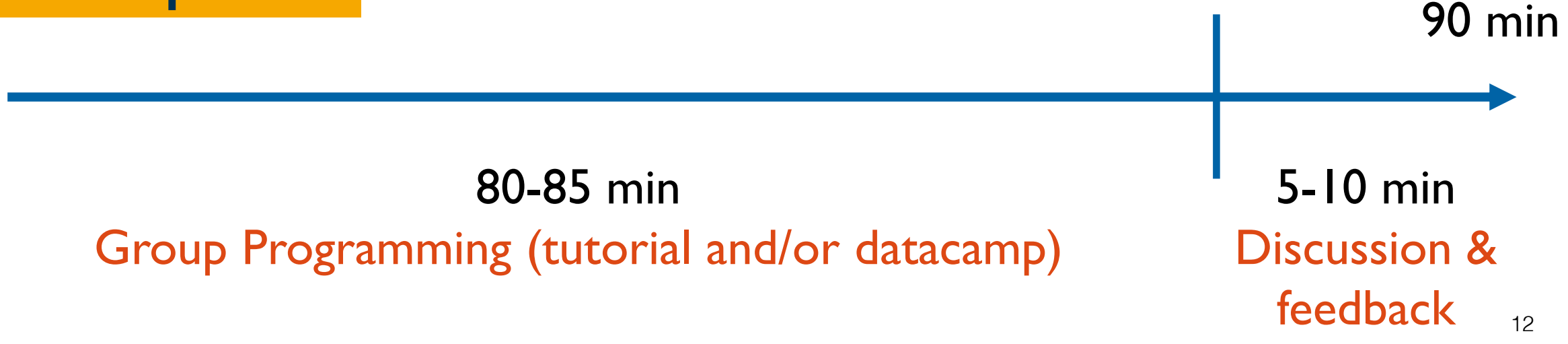
Programming project

Course structure

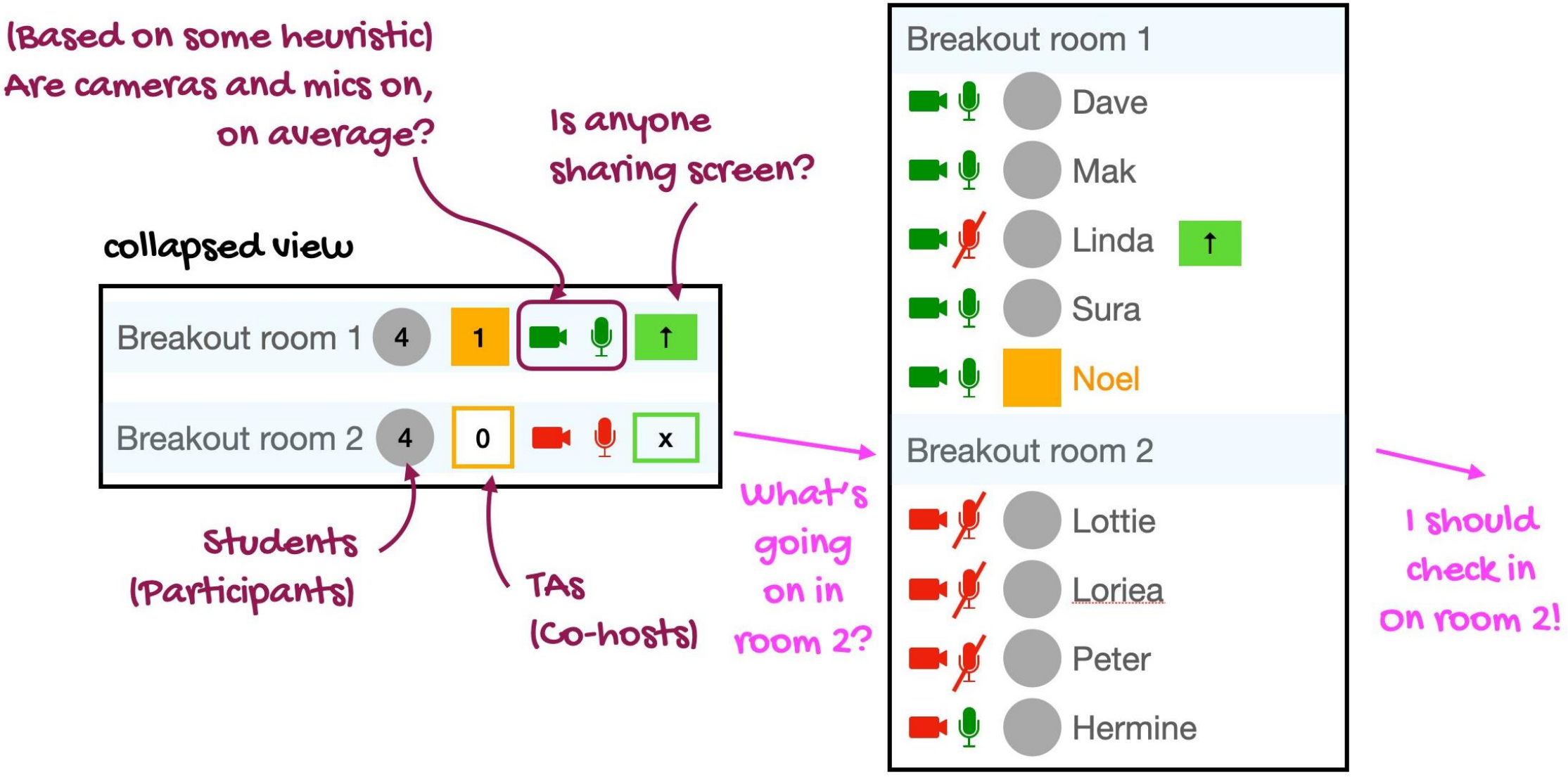
Theoretical part



Practical part



Group programming



Programming project

- already on Github
- should be summitted before the end of semester (07.02.2021)
- use R and RStan
- will be a real-world cognitive modeling problem

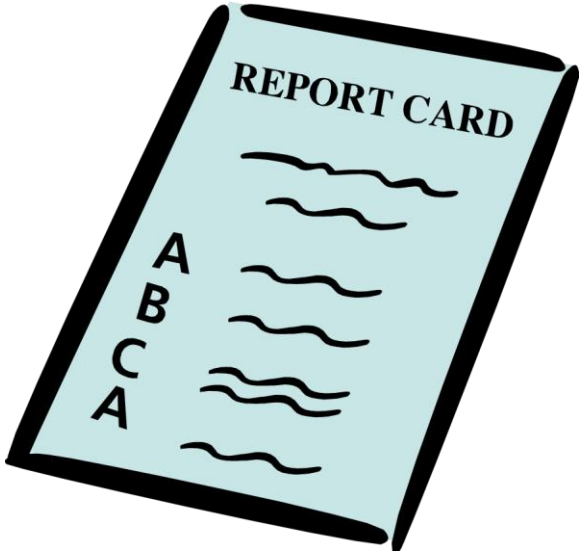
- hand in the *.R and *.stan files in a ZIP file
- name as: lastname_matriculatenumber_200149.ZIP
- no need to write a report

Example exam question: real-world situation

- Your colleague Lisa encountered a term "likelihood" when reading papers, but she has never learned Bayesian statistics. She comes to you and asks which of the following is "likelihood". (assuming ϑ is unknown parameter, D is observed data)
  - (A) $p(\vartheta)$
  - (B) $p(D)$
  - (C) $p(\vartheta|D)$
  - (D) $p(D|\vartheta)$

Gradings

- Regular participation (25%; counting from the 14/10)
  - using Google Sheets (later via email); Be honest ☺
- Regular programming tutorials (datacamp.com) (35%)
- Programming project, 10 (25%), due on 07.02.2021*
- Exam (15%); 10 multiple-choice questions



- Grades: >87% 1, >75% 2, >63% 3, >50% 4, <=50% 5
- At least 51% to obtain 8 ECTS

*0.5 point deduction per day for overdue submission

More survey results.

More Qs about the course

NA

What shall i do, If i cant join the lecture? (i anyway will watch it later or does it count as unattended?)

no

Not yet :)

What are the differences to the course you held in the past semester?

not yet

Q regarding the instructor

NA

Maybe why you have chosen this subject? (Bayesian)

no

Are you as awesome as your description of the course? ;))

not yet

misc.

NA

Am taking an R introductory class in parallel this semester, which I have faith will help me keeping up with this class! Also excited about finally learning some programming skills!

I started with the advent_calendaR today, so I'm far away from finishing the "crash-course" before starting the TEWA unfortunately, so I hope there will be some time, to get used to R

I would love at least some "in person" teaching units

There's no other TEWA 1 course for Geist & Gehirn available this semester. To finish my studies, I can't wait for another semester. I do not have any experiences working with bayesian statistics. I hope that the course is makable for beginners as well.

About me

- Current: Postdoc @ SCAN-Unit, with Prof. Claus Lamm
- Ph.D. Cognitive/computational neuroscience, *summa cum laude*
- M.Sc. Cognitive neuroscience
- B.Sc. Psychology
- Office hours: by appointment (online or Liebiggasse 5, 3. OG)




My research

- Overarching goal: uncover the neuro-computational mechanisms underlying social decision-making
- Methods: behavioral/physiological measurement, cognitive modeling, fMRI
- Previous project: social influence on goal-directed learning
- Current project: focusing on the predictive process of pain perception and empathy for pain
- Read more: www.lei-zhang.net

- Potential research assistant / master's thesis opportunity

My research

SCIENCE ADVANCES | RESEARCH ARTICLE

COGNITIVE NEUROSCIENCE

A brain network supporting social influences in human decision-making

Lei Zhang[1,2]* and Jan Gläscher[1]*†

Using reinforcement learning models in social neuroscience: frameworks, pitfalls and suggestions of best practices

Lei Zhang,[1,2] Lukas Lengersdorff,[1,2] Nace Mikus,[1] Jan Gläscher,[3] and Claus Lamm[1,2,4]

Revealing Neurocomputational Mechanisms of Reinforcement Learning and Decision-Making With the hBayesDM Package

Woo-Young Ahn[1], Nathaniel Haines[1], and Lei Zhang[2]

Full title: Modeling cognitive flexibility in autism spectrum disorder and typical development reveals comparable developmental shifts in learning mechanisms

Authors: Crawley, Daisy*[1]; Zhang, Lei*[2,3,4]; Jones, Emily[5]; Ahmad, Jumana[1]; San José Cáceres, Antonia[1,6]; Oakley, Bethany[1]; Charman, Tony[7]; Buitelaar, Jan[8]; Murphy, Declan[1,9]; Chatham, Christopher[4]; den Ouden, Hanneke^[8]; Loth, Eva^[1,9] & the EU-AIMS LEAP group

Further questions

- What knowledge is expected as a prerequisite?
  - some stats, some programming. I'll start from the beginning, and you need to do the exercise.

- How many R skills will we get taught?
  - As much as I could, but fit everything in one semester is difficult.

- Is this course difficult?
  - this varies from person to person, but from my experience this course is indeed demanding, and can be overwhelming…

What do other people say?

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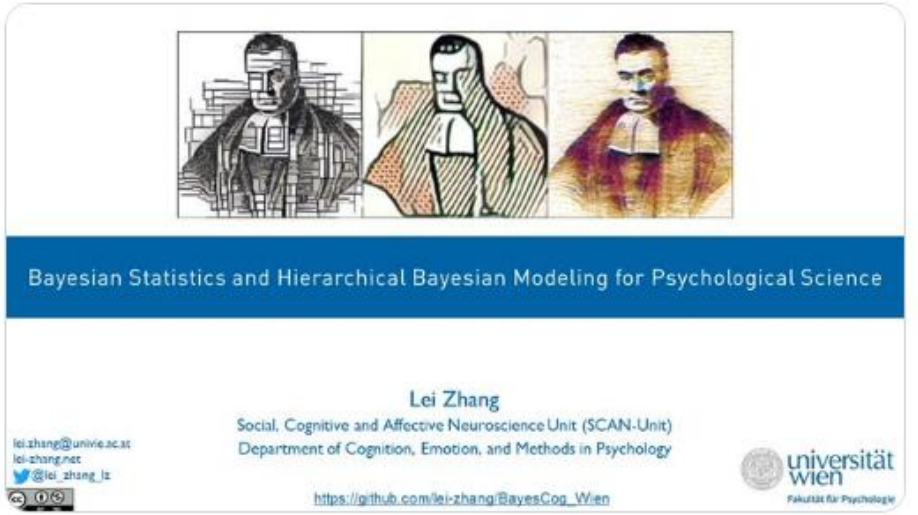
1/13) This semester's teaching on Bayesian stats and cognitive modeling is over! Thanks to COVID (ironically!), I recorded all my teaching sessions w/ @zoom_us, and they are available on #Youtube.

Wondered what have we covered to the cog-neuro audience? A thread.



3:24 PM · Jun 26, 2020 · Twitter Web App

View Tweet activity

174 Retweets **14** Quote Tweets **634** Likes

Richard McElreath
@rlmcelreath

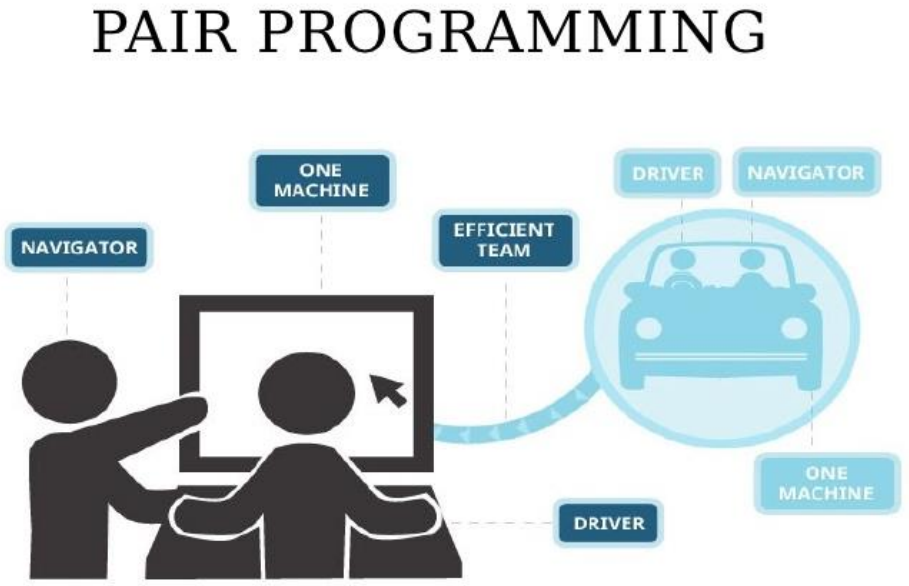
I say this a lot, bc I am also confused quite often.

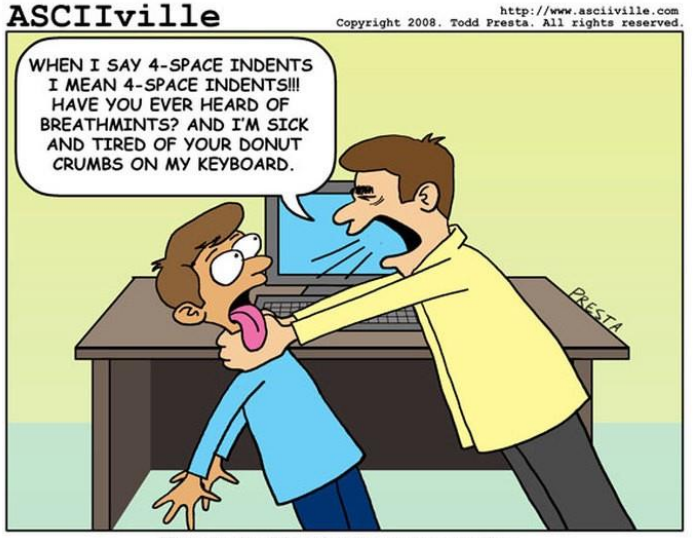
> 
> **Anna Jacobson** @AnnaChingChing · Feb 21
>
> "If you are confused, it is only because you are trying to understand." - @rlmcelreath in Statistical Rethinking

Anything else?

How to Get the Most out of the course

- Lecture structure: 60min theory + demo, 20-30min exercise + discussion
- Work in pairs: Talk to each other & help each other
- Ask questions
- Try the exercises



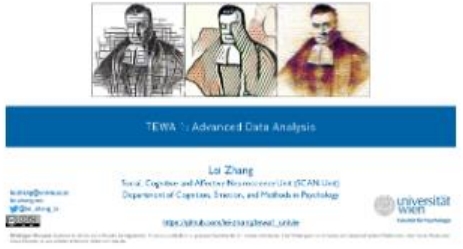


The dark side of pair programming.

A quick look at GitHub

TEWA 1

TEWA (Theorie und Empirie wissenschaftlichen Arbeitens) 1 / Theory and Empirical Research 1



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Unwatch 1

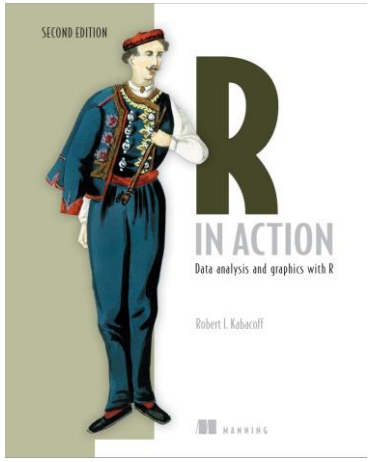
Code | Issues | Pull requests | Actions | Projects

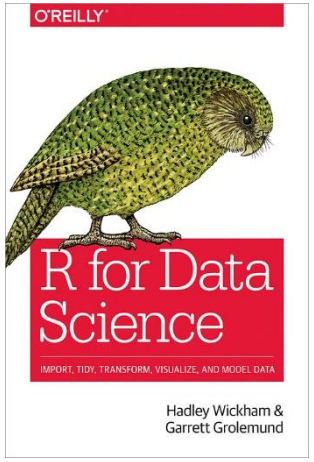
main | Go to file | Add file | Code

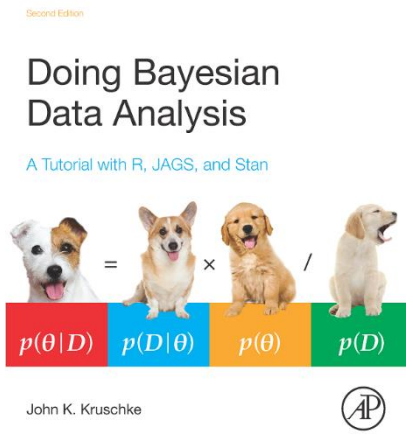
lei-zhang update ... 4 minutes ago 4

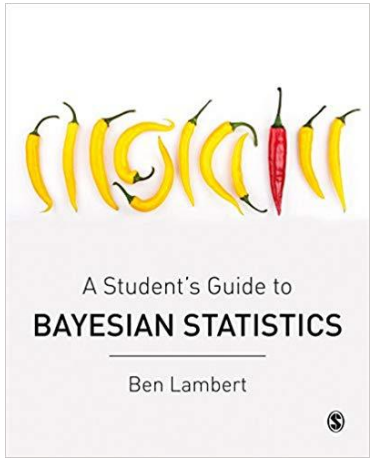
00_R_cheatsheet	update	4 minutes ago
01.R_basics	update	4 minutes ago
02.binomial_glo...	update	4 minutes ago
03.bernoulli_coin	update	4 minutes ago
04.regression_h...	update	4 minutes ago
05.regression_h...	update	4 minutes ago
06.reinforcemen...	update	4 minutes ago
07.optm_rl	update	4 minutes ago
08.compare_mo...	update	4 minutes ago
09.debugging	update	4 minutes ago
Programing_pro...	update	4 minutes ago
LICENSE	update	11 minutes ago
README.md	update	9 minutes ago
Thumbnail_tewa...	update	4 minutes ago

Resources









Statistical Thinking for the 21st Century

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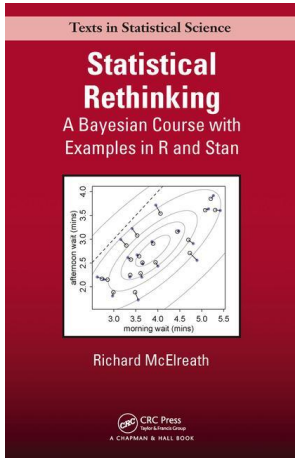
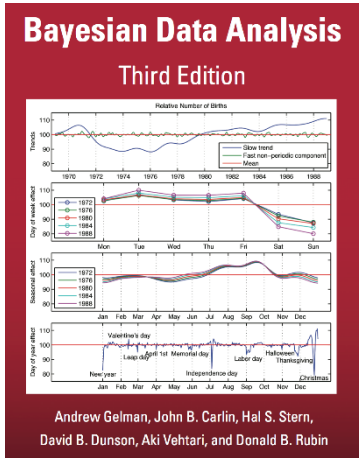
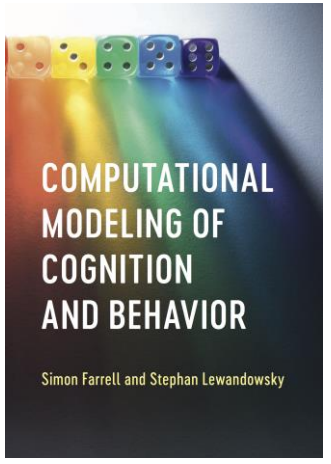
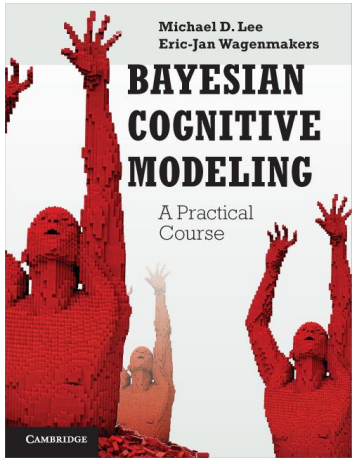
Draft: 2020-03-15

http://statsthinking21.org/









DataCamp

https://www.datacamp.com/

JASP

https://jasp-stats.org/

Now welcome to TEWA 1!


ANY
QUESTIONS
?

Happy Computing!