



Teaching Open Science - <https://psyteachr.github.io>

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psyTeachR

Teaching Reproducible Research

University of Glasgow School of
Psychology

Institute of Neuroscience &
Psychology



The psyTeachR team at the University of Glasgow School of Psychology has successfully made the transition to teaching reproducible research using R across all undergraduate and postgraduate levels. Our curriculum now emphasizes essential 'data science' graduate skills that have been overlooked in traditional approaches to teaching, including programming skills, data visualisation, data wrangling and reproducible reports. Students learn about probability and inference through data simulation as well as by working with real datasets.

This website contains our open materials for teaching reproducible research.

<https://psyteachr.github.io/>

2011

'...another important, albeit covert, theme: the benefit of collaboration across institutions and areas of interest. It is reassuring that this occurred so effectively here, despite the government's determination to create the cut-throat competition of a market in higher education through student choice, loan funding and alternative providers. We all benefit from the strengthening of the discipline of psychology.'



The Future of Undergraduate Psychology in the United Kingdom

Annie Trapp, Peter Banister, Judi Ellis,
Richard Latto, Dorothy Miell, Dominic Upton



AHΨD
ASSOCIATION OF HEADS OF PSYCHOLOGY DEPARTMENTS



<https://www.advance-he.ac.uk/knowledge-hub/future-undergraduate-psychology-united-kingdom>

2016

*'carry out an extensive piece of empirical research that requires them **individually** to demonstrate a range of research skills including planning, considering and resolving ethical issues, analysis and dissemination of findings.'*



Subject Benchmark Statement

Psychology

October 2016

UK Quality Code for Higher Education
Part A: Setting and maintaining academic standards

<https://www.qaa.ac.uk/>

2016

'Changing these incentives [for publication of positive results etc] requires a cultural shift in both thinking and practice. Improved doctoral and postdoctoral research methods training is vital (Munafò et al., 2014). However, changing scientific culture can begin at the undergraduate level, instilling the principles of transparency and scientific rigor at the grassroots.'

Instilling scientific rigour at the grassroots

A letter from our March edition advocates consortium-based undergraduate projects.



There is increasing awareness of the problem of unreliable findings across social, psychological and biomedical research. The 'publish or perish' culture, and the bias towards generating novelty and positive results, may incentivise running multiple small studies measuring multiple outcomes. This, combined with flexible analytical procedures, can generate a large number of positive results, but many will be false

2017

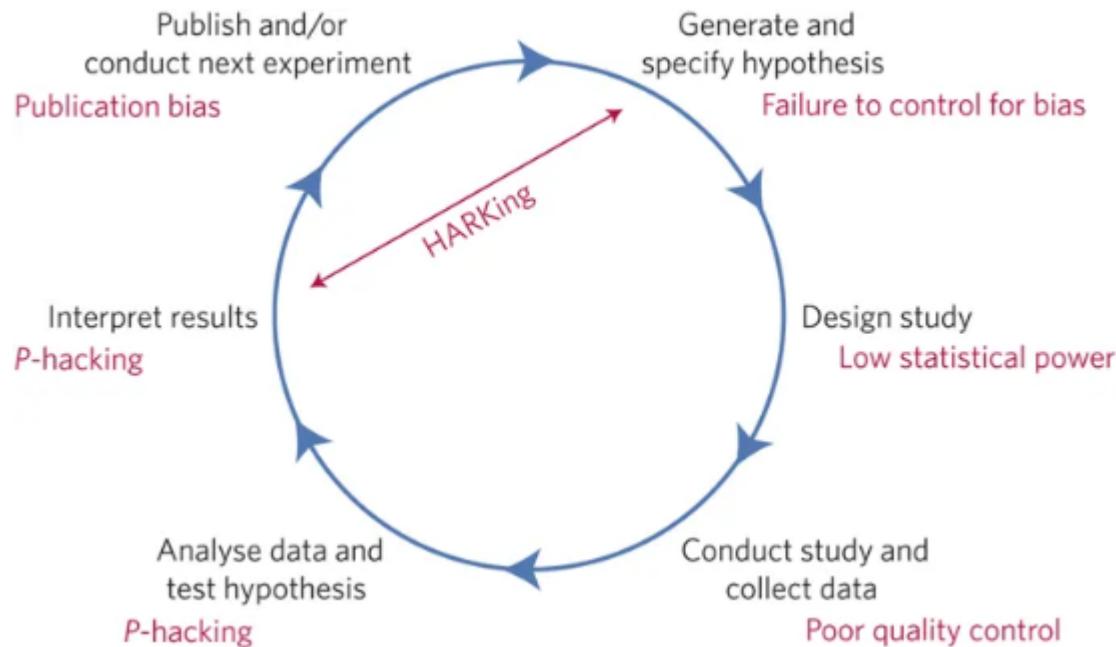
A manifesto for reproducible science

Marcus R. Munafò ✉, Brian A. Nosek, Dorothy V. M. Bishop, Katherine S. Button, Christopher D.

Chambers, Nathalie Percie du Sert, Uri Simonsohn, Eric-Jan Wagenmakers, Jennifer J. Ware & John P. A. Ioannidis

Nature Human Behaviour 1, Article number: 0021 (2017) | Download Citation ↓

Figure 1: Threats to reproducible science.



Box 2: Distributed student projects.

Student assessment requirements, and limited access to populations of interest, may hinder extensive collaboration within a single institution, but institutions in the form

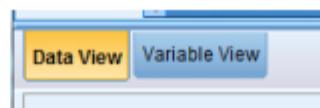
Box 3: Registered Reports.

The Registered Reports (RR) initiative seeks to eliminate various forms of bias in hypothesis-driven research^{52,53}, and in particular, the evaluation of a study based on the results. Unlike conventional journal articles, RRs split the peer review process into two stages, before and after results are known. At the first stage, reviewers and editors assess a detailed protocol that includes the study rationale, procedure and a detailed analysis plan. Following favourable reviews (and probably revision to meet strict methodological standards), the journal offers in-principle acceptance: publication of study outcomes is guaranteed provided the authors adhere to the approved protocol, the study meets pre-specified quality checks, and conclusions are appropriately evidence-bound. Once the study is completed, the authors resubmit a complete manuscript that includes the results and discussion. The article is published at the end of this two-stage process. By accepting articles before results are known, RRs prevent publication bias. By reviewing the hypotheses and analysis plans in advance, RRs should also help neutralize P-hacking and HARKing (hypothesizing after the results are known) by authors, and CARKing (critiquing after the results are known) by reviewers with their own investments in the research outcomes, although empirical evidence will be required to confirm that this is the case.



	VAR00007	VAR00008	VAR00009
1	92.45	WEST	PROB
2	93.15	WEST	PROB
3	89.23	WEST	PROB
4	94.37	WEST	PROB
5	88.51	WEST	PROB
6	95.36	WEST	PROB
7	98.12	WEST	PROB
8	91.25	WEST	PROB
9	92.75	WEST	PROB
10	89.75	WEST	PROB
11	98.45	WEST	PROB
12	94.35	WEST	PROB
13	98.81	HML	PROB
14	97.96	HML	PROB
15	97.96	HML	PROB
16	97.86	HML	PROB
17	98.85	HML	PROB
18	98.84	HML	PROB
19	97.95	HML	PROB
20	98.10	HML	PROB
21	97.91	HML	PROB
22	98.84	HML	PROB
23	98.83	HML	PROB
24	98.83	HML	PROB
25	31.25	WEST	D8
26	29.74	WEST	D8
27	28.66	WEST	D8
28	24.49	WEST	D8

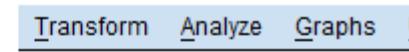
5.9. At the bottom of your sheet there is two tabs called, **DataView** and **Variable View**. Click **Variable View**



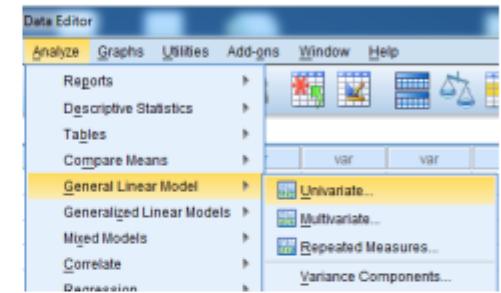
5.10. You will now see this page:

	Name	Type	Width	Decimals	Label	V
1	VAR00001	Numeric	8	2		None
2	VAR00002	String	4	0		None
3	VAR00003	String	4	0		None
4						
5						

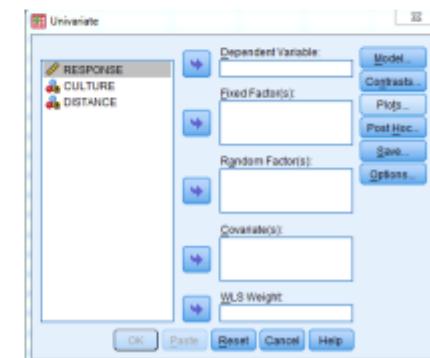
6.1. On the top menu, select '**Analyze**':



6.2. Then select, '**General Linear Model**', and then '**Univariate**':



And the following box will appear:



WHO WILL CHANGE THE FUTURE?



Transition to R



Dale Barr @dalejbarr · 16 Feb 2016

Replying to @Eavanmac

@Eavanmac @lam_bis when I heard there was a FB campaign about stats, this was the first image that came to mind



Q 1

1

2

✉

MAKING THE TRANSITION

- *Ongoing*: stats journal club
- R/RStudio training sessions
- Phase in gradually
 - translate descriptive/inferential stats materials into R
 - introduce data wrangling labs at intro level
- Support staff and students using [slack.com](#) messaging
 - separate workspaces for staff and students

**It's not just about changing what you teach...
it's about building a community**

It's not just about R, it's about:

- building confidence and independence
- enabling more efficient data analysis workflows
- instilling values of reproducibility and transparency



=



SOLUTION: EMBED R INTO TEACHING

- generating academic web pages on github
- using R in marking
- tracking student engagement with Moodle logs
- make exams with the exams package
- generate self-guided web exercises with RMarkdown and webex
- semi-automated assessment/feedback on RMarkdown-based assignments with assessr

2.3.3 Task 3: Load in the Data

Now we have to load in the `.csv` datafiles using the `read_csv()` function and save them as variables in our environment. For example, to load in the `responses` we would type:

```
responses <- read_csv("responses.csv")
```

1. Add the following lines of code to your script and complete them to load in all four `.csv` datafiles.

Use the above code as an example and name each variable the same as its original filename (minus the `.csv` part), again as above, e.g. `responses.csv` gets saved as `responses`. Remember to run the lines so that the data loaded in and is stored in your environment.

```
responses <- read_csv()      # survey responses
qformats <-                  # question formats
scoring <-                   # scoring info
pinfo <-                     # participant information
```

Portfolio Point - Haven't I `read_csv` before



As you work with data and functions you will find there are functions with similar names but that give different results. One of these is the `read` function for `csv`. Make sure to always use `read_csv()` as your function to load in `csv` files. Nothing else. It is part of the `readr` package automatically brought in with `tidyverse`.

1. From the options, choose the correct citation for the AQ 10 question questionnaire:

Allison, Auyeung, and Baron-Cohen, (2012) ▾

2. Complete the sentence, the higher the AQ score... the more autistic-like traits displayed ▾

3. Type in the AQ score (just the number) of Participant ID No. 87: □□□□

4. Type how many participants had an AQ score of 3 (again just the number): □□□□

5. The cut-off for the AQ10 is usually said to be around 6 meaning that anyone with a score of more than 6 should be referred to for diagnostic assessment. Type in how many participants should we refer from our sample: □□□□

Explain This - I dont get these answers



1. From the link above you can see that an appropriate citation for the AQ10 would be (Allison, Auyeung, and Baron-Cohen, (2012))

2. As mentioned, the higher the score on the AQ10 the more autistic-like traits a participant is said to show.

3. You could do this by code with `filter(aq_scores, Id == 87)`, which would give you a tibble of 1x2 showing the ID number and score. If you just wanted the score you could use `pull()` which we havent shown you that yet: `filter(aq_scores, Id == 87) %>% pull(AQ)`. The answer is an AQ score of 2.

4. Same as above but changing the argument of the filter. `filter(aq_scores, AQ == 3) %>% count()`. The answer is 13. Remember you can do this by counting but the code makes it reproducible and accurate every time. You might make mistakes.

5. `filter(aq_scores, AQ > 6) %>% count()` or `filter(aq_scores, AQ >= 7) %>% count()`.
The answer is 6.

2.3.7 Task 7: Calculating the AQ Scores.

We have now created `rscores` which has information on how each participant responded to each question and how each question should be coded and scored, all within the one tibble. All we need now is to sum the scores for each participant to get their AQ score.

1. Based on your Preclass knowledge, copy the below line into your code and complete it to obtain individual `aq_scores` for each participant.
2. Save your script and run it all again from the start to make sure it works!

```
aq_scores <- rscores %>%
  group_by() %>% # how will you group individual participants?
  summarise(AQ = sum()) # which column will you sum to obtain AQ scores?
```

Helpful Hint



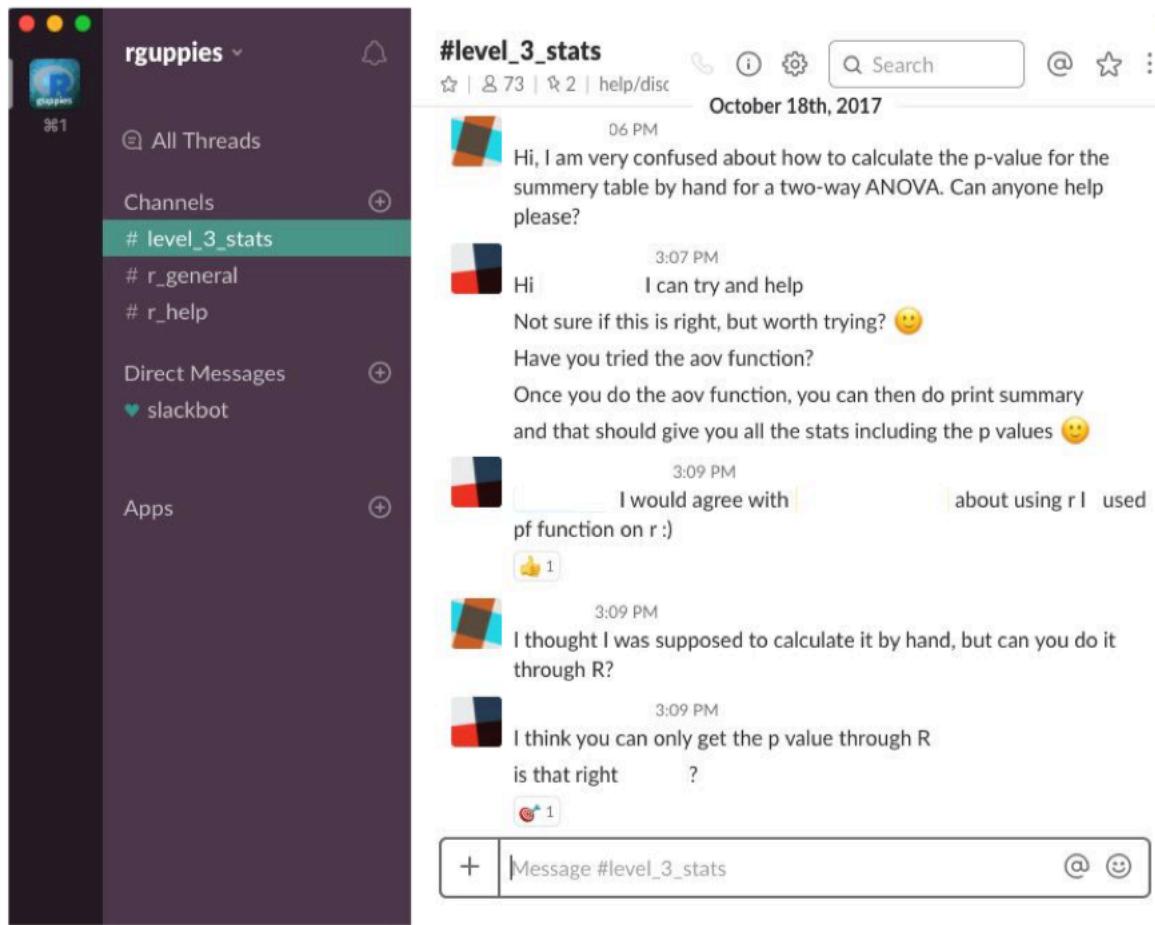
Each participant could be grouped by their Id.

If we summed up the value for each Score we might get a full AQ Score for each participant.

2.5.2.3 InClass Task 7

```
aq_scores <- rscores %>%
  group_by(Id) %>% # group by the ID number in column Id
  summarise(AQ = sum(Score)) # sum column Score to obtain AQ scores.
```

Support: Slack



- Variety of online channels
- Guidance from staff
- Peer support
Plus: UofG PAL
(Peer Assisted Learning) scheme



Cloud-based chat & communication tool



5 tips from our experience as GTAs

- Calming nerves
- Don't be an expert
- Talk through the code
- Don't touch the keyboard
- Joint problem solving



Practice: Weekly Homework Exercises

Submit your homework

<http://talklab.psy.gla.ac.uk/L3stats/ps02>

Correlation matrices using stat software

Click [here](#) to download the data for this exercise.

This (real!) dataset contains activity on the social media site twitter.com for 50 users, whose activity was measured during a month in 2014. Each row of data is for a different Twitter user. The variables are:

Variable Description

n_su Number of status updates posted

fol_chg Number of followers the user gained over the month

fav_chg Number of tweets the user "liked" over the month

fri_chg Number of "friends" (people the user started following) over the month

Create a correlation matrix for all bivariate relationships (use Spearman correlations) and then answer the following questions.

How many unique bivariate relationships are represented in the matrix (not including variables correlated with themselves)?



Entering data into R

- For now, we will just type the data into Excel and save as csv
 - CSV = comma-separated values
- Alternative: just type into a text file as shown below
- Then import into R using the `read.csv()` function
- See [Appendix](#) for how to type it directly into R

How data.csv looks

```
"SubjID","Cond","Mood","SelfEst","PosOut"  
1,"E",75,52,65  
2,"E",62,69,65  
...  
19,"C",58,56,51  
20,"C",50,74,27
```

Task 6: The descriptives

Looking Good! Next, when writing up experiments we need to have a note of measures of spread (e.g. standard deviation) and central tendency (e.g. mean) for each condition, as well as how many people are in each condition.

- Using **one pipeline** replace the `NULL` in the T6 code chunk below to recreate the descriptives table shown below. Pay particular attention to the names and order of columns, and order of rows.

Store the output in the tibble called `descriptives`. Your table should match what is shown below.

Your answer and feedback

```
descriptives <- combined %>%
  group_by(country, condition) %>%
  summarise(n = n(), mean = mean(correct_pct), sd = sd(correct_pct))
```

- your table `descriptives` matched the solution table

Solution

```
descriptives <- group_by(combined, country, condition) %>%
  summarise(n = n(), mean = mean(correct_pct), sd = sd(correct_pct))
```

country	condition	n	mean	sd
Canada	hooligan	47	46.31206	12.93301
Canada	professor	40	41.75000	13.83640
United Kingdom	hooligan	38	54.91228	13.41723
United Kingdom	professor	30	53.44444	11.49657

- Again goes back to the idea of wrangling. Key skills that you have developed over the semester by asking the same task with different datasets.
- We have also introduced a slightly different mindset here where we show you what we want and ask you to reproduce it. It is all about thinking about what you want to achieve, and then thinking the steps through.

- Better statistics skills:

- GLM teaching supported by R and Open Science.
- Increased engagement with materials.
- More efficient use of staff time through Slack.
- Learning through teaching and discussion *with* peers.

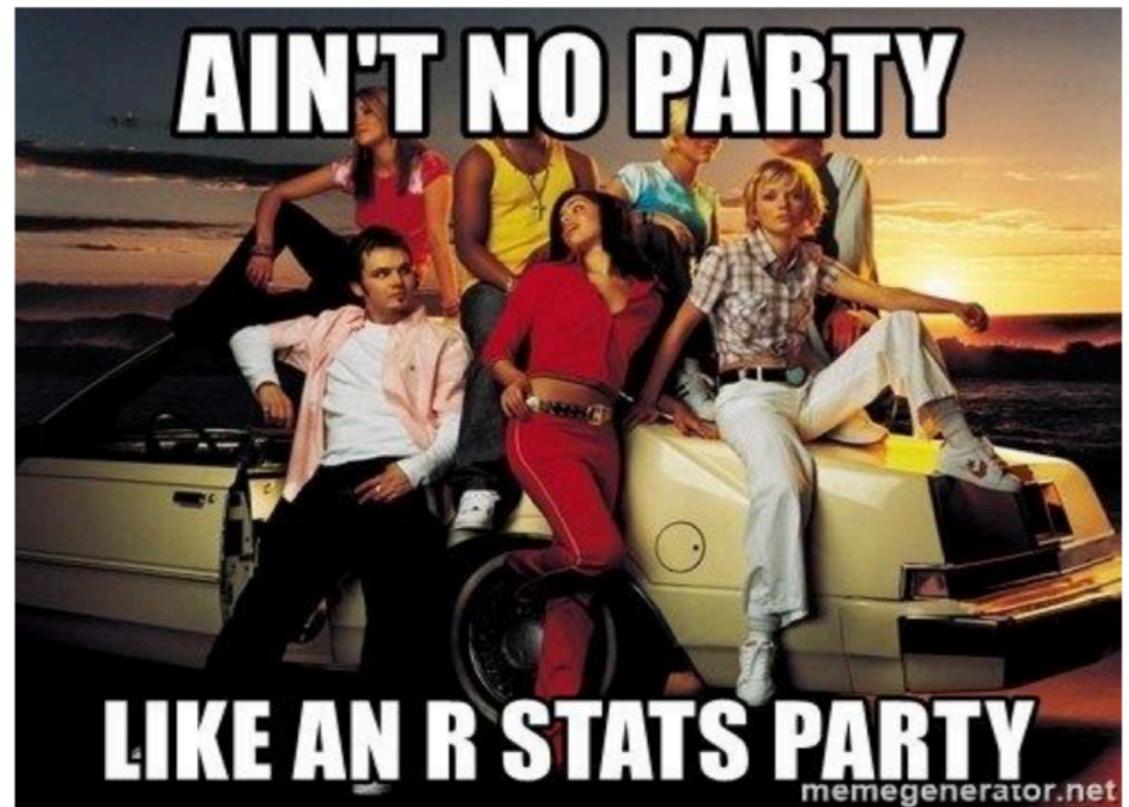
- Better communication skills:

- Written and verbal communication skills developed through peer support.
- Scientific communication through better understanding of stats, Open Science and data visualisation.



Altered Perceptions

- A whole system of interconnected principles that could be understood.
 - Reflected in the R, not completely compartmentalised.
- Re-engagement with the material with a positive attitude and less fear.
 - Fun challenge, not inescapable horror!
- Great preparation for postgrad:
 - Getting used to coding!
 - Teaching and communication.



Your Feedback

Group	GUID	MoodleID	Research	Evaluation
Lab 3 Tues		1E+08	You have obtained excellent resources to answer the question you have set. They are mostly from peer-reviewed sources and many are from recent publications meaning that your work is also relevant. D1 are examples where you need to expand on detail some more and ST1 is an example where you need to provide evidence for the claim. However in general there was good detail and you used literature effectively to support ideas, it was also clear that you understood the literature on this.	All feedback for your report was provided by Dr. Helena Paterson .
Lab 3 Tues		1E+08	You have obtained excellent resources to answer the question you have set. They are mostly from peer-reviewed sources and many are from recent publications meaning that your work is also relevant. D1 are examples where you need to expand on detail some more and ST1 is an example where you need to provide evidence for the claim. However in general there was good detail and you used literature effectively to support ideas, it was also clear that you understood the literature on this.	
Lab 3 Tues		1E+08	You have obtained excellent resources to answer the question you have set. They are mostly from peer-reviewed sources and many are from recent publications meaning that your work is also relevant. D1 are examples where you need to expand on detail some more and ST1 is an example where you need to provide evidence for the claim. However in general there was good detail and you used literature effectively to support ideas, it was also clear that you understood the literature on this.	
Lab 3 Tues		1E+08	You have obtained excellent resources to answer the question you have set. They are mostly from peer-reviewed sources and many are from recent publications meaning that your work is also relevant. D1 are examples where you need to expand on detail some more and ST1 is an example where you need to provide evidence for the claim. However in general there was good detail and you used literature effectively to support ideas, it was also clear that you understood the literature on this.	

Research

Helena says: You have obtained excellent resources to answer the question you have set. They are mostly from peer-reviewed sources and many are from recent publications meaning that your work is also relevant. D1 are examples where you need to expand on detail some more and ST1 is an example where you need to provide evidence for the claim. However in general there was good detail and you used literature effectively to support ideas, it was also clear that you understood the literature on this.

Evaluation

Helena says: Evaluation was also excellent. You structured arguments well and supported your research question very well. L1 is an example of misplaced evaluations, I think that this might have been better placed in the discussion. Your discussion could be expanded as it represents unbalanced evaluation compared to the excellent introduction. For instance in your abstract you make a very good point about perceived competence being driven by things other than voices and I would have liked to see this expanded in the discussion.

Communication

Helena says: Writing was also excellent overall. You structured this according to standard conventions for a report and you clearly made the effort to redraft to make the writing flow well. Some specific things: V1 is an example where you need to use a different word, perhaps replicate. R1 are examples where you need to look at the placement of citations - these statements need citations, but attribution is ambiguous so you either need to move the citations from the current location or add some. T1 is about the title in your figures, for APA you do not have figure titles, but have all the information in the captions. Your methods and results sections could do with some refinement. For instance add section headings for participants, measures and data analysis to the methods to structure the information better. You present a lot of figures in the results, but I think that the interaction figure represents all that is necessary.

Feedforward

Helena says: You asked about the discussion section and I think that my comments above will give you some ideas on this. Generally this was very well done, but could do with some expansion of ideas to be symmetrical to the introduction. In general keep doing what you are doing, but refine ideas and writing even more. I think that you are well set to expand your skills in both writing and reasoning so your hard work has been worth it. In terms of your design, this was good, but you do need to specify some things further such as why you would expect an interaction effect with differential ratings between male and female listeners on male and female voices.

Cognition: Question 2**Perception: Question 4****Psychobiology: Question 8****Distribution of Marks**

Question: Under what conditions may some people be susceptible to false memories?

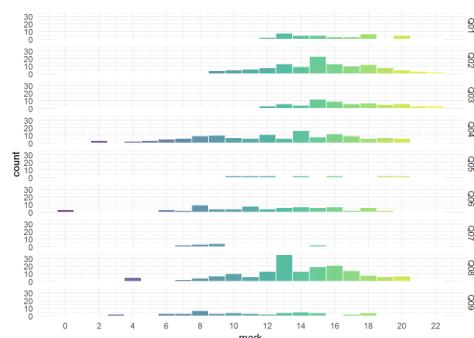
Individual Feedback

NB: Stars represent marker's assessment of your attainment of ILO

Category	<i>Excellent</i> keep this up	<i>Very Good</i> can be improved by further refining	<i>Good</i> though still room for further improvement	<i>Satisfactory</i> but considerable room for improvement	<i>Weak/Poor/Very Poor</i> this area should be worked on extensively in the future
Knowledge & Research	*				
Comprehension & Evaluation	*				
Academic Communication		*			

Generic Feedback

False memories can occur due to a range of conditions. In general, memory is a process of reconstruction rather than simple recollection, which allows for errors and intrusions to take place. Examples of research findings relevant to false memories include: Substitution of related words in memorized lists (the DRM procedure); contextual or situational similarities may induce errors in reconstruction (such as the Loftus study showing mistaken identification of Bugs Bunny at Disneyland); individual differences in susceptibility (such as the False Fame study with individuals who believe in reincarnation). Good answers explored and gave examples of false memories, and the best answers cited relevant examples from the scientific literature, and showed evidence of scholarship beyond the material presented in lectures.

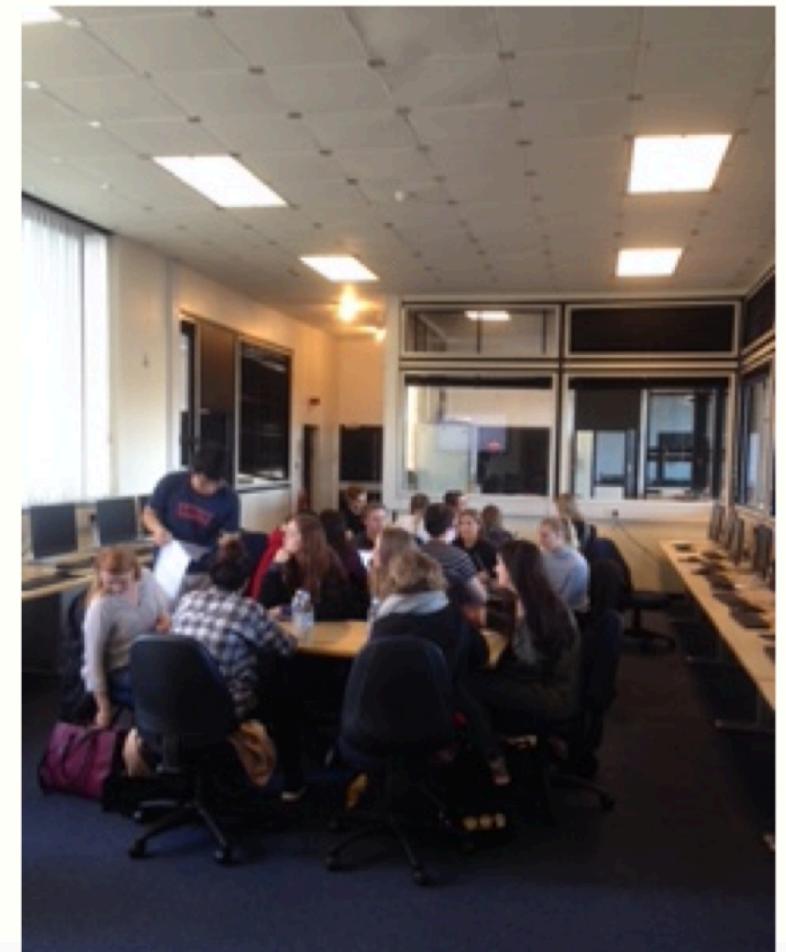


Individual work to group activities

- Group work dominated labs from first class
- Working through tasks with peers
- Moved away from quiet labs with students working on tasks individually



Busy noisy labs with lots of discussion!





Not just about



Other assessments in line with new approach

Moved away from choice of topic-specific essay questions to one question open to interpretation

Semester 1: How can psychological research help you be a better student?

Semester 2: Reproducible and open science is a hot topic within the scientific community. What does it mean and why is it important in Psychology?

@jude glad you have felt the benefit of one question from your end. What do you think about the student skill development with the new approach?



jude 10:36 AM

@heather well we are training them to think as Psychologists more widely and not just to filter to a specific area. They are already applying their knowledge more widely to concepts. Thanks again for keeping this running during the circumstances.



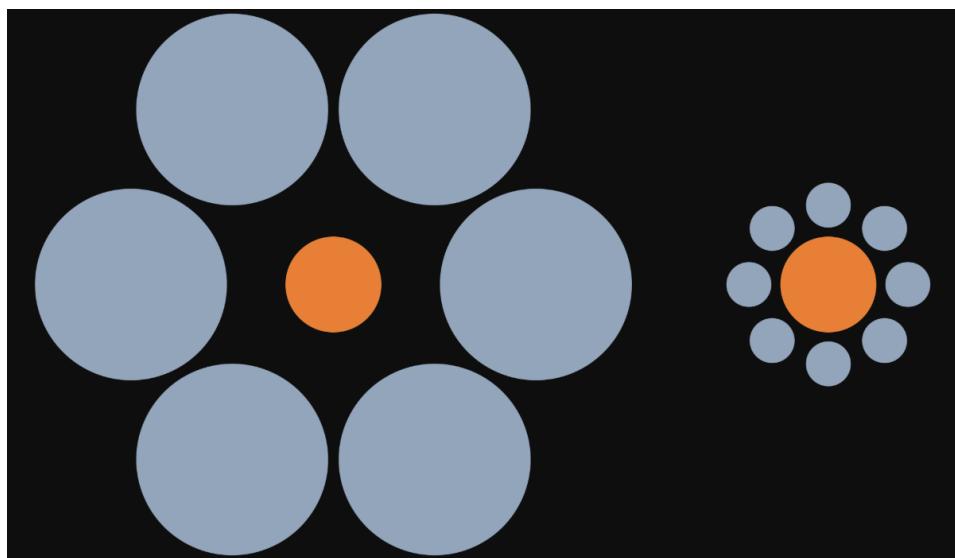
heather 10:55 AM

Good to know @jude thanks for your thoughts

Year 2 Semester 1 – Registered Reports

Box 3: Registered Reports.

The Registered Reports (RR) initiative seeks to eliminate various forms of bias in hypothesis-driven research^{52,53}, and in particular, the evaluation of a study based on the results. Unlike conventional journal articles, RRs split the peer review process into two stages, before and after results are known. At the first stage, reviewers and editors assess a detailed protocol that includes the study rationale, procedure and a detailed analysis plan. Following favourable reviews (and probably revision to meet strict methodological standards), the journal offers in-principle acceptance: publication of study outcomes is guaranteed provided the authors adhere to the approved protocol, the study meets pre-specified quality checks, and conclusions are appropriately evidence-bound. Once the study is completed, the authors resubmit a complete manuscript that includes the results and discussion. The article is published at the end of this two-stage process. By accepting articles before results are known, RRs prevent publication bias. By reviewing the hypotheses and analysis plans in advance, RRs should also help neutralize P-hacking and HARKing (hypothesizing after the results are known) by authors, and CARKing (critiquing after the results are known) by reviewers with their own investments in the research outcomes, although empirical evidence will be required to confirm that this is the case.



Year 2 Semester 2 – Analysis and Report from an Open Data Sets

Face Research Lab London Set

Version 3 Dataset posted on 30.05.2017, 17:28 by [Lisa DeBruine, Benedict Jones](#)

Images are of 102 adult faces 1350x1350 pixels in full colour. Template files mark out 189 coordinates delineating face shape, for use with Psychomorph or WebMorph.org.

Self-reported age, gender and ethnicity are included in the file [london_faces_info.csv](#). Attractiveness ratings (on a 1-7 scale from "much less attractiveness than average" to "much more attractive than average") for the neutral front faces from 2513 people (ages 17-90) are included in the file [london_faces_ratings.csv](#).

All individuals gave signed consent for their images to be "*used in lab-based and web-based studies in their original or altered forms and to illustrate research (e.g., in scientific journals, news media or presentations).*" Images were taken in London, UK, in April 2012.

FUNDING

ERC OCMATE, ERC KINSHIP

Judgement of a speaker's personality are correlated across different content and stimulus type

Public

Contributors: [Gaby Mahrholz](#), [Phil McAleer](#)

Date created: 2018-08-29 06:52 PM | Last Updated: 2018-10-05 11:35 AM

Category: Project

Files	
Name	Modified
Judgement of a speaker's personality are correlated across differ...	
- OSF Storage (United States)	
acoustics_plos.csv	2018-08-29 06:53 PM
normalised_stimuli.zip	2018-09-10 11:50 AM
RawData.csv	2018-09-21 03:42 PM

```
3 library("everyone_needs_R")
4
5 loveR <- read_csv("tell_me_what_I_want_what_I_really_really_want.csv")
6 weirdpeople <- read_csv("I'll_tell_you_what_you_want_what_you_really_really_want.csv")
7 madskillz <- read_csv("madskillz.csv")
8
9
10 why_though <- becauseitscool(madskillz, there, you, go)
11 and_how <- clever %>% fancy(contact, GURU) %>%
12   supGURU (Glasgow University R Undergraduates) %>%
13   beamazed %>% cool, stuff)
14
15 # scared? coding is weird, but R is super accessible and pretty quickly anyone can make the best graphs and
16 # wrangler your data
17
18 adva
19 c
20
21
22
23
24
```



GURU (Glasgow University R Undergraduates)

@GuruGlasgow

install.packages("fancy_club_for_teaching_R") because you will need it at some point and we love teaching and learning together!

Tweets 1 Followers 66 Likes 5

[Tweets](#) [Tweets & replies](#)

@GuruGlasgow hasn't Tweeted

When they do, their Tweets will show up here.

Files Plots Packages Help
R: Search Results Find in To

Search Results



Hack Your Data Beautiful

Anna Henschel, Carolyn Saund, Jack Taylor, Lovisa Sundin, Rebecca Lai, Shannon McNee, Steph Allan

 [#hackYourDataBeautiful](#)



Abstract

Coding is a skill that can be picked up by people from all backgrounds, for any kind of data. Everyone can be a data scientist! Coding skills provide tools to



Ruud Hortensius
@RuudHortensius

Following

Student: "I finished my experiment, here is a shared folder with the data and a R markdown"

Me: *running R markdown file *

Result: fully reproducible pipeline with tidyverse and ggplot 😍😍😍😍😍

Hard to miss how awesome #psyTeachR is when supervising UG and MSc students.



Stephanie Boyle
 @_stephanieboyle

Following

Replying to @Eavanmac @LisaDeBruine and 4 others

Random anecdotal evidence, but I told the director of company I'm at now how I taught R to undergrads at Glasgow with you all. He commented that was super interesting and would be “a good new pool of potential employees to take a closer look at”.

12:27 PM - 19 Feb 2019 from Edinburgh, Scotland

A bit bruised but definitely better...



Conclusions:

- Pedagogical collaboration both internally and externally.
- Identify the skillset you want your students to have.
- Find your tools.
- Integrate into teaching, research, and admin.
- Everyone benefits.



@mcaleerp & @uogpsychology

#psyteachr

philip.mcaleer@glasgow.ac.uk