

FOURTH YEAR STATS REFRESHER 2025

Practical stats tips for surviving 4th year

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SLIDES ARE OPEN SOURCE

Link for the [HTML version](#) of these slides (always up to date)



**DON'T
PANIC**

CAN'T I WAIT TILL I GET THE DATA?

- No!!! It's much better if you understand what you're doing BEFORE you even collect any data
- Then you can design a good study that will produce results you can interpret easily
- There are some things you may not have learned (or have forgotten) in undergrad that will be helpful to know now
- You should be able to write your Methods and Analysis sections before you even see the data (and ideally, **preregister** the project).

PREREGISTRATION

 OSF REGISTRIES ▾ My Registrations Search Support Donate 

The OSF REGISTRIES homepage features a dark blue background with a subtle geometric pattern. At the top, the OSF REGISTRIES logo is displayed, followed by navigation links for 'My Registrations', 'Search', 'Support', 'Donate', and a user profile icon. The main title 'OSF REGISTRIES' is prominently shown with the subtitle 'The open registries network'. Below this is a search bar with the placeholder 'Search registrations...' and a 'Search' button. A message indicates '287,086 searchable registrations as of February 5, 2019'. A 'See an example' link is also present. The page is divided into several sections, each listing a registration entry with its title, author(s), and a brief description.

OSF REGISTRIES

The open registries network

Search registrations... Search

287,086 searchable registrations as of February 5, 2019

See an example

Browse Registrations See more

2016, Deutchman, The Role of Framing Effects, the Dark Triad, and Empathy in Predicting Behavior in a One-shot Prisoner's Dilemma
Paul Michael Deutchman, Jess Sullivan

Pragmatic adaptation: testing whether inference judgments are susceptible to bias over the course of an experiment
Stephen Politzer-Ahles, Edward Matthew Husband

Does Practicing Cognitive Reappraisal Enhance Impulse Inhibition during Subsequent Risk Taking?
Joao F Guassi Moreira, Emilia Ninova, Jennifer A Silvers

Local predictors of variation in plant phenology
Margaret Kosalma

Promoting School Belongingness and Academic Performance: A Multisite Effectiveness Trial of a Scalable Student Mindset Intervention
25.0-IM-S25STAT-A.zip ... | h 25.0-IM-S25STAT-A.zip ... | h 25.0-IM-S25STAT-A.zip ... | h 25.0-IM-S25STAT-A.zip ... | h python-3.7.2-macos.pkg ... | d 25.0-IM-S25STATC.dmg ... | d 25.0-IM-S25STATC.dmg ... | d

OSF guide to preregistrations

GUIDE TO PREREGISTRATION AND REGISTERED REPORTS

- You submit a public time-stamped plan BEFORE you analyse your data (preferably before you collect it)
- If you submit this for **peer review**, it's called a Registered Report
- Useful paper here
- Henderson, E. L. (2022, January 25). A guide to preregistration and Registered Reports. doi.org/10.31222/osf.io/x7aqr
- Here's a simplified diagram:



TOOLS

Program	Advantages	Disadvantages
SPSS	Powerful, reasonably simple, you already know how to use it	Expensive, too much output, need to run analysis again if you get it wrong, terrible graphs
jamovi	FREE, very simple to use, intuitive, makes nice graphs, powerful, lots of help online	May not have some of the more complex analyses you need, your supervisor may need persuading
JASP	FREE, also simple to use, fantastic for Bayesian analyses, also does SEM and machine learning!	Not quite as good for non-parametric tests and traditional stats, graphs not as pretty
R/RStudio	FREE, extremely powerful, makes AMAZING plots, best for reproducibility	Steep learning curve, sometimes not super easy to interpret output, need to Google a lot

STATISTICS LANGUAGES

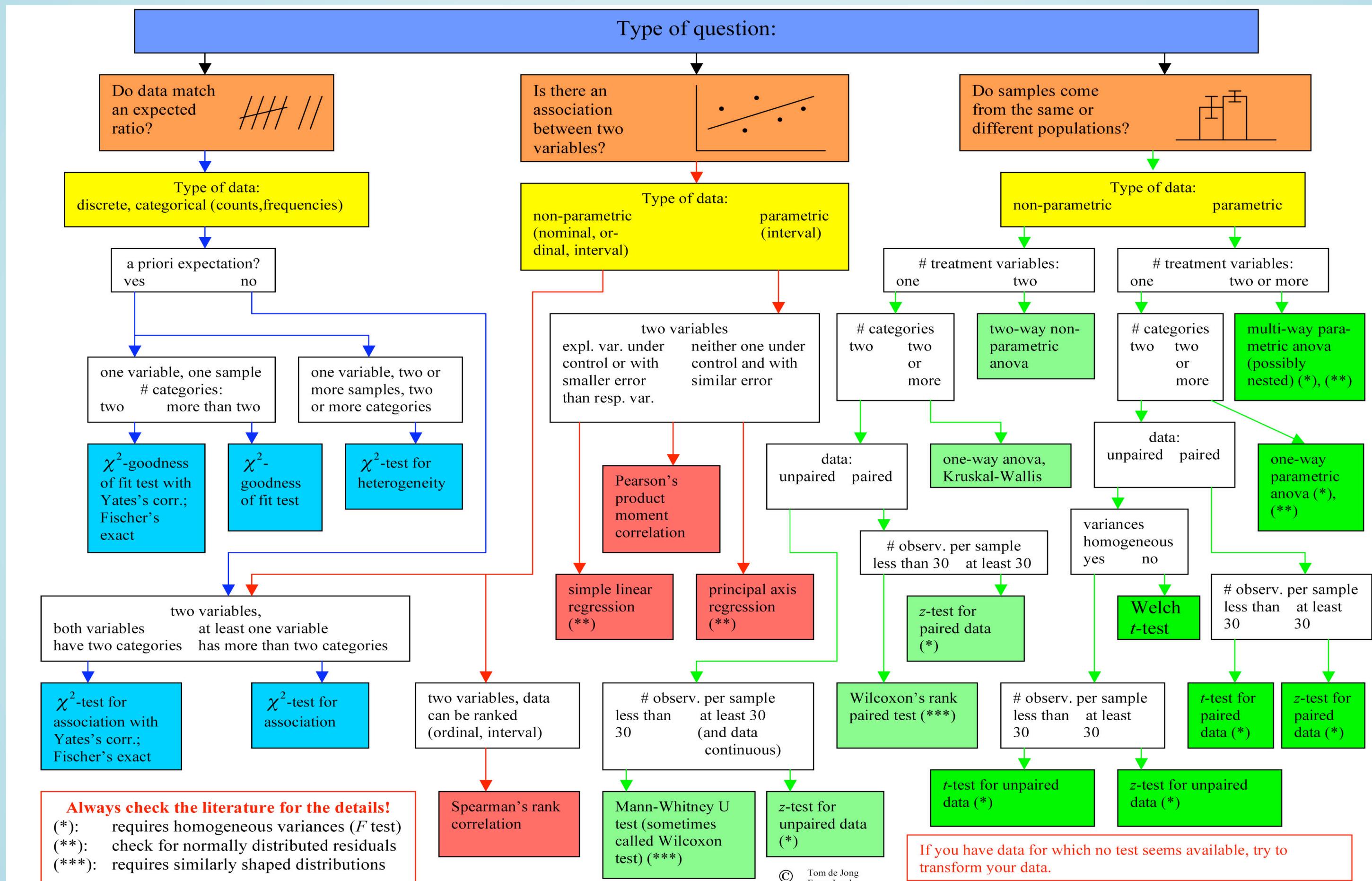
If statistics programs/languages were cars...



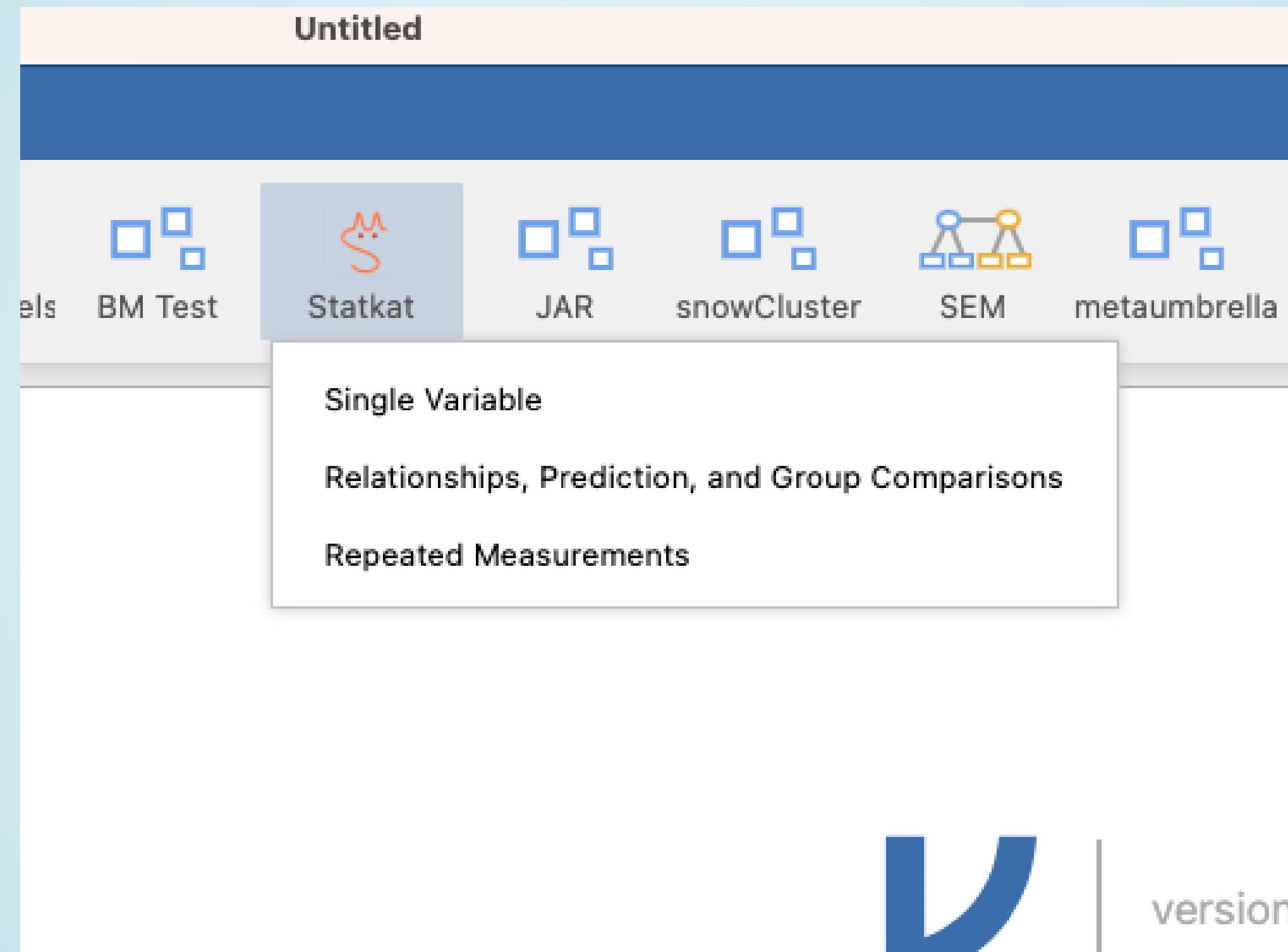
Image credit - Darren L. Dahly

WHAT STATISTIC TO USE?

- Questions to start with: What is your dependent variable? What is/are your independent variable/s?
- Is your design between-subjects or within-subjects?
- Is your DV interval/ratio (continuous) or categorical?
- Are your IVs interval/ratio (continuous) or categorical, or both?
- Are your assumptions [likely to be] met?
- Handy flowchart here
- Also a mobile app & website, [StatHand](#) - written by our own Adam Rock



NEW TOOL IN JAMOVI - STATKAT



StatKat - helps you decide what statistic to use

DATA TYPES FOR TESTS

	Parametric	Non-parametric
Assumed distribution	Normal	Any
Assumed variance	Homogeneous	Any
Typical data	Ratio or interval	Ordinal or nominal
Dataset relationships	Independent	Any
Usual central measure	Mean	Median
Benefits	Can draw more conclusions	Simplicity; less affected by outliers

TESTS

	Parametric	Non-parametric
Choosing	Choosing a parametric test	Choosing a non-parametric test
Correlation test	Pearson	Spearman
Independent measures, 2 groups	Independent-samples t-test	Mann-Whitney test
Independent measures, >2 groups	One-way, independent-measures ANOVA	Kruskall-Wallis test
Repeated measures, 2 conditions	Paired-samples t-test	Wilcoxon signed-ranks test
Repeated measures, >2 conditions	One-way, repeated-measures ANOVA	Friedman test

SOME EXAMPLES OF RESEARCH QUESTIONS

HOW WOULD YOU TEST THESE?

- Are people better at recognising upright faces compared to upside-down ones?
 - Extension: is this different for faces compared to objects?
- Do people who recall their dreams more often perform better on a short-term memory task?
 - Extension: Is this relationship affected by poor sleep?
- Did more men than women drop out of your experiment?
- Anyone care to contribute?

EXPECTATION VS. REALITY

- Your data will probably look very different to the datasets you are used to!



The datasets you're used to



Your dataset

GET A PREVIEW OF YOUR DATA FROM QUALTRICS!

The screenshot shows the Qualtrics Survey interface for a survey titled "DASS21". The top navigation bar includes "Survey" (which is selected), "Actions", "Distributions", "Data & Analysis", and "Reports". Below the navigation is a toolbar with "Look & Feel", "Survey Flow", "Survey Options", and a "Tools" dropdown. The "Tools" dropdown menu is open, showing options like "Auto-Number Questions...", "Reset Recode Values...", "Collaborate", "Review" (which is selected and highlighted in blue), "Triggers", "Salesforce", "Quotas...", "Manage Reusable Choices...", "Scoring...", "Translate Survey...", "Versions", and "Import/Export". The "Review" option has a submenu with "Search and Replace...", "Strip Formatting...", "Generate Test Responses..." (which is also highlighted in blue), "Check Survey Accessibility...", "Analyse Survey...", and "Turn off ExpertReview...". The main survey content area displays a question about stress levels with two response options: "Did not apply to me at all" and "Applied to me very much, or most of the time". Below this, there are two statements: "I found it hard to wind down." and "I was aware of dryness of my mouth.", each with a radio button next to it.

DATA INTEGRITY TIPS

- ALWAYS save your data in a non-proprietary format (.csv is best).
- Avoid saving multiple versions if possible. Do save a raw version and a minimally processed version (e.g. deleting non-completers), but after that try to use filters rather than deleting participants.
- BACK UP!!!
- Keep a copy of your syntax for making scales etc. (if using SPSS). This will save you a lot of work. (Can also save a template in jamovi, or save the R code.) I'll show you how in a minute.
- Really good blog post [here](#) about principles of data management

DATA CARPENTRY

SOMETIMES KNOWN AS DATA CLEANING

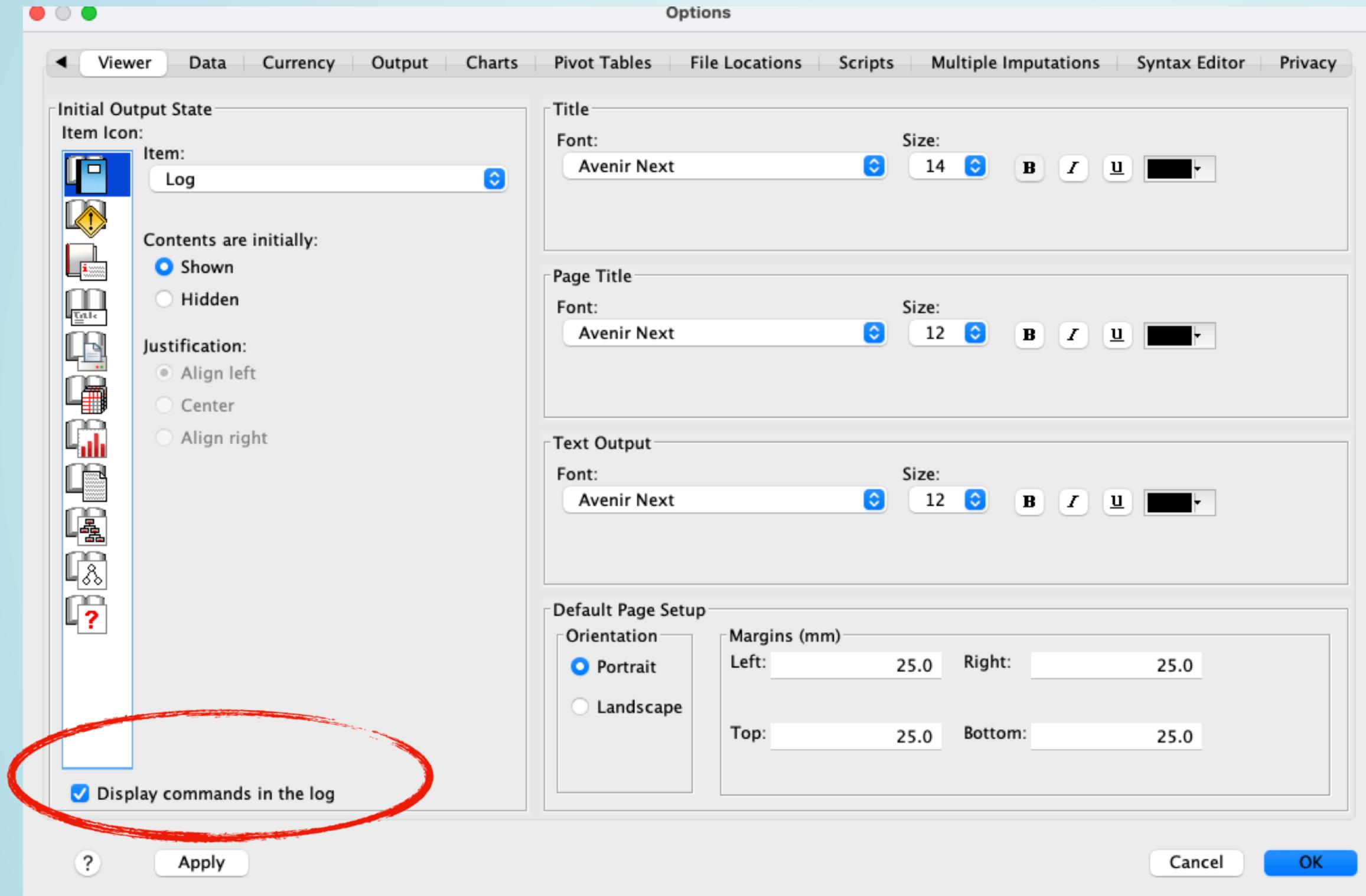
- You'll have participants who haven't completed your surveys/experiments
- You'll have participants who don't meet inclusion criteria
- You might have people who did the survey twice
- Sometimes you need to compile 2 datasets (e.g. at two timepoints). HAN^{DY} HINT - do NOT let participants generate their own random code. Have Qualtrics do it for you.
- You'll need to compute scales and subscales (e.g. DASS Depression, Anxiety, Stress)
 - may need to reverse-score items first
- You might want to check outliers (if real and not data error, think CAREFULLY before excluding them).

CREATING SCALES

- Most survey-type studies will consist of established scales with published reliability figures and scoring systems
- Make sure you ALWAYS check reliability in your own sample as well
- You'll need to sum or average items to create your scale and/or subscale (also, only use validated cutoff scores)
- Sometimes you need to re-score items (e.g. reverse scaled, scored in a different way by Qualtrics)
- DEMO

DEMO

GET SPSS TO SHOW YOU THE SYNTAX!



CHECKING SCALE RELIABILITY (SPSS)

The screenshot shows the IBM SPSS Statistics Data Editor interface. The menu bar at the top includes 'Data', 'Transform', 'Analyze' (which is highlighted in blue), 'Graphs', 'Utilities', 'Extensions', 'Window', and 'Help'. Below the menu bar is a toolbar with various icons. The main area displays a data table titled 'ExpVars_ScaleScores_FINAL.sav [DataSet1] - IBM SPSS Statistics Data Editor'. The table has 23 rows and several columns, with the last column labeled 'Role' containing values like 'Scale' and 'Input'. A context menu is open over the data table, with the option 'Reliability Analysis...' highlighted in blue. The status bar at the bottom indicates 'IBM SPSS Statistics Processor is ready' and 'Unicode:ON'.

CHECKING SCALE RELIABILITY (SPSS)

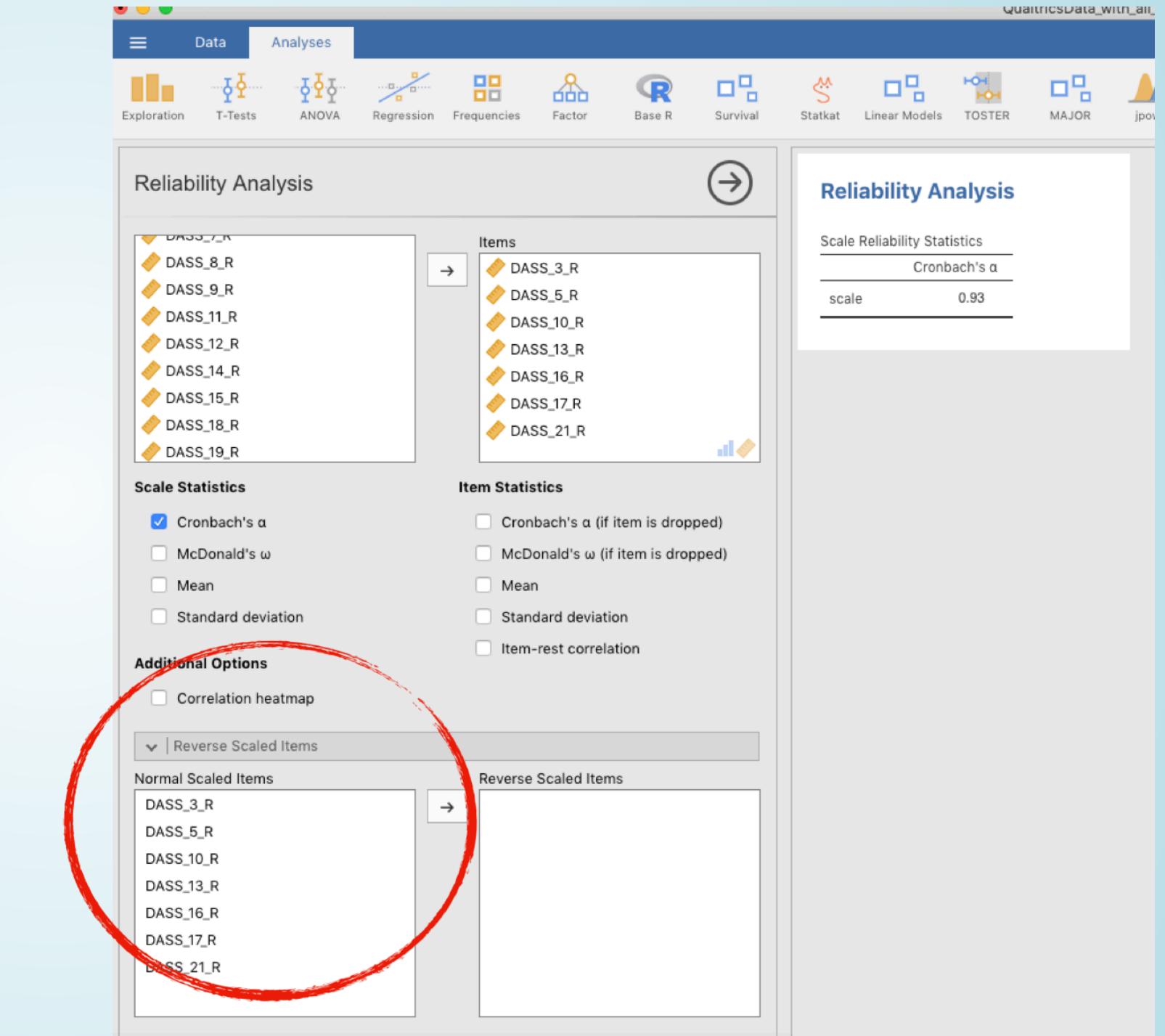
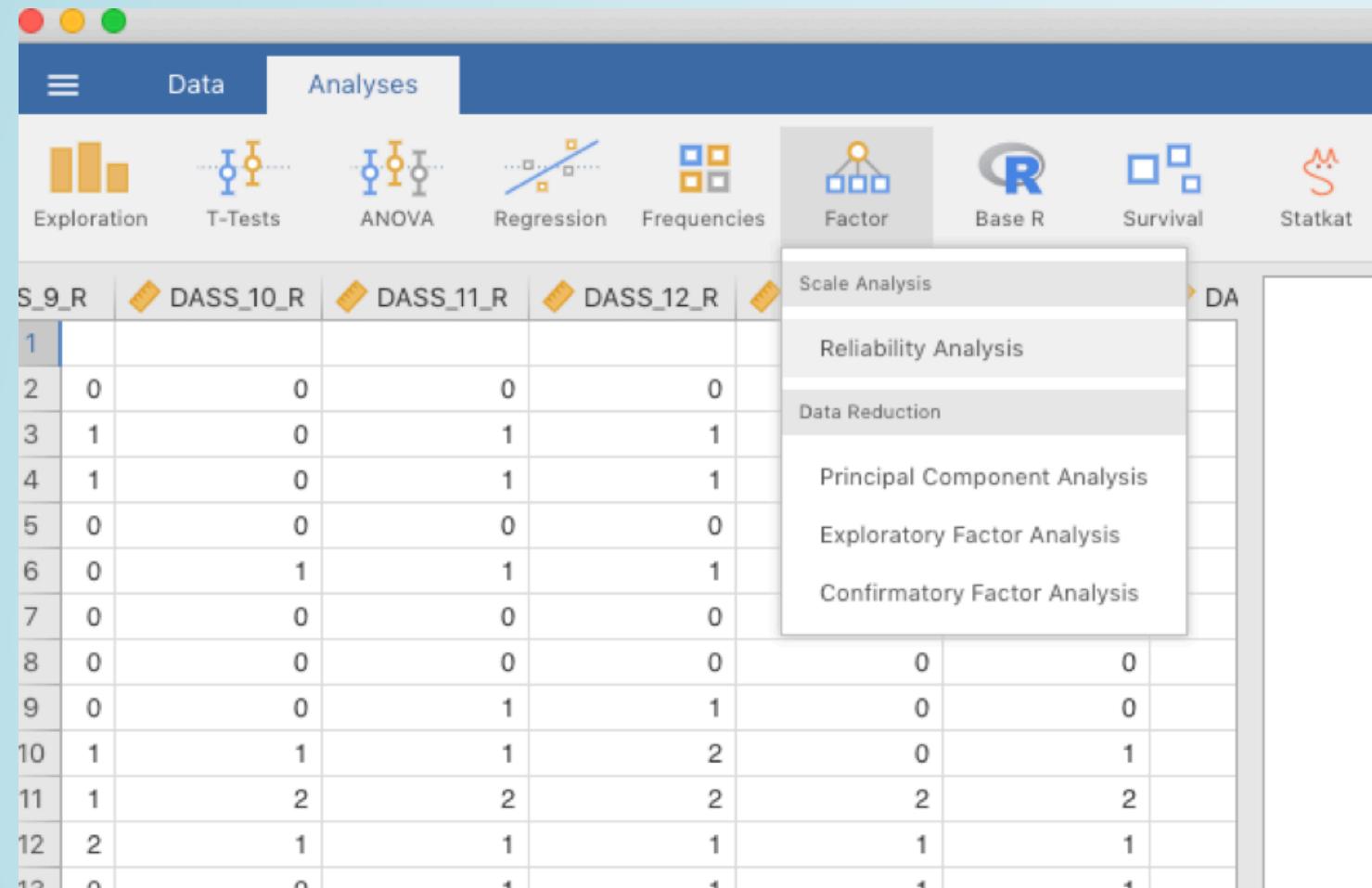
The screenshot shows the SPSS Reliability Analysis dialog box. In the main dialog, under 'Items:', 'DASS_21_R' is selected. A red circle highlights the 'Statistics...' button. Below it, the 'Reliability Analysis: Statistics' dialog is open, showing various statistical tests checked:

- Descriptives for:** Item, Scale, Scale if item deleted
- Inter-Item:** Correlations, Covariances
- Summaries:** Means, Variances, Covariances, Correlations
- ANOVA Table:** F test
- Other:** Tukey's test of additivity, Intraclass correlation coefficient

At the bottom of the dialog, 'Model:' is set to 'Two-Way Mixed' and 'Type:' is 'Consistency'. The 'Reliability Statistics' table shows:

Reliability Statistics		
Cronbach's Alpha Based on Standardized Items		
Cronbach's Alpha	d Items	N of Items
.930	.931	7

CHECKING SCALE RELIABILITY (JAMOVI)



CHECKING SCALE RELIABILITY (JAMOVI) - OUTPUT

QualtricsData_with_all_ExpVars_ScaleScores_FINAL

Reliability Analysis

Items

- DASS_7_R
- DASS_8_R
- DASS_9_R
- DASS_11_R
- DASS_12_R
- DASS_14_R
- DASS_15_R
- DASS_18_R
- DASS_19_R
- DASS_3_R
- DASS_5_R
- DASS_10_R
- DASS_13_R
- DASS_16_R
- DASS_17_R
- DASS_21_R

Scale Statistics

- Cronbach's α
- McDonald's ω
- Mean
- Standard deviation

Item Statistics

- Cronbach's α (if item is dropped)
- McDonald's ω (if item is dropped)
- Mean
- Standard deviation
- Item-rest correlation

Additional Options

- Correlation heatmap

Reverse Scaled Items

Scale Reliability Statistics

	mean	sd	Cronbach's α	McDonald's ω
scale	0.73	0.75	0.93	0.93

Item Reliability Statistics

	mean	sd	item-rest correlation	Cronbach's α	McDonald's ω
DASS_3_R	0.67	0.80	0.79	0.92	0.92
DASS_5_R	1.20	0.95	0.65	0.93	0.93
DASS_10_R	0.67	0.91	0.84	0.91	0.91
DASS_13_R	0.83	0.94	0.80	0.92	0.92
DASS_16_R	0.66	0.84	0.79	0.92	0.92
DASS_17_R	0.61	0.93	0.81	0.92	0.92
DASS_21_R	0.48	0.86	0.76	0.92	0.92

Correlation Heatmap

	DASS_3_R	DASS_5_R	DASS_10_R	DASS_13_R	DASS_16_R	DASS_17_R	DASS_21_R
DASS_3_R	1	0.56	0.72	0.71	0.72	0.68	0.62
DASS_5_R		1	0.54	0.59	0.61	0.54	0.51
DASS_10_R			1	0.73	0.73	0.76	0.74
DASS_13_R				1	0.65	0.73	0.65
DASS_16_R					1	0.66	0.62
DASS_17_R						1	0.73
DASS_21_R							1

QUALTRICS TIP TO AVOID RE-SCORING

The DASS₂₁ Scale

Please read each statement and choose the option which indicates how much the statement applied to you during the past week. There are no right or wrong answers. Do not spend too much time.

	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of time	Applied to me very much, or most of the time
1. I felt tense or wound up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I felt nervous.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I felt restless.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I had trouble sleeping.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I was easily annoyed or irritable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I felt upset or blue.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I lost interest in things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I felt hopeless.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I felt like I wanted to cry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I felt bad about myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I felt depressed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I had trouble concentrating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I made mistakes at work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I lost my temper.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I felt anxious.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I felt restless.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. I had trouble sleeping.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. I felt tense or wound up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. I felt nervous.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. I felt restless.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. I had trouble concentrating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Scoring
Recode Values... Randomisation... Answer Randomisation... Add Choice Group

Go to settings > recode values

QUALTRICS TIP TO AVOID RE-SCORING

Recode Values

Recode Values Variable Naming Question Export Tags

0	1	2	3
Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of time	Applied to me very much, or most of the time

I found it hard to wind down.

I was aware of dryness of my mouth.

I couldn't seem to experience any positive feeling at all.

I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion).

I found it difficult to work up the initiative to do things.

I tended to over-react to situations.

I experienced trembling (eg, in the hands).

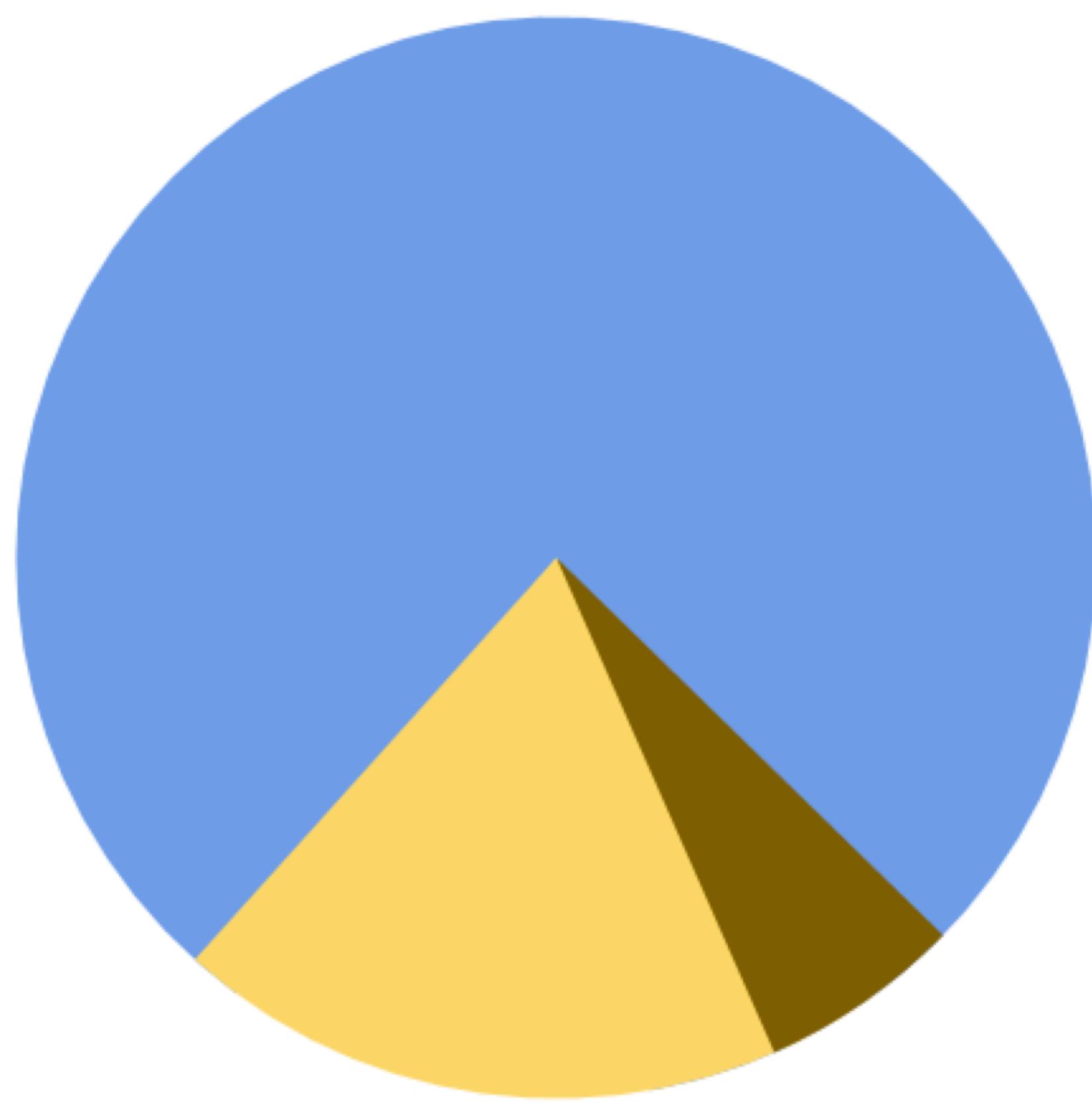
I felt that I was using a lot of nervous energy.

I was worried about situations in which I might panic and make a fool of myself.

I felt that I had nothing to look forward to.

Rescore with the appropriate values from the scale

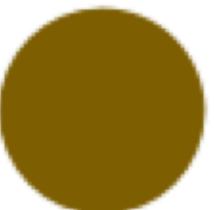
VISUALISE YOUR DATA!!



Sky

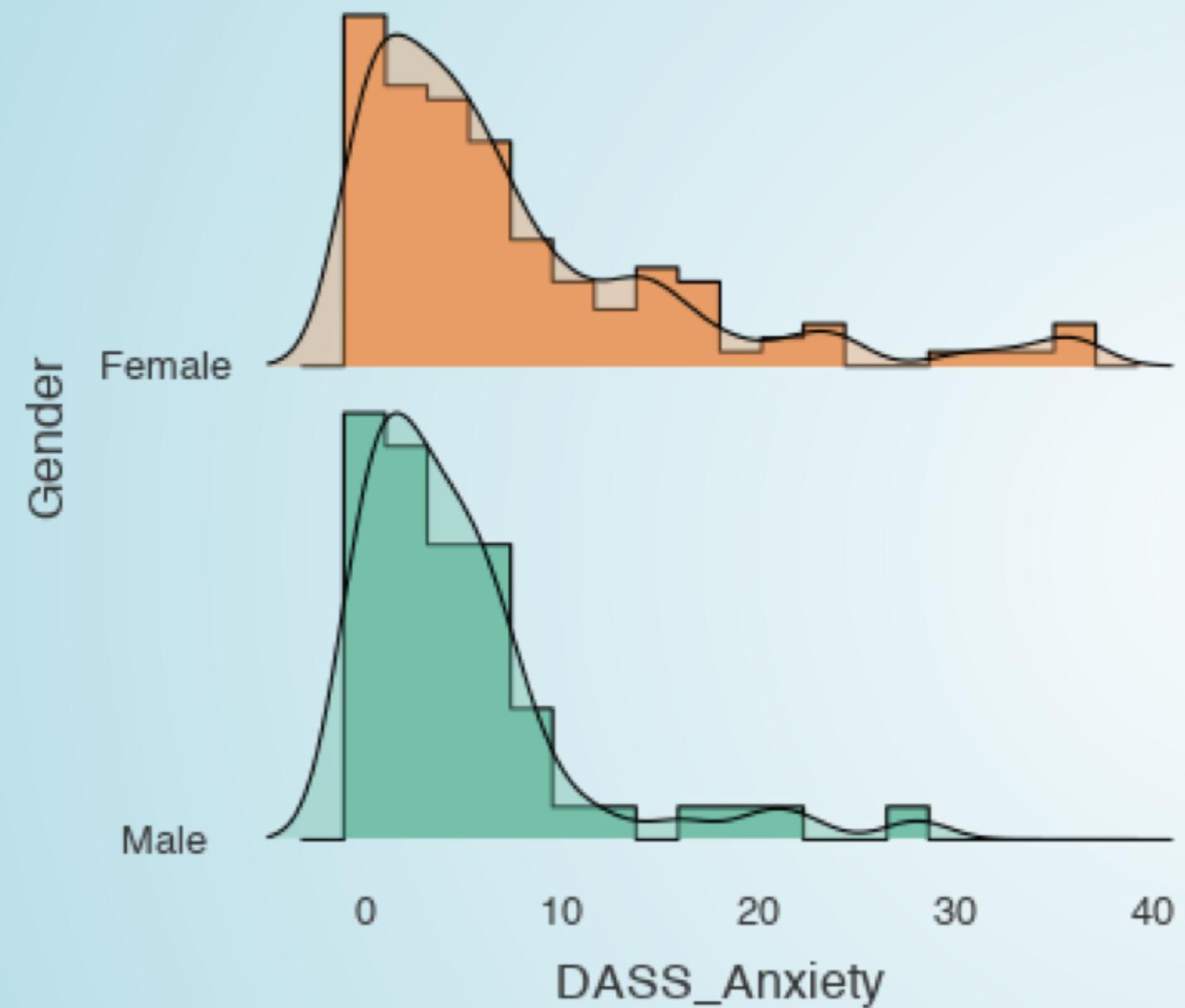


Sunny side of pyramid

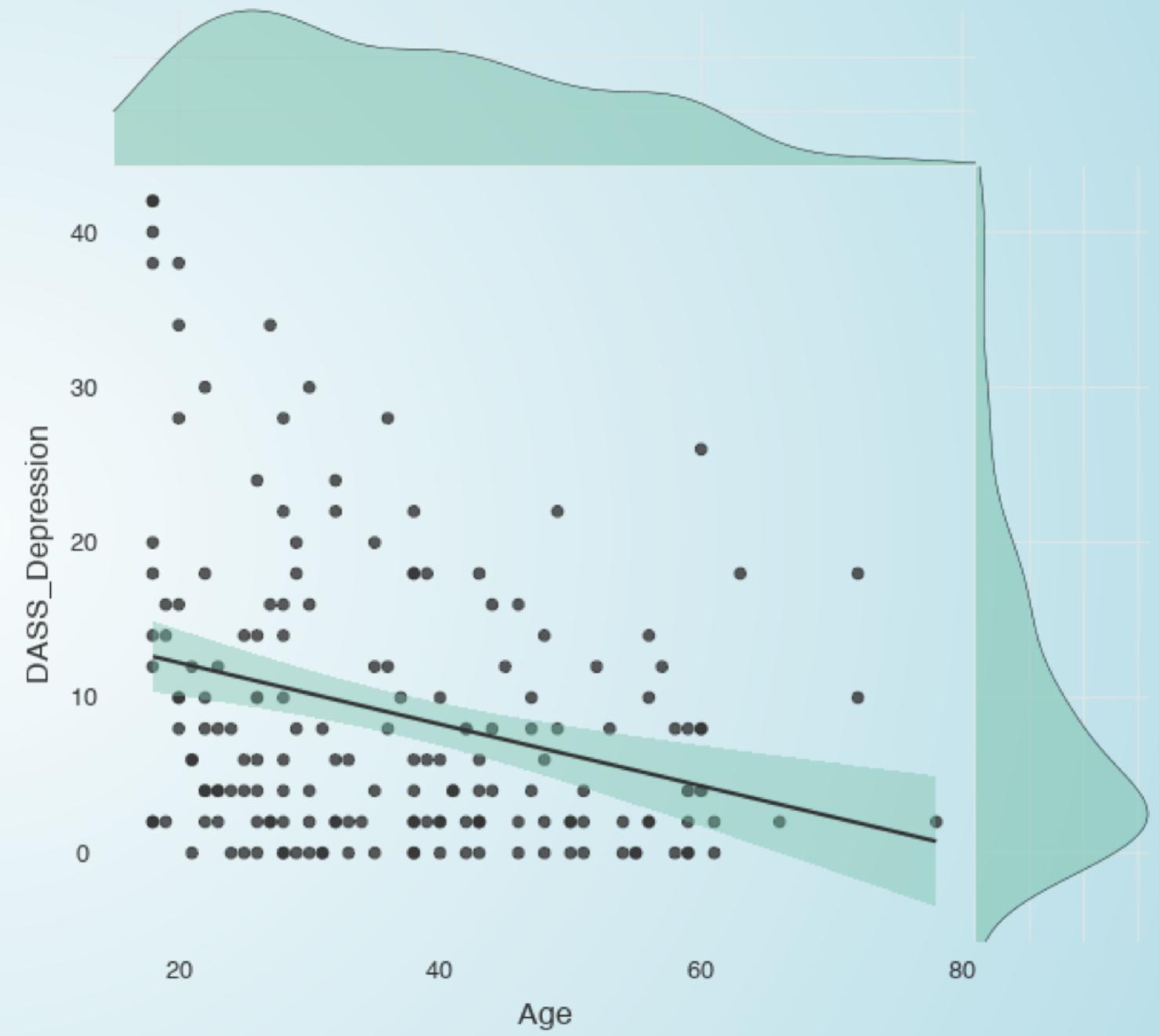


Shady side of pyramid

VISUALISE YOUR DATA!!



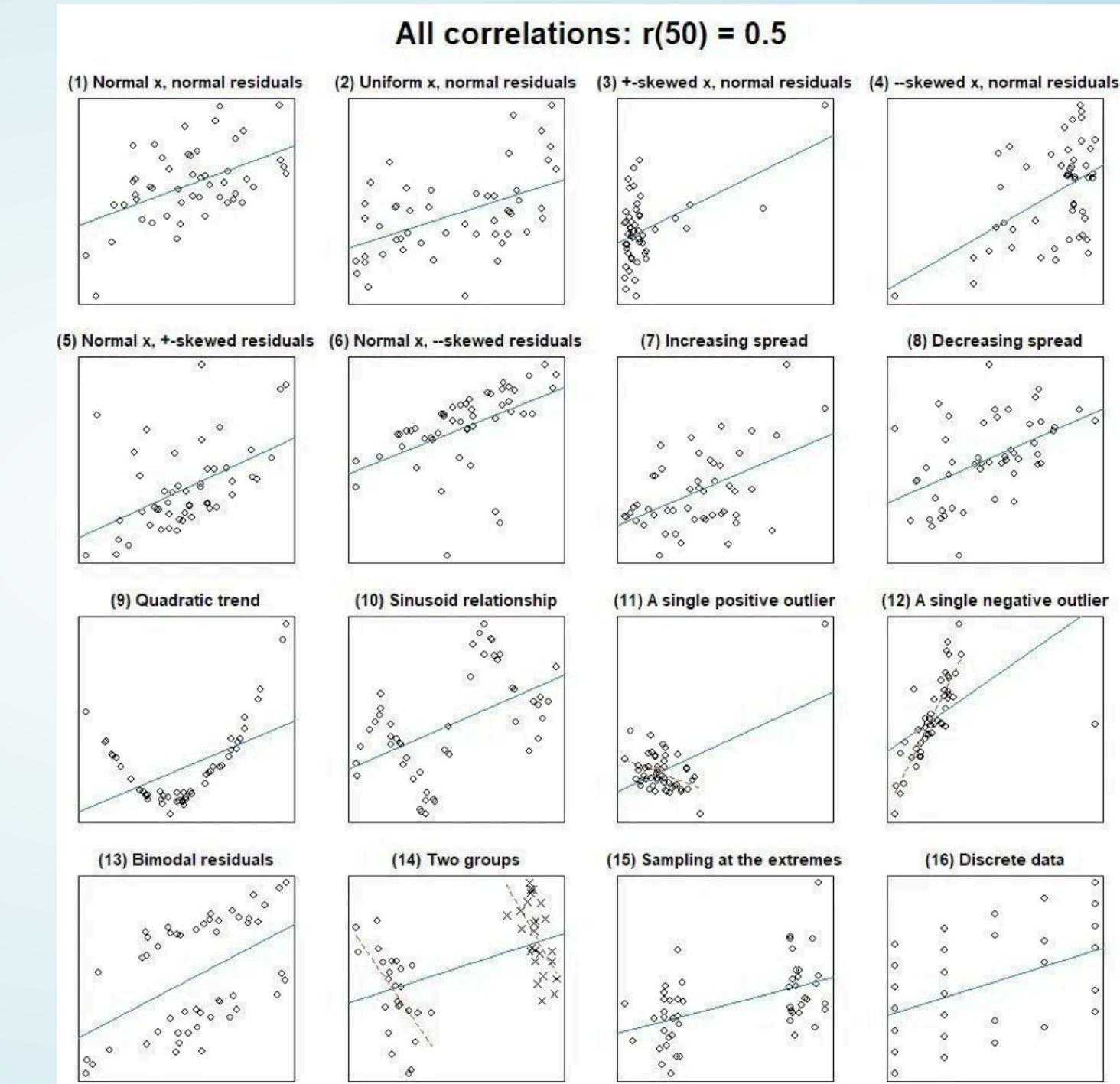
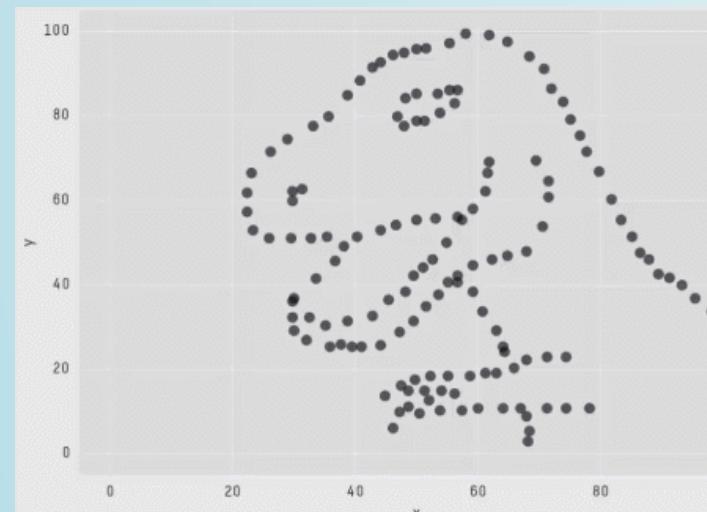
Histograms



Scatterplots

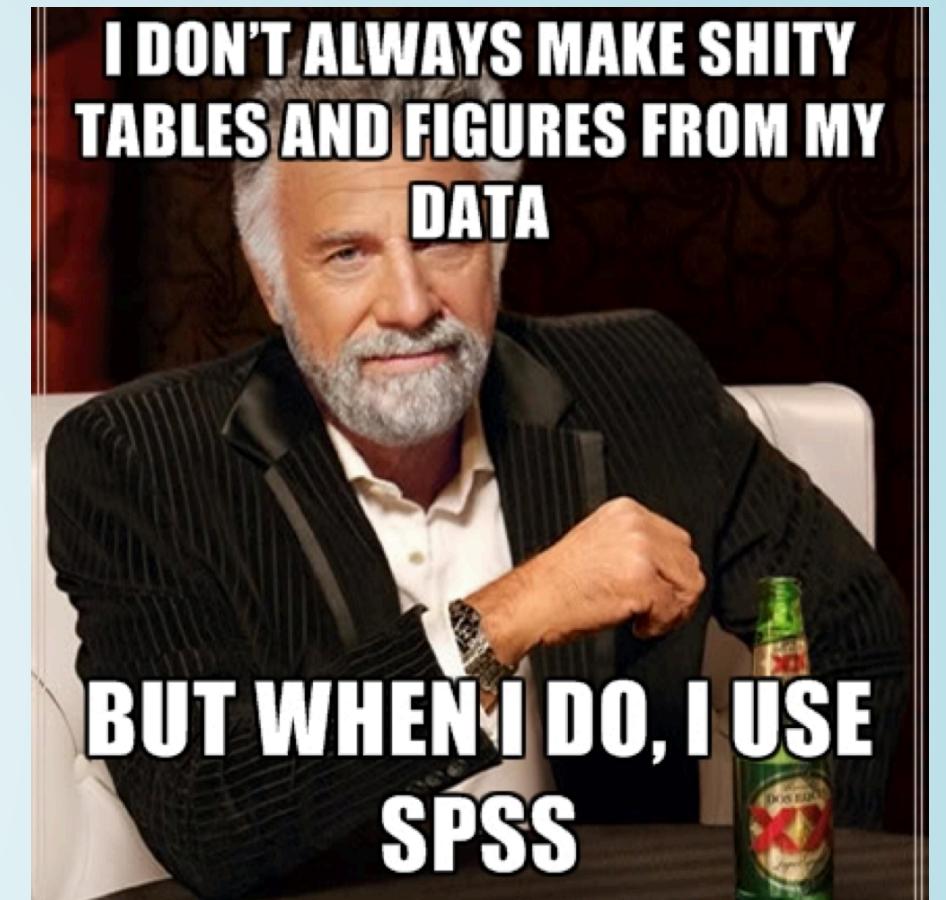
CORRELATIONS - A CAUTIONARY TALE

- All these correlations are $r(50) = .5$
- Code available here
- **Visualise your data!**
- See also: the DataSaurus Dozen

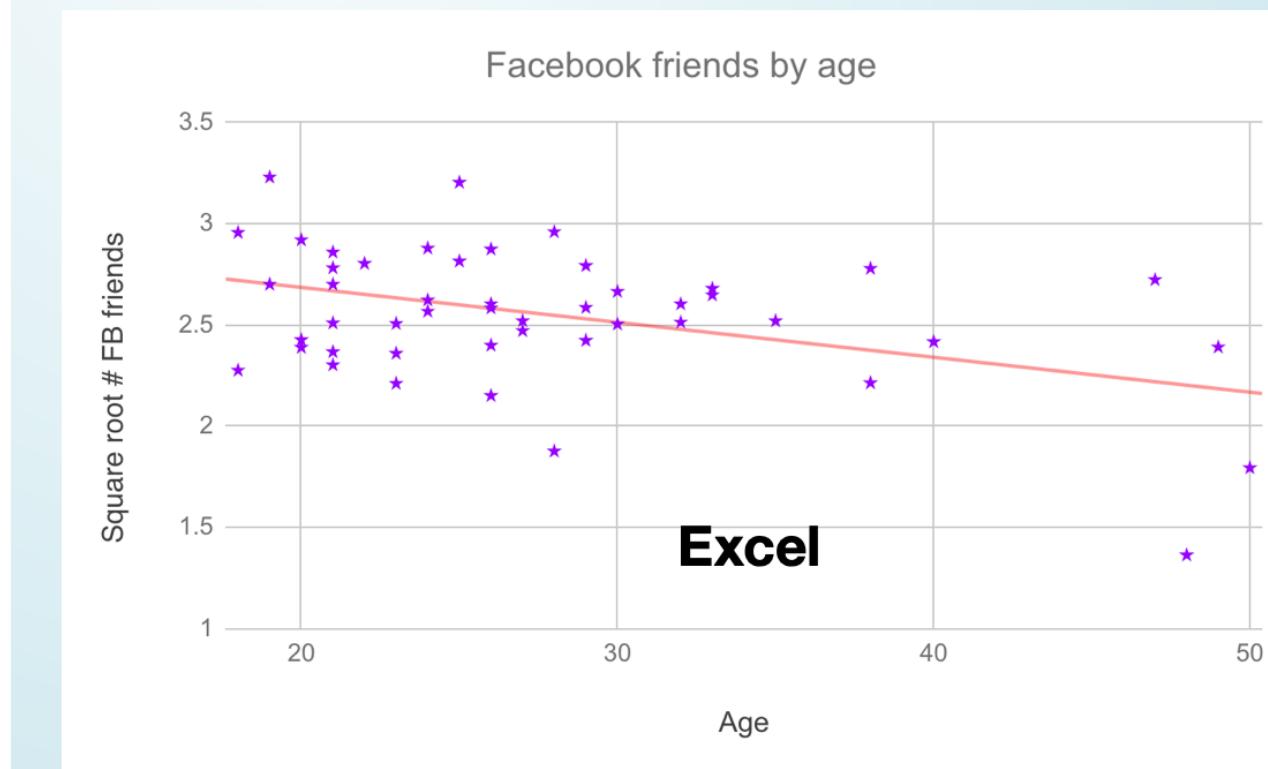
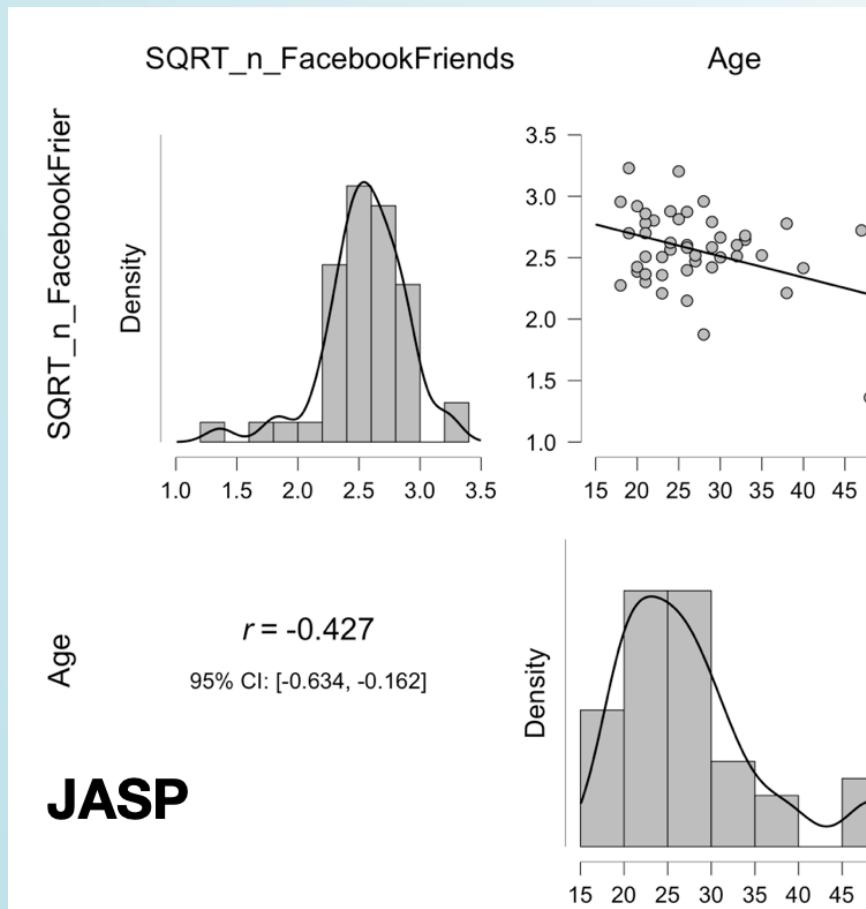
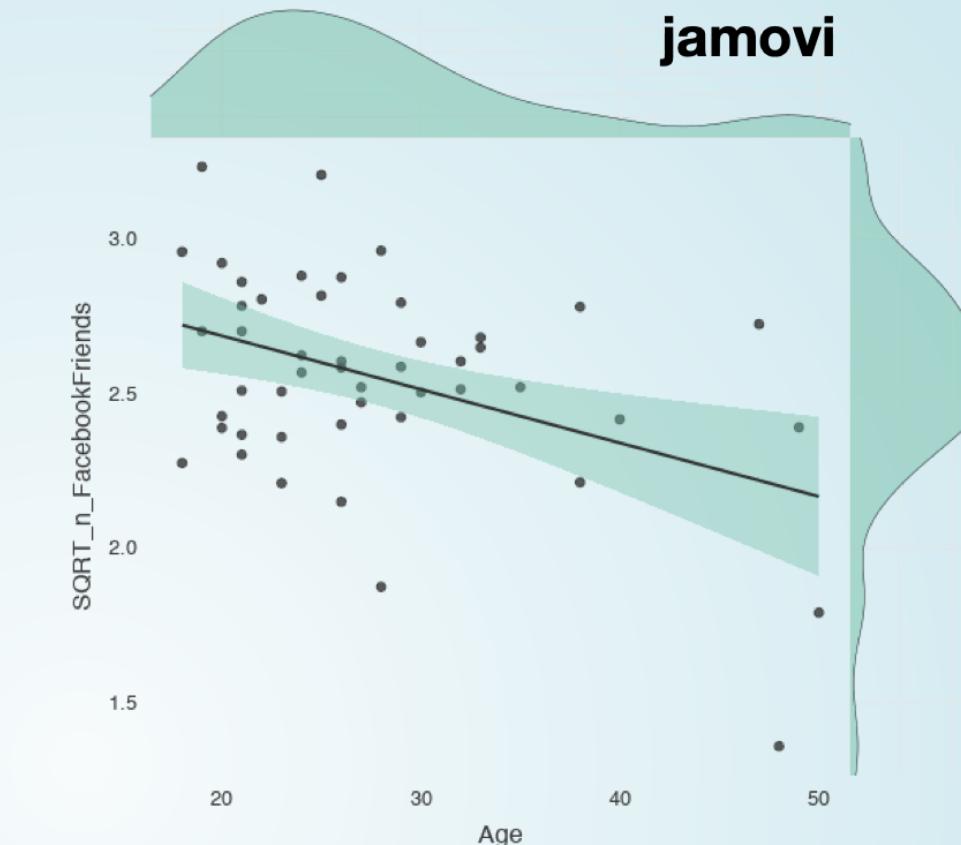
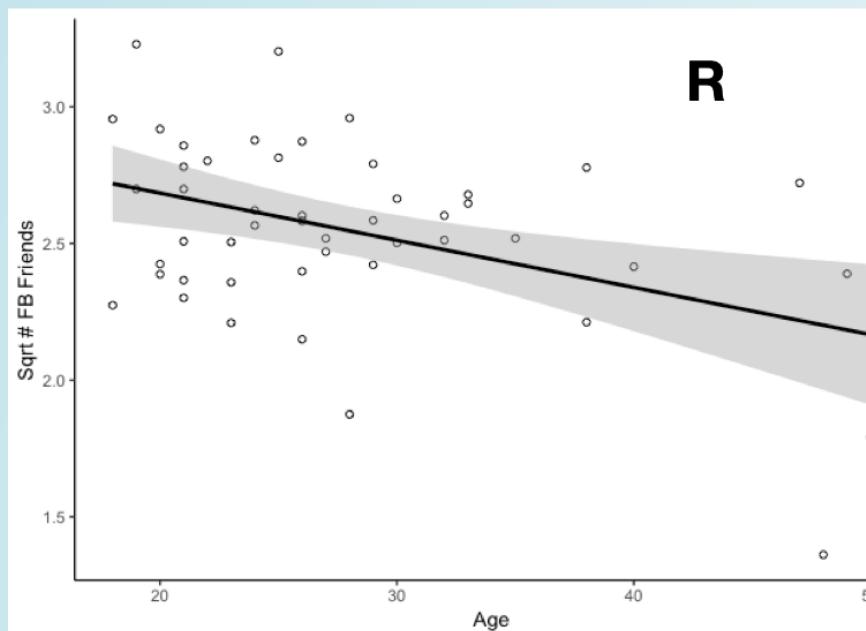


REPORTING RESULTS

- Try to report as much detail as possible (means/mean difference, SD, test stat, df, p-value, effect size and 95% confidence interval)
- APA format!!! Make sure you do it right!
- Tables are good for stats (but format them properly!)
- You can make SPSS produce APA style tables!!
- Good graphs can make all the difference in your thesis (but DON'T cut & paste straight from SPSS)

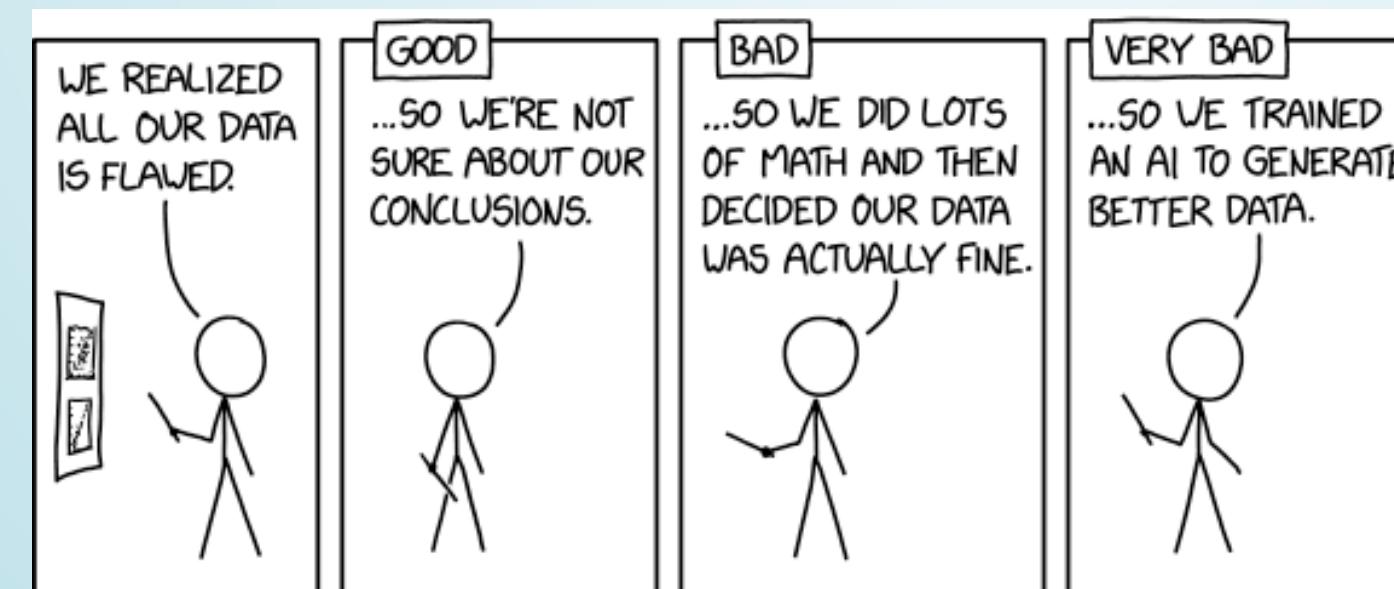


MAKE NICE GRAPHS!



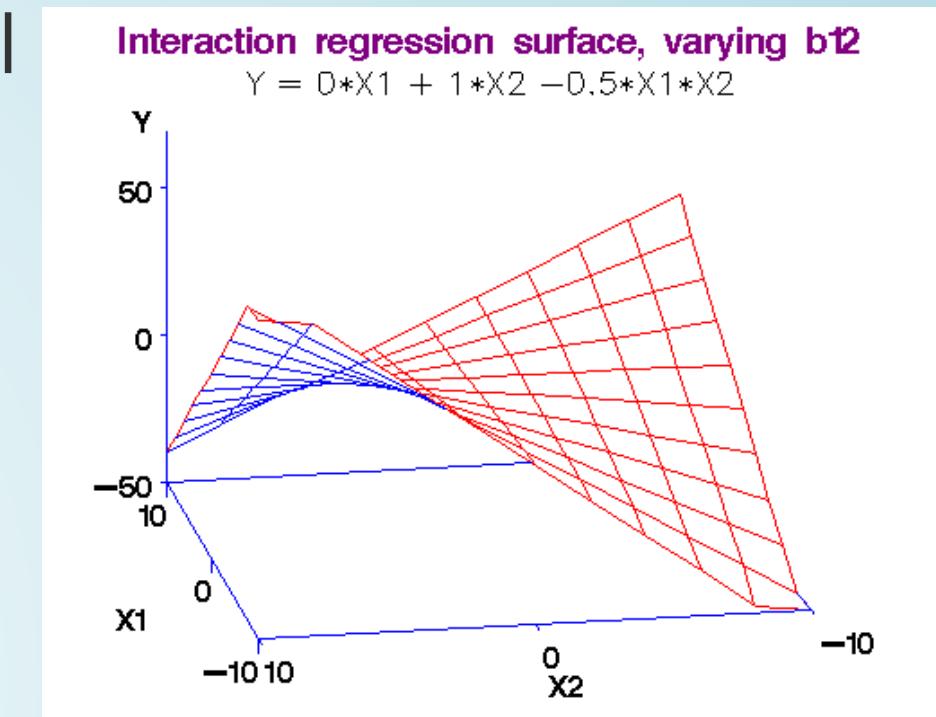
WHAT TO DO WHEN ASSUMPTIONS AREN'T MET

- Non-parametric tests (Mann-Whitney U, Spearman's Rank Correlations, Friedman ANOVA)
- Transform data? (log, square root, inverse - ONLY for interval/ratio variables)
- Poisson regression, ordinal logistic regression, negative binomial regression (all available in SPSS under the Generalized Linear Model menu, or in jamovi's GAMLj3 add-on)
- Bootstrapping is another possibility - available in SPSS and ALSO now in jamovi!



SURPRISING/CONTROVERSIAL THINGS

- Dichotomising or grouping variables can reduce statistical power considerably (e.g. low/med/high instead of summed scores)
- Using metric models (e.g. ANOVA, regression) for ordinal data (e.g. Likert scales) can seriously distort your results (see [this article](#) - blog post digest [here](#)).
- Moderation is mathematically exactly the same thing as interaction in regression
- Mediation using correlational designs has been heavily criticised (see [here](#), for instance).



LEARNING RESOURCES

- Fantastic [FREE book](#) about learning statistics with jamovi
- Online [FREE course](#) with video tutorials (datalab)
- [Rosetta](#) (covers many analyses in jamovi, R and SPSS)
- For SPSS - YouTube is great!
- [Statistics of DOOM](#) YouTube Channel (thanks Bernie!)
- For R - R Ladies Sydney's course [R You With Me](#) is really great for beginners
- If you want to go further with R, [PsycTeachR](#) from the University of Glasgow has a fantastic array of resources

QUESTIONS?

