Conducting a Registered Report (as an Early Career Researcher)

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Our registered report…

Hobson, H. & Bishop, D. (2016). Mu suppression – a good measure of the human mirror neuron system? *Cortex*. *82:* 290-310

Preregistration / Registered Reports (RR)

(The exact publication procedure might vary from journal to journal but essentially…)

- **Preregistration is where scientific articles are reviewed and accepted before data collection**.
- The introduction, aims, hypotheses, detailed methods section, analysis plan and power analyses are reviewed.

Why do an RR?

- **Combats publication bias** – studies are published on the basis of their merit rather than significant findings.
- **Combats p-hacking/HARKing** – researchers must stick to their original hypotheses and analyses.

Registered Reports are a controversial topic…

Peer review and scientific publishing

Trust in science would be improved by study pre-registration

Open letter: We must encourage scientific journals to accept studies before the results are in

Chris Chambers, Marcus Munafo and more than 80 signatories

Wednesday 5 June 2013 12.45 BST

Pre-registration would put science in chains

The pre-registration of study designs must be resisted, says Sophie Scott

July 25, 2013

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The position of the ECR…

- Need for early publications
- Short contracts/time limitations on studies
- May not be in control of own research budget
- (Ideological?)

Do the potential positives of an RR outweigh the risks/draw backs?

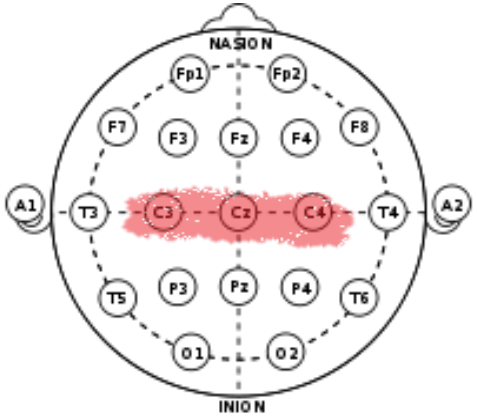
Today's Talk

- Context – how did I end doing a RR?
- The process
  - Stage 1 Submission
  - Data collection
  - Stage 2 Submission
- The positives
- The challenges
- Q&A

How did it all happen?

- Researching imitation and language in developmental disorders
- Intrigued to try out neuroimaging procedure already written about in autism – *mu suppression*
- Mu suppression had been argued to reflect activity of the human mirror neuron system (MNS), linked to imitation and autism.

Rizzolatti, Fogassi, Gallese (2001)



Mu suppression – a good measure of the MNS…?

- Mu suppression was already being used as an individual differences measure of MNS quality
- Investigated as a target for neurofeedback intervention in ASD
- But is it reliable, and is it valid?
- Possibility that mu suppression is confounded by changes in other EEG frequency bands, especially alpha (linked to attention and vigilance).

Our Registered Report with *Cortex*

- Originally, we proposed to examine one methodological factor in particular, namely choice of baseline condition, and examine mu suppression to goal- versus non-goal-directed actions.
- Editors were quick to point out that if we found mu suppression was not valid measure, then the second part of our proposed study would make no sense…
- Decision was made to make the paper a pure thorough look at baseline choice, with a number of positive control conditions. This would be the largest mu suppression study ever done.

Stage 1 Submission

- At this stage, the manuscript consisted of our introduction, aims, hypotheses, detailed methods sections, analysis plan and power analyses.
- For me, felt a bit like going in blind (What tense was I even supposed to write an RR in?), but I was fortunate to have a supportive supervisor.

Stage 1 Submission

- Two rounds of anonymous reviewer feedback
- Did lead to important changes that made the experiment more robust:
  - Changed our control stimuli
  - Added in EMG recordings
  - Used CSD to make our EEG recordings “reference-free”
  - Attention check task.
- Felt the reviewers were on our side and actively participating in the research process to make the experiment the best it could be.

Data collection

- We needed 61 EEGs to meet power criteria.
- I collected many more than this that ended up being rejected due to: poor EEG quality, unable to get reliable EMG recordings from the arm muscles, failing attention check task. Strict pre-registered criteria for rejection.
- All EEGs and data logs needed to be time stamped. Raw EEGS and scripts uploaded after publication (we used a combo of the Open Science Framework and Harvard Dataverse).

Stage 2 Submission

- 4 weeks after the last EEG was collected I had written up the Stage 2 submission.
- This received one round of reviewer feedback, after which it was accepted. Again, this feedback was very constructive.
- What we found: mu suppression was confounded by alpha, particularly in the baseline conditions that had been used in autism research.
- Reception of our article: no one seemed all the surprised. Indication that there had been a file drawer problem around mu suppression.

The positives

- **Reviewing before data collection made the experiment better -** Paper was definitely made better by being scrutinised by the reviewers before data collection. We did have very constructive reviewers.
- **Hypothesis-driven approach -** Raised the bar for what I expect of my work.
- **Negative findings are okay -** Allows science to be self-correcting, and helps to combat publication bias. Would we have been able to publish this without registering?
- **Guaranteed publication** - As an ECR, we live in fear of negative findings as early publications are critical. Having a registered report meant I could get on with doing my experiment to the best of my ability, knowing my hard work would be rewarded, whatever we found.
- **Speedy write up.**

The challenges

- **Do RRs take longer?** It can take a longer time to get to data collection, but could argue this pays off at the end, when publication is comparatively speedy.
- **Do RRs require more resources?** Power criteria mean that larger samples are needed, which mean projects are more expensive, and more time-consuming. For example, in an fMRI experiment, the cost of scanning a participant is hundreds of pounds. Particularly problematic, unless you budget for doing so in the grant.
- **Not ideal for research on special populations -** Recruitment to meet these power requirements becomes very hard.

The challenges

- **Not appropriate for all questions** – RRs are best suited to projects where there are clear hypotheses based on previous literature. Very exploratory questions are not suitable, or projects where you are trying to develop a protocol/method.
- **Less flexibility…?** – Idea that you are "locked in" to analyses/ methods, which you may discover later are inappropriate. (Arguably this lack of flexibility is also a plus point, because analytical flexibility is a risk factor for poor reproducibility). I would argue this is dealt with by doing appropriate pilot testing. You can report clearly labelled exploratory analyses.

How are RRs perceived by the science community?

Broadly, the RR I did has been great for my career, but that's not to say I didn't sense some reservations from others in my field…

- *"Could ECRs "bulk out" their CV with unfinished RRs?"*
- *"Couldn't you still p-hack an RR?"*
- *"Where's the evidence that RRs are better?"*

Pre-registering reports is not a silver bullet to the problem of reproducibility. It is one approach, suited to certain experimental questions.

Should I do an RR as an ECR?

Overall, my experience has been very positive, and I would recommend RR to other ECRs. Providing you have the following…

- A question that can be formulated into clear, testable hypotheses;
- Sufficient time and budget to conduct your RR;
- Ideally – a supervisor or mentor who is supportive!

Useful resources…

- Academy of Medical Science report. Section on pre-registration includes input from both Chris Chambers and Sophie Scott.

Thank you for listening!

Any questions?

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Psychology/ Neuroscience Journals offering Registered Reports:

- AIMS Neuroscience
- Attention, Perception, and Psychophysics
- Cognition and Emotion
- Cognitive Research: Principles and Implications
- Comprehensive Results in Social Psychology
- Cortex
- Drug and Alcohol Dependence
- European Journal of Neuroscience
- Experimental Psychology
- Human Movement Science
- International Journal of Psychophysiology
- Journal of Accounting Research
- Journal of Business and Psychology
- Journal of European Psychology Students
- Journal of Media Psychology
- Journal of Personnel Psychology
- Nicotine & Tobacco Research
- Nutrition and Food Science Journal
- Perspectives on Psychological Science
- Royal Society Open Science
- Social Psychology
- Stress and Health
- Working, Aging and Retirement