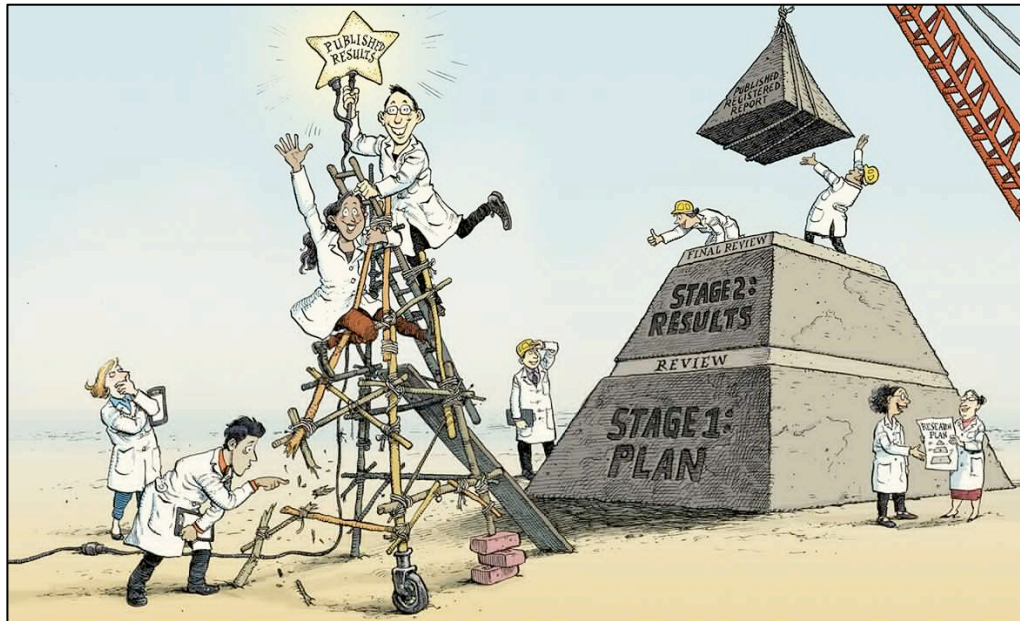


# Registered Reports

Hypothesis-testing as it was originally intended?



Chris Chambers

Cardiff University Brain Research Imaging Centre (CUBRIC)

School of Psychology, Cardiff University

Email: [chambersc1@cardiff.ac.uk](mailto:chambersc1@cardiff.ac.uk)

Twitter: [@chrisdc77](https://twitter.com/chrisdc77)

These slides: <https://osf.io/h5du2/>

# A paradox

Which part of a research study do you believe should be beyond your control as a scientist?

## The results

Which part of a research study do you believe is most important for advancing your career?

## The results

**Don't touch THIS**

Which part of a research study do you believe should be beyond your control as a scientist?



**The results**

**But make sure THIS is amazing**

Which part of a research study do you believe is most important for advancing your career?



**The results**

# What happens when we put researchers under pressure to get “great results”?

~92% positive  
Fanelli (2010)

Publication bias  
Lack of data sharing

Publish or conduct  
next experiment

Generate and specify  
hypotheses

Lack of  
replication

1 in 1000 papers  
Makel et al (2012)

~70% failure  
Wicherts et al (2006)

Interpret  
data

Changing the hypothesis

~50-90% prevalence  
John et al (2012)  
Kerr (1998)

Design study

Low statistical power

~50% chance to detect  
medium effects  
Cohen (1962); Sedlmeier and  
Gigerenzer (1989); Bezeau  
and Graves (2001)

Selective reporting

~50-100% prevalence  
John et al (2012)

Selective reporting

Analyse data &  
test hypotheses

Collect data

Solution: make results a  
**dead currency** in quality evaluation

# Registered Reports

CORTEX 49 (2013) 609–610



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**SciVerse ScienceDirect**

Journal homepage: [www.elsevier.com/locate/cortex](http://www.elsevier.com/locate/cortex)



---

## Editorial

### **Registered Reports: A new publishing initiative at Cortex**

*Christopher D. Chambers*

*Cardiff University Brain Research Imaging Centre (CUBRIC), School of Psychology, Cardiff University, United Kingdom*

---

## **Four central aspects of the Registered Reports model:**

- Researchers decide hypotheses, study procedures, and main analyses *before* data collection
- Part of the peer review process takes place before studies are conducted
- Passing this stage of review virtually guarantees publication
- Original studies and high-value replications are welcome

# How it works

Authors submit **STAGE 1** manuscript with Introduction, Proposed Methods & Analyses, and Pilot Data (if applicable)



Stage 1 peer review

*Reviewers assess importance of research question and rigour of the methodology according to specific criteria*



If reviews are positive then journal offers **in-principle acceptance (IPA)**, regardless of study outcome  
*(protocol archived)*

# How it works

Authors do the research



- Authors resubmit completed **STAGE 2** manuscript:
- **Introduction** and **Methods** (virtually unchanged)
  - **Results (new)**: Registered confirmatory analyses + unregistered exploratory analyses
  - **Discussion (new)**
  - **Data and materials deposited in a public archive**



Stage 2 peer review



Manuscript published!

*Reviewers assess compliance with study protocol, whether pre-specified quality checks were passed, and whether conclusions are evidence-based*



# None of these things matter

A red circle with a diagonal slash through it, indicating prohibition or negation.

**WHETHER  
HYPOTHESIS  
SUPPORTED**

A red circle with a diagonal slash through it, indicating prohibition or negation.

**WHETHER  
 $p < .05$**

A red circle with a diagonal slash through it, indicating prohibition or negation.

**WHETHER  
RESULTS  
ARE NOVEL**

A red circle with a diagonal slash through it, indicating prohibition or negation.

**WHETHER  
RESULTS  
HAVE  
"IMPACT"**

# Main advantages of Registered Reports

## For the scientific community

- Rigorous review of theory and methods
- Eliminates publication bias and reporting bias

## For scientists

- Peer review when it is most helpful
- Publication guaranteed regardless of the results

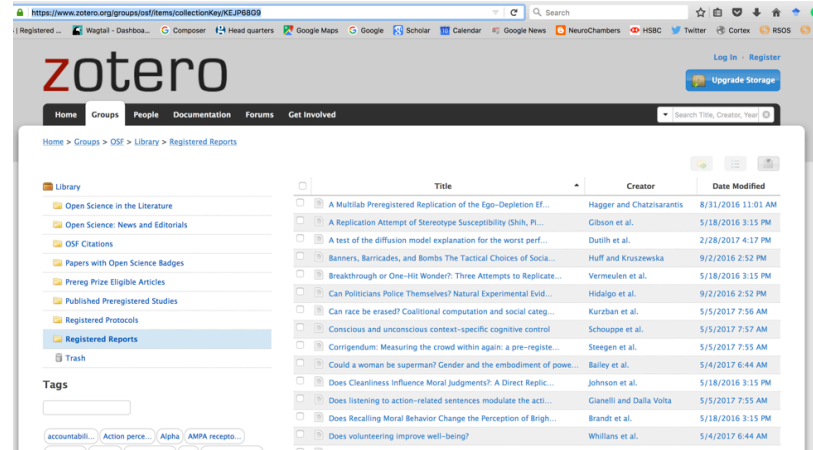
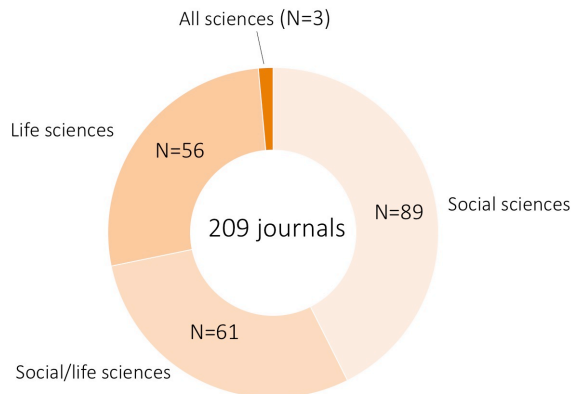
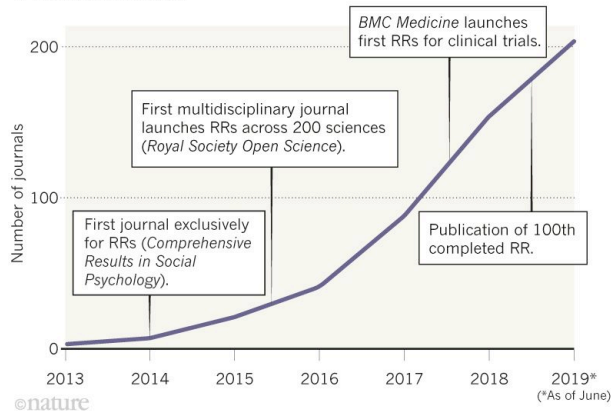
**Six years later...**

# Registered Reports are now mainstream

- **215** journals have adopted them so far
- Fields covered
  - **Life/medical sciences:** neuroscience, nutrition, psychology, psychiatry, biology, botany, cancer research, ecology, endocrinology, clinical medicine, preclinical science, veterinary science, agricultural & soil sciences
  - **Social sciences:** education, political science, economics, finance and accounting research
  - **Physical sciences:** chemistry, physics, computer science

## RAPID RISE

Since 2013, the number of journals offering Registered Reports (RRs) has risen to more than 200 titles.



<https://www.zotero.org/groups/osf/items/collectionKey/KEJP68G9>

~300 fully completed RRs have been published so far

# Registered Reports at *Royal Society Open Science*

Now available in all STEM areas, from physics to psychology



## ROYAL SOCIETY OPEN SCIENCE



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## Registered Reports

1. [Summary and benefits](#)
2. [Stage one](#)
3. [Stage two](#)
4. [Reviewer guidelines](#)
5. [More information](#)

### Summary and Benefits

A Registered Report (RR) is a form of journal article in which methods and proposed analyses are pre-registered and peer-reviewed prior to research being conducted (stage 1). High quality protocols are then provisionally accepted for publication before data collection commences. The format is open to attempts of replication as well as novel studies. Once the study is completed, the author will finish the article

### May 2016

#### Alert me to new content

A fast, open journal publishing high quality research across all of science, engineering and mathematics

[Find out more](#)

### BROWSE BY SUBJECT

<a href="#">acoustics</a>	<a href="#">algebra</a>
<a href="#">algorithmic information theory</a>	<a href="#">analysis</a>
<a href="#">analytical chemistry</a>	<a href="#">applied mathematics</a>
<a href="#">artificial intelligence</a>	<a href="#">astrobiology</a>

# Registered Reports at *Nature Human Behaviour*

nature  
human behaviour

Search E-alert Submit Login

May issue  
Our May issue is now available to read.

Announcement  
[Join our editorial team](#)  
We are looking for an Associate or Senior Editor with a background in psychology and cognitive neuroscience to join... [show more](#)

Announcement  
[Registered reports](#)  
Have your article accepted in principle before data collection has started by submitting a registered report. With... [show more](#)

Announcement  
[Preregistration Challenge](#)  
Nature Human Behaviour is participating in the Center for Open Science \$1,000,000 Preregistration challenge: 1,000... [show more](#)

Disciplines covered in the journal include:

Anthropology	Evolution
Artificial Intelligence	Genetics
Business Studies	Geography
Cognitive Science	Linguistics
Communication	Management
Criminology	Neurology
Cultural Studies	Neuroscience
Ecology	Political Science
Economics	Psychiatry
Education	Psychology
Epidemiology	Public Policy
Ethology	Sociology

- Sets extremely high bar on **importance** of the proposed research question and **rigour and robustness** of proposed methodology

# Registered Reports at *BMC Medicine*

The screenshot shows the BMC Medicine website. At the top left is the BioMed Central logo. Below it is the text 'BMC Medicine'. A navigation bar contains links for HOME, ABOUT, ARTICLES, and SUBMISSION GUIDELINES. On the left side, there is a sidebar menu with the following items: Aims and scope, Fees and funding, Language editing services, Copyright, Preparing your manuscript (with sub-items Research articles and Software articles). The main content area is titled 'Registered Reports' and has a sub-section 'Overview'. The text in the overview states: 'Registered Reports are intended to strengthen the methodology and the transparency of research papers seeking to answer defined questions. Submission is a two-stage process. In the first, the authors submit a proposed study protocol. If the study protocol passes initial review, *BMC Medicine* will post it in the Registered Reports section of its website and make a commitment to publish the results,'

- **The first Registered Reports model for clinical trials**
  - Prevents hidden outcome switching (AKA outcome reporting bias; see <http://www.compare-trials.org/>)
  - Eliminates publication bias and ensures all trials are published regardless of outcome
  - Should all clinical trials be published as Registered Reports?

# Registered Reports appear to be working as intended

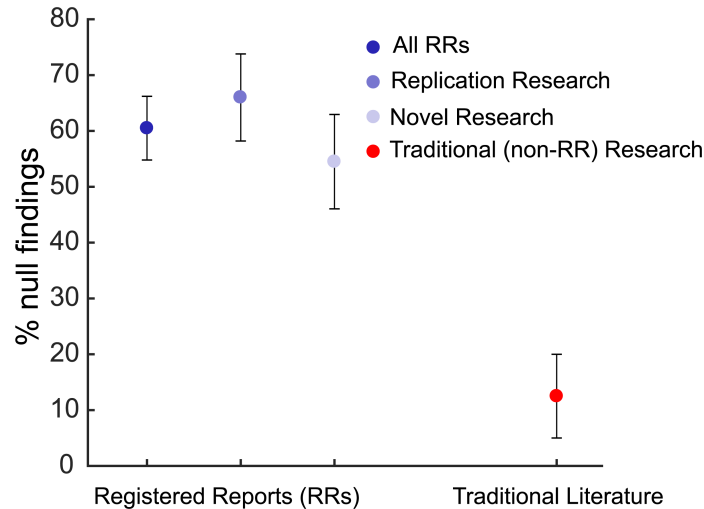
NEWS · 24 OCTOBER 2018

## First analysis of 'pre-registered' studies shows sharp rise in null findings

Logging hypotheses and protocols before performing research seems to work as intended: to reduce publication bias for positive results.

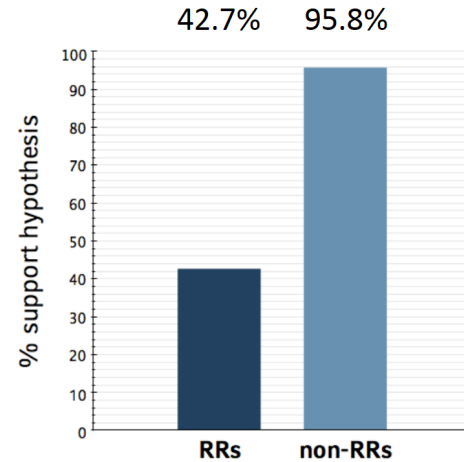
Matthew Warren

### Percentage of null findings



Hypotheses are ~5 times more likely to be **unsupported** in Registered Reports compared with regular articles

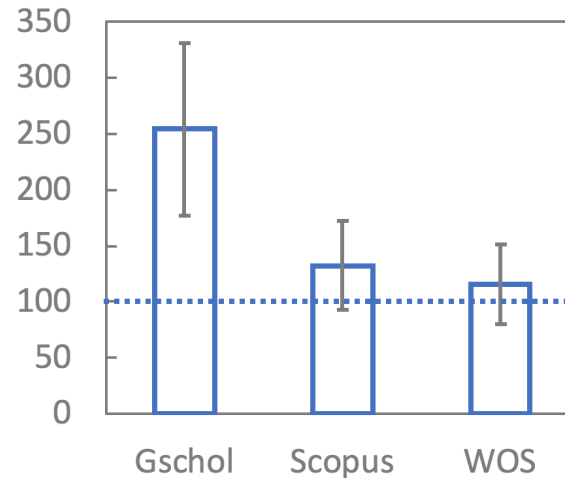
Allen C, Mehler DMA (2019) Open science challenges, benefits and tips in early career and beyond. PLoS Biol 17(5): e3000246. <https://doi.org/10.1371/journal.pbio.3000246>



Same observation in RRs within psychology specifically

Schijen, Scheel & Lakens (2019)

### % citations relative to JIF



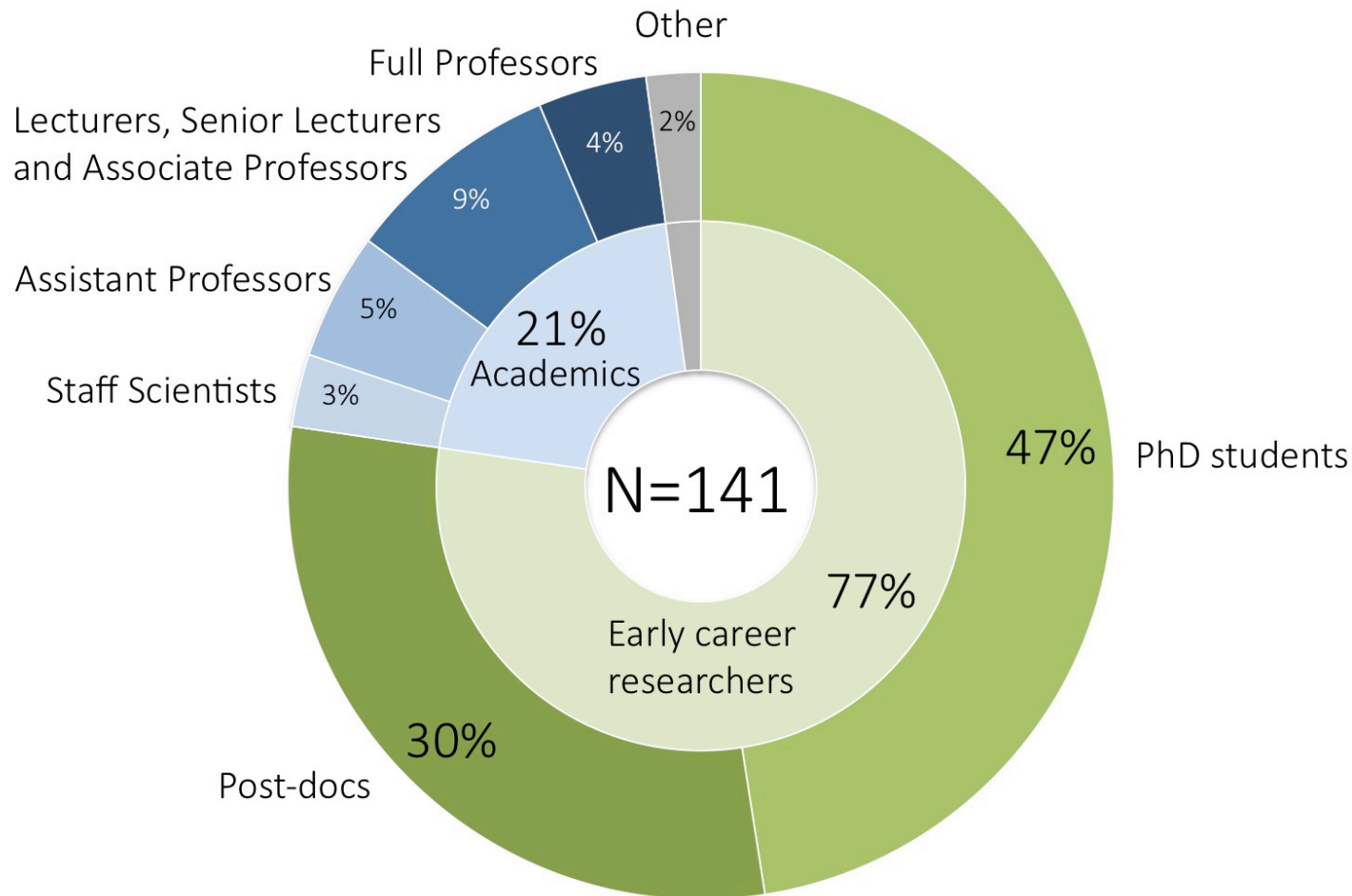
Well cited -- at or above respective journal impact factor

<https://tinyurl.com/RR-citations>

And see Hummer, L. T., Singleton Thorn, F., Nosek, B. A. & Errington, T. M. Preprint: <https://doi.org/10.31219/osf.io/5y8w7>

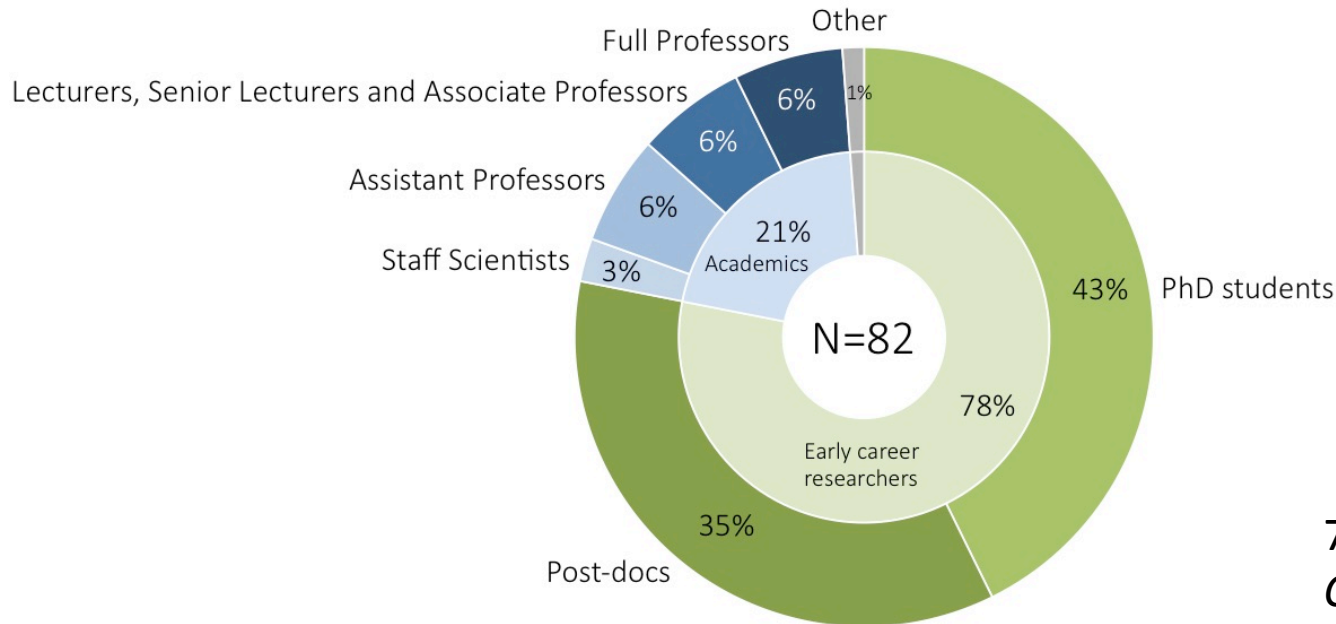


# Who is submitting Registered Reports?



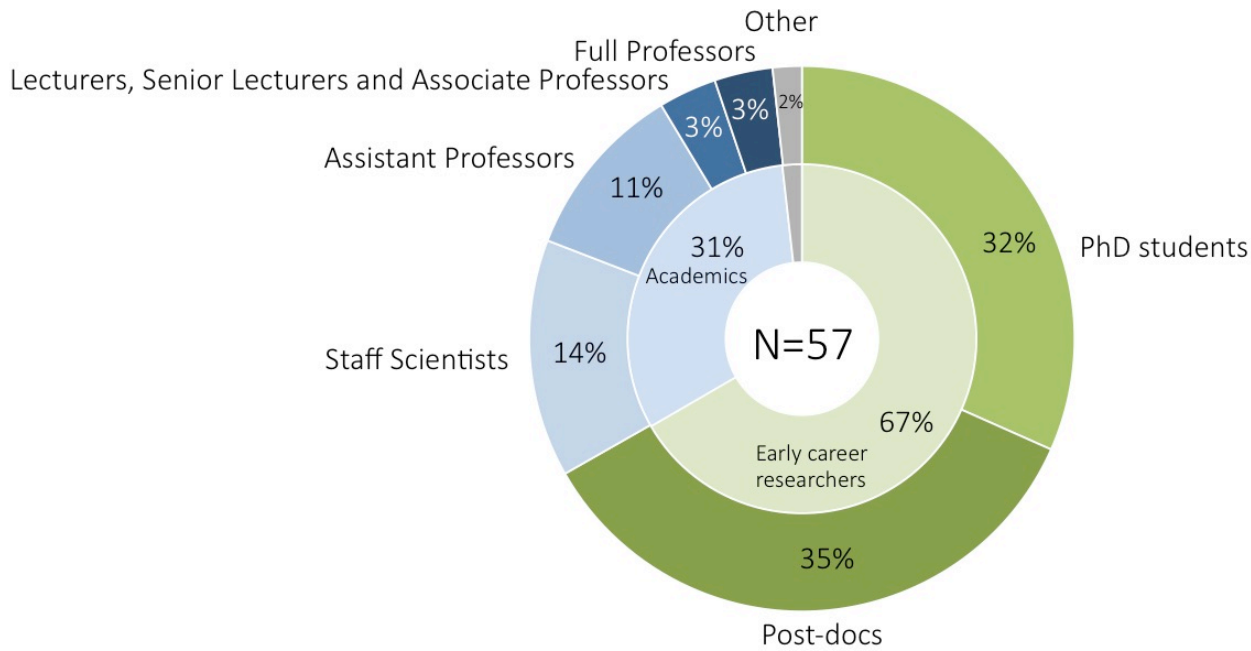
Of 141 Registered Reports submitted so far to *Cortex*, *European Journal of Neuroscience*, *NeuroImage* and *Royal Society Open Science*, 77% were first-authored by early career researchers

## REGISTERED REPORTS



78% of submitted RRs at *Cortex* are 1<sup>st</sup>-authored by ECRs vs. 67% of comparable regular articles

## REGULAR ARTICLES



# Curated list

<https://cos.io/rr/>

Registered Reports: Peer review before results are known to align scientific values and practices.

Registered Reports

Participating Journals

Details & Workflow

Resources for Editors

For Funders

FAQ

Allied Initiatives

Currently, **209** journals use the Registered Reports publishing format either as a **regular submission option** or as part of a single **special issue**. Other journals offer **some features** of the format. This list will be updated regularly as new journals join the initiative.

For an article type to qualify as a registered report, the journal policy must include at least these features:

- Peer review occurs prior to observing the outcomes of the research.
- Manuscripts that survive pre-study peer review receive an in-principle acceptance that will not be revoked based on the outcomes, but only on failings of quality assurance, following through on the registered protocol, or unresolvable problems in reporting clarity or style.

See also [this table](#) that compares the specific features of Registered Reports at different outlets or a summary of each journal [here](#).

If you are considering a Registered Reports submission but not sure how to get started, a good way to begin is to **(a)** read the specific author guidelines included in the list of participating journals below, **(b)** complete [this template protocol](#) and then **(c)** expand the template protocol into a full Stage 1 manuscript.

Journals that have adopted Registered Reports

Special Issues

Some Features

Journal	Notes
<a href="#">AAS Open Research</a>	<a href="#">Author Guidelines</a>
<a href="#">Academia Journal of Stroke</a>	Details to follow

# Policy features tables

<https://tinyurl.com/RR-policyfeatures>

Comparison of Registered Reports ☆ 🗑️

File Edit View Insert Format Data Tools Add-ons Help Last edit was on 12 December 2017

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		<a href="#">Return to the Registered Reports page at the COS</a>															
2	Journal	1. Includes pre-study peer review	2. Offers provisional pre-study acceptance	3. Permanence of adoption	4. Offered for novel studies	5. Offered for replication studies	6. Offered for meta-analysis	7. Offered for analyses of existing data sets	8. Publishes Registered Reports only	9. Allows reporting of unregistered analyses	10. Includes post-study peer review	11. Allows inclusion of unregistered pilot studies	12. Requires public data deposition	13. Specifies structured criteria for editorial decisions	14. Requires submitted protocols to have prior ethical approval	15. Specifies minimum statistical power requirements	16. Other
3	<b>JOURNALS OFFERING REGISTERED REPORTS</b>																
4	Advances in Methodologies and Practices in Psychological Science	✓	✓	Indefinite	✓	✓	✓	✓		✓	✓	✓		✓			
5	AERA Open	✓	✓	Special issue	✓	✓	✓	✓		✓	✓	✓					
6	AIMS Neuroscience	✓	✓	Indefinite	✓	✓				✓	✓	✓	✓	✓	✓	✓	
7	American Journal of Political Science	✓	✓	<a href="#">Special issue: 2016 ANES Preacceptance Initiative</a>	✓			✓		✓	✓						
8	American Political Science Review	✓	✓	<a href="#">Special issue: 2016 ANES Preacceptance Initiative</a>	✓			✓		✓	✓						
9	American Politics Research	✓	✓	<a href="#">Special issue: 2016 ANES Preacceptance Initiative</a>	✓			✓		✓	✓						
10	Animal Behavior and Cognition	✓	✓	Indefinite	✓	✓	✓	✓		✓	(discretionary)			✓			
11	Attention, Perception & Psychophysics	✓	✓	Indefinite	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓
12	Behavioral Neuroscience	✓	✓	Indefinite	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓
13	BMC Biology	✓	✓	Indefinite	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓
14	BMC Ecology	✓	✓	Indefinite	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓
15	BMC Medicine	✓	✓	Indefinite	✓	✓	✓	✓		✓	✓	✓		✓	✓*but negotiable for trials	✓	✓
16	BMJ Open Science	✓	✓	Indefinite	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
17	Campbell Systematic Reviews	✓	✓	Indefinite			✓	✓	✓		✓	✓		✓			
18	Canadian Journal of School Psychology	✓	✓	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA	TBA
19	Cochrane Reviews	✓	✓	Indefinite			✓	✓	✓		✓	✓		✓			

# Curated list

<https://cos.io/rr/>

Registered Reports: Peer review before results are known to align scientific values and practices.

Registered Reports

Participating Journals

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Journals that have adopted Registered Reports

Special Issues

Some Features

Journal	Notes
<a href="#">AAS Open Research</a>	<a href="#">Author Guidelines</a>
<a href="#">Academia Journal of Stroke</a>	Details to follow

# FAQS

<https://cos.io/rr/>

Registered Reports

Participating Journals

Details & Workflow

Resources for Editors

For Funders

FAQ

Allied Initiatives

## Frequently Asked Questions

### Novelty of Format

How do Registered Reports differ from clinical trial registration?

Why are Registered Reports needed for grant-funded research? Isn't the process of grant assessment in itself a form of pre-registration?

### Philosophy of Science

The Registered Reports model is based on a naïve conceptualisation of the scientific method.

Registered Reports may not apply to my specific field therefore it is not a useful solution.

### Design and Analysis

Where authors are unable to predict the likely effect size for an experiment, how can they report a power analysis as part of a Stage 1 submission?

Setting a requirement of 90% for statistical power is unrealistic for expensive methods and would require impossibly large sample sizes. The Registered Reports format therefore disadvantages researchers who work with expensive techniques or who have limited resources.

Some of my analyses will depend on the results, so how can I pre-register each step in detail?

My aim is to publish a series of experiments but the design of the later experiments is contingent upon the outcomes of the earlier ones. Isn't Registered Reports limited to single experiments?

### Timescale

**What happens next?**

**Five advances in development for  
the future of Registered Reports**

# 1. Registered Reports Funding Models

- Authors submit their research proposal **before** they have funding
- Following review by the both the **funder and the journal**, proposals are offered financial support by the funder AND in-principle acceptance for publication by the journal





# 1. Registered Reports Funding Models

## Journals/publishers

*Nicotine and Tobacco Research*

*PLOS Biology*

*PLOS ONE*

*Royal Society Open Science*

*BMC, including BMC Medicine*

*Collabra: Psychology*

## Funders

Cancer Research UK

Pfizer

Children's Tumor Foundation

CHDI

DARPA



**Volume 19, Issue 7**  
1 July 2017

**Article Contents**

References

## Improving the Efficiency of Grant and Journal Peer Review: Registered Reports Funding <sup>FREE</sup>

Marcus R. Munafò, PhD

Nicotine Tob Res (2017) 19 (7): 773. DOI: <https://doi.org/10.1093/ntr/ntx081>

Published: 06 April 2017

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Peer review—the process whereby scientific research is evaluated by independent experts within the field—remains a cornerstone of scientific research, and acts as a critical gatekeeper in relation to both grant funding



<https://doi.org/10.1093/ntr/ntx081>

# 2. Variants of Registered Reports: *Accountable Replications*



Reproducibility meets accountability: introducing the replications initiative at Royal Society Open Science

15 October 2018 by [Chris Chambers](#)

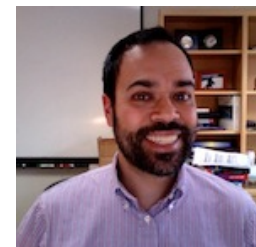
*Today marks the launch of a new initiative in which the Psychology and Cognitive Neuroscience section of [Royal Society Open Science](#) guarantees to publish any close replication of any article published in our journal, and from most other major journals too.*

Replication – it's the quiet achiever of science, making sure previous findings stand the test of time. If the scientific process were a steam ship, innovation would be sipping cognac in the captain's chair while replication is down in the furnaces shoveling coal and maintaining the turbines. Innovation gets all the glory but without replication the ship is going nowhere.

In the social and life sciences, especially, replication is terminally neglected. [A retrospective analysis of over a hundred years of published articles in psychology](#) estimated that



Concept created by  
Sanjay Srivastava



## Principle:

- When a journal publishes an empirical study it assumes accountability for the replicability of that study
- Journal guarantees to publish any methodologically sound replication of any study previously published in the journal

- *At Royal Society Open Science* we guarantee to publish any methodologically sound replication of any study published in RSOS or one of dozens of other major journals
- All submissions reviewed **results-blind** – with either results redacted or before results exist

Introductory blogpost:



<https://blogs.royalsociety.org/publishing/reproducibility-meets-accountability/>

Full journal policy <http://rsos.royalsocietypublishing.org/page/replication-studies>

## 2. Variants of Registered Reports: *Accountable Replications*

ROYAL SOCIETY  
OPEN SCIENCE

royalsocietypublishing.org/journal/rsos


Replications  

**Cite this article:** Macnamara BN, Maitra M. 2019 The role of deliberate practice in expert performance: revisiting Ericsson, Krampe & Tesch-Römer (1993). *R. Soc. open sci.* **6**: 190327. <http://dx.doi.org/10.1098/rsos.190327>

The role of deliberate practice in expert performance: revisiting Ericsson, Krampe & Tesch-Römer (1993)

Brooke N. Macnamara and Megha Maitra

Department of Psychological Sciences, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106-7123, USA

 BNM, 0000-0003-1056-4996

ROYAL SOCIETY  
OPEN SCIENCE

royalsocietypublishing.org/journal/rsos

Replications  

**Cite this article:** Rodríguez-Ferreiro J, Barbería I, González-Guerra J, Vadillo MA. 2019 Are we truly special and unique? A replication of Goldenberg *et al.* (2001). *R. Soc. open sci.* **6**: 191114.

Are we truly special and unique? A replication of Goldenberg *et al.* (2001)



Javier Rodríguez-Ferreiro<sup>1,2</sup>, Itxaso Barbería<sup>1</sup>, Jordi González-Guerra<sup>1</sup> and Miguel A. Vadillo<sup>3</sup>

<sup>1</sup>Departament de Cognició, Desenvolupament i Psicologia de l'Educació, and <sup>2</sup>Institut de Neurociències, Universitat de Barcelona, Barcelona, Spain  
<sup>3</sup>Departamento de Psicología Básica, Universidad Autónoma de Madrid, Madrid, Spain

 MAV, 0000-0001-8421-816X

ROYAL SOCIETY  
OPEN SCIENCE

royalsocietypublishing.org/journal/rsos


Replications  

**Cite this article:** Bliss-Moreau E, Baxter MG. 2019 Interest in non-social novel stimuli as a function of age in rhesus monkeys. *R. Soc. open sci.* **6**: 182237.

Interest in non-social novel stimuli as a function of age in rhesus monkeys



Eliza Bliss-Moreau<sup>1</sup> and Mark G. Baxter<sup>2</sup>

<sup>1</sup>Department of Psychology, California National Primate Research Center, University of California, Davis, CA, USA  
<sup>2</sup>Nash Family Department of Neuroscience, Friedman Brain Institute, Mount Sinai School of Medicine, New York, NY, USA

 EB-M, 0000-0002-0740-5612; MGB, 0000-0002-8907-0923

ROYAL SOCIETY  
OPEN SCIENCE

royalsocietypublishing.org/journal/rsos


Replications  

**Cite this article:** McCormick CR, Redden RS, Hurst AJ, Klein RM. 2019 On the selection of endogenous and exogenous signals. *R. Soc. open sci.* **6**: 182237.

On the selection of endogenous and exogenous signals

C. R. McCormick<sup>1</sup>, R. S. Redden<sup>1</sup>, A. J. Hurst<sup>2</sup> and R. M. Klein<sup>1</sup>

<sup>1</sup>Psychology and Neuroscience, Dalhousie University, Halifax, Nova Scotia, Canada  
<sup>2</sup>University of Waterloo, Waterloo, Ontario, Canada

 CRM, 0000-0001-7326-2560

ROYAL SOCIETY  
OPEN SCIENCE

royalsocietypublishing.org/journal/rsos

Replication  

**Cite this article:** Politzer-Ahles S, Pan L. 2019 Skilled musicians are indeed subject to the McGurk effect. *R. Soc. open sci.* **6**: 181575. <http://dx.doi.org/10.1098/rsos.181575>

Skilled musicians are indeed subject to the McGurk effect

Stephen Politzer-Ahles and Lei Pan

Department of Chinese and Bilingual Studies, The Hong Kong Polytechnic University, Hung Hom, Hong Kong

 SP-A, 0000-0002-5474-7930

ROYAL SOCIETY  
OPEN SCIENCE

royalsocietypublishing.org/journal/rsos

Replication  

**Cite this article:** IJzerman H, Denissen JJA. 2019 Social value orientation and attachment: a replication and extension of Van Lange *et al.* (1997). *R. Soc. open sci.* **6**: 181575. <http://dx.doi.org/10.1098/rsos.181575>

Social value orientation and attachment: a replication and extension of Van Lange *et al.* (1997)

Hans IJzerman<sup>1</sup> and Jaap J. A. Denissen<sup>2</sup>

<sup>1</sup>LIP/PC25, Université Grenoble Alpes, Grenoble, France  
<sup>2</sup>Tilburg University, Tilburg, The Netherlands

 HIJ, 0000-0002-0990-2276

# 3. Monitoring implementation and impact



WORK IN PROGRESS



Meta-scientists assemble!

## We need to know:

- How Registered Reports differ from regular articles
- Are they working as hoped?
- How to improve and optimise implementation
- Wider impact on the scientific landscape

# 4. Reinventing the research article itself

17<sup>th</sup> century manuscript



## Registered Reports 1.0

- Written in Word
- Hypotheses are often vague (at least initially)
- Insufficient links between theory, hypotheses, sampling plans, analyses plans, and prospective interpretation

# 4. Reinventing the research article itself

Standardisation of protocols to maximise computational reproducibility



- **Registered Reports 2.0** → article generated from protocol template and checklist
  - Background and theory
  - Rationale and aims
  - Procedures
  - Hypotheses (stated in terms of specific variables)
    - $H_1 \dots H_n \rightarrow$  sampling plan  $\rightarrow$  analysis plan
  - Analysis code verified on simulated data
  - Prospective interpretation (which outcomes will lead to which conclusions?)
  - Results: preregistered
  - Results: exploratory
  - Discussion
    - Synthesis of findings
    - Limitations
    - Implications and Future Directions
    - Conclusion
  - Checklist
  - Data, code, materials (in fully reproducible workspace, e.g. Code Ocean)
- **Standardised article constructed from template**

## Degrees of Freedom in Planning, Running, Analyzing, and Reporting Psychological Studies: A Checklist to Avoid *p*-Hacking

Jelte M. Wicherts\*, Coosje L. S. Veldkamp, Hilde E. M. Augusteijn, Marjan Bakker, Robbie C. M. van Aert and Marcel A. L. M. van Assen

## 5. Universal adoption

- Registered Reports offered as an option at **all reputable empirical journals** so that they can be a legitimate career option **for every researcher**
- All clinical trials published as Registered Reports
- While also recognising that Registered Reports are not applicable for all modes of research...

# Transparent exploratory research is vital – and it needs a home

## Exploratory Reports article type

CORTEX 96 (2017) A1–A4



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

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Journal homepage: [www.elsevier.com/locate/cortex](http://www.elsevier.com/locate/cortex)



### Editorial

#### Exploratory reports: A new article type for Cortex



Robert D. McIntosh\*

Human Cognitive Neuroscience, Psychology, University of Edinburgh, UK

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##### Article history:

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There are many ways to find things out. In science, the process of discovery can be divided conceptually into exploratory and confirmatory phases. In the exploratory phase, we observe

'hypothesis-driven' – the death sentence for many a hopeful submission.

This idealisation of the confirmatory mode creates pressure for published research to conform neatly to the template, even though the reality may be more messy or complex. A preference for positive findings, combined with the expectation that the main results should be predicted a priori, incentivise some 'questionable' practices that, whether engaged in consciously or not, seriously distort the scientific record (John, Loewenstein, & Prelec, 2012). High on this list are: p-hacking, whereby analytic flexibility is exploited to probe the data for p-values below the threshold for significance, the fruits of this exploration being reported as if from a

CORTEX 120 (2019) 240–248



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Journal homepage: [www.elsevier.com/locate/cortex](http://www.elsevier.com/locate/cortex)



### Exploratory Report

#### Executive function predictors of delayed memory deficits after mild traumatic brain injury



James M. Broadway<sup>a</sup>, Rebecca E. Rieger<sup>b</sup>, Richard A. Campbell<sup>c</sup>, Davin K. Quinn<sup>c</sup>, Andrew R. Mayer<sup>d</sup>, Ronald A. Yeo<sup>b</sup>, J. Kevin Wilson<sup>b</sup>, Darbi Gill<sup>a</sup>, Violet Fratzke<sup>b</sup> and James F. Cavanagh<sup>b,\*</sup>

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<sup>b</sup> University of New Mexico, Department of Psychology, USA

<sup>c</sup> University of New Mexico Health Sciences Center, Department of Psychiatry and Behavioral Sciences, USA

<sup>d</sup> Mind Research Network, USA

De-emphasis on *a priori* hypotheses and p values

Greater emphasis on parameter estimation and hypothesis generation

Editorial

<https://www.sciencedirect.com/science/article/pii/S0010945217302393>

Guidelines

[https://www.elsevier.com/\\_data/promis\\_misc/Exploratory\\_Reports\\_Guidelines.pdf](https://www.elsevier.com/_data/promis_misc/Exploratory_Reports_Guidelines.pdf)

See also: <https://www.rips-irsp.com/about/exploratory-reports/>



Exploratory Reports at IRSP: Guidelines for Authors

Exploratory Reports (ERs) is a format for empirical submissions that tend to address relatively open research questions, without strong a priori predictions of hypotheses.



# Suggested next steps

1. For quantitative researchers: learn how to construct a Registered Report using this template: <https://osf.io/93znh/>

## If you can answer these TEN questions you will have built the engine of a Stage 1 Registered Report

- 1) What is the main question being addressed in your study?
  - Why is it important that we answer this question? What's the big picture?
- 2) Describe the key independent and dependent variable(s), specifying how they will be measured.
  - Ensure that they are defined precisely
- 3) What are your hypotheses?
  - Ensure that your predictions are defined precisely in terms of the specific IVs and DVs
  - Listing them as H0, H1, H2...Hn is recommended
- 4) How many and which conditions will participants/samples be assigned to?
  - Where applicable be sure to include details of randomisation, blinding and counterbalancing. Make it clear whether the design is within-subjects, between-subjects, mixed, or other.
- 5) How many observations will be collected and what rule will you use to terminate data collection?
  - Ensure that your stopping rule takes into account any data exclusions.
  - If adopting null hypothesis significance testing, what power will your study achieve? What effect size will you target and why? Remember that you are choosing the smallest effect size of theoretical or applied interest, or the smallest you can feasibly detect. For an actual RR you can use pilot data to help motivate this estimate, but you shouldn't rely on pilot data alone because it is vulnerable to bias.
  - If adopting Bayesian sampling methods, what is your prior? And what is your criterion Bayes factor for asserting relative support of H0 or H1, or your maximum resource limit?
- 6) What are your study inclusion criteria?
  - How will participants/samples be recruited/included and under what specific rules?
- 7) What are your data exclusion criteria?
  - State rules for excluding data both at the level of samples/participants (within groups) and at the level of raw data (within samples/participants), e.g. conditions involving data quality, completeness and outliers.
  - Remember to be comprehensive: exclusion criteria are very difficult to change after data collection has commenced because doing so risks introducing bias. Think about previous experiments you have done and all the reasons you have ever thrown out a data set or data point.
- 8) What positive controls or quality checks will confirm that the obtained results are able to provide a fair test of the stated hypothesis?
  - **WHAT'S THIS?** A positive control tests the existence of phenomena that would confirm that the IV, DV or instrumentation was used correctly and is therefore capable of testing the main study predictions. One of the most famous positive control experiments was the use of the [Galileo spacecraft to test for the existence of life on Earth](#). If the instrumentation on the probe couldn't detect life on Earth (i.e. had the positive control failed), then it would not be reasonable to use to the probe to test the hypothesis that life existed on other planets.
  - Not all experimental designs have suitable positive controls. Where a positive control isn't possible, think of what quality checks or verifications you would build into your design **before results are known** to convince a skeptic that you had conducted the experiment to a sufficient standard (e.g. noise within certain limits etc.). Make sure these are independent of your main hypothesis tests.
  - Where a positive control (e.g. manipulation check) or quality check (e.g. lack of floor or ceiling effects in data) requires a statistical test, ensure that the test is adequately powered or sampled.

- 9) Specify exactly which analyses you will conduct to examine the main question/hypothesis(es)
  - Ensure that there is an **exact** correspondence between each scientific hypothesis and each statistical test. Failure to precisely specify these links is one of the main reasons RRs are rejected.
  - If your analysis strategy will depend on the results (e.g. normal vs. non-normal distribution) then specify the contingencies for making different choices, i.e. IF-THEN statements.
  - In the event of a negative result, would you be happy to conclude that there "was no evidence of a difference" between conditions, or would you instead want to be able to make the stronger claim that "there is evidence of no difference between conditions"? The first inference is limited to absence of evidence while the second (stronger) one refers to evidence of absence. If you want to make the stronger inference, you will need [Bayesian inferential methods](#) or [frequentist equivalence testing](#).
  - Complete the design planner below to make the links absolutely clear between the research question (or questions), hypothesis (or hypotheses), sampling plans, analysis plans, and contingent interpretation

Question	Hypothesis	Sampling plan (e.g. power analysis)	Analysis Plan	Interpretation given different outcomes
















- 10) Are you proposing to collect new data or analyse existing data?
  - If the proposal involves existing data, what steps will you take to ensure that your analysis plan isn't biased by any prior observation you have had of the data?

**You might be wondering:** why is there no section for specifying exploratory analyses? That's because for RRs we usually don't allow authors to specify exploratory analyses in Stage 1 submissions. A central strength of the RR format is the unequivocal distinction it draws between confirmatory pre-registered analyses and exploratory unregistered analyses. Pre-specifying (usually vague) plans for exploratory analyses blurs this separation. Any analysis that can be precisely planned should be specified as confirmatory at Stage 1, even if a secondary hypothesis. And any analysis that can't be precisely planned should be withheld until Stage 2, where it is then introduced and comprehensively reported in the Exploratory Analyses section of the Results.

# Suggested next steps

2. Check out the Zotero database for completed examples of Stage 2 Registered Reports, and the the OSF archive of registered Stage 1 protocols

zotero

<input type="checkbox"/>	Title
<input type="checkbox"/>	 A closer look at the size of the gaze-liking effect: a prere...
<input type="checkbox"/>	 A Feasible and Efficacious Mobile-Phone Based Lifestyle Inte...
<input type="checkbox"/>	 A Low-Intensity Mobile Health Intervention With and Without ...
<input type="checkbox"/>	 A Multilab Preregistered Replication of the Ego-Depletion Ef...
<input type="checkbox"/>	 A Patient-Held Smartcard With a Unique Identifier and an mHe...
<input type="checkbox"/>	 A Replication Attempt of Stereotype Susceptibility (Shih, Pi...
<input type="checkbox"/>	 A Secondary Replication Attempt of Stereotype Susceptibility...
<input type="checkbox"/>	 A test of the diffusion model explanation for the worst perf...
<input type="checkbox"/>	 A Web-Based Psychoeducational Program for Informal Caregiver...
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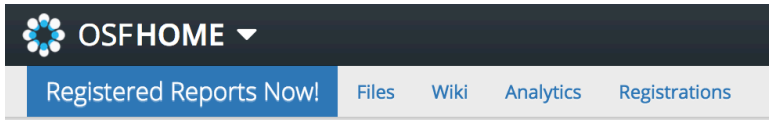
Replication of Moore & Egeth (1997) and Mack & Rock (1998)

<https://osf.io/registries/discover?provider=OSF&type=Registered%20Report%20Protocol%20Preregistration>

<https://www.zotero.org/groups/479248/osf/items/collectionKey/KEJP68G9?>

# Suggested next steps

3. Lobby for reform – if your journal of choice doesn't yet offer RRs then ask the editor



## About Registered Reports

Registered Reports emphasize the importance of the research question and the quality of methodology by conducting peer review prior to data collection. High quality protocols are then provisionally accepted for publication if the authors follow through with the registered methodology. See [cos.io/rr](https://cos.io/rr) for more information.

## About this project

Registered Reports Now! is a camp...

[Read More](#)

## Files

Name ^ v	Modified ^ v
Registered Reports Now!	
OSF Storage (United States)	
RR-factsheet-for-editors.pdf	2017-12-14 07:44 PM
RR-factsheet-foreditors-RTF.rtf	2017-12-14 02:33 PM

<https://osf.io/3wct2/>

“RR Now” site has template letters to editors that you can use/modify/send

This page will describe the ongoing or finished communications with journals  
See the [Journal Requests](#) page with more information about how we approach  
See [this overview](#) for journals which have already started accepting Registered

## Curated list of journals with responses

Journal	Response
Acta Acustica united with Acustica	Awaiting response (1
Acta Psychologica	Contacted (04.8.18)
Addiction	Under Consideration
AERA Open	Have now adopted
Age and Ageing	Contacted (19/10/18)
Aging & Mental Health	Contacted (19/10/18)
Agriculture Ecosystems and Environment	contacted (20.9.18)
American Journal of Audiology	Under consideration
American journal of speech-language pathology	Under consideration
American Speech	Contacted (04.8.18)
Animal Behaviour	Contacted (18/2/19)
Animal Cognition	Contacted (18/2/19)
Annals of Dyslexia	Contacted (18.6.18)

Public list of journals and responses



# Information Hub at the Center for Open Science



Registered Reports: Peer review before results are known to align scientific values and practices.

- Detailed FAQs
- Table comparing journal features
- Resources for authors, editors, funders

Registered Reports   Participating Journals   Details and Workflow   Resources for Editors   For Funders   FAQ

Registered Reports emphasize the importance of the research question and the quality of methodology by conducting peer review prior to data collection. High quality protocols are then provisionally accepted for publication if the authors follow through with the registered methodology.

This format is designed to reward best practices in adhering to the hypothetico-deductive model of the scientific method. It eliminates a variety of questionable research practices, including low statistical power, selective reporting of results, and publication bias, while allowing complete flexibility to report serendipitous findings.



<https://cos.io/rr/>

University of BRISTOL **UK Reproducibility Network** Current students   Current staff   Alumni

<http://www.ukrn.org>

<b>UK Reproducibility Network</b>
About
Local Networks
Steering Group
Advisory Board
Stakeholders
Contacts

## The UK Reproducibility Network (UKRN)

The UK Reproducibility Network (UKRN) is a peer-led consortium that aims to ensure the UK retains its place as a centre for world-leading research.

This will be done by investigating the factors that contribute to robust research, providing training and disseminating best practice, and working with stakeholders to ensure coordination of efforts across the sector.

It is led by Marcus Munafò (Bristol), Chris Chambers (Cardiff), Laura Fortunato (Oxford), and Malcolm Macleod (Edinburgh).

**UKRN News**  
See the [latest news](#) about the Network



These slides: <https://osf.io/h5du2/>

For more info: [chambersc1@cardiff.ac.uk](mailto:chambersc1@cardiff.ac.uk) or [ukrn-admin@bristol.ac.uk](mailto:ukrn-admin@bristol.ac.uk)

# UK Reproducibility Network



## Key Initiatives

- *Open Research Working Groups at UK universities:* <https://osf.io/vgt3x/>
- *ReproducibiliTea* <https://osf.io/3qrj6/wiki/home/>
- *Open Research and Reproducibility Short Course*
- *Hiring Policies Certification Scheme:* <https://osf.io/qb7zm/>
- *Laboratory Efficiency Assessment Framework (LEAF)*
- *Consortium-Based Student Projects*
- *Primers on Open Research Practices*
- *Ensuring teaching curricula include training in reproducibility and transparency*

**Registered Reports:** a format of research article currently offered by >200 academic journals in which study protocols are peer reviewed and the completed research accepted in advance of the results (see <https://cos.io/rr/>).

**Registered Reports Funding:** a form of research funding in which funders and journals coordinate to review and accept detailed Registered Reports protocols (see For Funders at <https://cos.io/rr/>).

**Accountable Replication Policies:** an initiative whereby journals commit to publishing any close and valid replication of any study published in the same journal (see <https://blogs.royalsociety.org/publishing/reproducibility-meets-accountability/>).

**Editors4BetterResearch:** an initiative in which journal editors publicly state their degree of commitment to upholding a variety of practices in support of open and reproducible research (see <https://osf.io/u8rks/>).

**ECR Fellowship Track Programme:** an initiative to create a dedicated and fully supported career trajectory for early career researchers who seek to embed open research practices in their work (see <https://osf.io/gr2n8/>).