

Registered Reports - Guidelines for reviewers

Registered Reports are a form of publication of empirical research in which the methods and proposed analyses are pre-registered and reviewed prior to the research being conducted. This publication format rewards best practice in adhering to the hypothetico-deductive model of the scientific method and counteracts inappropriate research practices, including inadequate statistical power, selective reporting of results, undisclosed analytic flexibility, and publication bias (Chambers, 2013).

The review process for *Registered Reports* is divided into two stages:

Stage 1 Assessment of study proposals *before data is collected*.

Stage 2 Assessment of the full study, including results and interpretation.

Stage 1 manuscripts will include only an Abstract, Introduction, Methods (including proposed analyses, sample size calculation, etc.), and Pilot Data (where applicable). At Stage 1, reviewers will be asked to assess:

- The significance of the research question(s)
- The logic, rationale, and plausibility of the proposed hypotheses
- The soundness and feasibility of the methodology and analysis pipeline (including statistical power analysis)
- The appropriateness of the sample(s), including adequate power and sample size calculation
- whether the proposed sampling procedures are as free from bias as possible and appropriate for the study design and questions of interest
- Whether the clarity and degree of methodological detail would be sufficient to replicate exactly the proposed experimental procedures and analysis pipeline
- Whether the authors provide a sufficiently clear and detailed description of the methods to prevent undisclosed flexibility in the experimental procedures or analysis pipeline
- Whether the authors have considered sufficient outcome-neutral conditions (e.g., absence of floor or ceiling effects; positive controls) for ensuring that the results obtained are able to test the stated hypotheses

Following Stage 1 peer review, manuscripts will be *accepted* or *rejected*, or authors may be offered the opportunity to *revise*. Manuscripts that pass peer review will receive an in principle acceptance (IPA), which implies that *the International Journal of Psychophysiology* commits to publishing the article, as long as the authors follow the exact pre-registered methods and analytic procedures, and provide a logical, evidence-bound interpretation of the results.

At Stage 2, which must be after the data has been collected, authors will submit a manuscript that contains a description of any additional, post-hoc analyses, the Results and Discussion sections. This manuscript will be appended to the pre-approved Introduction and Methods; the so-created full manuscript will be sent out for review to the same reviewers.

Reviewers will be asked to assess:

- Whether the data are able to test the authors' proposed hypotheses by passing the approved outcome-neutral criteria (such as absence of floor and ceiling effects)
- Whether the authors adhered precisely to the pre-registered experimental procedures
- Whether any extra post-hoc analyses are justified, methodologically sound, and informative
- Whether the authors' conclusions are justified given the data
- Whether the sample (including adequate sample size) and sampling procedures are appropriate and any changes from Stage 1 are justified

Importantly, reviewers' assessments and editorial decisions may **not** be based on the perceived importance, novelty, or clarity of the results.

General reviewer guidelines are described at <http://www.elsevier.com/reviewers/reviewerguidelines>.

Registered reports - Guidelines for authors

Registered Reports are a form of empirical article in which the hypotheses, methods, sampling procedures and sample size, and proposed analyses are pre-registered and reviewed prior to research being conducted.

The cornerstone of this article format is that a significant part of the manuscript will be assessed prior to data collection. Initial submissions will include a description of the key research question and background literature, hypotheses, experimental procedures, analysis pipeline, and a statistical power analysis (or Bayesian equivalent), potentially based on pilot data (which would also be described within the statistical power analyses/sample size calculation section).

Initial submissions will be triaged by the section editor for scientific significance. Those that pass triage will then be sent for in-depth peer review (Stage 1). Following review, the article will be either rejected or receive in principle acceptance (IPA); authors may also receive the suggestion to revise and resubmit. After obtaining IPA, the authors will proceed to conduct the study, adhering exactly to the peer-reviewed procedures.

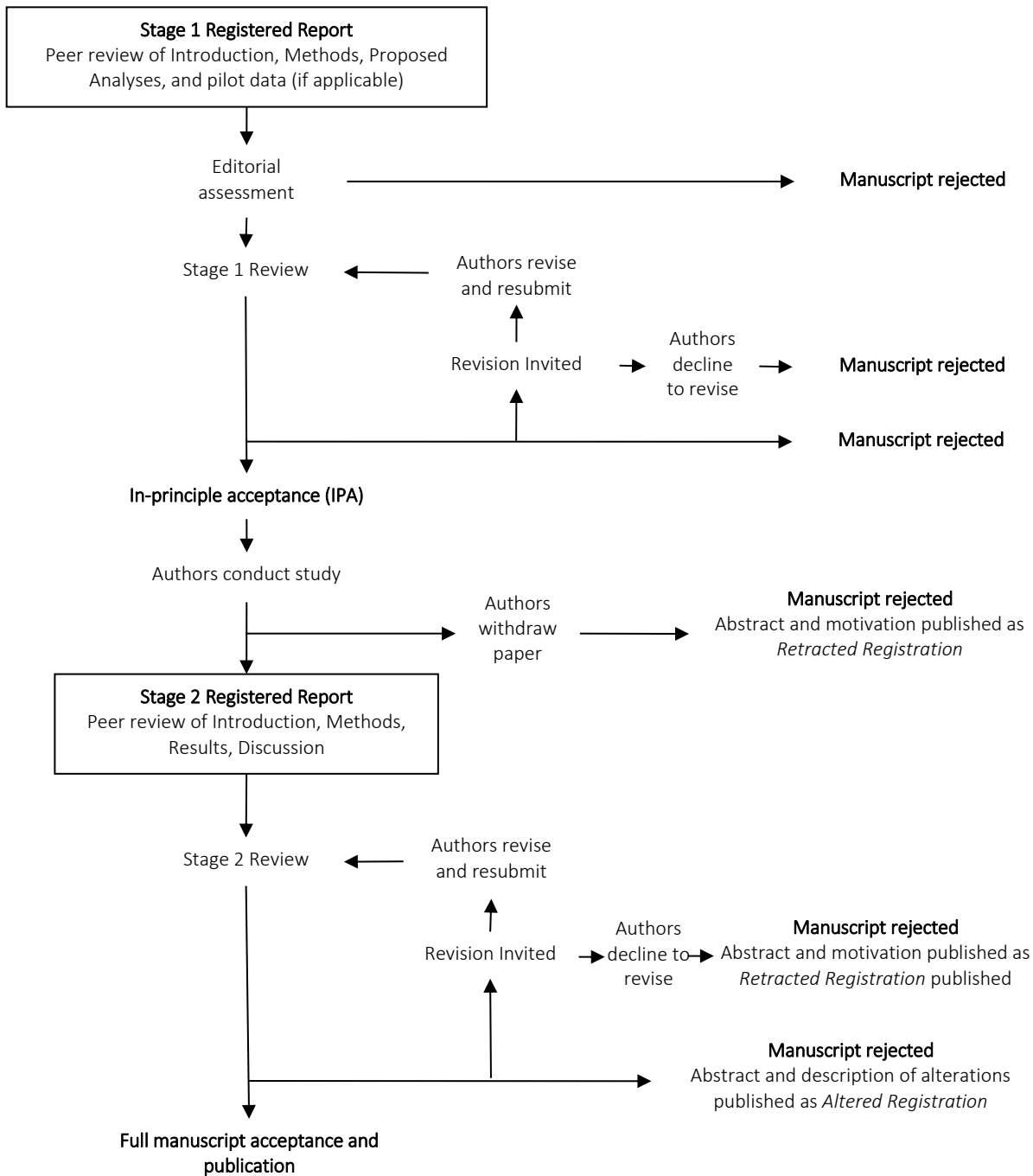
When the study is complete the authors will submit their finalised manuscript for re-review (Stage 2), and will upload their time-stamped raw data and laboratory log/procedures to a free and publicly accessible file-sharing service (e.g., <https://osf.io/>). Pending quality checks and a sensible interpretation of the findings, the manuscript will be published regardless of the results. It will be regarded as scientific fraud if authors fake the time-stamps on their raw data and/or fabricate their laboratory log/procedures.

Stage 1: Initial manuscript submission and review

Due to the high volume of submissions, the editorial team will select only the most scientifically promising manuscripts. Stage 1 submissions should include the manuscript and a brief cover letter. Authors are welcome to submit presubmission enquires (to michael_larson@byu.edu) for advice on the likely suitability of a study as a Registered Report, while realizing that the actual editorial decision to send manuscripts for in-depth review is made only when a full Stage 1 manuscript has been submitted.

The cover letter should include:

1. A brief scientific case for consideration. Authors are encouraged to refer to the likely replication value of the research (Nosek et al., 2012). High-value replication studies are welcome and will be treated with equal priority to novel studies.
2. A statement confirming that all necessary support (e.g. funding, facilities) and approvals (e.g. ethics) are in place for the proposed research. Manuscripts are only considered for studies that can be started immediately.
3. An anticipated timeline for completing the study if the initial submission is accepted.
4. A statement confirming that the authors agree to share their raw data and laboratory log/procedures for all published results (including data excluded from the analyses).
5. A statement confirming that if the authors retract their paper after having received IPA, they agree to the Journal publishing the pre-registered Abstract under a section *Retracted Registrations*.
6. A statement confirming that the authors are aware that, in case they change their pre-approved hypothesis or any part of their analysis without consulting the editor, the paper will be summarily rejected and the accepted abstract will be published under a section *Altered Registrations*.



Manuscript preparation guidelines

Stage 1: study proposals

For general guidelines for manuscript preparation, see:

<https://www.elsevier.com/journals/international-journal-of-psychophysiology/0167-8760/guide-for-authors>

Stage 1 submissions should include the following sections:

Abstract

- A summary of the background and motivations, ALL tested hypotheses, and the methodology and analyses.

Introduction

- A review of the relevant literature that motivates the research question and a full description of the experimental aims and hypotheses. Please note that following IPA, the Introduction section by and large cannot be altered (see below).

Methods

- Full description of proposed sample characteristics, including criteria for subject inclusion and exclusion, and detailed description of procedures for defining outliers. Procedures for objectively defining exclusion criteria due to technical errors (e.g. defining what counts as 'excessive' head movement during fMRI or an 'artifact' for EEG/ERP studies) or for any other reasons must be documented, including details of how and under what conditions subjects would be replaced.
- A description of experimental procedures in sufficient detail to allow another researcher to repeat the methodology exactly, without requiring further information. These procedures must be adhered to exactly in the subsequent experiments or any Stage 2 manuscript will be summarily rejected. Please note that reviewers at Stage 1 will be asked to specifically consider whether the described experimental procedures contain sufficient detail to prevent undisclosed procedural flexibility.
- Proposed analysis pipeline, including all preprocessing steps, and a precise description of all planned analyses, including appropriate correction for multiple comparisons. Any covariates or regressors must be stated. Consistent with the guidelines of Simmons et al. (2011), proposed analyses involving covariates must be reported with and without the covariate(s) included. The Methods must document in advance, and in precise detail, the complete analysis pipeline from raw data onwards. Where analysis decisions are contingent on the outcome of prior analyses, these contingencies must be specified and adhered to. Only pre-planned analyses can be reported in the main Results section of Stage 2 submissions. However, unplanned post hoc analyses will be admissible in a separate section of the Results (see below).
- Studies involving Neyman-Pearson inference should include a statistical power analysis. Estimated effect sizes should be justified with reference to the existing literature. To account for existing publication bias, which leads to overestimation of true effect sizes (Hedges and Vevea, 1996; Lane and Dunlap, 1978), power analysis must be based on the lowest available or meaningful estimate of the effect size. The a priori power ($1 - \beta$) must be 0.9 or higher for all proposed statistical tests. In the case of highly uncertain effect sizes, a variable sample size and interim data analysis will be permissible but with inspection points stated in advance, appropriate Type I error correction for 'peeking' employed (Strube, 2006), and a final stopping rule for data collection outlined.
- For studies involving analyses with Bayes Factors, the predictions of the theory must be specified so that a Bayes factor can be calculated. Authors should indicate what distribution will be used to represent the predictions of the theory and how its parameters will be specified. For example, will you use a uniform up to some specified maximum, or a normal/half-normal to represent a likely effect size (Dienes, 2011), or a JZS/Cauchy with a specified scaling constant (Rouder et al., 2009)? The parameters need not be stated in advance, but where unstated, authors must indicate what aspect of data will be used to set those parameters. For inference by Bayes factors, authors should guarantee testing participants until the Bayes factor is either more than 3 or less than 0.33 to ensure clear conclusions. When using Bayes factors, adjustments for multiple comparisons are not required.
- Full descriptions must be provided of any outcome-neutral criteria that are required for successful testing of the stated hypotheses. Such 'reality checks' might include the absence of floor or ceiling effects, or positive controls. Please note that reviewers will be asked to judge whether the manuscript includes sufficient specification of reality checks.
- Timeline for completion of the study and proposed resubmission date if registration review is successful. Extensions to this deadline can be negotiated with the section editor.
- Any description of prospective methods or analysis plans should be written in future tense.

Pilot Data

- Optional. Can be included to establish reality checks, power/effect size estimations, feasibility, or proof of principle. Any pilot experiments will be published with the final version of the manuscript and will be clearly distinguished from data obtained for the main experiment(s).

Stage 1 submissions that are judged by the editorial board to be of sufficient quality and scientific significance will be sent for peer review. In considering papers at the registration stage, reviewers will be asked to assess:

- The scientific importance of the research question(s)
- The logic, rationale, and plausibility of the proposed hypotheses
- The soundness and feasibility of the methodology and analysis pipeline (including statistical power analysis)
- The appropriateness of the sample(s), including adequate power and sample size calculation
- Whether the proposed sampling procedures are as free from bias as possible and appropriate for the study design and questions of interest
- Whether the Methods section is sufficiently detailed to afford exact replication of the proposed experiment and analyses
- Whether the Methods section is sufficiently clear and detailed to prevent undisclosed flexibility in the experimental procedures or analysis pipeline
- Whether the authors have considered sufficient outcome-neutral conditions (e.g. absence of floor or ceiling effects; positive controls) for ensuring that the results obtained are able to test the stated hypotheses

Following Stage 1 peer review, manuscripts will be rejected outright, offered the opportunity to revise, or accepted. Manuscripts accepted at Stage 1 will be issued an IPA, indicating that the *International Journal of Psychophysiology* commits to publishing the article pending successful completion of the study according to the exact methods and analytic procedures outlined, as well as a defensible and evidence-bound interpretation of the results. It is this feature – acceptance prior to data collection – that sets the *Registered Report* apart from regular research articles.

Any deviation from the stated experimental procedures, regardless of how minor it may seem to the authors, could lead to rejection of the manuscript. In cases where the pre-registered protocol is altered after IPA due to unforeseen circumstances (e.g. change of equipment or unanticipated technical error), the authors must consult the editorial board immediately for advice, and prior to the completion of data collection. Minor changes to the protocol may be permitted according to editorial discretion. In such cases, IPA would be preserved and the deviation reported in the Stage 2 submission. If the authors wish to alter the experimental procedures more substantially following IPA but still wish to publish their article as a Registered Report then the manuscript must be withdrawn and resubmitted as a new Stage 1 submission. Note that registered analyses must be undertaken, but additional unregistered analyses can also be included in a final manuscript (see below). In case the experimental procedures are altered without consulting the editor, the pre-registered Abstract will be published as an *Altered Registration* and the altered study precluded from resubmission.

Stage 2: Full manuscript review

Once the study is complete, authors prepare and resubmit their manuscript for full review, with the following additions:

- Submission of raw data and laboratory log/procedures
 - Raw data must be made freely available in a public repository with a link to the archive provided within the Stage 2 manuscript (e.g., <https://osf.io/>). Data files should be appropriately time stamped to show that data was collected after IPA and not before. Other than pre-

registered and approved pilot data, no data acquired prior to the date of IPA is admissible in the Stage 2 submission. Raw data must be accompanied by guidance notes, where required, to assist other scientists in replicating the analysis pipeline. Authors are also encouraged to upload any relevant analysis scripts and other experimental materials that would assist in replication (e.g. stimuli & presentation code).

- Any supplementary figures, tables, or other text (such as supplementary methods) can either be included as standard supplementary information that accompanies the paper, or they can be archived together with the data. Please note that the raw data itself should be archived (see above) rather than submitted to the journal as supplementary material.
- The authors must collectively certify in the resubmission Cover Letter that all non-pilot data was collected after the date of IPA. A basic laboratory log/procedures outline must also be provided outlining the range of dates during which data collection took place. This log should be uploaded to the same public archive as the data, with a link provided to the log in the resubmission Cover Letter. Authors who fake these time stamps commit scientific fraud.
- Revisions of the background and rationale
 - The stated hypotheses cannot be altered or appended. However, it is acceptable for the tone and content of an Introduction to be shaped by the results. Moreover, depending on the timeframe of data collection, new relevant literature may have appeared between registration review and full manuscript review. Therefore, authors will be allowed to update part of the Introduction.
- Results & Discussion
 - These will be similar to standard *Research Reports* but with added requirements. The outcome of all registered analyses must be reported in the manuscript, except in rare instances where a registered and approved analysis is subsequently shown to be logically flawed or unfounded. In such cases, the authors, reviewers, and editor must agree that a collective error of judgment was made and that the analysis is inappropriate. The flawed analysis must still be described in the Methods section, but omitted with justification from the Results. In case the hypothesis-test critically depends on the flawed analysis the authors may wish to retract their submission.
 - It is reasonable that authors may wish to include additional analyses that were not included in the registered submission. For instance, a new analytic approach might become available between IPA and full review, or a particularly interesting and unexpected finding may emerge. Such analyses are admissible but must be clearly justified in the text, appropriately caveated, and reported in a separate section of the Results titled “Post hoc analyses”. Authors must be careful not to base their conclusions entirely on the outcome of statistically significant post hoc analyses.
 - Authors will be required to report exact p -values and effect sizes for all inferential tests using the Neyman-Pearson approach.

The resubmission will ideally be considered by the same reviewers as in the registration stage, but could also be assessed by fresh reviewers. In considering papers at Stage 2, reviewers will be asked to decide:

- Whether the data are suitable to test the authors’ proposed hypotheses by passing the approved outcome-neutral criteria (such as absence of floor and ceiling effects)
- Whether the authors adhered precisely to the registered experimental procedures
- Whether any unregistered post hoc analyses added by the authors are justified, methodologically sound, and informative
- Whether the authors’ conclusions are justified given the data
- Whether the sample (including adequate sample size) and sampling procedures are appropriate and any changes from Stage 1 are justified

Crucially, reviewers will be informed that editorial decisions will not be based on the perceived importance, novelty or clarity of the results. Thus, while reviewers are free to enter such comments on the record, they will not influence editorial decisions.

Manuscript withdrawal, Retracted Registrations, and Altered Registrations

It is possible that authors that received IPA may wish to withdraw their manuscripts following or during data collection. Possible reasons could include technical error or an inability to complete the study due to other unforeseen circumstances. In all such cases, manuscripts can of course be withdrawn. However, we will record each case in the next issue of the journal in a section called *Retracted Registrations*. This section will mention the authors, proposed title, the abstract from the approved Stage 1 submission, and brief reason(s) for the failure to complete the study. Authors cannot publish part of a registered study by selectively retracting one of the planned experiments or analyses. Such cases must lead to retraction of the entire paper.

When authors change their hypotheses or methods after IPA has been obtained, the manuscript will be automatically rejected. To discourage this behaviour, we will record these cases in the next issue of the journal in a section called *Altered Registrations*. This section will mention the authors, proposed title, the abstract from the approved Stage 1 submission, and brief description of the changes.

Incremental Registrations

Authors have the option to add experiments to approved submissions. In such cases the approved manuscript will be considered accepted for publication, and authors will be able to propose additional experiments for Stage 1 consideration. Where these experiments would extend the approved submission (as opposed to being part of new submissions), the editorial team will seek to fast-track the review process. This option may be particularly appropriate where an initial experiment reveals a major serendipitous finding that warrants follow-up within the same paper, but only if this pertains to pre-registered analyses; incremental registrations cannot be submitted based on serendipitous findings following from post-hoc analyses. In cases where an incremented submission is rejected (at either Stage 1 or 2), authors will retain the option of publishing the most recently approved version of the manuscript. For further advice on specific scenarios for incremental registration, authors are invited to contact the Editor-in-Chief (michael_larson@byu.edu).

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- Strube, M. J. (2006). SNOOP: A program for demonstrating the consequences of premature and repeated null hypothesis testing. *Behavior Research Methods*, 38, 24–27. Software available from <http://www.artsci.wustl.edu/~socpsy/>