Elsevier & o2r pilot study for Reproducible Articles

Virtual Special Issue with Open & Reproducible
Supplementary Material based on Containers and R

Reproducibility is a cornerstone of research and faces challenges with computer-based workflows. *How can the scholarly article and the peer review process sufficiently support researchers to create, evaluate, scrutinise, and build upon research that relies on data and computations?*

To meet this challenge, Elsevier and the research project Opening Reproducible Research (o2r) collaborate on a virtual special issue (VSI, see www.journals.elsevier.com/applied-soft-computing/news/virtual-special-issue-vsi-introduction). We want to explore the potential of current technology to **connect articles with open data and open code for better science**.
We invite all Elsevier journals, especially with a connection to the Geosciences and spatial data analysis, to participate in this endeavour. The reproducible VSI will increase the understanding of the needs of and costs for authors, editors, reviewers, readers, and publishers to open the computations behind scientific findings. The lessons learned will help to reduce barriers for publishing open and reproducible research.

What are the benefits for authors and reviewers?
The o2r team will help authors to create an executable research compendium (ERC, see right column) as a supplement to their submission. This packaging process alone is powerful, because it increases the trustworthiness, transparency, and reusability of the scientific contribution. The supplement can include figures, e.g. plots or maps, based on R (www.r-project.org) and R Markdown (rmarkdown.rstudio.com). During the review process, reviewers can interact with a crucial part of the analysis. Using the o2r platform, they can investigate the underlying code and data without manually re-creating a potentially complex virtual environment.
The VSI will reveal how barriers for authors can be reduced and help participating authors to learn about reproducibility. The increased visibility of the participating journals and publications can increase the reach.

What are the benefits for journals?
Journal systems lack features fundamental for creating and evaluating reproducible research. A double blind review process poses challenges for analysis evaluation, which benefits from transparency/communication. Workflows are often impossible to anonymise. Providing interactive access to reproducible code and data and thorough evaluation of these require changes to both system and review process. We provide a way to explore what this means for journals' practices and infrastructure by providing plugging in a novel platform and approach: (1) a reproducibility service to create reproducible papers, (2) user interfaces to interact with code, data, and visualisations of papers, and (3) technical support. The "plugin" only requires small changes to existing infrastructure.

What is required from participants?
The effort to become acquainted with the o2r platform is low and the o2r team provides support at short notice. The benefits of just creating an ERC are high. Editors must find suitable reviewers (e.g. matching expertise in the software used), who in turn can increase review intensity and hopefully quality by leveraging ready-to-use interactive plots and linked text, code, and data. The VSI is accompanied by anonymised monitoring and user studies, to which involved stakeholders will be invited, e.g. a survey or online interview. All participants must be willing to engage in an open, transparent, and new but potentially groundbreaking pilot study.

Tentative schedule
Q3 2019: Reach out to stakeholders; author & reviewer guidelines for ERC supplements
Q4 2019: Identify journals, evaluate technical integration of ERC UI
Q1 2020: VSI call for Papers, start support and courses on ERC creation and interaction
Q1 2021: Papers & supplements published, conduct evaluation studies
Q3 2021: o2r project infrastructure maintained, meta-analysis results published

Get in touch with o2r
The whole matter of reproducibility in the scholarly publication process is too complex to cover all aspects and answer all questions on a single page. The o2r team hopes to have sparked your interest and looks forward to learning about your comments or doubts, and to convincing you and your fellow editors to join this exploration into tools for more transparent, effective, and impactful research publications.
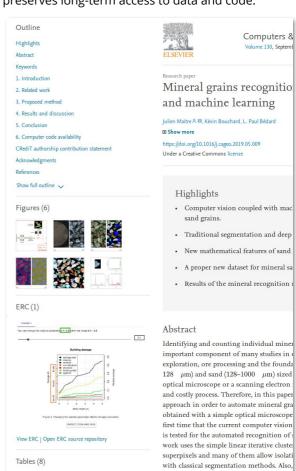
Email: **o2r.team@uni-muenster.de**
Chat: https://gitter.im/o2r-project/pilots

How does it work?
o2r is a DFG-funded research project at the University of Münster, Germany. The o2r team has developed a prototype for creating and inspecting the **Executable Research Compendium** (ERC).
An ERC integrates data files, software (e.g. scripts, configuration, runtime environment), text (e.g. instructions, documentation, article), and UI bindings (i.e. interaction interface definitions) into a single archivable artefact. It enables a deeper understanding and easier reuse of research results by enabling the execution and manipulation of workflows. The creation process ensures figures are based on the submitted data and code. Learn more about o2r at **https://o2r.info/results**.

Reviewers still evaluate a manuscript's credibility, but they are helped by the ERC inspection user interface. ERCs leverage two **best practices for reproducibility**: containerisation technology (a snapshot of the virtual laboratory) and the notebook paradigm (combining data and code in a single text file). These building blocks of an article are preserved and are useful beyond the VSI, because the created reproducibility packages are publicly stored in a citable (via a DOI) scientific data repository (e.g. Zenodo, b2share). During the VSI lifetime, the ERC will be displayed on an article's page. Afterwards the link to the repository record preserves long-term access to data and code.

Partial screenshot of a mock-up with an integration of the ERC user interface into the sidebar of an article on ScienceDirect. The figure from a testing ERC (o2r.uni-muenster.de/#!/erc/5LVIQ) provides a slider to manipulate an interactive plot. Original article: "Mineral grains recognition using computer vision and machine learning", https://doi.org/10.1016/j.cageo.2019.05.009