



### **Guidance on completing this form**

Wellcome will use the information provided here to assess the eligibility and suitability of your proposal for the Open Research Fund. If your concept note is successful, we'll invite you to submit a full application.

You should provide enough information to give us an indication of your proposed activities and aims. At this stage, we don't require all details to be finalised, but please be aware that this will be necessary at the full application stage.

Further details about the Open Research Fund and the application process can be found on the website: <https://wellcome.ac.uk/funding/open-research-fund>

The completed concept note should be returned by email to [OpenResearch@wellcome.ac.uk](mailto:OpenResearch@wellcome.ac.uk) by 11:59PM on 17<sup>th</sup> June 2019.

### **Consent for sharing concept notes openly**

We want to be transparent about the decisions we've made. For this scheme, where you have given your consent, we will make your name, project title(s), and details of proposal(s) for successful and unsuccessful concept notes openly available on our publicly accessible [website](#).

This information is your personal data and you are ultimately in control of it. If you are happy for us to share the following sections of your concept note as noted above, please check the following boxes. Please note this is entirely optional; it is up to you which boxes are checked. We will not take your willingness to share these details into account when making the decision on inviting full applications.

I am happy to share my full name ☒

I am happy to share my project title ☒

I am happy to share my 'details of proposal' section (questions 2a, 2b and 2c) ☒

I am happy for you to use my personal details to contact me in relation to the 'Potential further uses of your personal data and your consent' set out below ☒

The legal basis for this processing of your personal data noted above is your consent and the Wellcome Trust will be the "data controller".

### **Withdrawing your consent**

You can withdraw your consent for us to use your personal data in this way at any time by contacting Wellcome's Data Protection Officer ([Dataprotection@wellcome.ac.uk](mailto:Dataprotection@wellcome.ac.uk)).

### **Potential further uses of your personal data and your consent**

Please also note that if you are invited to submit a full application, we may contact you subsequently to ask your consent to share some details of the full application online, and once all decisions have been communicated to applicants, a short summary of why you have been successful or not. Again, it will be entirely optional whether or not you provide consent for this.

The legal basis for this processing of these personal data noted above would be your consent and the Wellcome Trust will be the "data controller".

This and all other information will be stored and used, in addition to the details noted above, as per the [Wellcome Grants Privacy Statement](#).

**Please do not exceed three A4 pages in length.**



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## 1) Proposed project title

Scienceverse: Towards a Grammar of Science

## 2) Details of proposal

**2a) Please list your team members or key collaborators (name and organisation) and provide a very brief outline of their role in the proposed research. (200 words max)**

All team members will contribute to the development of the grammar.

**Lisa DeBruine** (University of Glasgow, UK) will coordinate the development of the tools and database, working closely with the postdoctoral researcher. She has extensive experience with online tool and database development (e.g., ERC-funded development of [webmorph.org](http://webmorph.org)).

**Daniël Lakens** (Eindhoven University of Technology, NL) will coordinate the creation of tutorial materials and best practice documents. He has extensive experience with communication of best practices in methods (e.g., >27K students enrolled in [Improving your Statistical Inferences](#)).

**Gjalt-Jorn Peters** (Open Universiteit, NL) will coordinate initial testing of Scienceverse in Registered Reports at [Health Psychology Bulletin](#), where he is an editor.

**2b) Provide a summary of your Open Research Fund proposal, including:**  
**(i) the vision for your proposal, including aims, target audiences, activities;**  
**(ii) how your proposal will influence open research practices in your field or more broadly**  
**(700 words max)**

**Vision:** The increasingly digital workflow in science has made it possible to share almost all aspects of the research cycle, from pre-registered analysis plans and study materials to the data and analysis code that produce the reported results. Although the growing availability of research output is a positive development, most of this digital information is in a format that makes it difficult to find, access, and reuse. A major barrier is the lack of a framework to concisely describe every component of research in a machine-readable format: A grammar of science.

A grammar is a formal system of rules that allow users to generate lawful statements. The goal of a grammar of science is to allow users to generate rich, standardized metadata describing experiments, materials, data, code, and any other research components that scholars want to share. Such standardization would facilitate reproducibility, cumulative science (e.g., meta-analysis) and reuse (e.g., finding datasets with specific measures). While many projects focus on making *data* FAIR, Scienceverse aims to make *every* aspect of research findable, accessible, interoperable and reusable.

**Aims:** Developing a Grammar of Science, combined with a shared lexicon (e.g., standardized ways to reference manipulations, measures, and variables) aims to facilitate open research practices for researchers and journals. It is intended to mitigate several well-known problems that follow from the lack of organization of research output.

First, it has been shown that even when data and code are shared, computational reproducibility is low (Hardwicke et al., 2018, Obels et al., 2019). Scienceverse improves computational reproducibility by providing a framework that explicitly links hypotheses, materials, data, and code. Scienceverse archive files can store any aspect of research in a systematic way, allowing, for example, automatic evaluation of results against machine-readable specifications of statistical hypotheses. Automated reproducibility allows journals to compare pre-registered hypotheses with the conclusions in the final manuscript. Scienceverse helps researchers to specify which analyses would confirm or falsify predictions in a structured and unambiguous manner. Journals can automatically check these predictions for the final submission, which will prevent problems with undeclared deviations from the protocol – a known problem in pre-registered studies.

Second, Scienceverse aims to make shared outputs easier to find and re-use. Good meta-data are essential to find research output, but there have been few attempts in health psychology, or social sciences in general, to summarize the structure of those aspects of the empirical endeavour that need to be findable. Scienceverse aims to create a well-structured grammar that provides a complete description of these components of the research cycle, including hypotheses, materials, methods, study design, measured variables, codebooks, analyses, and conclusions. Referenced against discipline-specific lexicons, this allows researchers to retrieve any information from archive files. For example, researchers can search for studies that use similar manipulations and retrieve relevant information about the effects these manipulations produce. This information can be used when choosing manipulations for future studies, to design well-powered experiments, or to easily perform meta-analyses. Given specific inclusion criteria, Scienceverse makes it possible to automatically update meta-analyses and share these with the scientific community.

Our **target audience** is researchers who want to increase the impact of their outputs by making them more findable and reusable, researchers who want to find and reuse others' outputs, journal editors who want increased clarity about study design, and contributors to methods tools who want to increase interoperability of research components. Team members are holding a "hackathon" with potential users at the Society for the Improvement of Psychological Science ([osf.io/c52yh](https://osf.io/c52yh)) and presenting related ideas at the European Health Psychology Society ([osf.io/ndxha](https://osf.io/ndxha)).

**Activities:** In this project, we plan to 1) develop a grammar of scientific research in the social sciences, 2) create a tool to guide the creation of archive files describing studies using this grammar, 3) create

an online database where archive files can be uploaded and searched, and 4) create and disseminate tutorials with concrete examples for health psychology.

Compared to current practices, where data is increasingly shared, but in a format that makes it practically unusable except with great effort, we hope Scienceverse will move open science forward by providing a structured framework to organize and find research output, which should make all shared research components more findable and reusable.

**2c) Please briefly outline how you will monitor and evaluate the success of your proposed activities, including approximate targets. (300 words max)**

The first criterion of success is to get key users to adopt the grammar. To achieve this goal, we will make sure the grammar is useful and relevant through continuous contact with key users, including researchers, journal editors, data managers, and contributors to aligned meta-data projects (e.g., PsychDS, the Human Behaviour Change Project, and the Science of Behavior Change project). Since no alternative solutions currently exist, Scienceverse will break new ground and create a resource that has a high likelihood of being widely adopted by the community.

The second criterion for success will be demonstrating the benefits of machine-readable meta-data for pre-registered studies. In collaboration with editors of journals that offer Registered Reports (specifically Health Psychology Bulletin) we will guide authors through the process of creating machine-readable archive files that can be used to specify the preregistered predictions, which can then be evaluated automatically when the final report is submitted. Our goal is to demonstrate the feasibility of implementing Scienceverse in the research cycle and collect qualitative data about benefits and challenges experienced by authors, reviewers, and editors.

Finally, we will create an interface to share and search Scienceverse archive files. In collaboration with authors who publish in Health Psychology Bulletin, we will populate this database with several complete examples and use these real-life cases to improve the tutorials. Success is evaluated based on voluntary adoption of Scienceverse by authors after the tutorials are completed.

**3) Please provide a rough timeline and budget for the project**

**Project duration** (approximate, totalling no more than 12 months)

		Q1	Q2	Q3	Q4
Develop and Update Grammar	Full Team	X			X
Tool & Database Development	Post-Doc & LDB		X	X	X
Vignettes & Tutorials	Post-Doc & DL	X	X	X	
Implementation in Registered Reports	Post-Doc & GJP		X	X	X

**Total project cost** (approximate, no more than GBP50,000)

# Open Research Fund

## CONCEPT NOTE

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£ 45,570 for 12 months of a grade 6 post-doc at University of Glasgow, Scotland  
£ 4000 travel budget (2 international conferences, including SIPS in Vancouver, 2020)

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