

ARTICLE

Walking the walk through the open door: Realising Open Science infrastructures

Emma Norris, Maya Braun, James A. Green, Paquito Bernard and Gjalt-Jorn Peters

Abstract

This article summarises the 2025 roundtable ‘Walking the way through the open door: realising open science infrastructures’ held at the 2025 European Health Psychology Society Annual Conference. The roundtable aimed to identify perceived barriers to open infrastructure within the EHPS community, identify functionalities in closed software that the EHPS community value and how we can implement these in open infrastructure, and explore how we can ensure open infrastructure in health psychology. Our discussions in this roundtable and this article highlight the important role of institution and policy changes over individual researcher behaviour regarding open infrastructure. Moreover, we offer specific recommendations to increase adoption and sustainability of open infrastructure based on the Pyramid of Culture Change model/framework.

Key words: open infrastructure, open Science, behaviour change

What is open infrastructure?

Research infrastructure can be defined as “facilities, resources and services that are used (by the research community) to conduct research” (Science Europe, 2025). This includes research tools we use throughout the research lifecycle, from repositories (for e.g., study preregistration, data and preprints), through to data collection and analysis, document writing, citation management and the development of scientific figures. Open infrastructure involves these tools being open-source, community-owned and based on open standards. Open infrastructure tools are accountable to and maintained by their associated communities, not by shareholders or commercial actors and often with no or limited support for open standards (Krasodonski-Jones and Smith, 2022). They may not necessarily be free, to support ongoing maintenance of the given infrastructure. Open infrastructure includes open software, open repositories/servers and open materials (such as R Studio, CryptPad and Zotero). Closed infrastructure refers to proprietary infrastructure and software (such as SPSS, Microsoft 365/OneDrive etc., GSuite [Google docs etc.] and Endnote), requiring individual or institutional subscriptions.

Increased usage of AI tools for research purposes is also occurring alongside open infrastructure developments. The most popular generative AI tools (ChatGPT, Microsoft Copilot, Claude etc) to support research workflow activities such as analysis support, writing and literature screening, remain inherently closed for now. However, open source AI tool alternatives for research are emerging, such as STORM (<https://github.com/stanford-oval/storm>): a writing system for the Synthesis of Topic Outlines through Retrieval and Multi-perspective Question Asking (Shao et al., 2024) and Open Paper (<https://openpaper.ai/home>) for reading, annotating and understanding papers.

We ran an interactive roundtable session at EHPS Annual Conference 2025 in Groningen (NL) to introduce open infrastructure, discuss potential barriers to its use and, most importantly, brainstorm solutions for overcoming these barriers within the health psychology research community. This article reports a synthesis of prepared discussion points from the authorship team and discussion during the session. Slides from the session are available here: <https://osf.io/aqhvm/files/xnscq>.

Why should we care about open infrastructure in health psychology?

Our session began with a discussion on the multitude of reasons that open infrastructure is important for health psychology. Firstly, implementation of open research tools enables increased equity and accessibility in how we can conduct research in diverse communities globally. Secondly, our research aims to improve public health and is often funded by public money: open infrastructure reduces project budgets by using free or subsidized equivalent software to achieve research goals or redirects project budgets by using free or subsidized equivalent software to achieve research goals. Thirdly, we want to maximise the accessibility of health research to improve practice, including making our research FAIR: Findable, Accessible, Interoperable and Reusable (Lamprecht et al., 2019). How can we be FAIR if people without a software licence cannot open our files? Open infrastructure also allows continued accessibility to our own research projects that travel with us if we change research institutions, or collaborate across government, charity and industry settings. Use of open tools means we do not have to rely on businesses to maintain functionality in licensing agreements held by our research institutions. Additionally, adoption of open infrastructure aligns with a wider drive towards Open Science practices in health psychology, reflected by initiatives such as the EHPS Open Science Special Interest Group (Norris et al., 2024) and public statements advocating for Open Science from organisations such as the Behavioral Medicine Research Council (Segerstrom et al., 2022).

Perceived barriers to open infrastructure and how we solve them

Previous research has explored the barriers and facilitators to open research generally in health researchers (Gownaris et al., 2022; Zečević et al., 2021) or has assessed perceptions towards other specific open science behaviours such as preregistration (Osborne and Norris, 2022). However, research has not yet examined researcher perceptions towards open infrastructure specifically. Our session was hence organised using relevant components of the Capability Opportunity Motivation - Behaviour (COM-B Model) of behaviour change (Michie et al., 2011; Osborne and Norris, 2022), reflecting individuals, communities, institutions and funders (Table 1).

TABLE 1

Barriers and facilitators to adoption of open infrastructure in health psychology

COM-B Component	Barriers	Facilitators
Psychological capability	- Limited knowledge - Lack of skills	- Provide training and education on how to use open infrastructure
Physical opportunity	- Added time investment to familiarise with open infrastructure	- Protected time for training and using open infrastructure
Social opportunity	- Lack of community norms - Restrictive software policies from employers	- Set requirements for open infrastructure - Provide longer-term funding to maintain open infrastructure
Reflective motivation	- Open infrastructure is not incentivised - Perceived low quality of open infrastructure	- Re-prioritising importance of open infrastructure - Change identity towards continued learning as a researcher

Note: Reflecting audience discussion within EHPS 2025 Roundtable

Psychological capability barriers were discussed in relation to limited knowledge and skills regarding the availability of open infrastructure. Audience members described being aware of the monumental institutional subscription costs paid for access to tools such as SPSS (Aksoy and Beaudry, 2021). Institution-wide switching to open infrastructure alternatives is still highly uncommon, with no awareness on the alternative open and cheaper options. Associated facilitators to increase knowledge and skills include providing training and education on how to use open infrastructure, at both local institutional and national/international organisation levels. Physical opportunity barriers discussed included increased time investment for researchers to familiarise themselves with open infrastructure alternatives. Facilitators to support this included protected time for researchers to be trained in and to practice using open infrastructure.

Social opportunity barriers included a current lack of community norms to prioritise open infrastructure within health psychology and more widely (Invest in Open Infrastructure, 2024), or closed source models that provide perceived safety and sense of recourse. Many institutions no longer have local servers but instead use a cloud service storage and back-up (e.g. Microsoft Sharepoint/Teams/OneDrive), effectively ceding digital sovereignty to foreign corporations in jurisdictions that are increasingly seen as potentially hostile to European interests for all files. Facilitators to address these concerns would include policy and funding bodies setting requirements for open infrastructure to provide sustainable research tools. Additionally, wider long-term funding to maintain open infrastructure is required at national and international level to sustain these open infrastructure alternatives.

Valued functionalities in closed software to be implemented in open infrastructure

Our discussions then moved towards the functionalities that we as researchers value in closed infrastructure that we would like implemented within open infrastructure. We prompted the audience to discuss this across four aspects: tools for data collection, qualitative data analysis, quantitative data analysis and writing/reference management. Key functionalities included ease-of-use and familiarity. It's important that open infrastructure tools feel like the closed tools we are used to lessen the time and training to switch. Easy collaboration with colleagues is another key functionality. Ethical approval committees will have important concerns on data safety including General Data Protection Regulation (GDPR) (Crutzen et al., 2019)

if open infrastructure alternatives do not clearly and transparently address these. Alignment of open infrastructure with GDPR depends on careful implementation, including secure hosting, anonymisation, and consideration of differing legal requirements across countries. Future work should evaluate open infrastructure tools (Table 2) for their compatibility with privacy and data protection needs across diverse regulatory contexts.

Where to start in moving to open infrastructure

A need for increased awareness of open alternative to closed infrastructure was evident from initial discussions in this roundtable session. Accordingly, Table 2 highlights open alternatives to closed software infrastructure, organised by research activities (Peters and Varol, 2025). Some key swaps from closed to open infrastructure can be seen in referencing software (moving from closed Endnote/RefWorks to open Zotero), statistical software (moving from closed SPSS to open jamovi or JASP) and software development repositories such as git forges (moving from closed GitHub to open Codeberg). Relatedly, in drafting this very paper,

the authors successfully collaborated using CryptPad (an open online word processing tool with collaboration features which looks and functions very similar to Microsoft Word and Google Docs) and used Zotero (<https://www.zotero.org/>) for reference managing.

Table 2

Open versus closed science infrastructure alternatives

Task or Function	Closed Science	Open Science
Citations, bibliographies	EndNote, Mendeley	Zotero (https://www.zotero.org/), JabRef (https://jabref.org/)
Writing documents	Google Docs, MS Word, Apple Pages	CryptPad (https://cryptpad.fr/), LibreOffice Writer (https://www.libreoffice.org/), Typst (https://typst.app/), Quarto (https://quarto.org/), Zettlr (https://www.zettlr.com/)
Collaboration and version control	GitHub	Codeberg (https://codeberg.org/), GitLab (https://about.gitlab.com/)
Online Studies	Qualtrics, SurveyMonkey	LimeSurvey (https://www.limesurvey.org/), {formr} (https://formr.org/)
Statistical analyses	SPSS, SAS, Stata	Jamovi (https://www.jamovi.org/), JASP (https://jasp-stats.org/), R & RStudio (https://docs.posit.co/ide/user/# rstudio-ide-oss-downloads), Python (https://www.python.org/)
Qualitative analyses	NVivo, Atlas.ti, Dedoose, MaxQDA	ROCK (https://rock.openscience.org/), QualCoder (https://qualcoder.wordpress.com/), Taguette (https://www.taguette.org/), ReQual (https://requal.fsv.cuni.cz/)
Mock-ups and wireframes	Figma	Penpot (https://penpot.app/)
Scientific figures	Adobe Illustrator, Canva	InkScape (https://inkscape.org/)
Experience Sampling Method (ESM)	MoviSens	ExperienceSampler (https://www.experiencesampler.com/), ESMira (https://esmira.kl.ac.at/?lang=en)

Note: Adjusted from Peters & Varol (2025)

Recommendations for facilitating open infrastructure within health psychology

Next in the session, we discussed how we as individual researchers can advocate for open infrastructure switches that can be sustainable in the longer-term. We outlined two theories related to maximising sustainable behaviour change towards open science (Robson et al., 2021) (Figure 1). The Pyramid of Culture Change (Nosek, 2019) depicts that for any open research behaviour (here adopting open infrastructure), we must focus not only on changing individual motivation and behaviour, but on wider comprehensive strategies across infrastructure, user interface/experience, communities, incentives and policy. Implementation of any given open research behaviour (such as open infrastructure) is enhanced if we consider addressing all aspects of the EAST framework (Easy, Attractive, Social, and Timely, Behavioural Insights Team, 2024; Robson et al., 2021).

After having presented these theories, we discussed the more sophisticated approaches to behaviour change intervention development that we as health psychologists are familiar with, specifically using Intervention Mapping (Bartholomew Eldredge et al., 2016); see figure we presented as an example here: <https://zenodo.org/records/17077213>. Using this framework, we emphasized that when it comes to transitioning to open infrastructure, we as academics have the questionable privilege that we ourselves are the environmental actors that control the environmental conditions as well as the implementers of any behaviour change intervention, albeit in different roles such as department head or vice-dean of research.

Its oversimplification makes the Pyramid of Culture Change well suited as an organizational principle for the discussion of the recommendations discussed in the session. We must start, at the base of the pyramid, by making open infrastructure possible (Table 3). Funding opportunities for long-term maintenance of developed infrastructure are currently insufficient. Many efforts

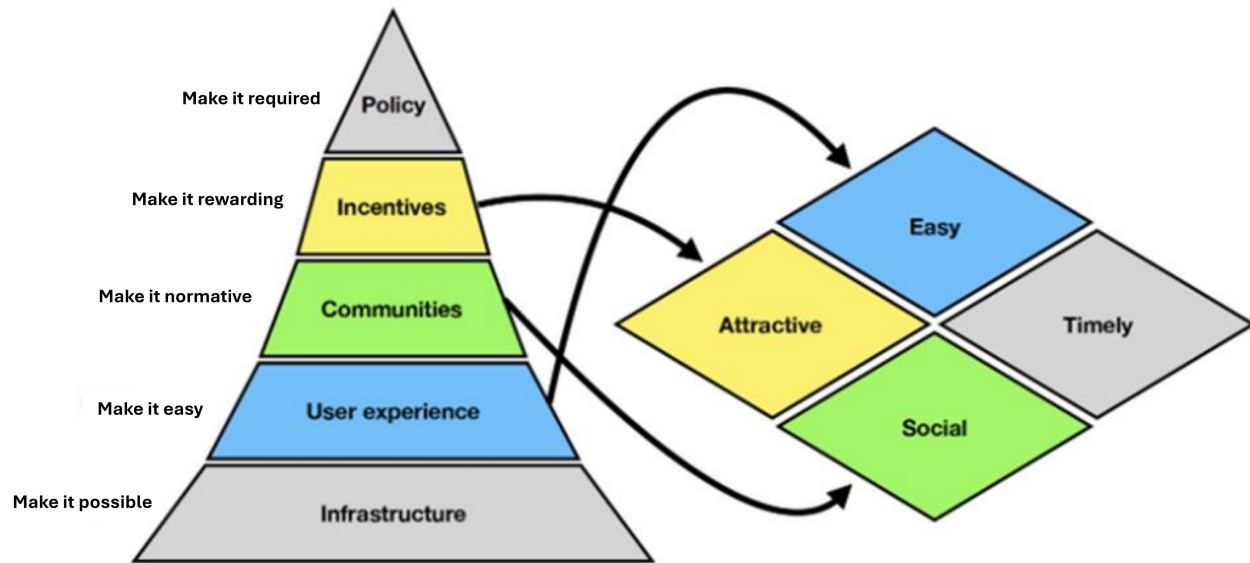


Fig. 1. Frameworks for behaviour change useful for considering open infrastructure implementation.

to sustain open infrastructure tools rely on the goodwill and free time of individual academics, which is not sustainable. Clear university policies and adequate budget allocation are necessary in the individual institutions, as well as guidance from funders is required to facilitate use and maintenance of open infrastructure within costings. Opening up funding structures to support open infrastructure will allow us to create infrastructure that is easy to use and interoperable with current infrastructure: making the “easy switch” even easier. Use of open infrastructure allows our time and money to be spent towards activities that benefit science, our research team and society as a whole, rather than closed infrastructure supporting external companies.

Secondly, we must make it easy for researchers to use open infrastructure. Find the key swaps, the ‘easy wins’ for adding one or two infrastructure changes within a given project, such as moving from closed to open referencing software (from closed Endnote/RefWorks to open Zotero, see this guidance: https://www.zotero.org/support/kb/endnote_import or statistical software (from closed SPSS to open jamovi or JASP).

Thirdly, we need to make open infrastructure normative. Researcher advocacy is key: we as researchers can contact -or are ourselves- Research Managers and Research Committee members within our respective institutions to open up the discussion of viable open infrastructure switches. We can request open infrastructure switches to our IT services to show appetite for these cheaper alternatives. Leverage the main drive for institutions: the fact that switching to open infrastructure provides a huge money-saving opportunity! Emphasise the UNESCO recommendation on Open Science (UNESCO, 2021). We can also mobilise open infrastructure within our teaching: perhaps starting smaller-scale with switching to open referencing software and surveys in-class (e.g., LimeSurvey or CryptPad Forms instead of Qualtrics), to large-scale switching to analysis tools for research projects and statistical training.

Fourth, we must make open infrastructure rewarding for researchers and institutions. Institutions must reward researchers making advances in the development and adoption of open infrastructure, such as via awards and inclusion within grant applications. Researchers can also benefit from flexible software options via open infrastructure. Within health psychology, we can adopt open behavioural change intervention measures or content, such as the example of Experience Sampling Item Repository (ESM Item Repository, 2025). Open and FAIR databases also offer unique opportunities for researchers to access and analyse larger and more diverse datasets, such as individual participant data meta-analyses. Finally, we must make open infrastructure required. We must prompt researchers to critically reflect and justify their use of closed infrastructure when open alternatives are available. We may be far from this at present, but opening up conversations on the benefits of open infrastructure

Table 3

Recommendations for facilitating open infrastructure within health psychology, structured by the Pyramid of Culture Change

Recommendations	
Make it required	- Prompt researchers to critically reflect & justify their use of closed infrastructure
Make it rewarding	- Reward development & use of open infra e.g. in grant applications, awards - Use open behavioural change intervention content or assessment tools
Make it normative	- Advocate for open science support at the university/department/lab level - Mobilise open infrastructure within our teaching e.g. Statistical software: from closed SPSS to open jamovi or JASP
Make it easy	- Find the “easy wins” e.g. referencing software: from closed Endnote/RefWorks to open Zotero
Make it possible	- Funding to support development and maintenance of open infrastructure

Conclusions

Running this roundtable session at EHPS 2025 gave us new insights into the current perceptions of health psychology researchers on open infrastructure. We identified key barriers and facilitators to adoption and implementation of open infrastructure. We also identified some key recommendations to empower researchers and institutions to initiate a switch to specific open infrastructure alternatives. Our insights here can now be enacted on by organisations working to support open research practices within the health psychology community, such as the EHPS Open Science Special Interest Group.

References

- Aksoy, A. Y. and Beaudry, C. (2021). How are companies paying for university research licenses? empirical evidence from university-firm technology transfer. *The Journal of Technology Transfer*, 46(6):2051–2121. <https://doi.org/10.1007/s10961-020-09838-x>.
- Bartholomew Eldredge, L. K., Markham, C. M., Ruiter, R. A. C., Fernández, M. E., Kok, G., and Parcel, G. S. (2016). *Planning health promotion programs: An Intervention Mapping approach*. Jossey-Bass Public Health, 4th edition.
- Behavioural Insights Team (2024). EAST Framework: Four Simple Ways to Apply Behavioural Insights. Technical report.
- Crutzen, R., Ygram Peters, G.-J., and Mondschein, C. (2019). Why and how we should care about the general data protection regulation. *Psychology & Health*, 34(11):1347–1357. <https://doi.org/10.1080/08870446.2019.1606222>.
- ESM Item Repository (2025). ESM Item Repository.
- Gownaris, N. J., Vermeir, K., Bittner, M.-I., Gunawardena, L., Kaur-Ghumaan, S., Lepenies, R., Ntsefong, G. N., and Zakari, I. S. (2022). Barriers to full participation in the open science life cycle among early career researchers. *Data Science Journal*, 21. <https://doi.org/10.5334/dsj-2022-002>.
- Invest in Open Infrastructure (2024). Trends in Open Infrastructure Performance and Adoption. Technical report, Invest in Open Infrastructure.
- Krasodomski-Jones, A. and Smith, J. (2022). The Open Road: How to Build a Sustainable Open Infrastructure System. Technical report, Demos, London.
- Lamprecht, A.-L., Garcia, L., Kuzak, M., Martinez, C., Arcila, R., Martin Del Pico, E., Dominguez Del Angel, V., van de Sandt, S., Ison, J., Martinez, P. A., McQuilton, P., Valencia, A., Harrow, J., Psomopoulos, F., Gelpi, J. L., Chue Hong, N., Goble, C., and Capella-Gutierrez, S. (2019). Towards fair principles for research software. *Data Science*, 3(1):37–59. <https://doi.org/10.3233/DS-190026>.
- Michie, S., van Stralen, M. M., and West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6(1):42. <https://doi.org/10.1186/1748-5908-6-42>.
- Norris, E., Varol, T., Coyne, R., O’Mahony, A., Green, J., Brooks, J., and Toomey, E. (2024). Reflecting on five years of the european health psychology society’s open science special interest group. *European Health Psychologist*, 23(4). <https://doi.org/10.62696/x3jq1z88>.
- Nosek, B. (2019). Strategy for Culture Change.
- Osborne, C. and Norris, E. (2022). Pre-registration as behaviour: developing an evidence-based intervention specification to increase pre-registration uptake by researchers using the behaviour change wheel. <https://doi.org/10.31234/osf.io/w3qg9>.
- Peters, G.-J. and Varol, T. (2025). Open Infra. In *A Guide that Opens Science*.
- Robson, S. G., Baum, M. A., Beaudry, J. L., Beitner, J., Brohmer, H., Chin, J. M., Jasko, K., Kouros, C. D., Laukkonen, R. E., Moreau, D., Searston, R. A., Slagter, H. A., Steffens, N. K., Tangen, J. M., and Thomas, A. (2021). Promoting open science: A holistic approach to changing behaviour. *Collabra: Psychology*, 7(1). <https://doi.org/10.1525/collabra.30137>.
- Science Europe (2025). Research Infrastructures. Technical report.

- Segerstrom, S. C., Diefenbach, M., Hamilton, K., O'Connor, D. B., and Tomiyama, A. J. (2022). Open science in health psychology and behavioral medicine: A statement from the behavioral medicine research council. <https://doi.org/10.31234/osf.io/dj3xe>.
- Shao, Y., Jiang, Y., Kanell, T. A., Xu, P., Khattab, O., and Lam, M. S. (2024). Assisting in Writing Wikipedia-like Articles From Scratch with Large Language Models.
- UNESCO (2021). *UNESCO Recommendation on Open Science*. UNESCO, Paris. <https://doi.org/10.54677/MNMH8546>.
- Zečević, K., Houghton, C., Noone, C., Lee, H., Matvienko-Sikar, K., and Toomey, E. (2021). Exploring factors that influence the practice of open science by early career health researchers: a mixed methods study. *HRB Open Research*, 3:56. <https://doi.org/10.12688/hrbopenres.13119.2>.



Emma Norris works at the Department of Health Sciences, Brunel University of London, United Kingdom.
ORCID: 0000-0002-9957-4025
Email: emma.norris@brunel.ac.uk
Website: <https://www.brunel.ac.uk/people/emma-norris>



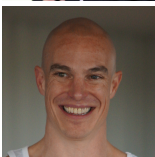
Maya Braun works at the Ghent University, Belgium and the University of Zürich, Switzerland.
ORCID: 0000-0002-1240-4550
Email: maya.braun@ugent.be
Website: <https://www.ugent.be/ebehaviourchange/en/team/team-pp05-1/page-mayabraun>



James A. Green works at the Health Research Institute, University of Limerick, Ireland.
ORCID: 0000-0002-7309-0751
Email: james.green@ul.ie
Website: <https://ajamesgreen.com>



Paquito Bernard works at the IRSET (Institut de recherche en santé, environnement et travail), University of Rennes, France.
ORCID: 0000-0003-2180-9135
Email: paquito.bernard@inserm.fr
Website: <https://avuer.hypotheses.org>



Gjalt-Jorn Peters works at the Department of Theory, Methods and Statistics, Open University of the Netherlands, Netherlands.
ORCID: 0000-0002-0336-9589
Email: gjalt-jorn.peters@ou.nl
Website: <https://behaviorchange.eu>