


# Open Access, Scholarly Communication, and Open Science in Psychology: An Overview for Researchers

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## Abstract

Scholarly communication, Open Access (OA), and open science practices in Psychology are rapidly evolving. However, most published works that focus on scholarly communication issues do not target the specific discipline, and instead take a more “one size fits all” approach. When it comes to scholarly communication, research practices and traditions vary greatly across and within disciplines. This monograph presents a current overview that aims to cover Open Access (OA) and some of the newer open science-related issues that are affecting Psychology. Issues covered include topics around OA of all types, as well as other important scholarly communication-related issues such as the emergence of preprint options, the evolution of new peer review models, citation metrics, persistent identifiers, coauthorship conventions, field-specific OA megajournals, and other “gold” OA psychology journal options, the challenges of interdisciplinarity, and how authors are availing themselves of green and gold OA strategies or using scholarly networking sites such as ResearchGate. Included are discussions of open science strategies in Psychology such as reproducibility, replication, and research data management. This overview will allow psychology researchers to get up to speed on these expansive topics. Further study into researcher behavior in terms of scholarly communication in Psychology would create more understanding of existing culture as well as provide researchers with a more effective roadmap to the current landscape. As no other single work is known to provide a current look at scholarly communication topics that is specifically focused on Psychology, this targeted overview aims to partially fill that niche.

## Keywords

open access, scholarly communication, Psychology, psychological science, scientific communication, open science

## Introduction

Across the disciplines, scholarly publishing and other aspects of scholarly communication are in a time of disruption and transition. The ongoing trend toward Open Access (OA) to the results of research continues to engage authors, publishers, librarians, research offices and others that seek to maximize impact of scholarly research. However, many treatments of these topics are very broad, and there are very few overviews that focus on how OA is playing out in the disciplines. Each discipline (and even subfield), due to disciplinary differences in scholarly communication practices must be considered separately. Overviews of this new open landscape for each discipline would be useful to researchers and allow comparisons and targeted studies that would help develop best practices that work for the discipline.

As OA has moved forward to encompass research outputs beyond publications, it has become clear that open science practices and principles have emerged as integral

to psychological science. It is important to understand the current landscape not only through a disciplinary lens, but also from a stakeholder perspective. Whether researcher, author, librarian, or publisher, this is a fast moving time of rapid change, largely due to technological advances and the power and reach of the internet. While the advent of the internet was one game changer, the development of OA (and now open science) present another large disruption and opportunity for effectively sharing the results of research on a global scale. In terms

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of Psychology, some traditional aspects of scholarly publishing remain the same, while many others continue to evolve. Authors find themselves writing for the more global audience that the internet continues to enable. Sharing articles online with colleagues near and far has become part of research culture, and collaboration is now possible across and between institutions and countries. Publishers are adapting to a changing culture of scholarly sharing and networking that authors have come to expect from the internet culture. Universities want to take advantage of services that showcase the work of their authors, using new metrics and research information systems that demonstrate impact in an age of assessment.

One major aspect of the scholarly landscape is the phenomenon of Open Access (OA) with its continuing trajectory. There is more OA all the time; more fully OA journals, more OA articles (of all types), more preprints and outlets for them, more repositories and articles in them. The COVID-19 pandemic only seemed to amplify both the need for access to peer reviewed literature and to fast availability of current research results. Lives were at stake, and the need for availability of the psychology literature could not be understated. The pandemic was a game changer for publishers too, with the 2022 release of Clarivate's Journal Citation Reports for 2022 announcing via their blog on the date that the Journal Impact Factors were released that "Journal Citation Reports 2022: COVID-19 research continues to drive increased citation impact" (Quaderi, 2022).

With a transition to Open Access/open research in psychological science already underway before the pandemic, COVID-19, with its lockdowns and up to the moment needs for access to current research results only shone the spotlight even more brightly on the existing systems of publication and their shortcomings. Suddenly, the rapid dissemination of preprints made perfect sense, and the need for peer review was imperative, but not with a traditional system that might've taken months. In the current landscape of scholarly publishing/scholarly communication, the pandemic has been a (further) disruption to existing scholarly publishing systems, and an accelerant to the need for OA and open research. If not now, when? The pandemic was catalyst for the understanding that information must flow freely to those that need to use it, reuse it, and build on the work of others via open science methods. It was a challenge, and an immediate one for stakeholders to develop seamless systems to keep up with what researchers needed and demanded. Examples of stakeholders included the researchers who developed new collaborative workflows using many new digital tools, publishers who had to get the most important research out with the type of licensing that allowed others to build on that work, and libraries that had to ensure that any faculty member or student had access to

all of the products of research in a timely manner. While many systems were poised to move forward, the pandemic demanded that they do so. Post-pandemic, everything in scholarly communication seems to have changed, and Open Access and open science have become more mainstream.

Throughout the pandemic, as readers and researchers demanded access to articles, books and other research outputs from anywhere in the world, there was even less patience for paywalls for readers. It would not suffice to hit a paywall on a subscription article where a reader unaffiliated with a major university might be asked to pay \$41, for example, to read an article for a brief time with a "no return" policy if the article wasn't as expected. Funders demanded OA to the research results funded by taxpayers (and extended that expectation to data). Libraries closed their doors for lockdowns and still had to serve up books and journals to their researchers. All of this demand pointed out the many inequities all over the system. Some are going to continue to be a challenge, such as the quick move toward requiring authors (or their funders) to pay APCs for publication, which does not work for many scholars.

Not only inequities in access in the publication of research were experienced and discussed. The inequities were geographic (biased toward the dominance of the North), or based on gender, language, or financial status. Ledgerwood et al. (2022) discussed all of the many exacerbations of the COVID-19 pandemic on inequities through the lens of psychological science and seek to "lead readers through a roadmap for reimagining psychological science in whatever roles and spaces they occupy" (p. 1). In this way, the pressures of the pandemic around research in psychological science can be studied and certainly some of the new workflows around open science practices can be kept and other traditional systems jettisoned more quickly than would normally be the case.

In terms of the discipline, there was so much focus on OA in biomedicine during the pandemic that this may have affected support for other areas such as psychology, sociology, and many others. The pandemic brought up issues in terms of digital access and infrastructure. The ability to secure funding for necessary research is a perennial and continuous challenge. During the pandemic, and requiring much more focus now and in the future, was a lack of access to all-important Indigenous voices, and that information not able to be digitally discoverable and available. In the article, "(In) equitable knowledge systems: before, during and beyond a pandemic," Harle (2020) describes various types of inequities, and how they might be mitigated.

One thing is certain: OA is here to stay, but many ask "who will pay?" This is an open question as the scholarly publishing systems evolves and changes and the sources

of needed revenue continue to transition. While continuing questions exist over how to fund OA (and there are many business models in the ecosystem currently), it is still unknown how much of the research literature will transition to OA, and how soon. There is little argument that opening up the research literature to scientists, practitioners and the public is on its way to becoming a realized goal with little downside. OA has become part of the values systems and mission of universities, libraries, university departments and individual scholars and researchers. There are many formal and informal definitions of Open Access, but a commonly cited one is from the Budapest Open Access Initiative (BOAI), which celebrated its 20th anniversary in 2022. The original statement, as well as 10th and 20th anniversary updates can be found at the BOAI website (<https://www.budapestopenaccessinitiative.org/read/>). The Berlin Declaration states:

By ‘open access’ to the literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself.

There is no single definition that exists for the term “scholarly communication.” In libraries, it likely has a different definition than what might be considered by a psychological scientist. In libraries, “scholarly communication librarians” are common (especially in research libraries) and the term functions as an umbrella term that can cover areas such as Open Access, copyright and licensing, research data management, research impact services, persistent identifier initiatives, open journal publishing programs, and often open educational resources programs. Universities may tie the scholarly communication activities and initiatives that are developed in their libraries with the type of university, the level of research activity at their university, or specific interests of the curriculum or certain faculty members or units. Other definitions of scholarly communication come from the disciplines such as a recent work focused on sociology (P. N. Cohen, 2019). Cohen, a sociologist and author of *Scholarly Communication in Sociology*, describing the term in a sociology context uses “scholarly communication” as a term in a way familiar to those in Library and Information Science fields, and states (p. 3) that:

it’s helpful to step outside the discipline and see it from the perspective of libraries. Libraries are responsible for collecting, describing, disseminating, and preserving our research. In keeping with that perspective, I use the general term scholarly *communication* rather than simply, “publishing.” Publishing is the thing you do to get your research out to

readers, while scholarly communication is the system that encompasses that activity, “the system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community, and preserved for future use.” (Association of College & Research Libraries, 2006)

In fact, in most research libraries, “scholarly communication” is a particular specialty of librarians who may work with OA policies, repositories, OA journal and book publishing issues, and services around research impact for the individual, department, school or university. Almost 20 years ago, The Association of College and Research Libraries (ACRL) included in its 2003 definition of scholarly communication that: “The system includes both formal means of communication, such as publication in peer-reviewed journals, and informal channels, such as electronic listservs.” (<https://acrl.libguides.com/scholcomm/toolkit/>). Scholarly communication is frequently defined or depicted as a lifecycle documenting the steps involved in the creation, publication, dissemination and discovery of a piece of scholarly research. While the ACRL definition may appear dated, it is still in use today. However, as open science/open research moves forward, the definition expands out into analyzing impact, identifying new tools for sharing research results, and other aspects.

While even Wikipedia also includes a comprehensive treatment of the various aspects of the complex topic of Open Access ([https://en.wikipedia.org/wiki/Open\\_access](https://en.wikipedia.org/wiki/Open_access)), there is a need to focus specifically on the issues for various disciplines and fields in order to understand the nuances and maximize the benefits. There is no “one size fits all” when it comes to how OA is affecting scholarly publishing and researcher behavior in psychological science. The goal of this monograph is to detail the current landscape around Open Access (and associated scholarly communication topics) specifically for areas of psychology and present practical strategies that researchers may employ to ensure that they take advantage of available Open Access strategies to increase the impact of their work. One major strategy, known as “green Open Access” is to deposit every article, to the extent possible in a digital repository that is crawled by search engines such as Google, making those articles available to anyone with an internet connection. Open Access can go beyond public access to openly licensing articles so that they can be machine-readable as well. This type of OA is possible for almost any traditionally-published research output and is definitely a missed opportunity for scholars to share their work to the world if not pursued for every article. Many scholars are committed to this green OA for their entire scholarly output, and many universities expect their faculty to make their works Open Access. Many funders have moved in recent years from a focus on public access to a more fully “Open Access” to the

results of research (that includes open licensing, and this is causing some pain points for authors, publishers and funders). There is a significant pivot going on in the direction of OA.

With the maturing of Open Access strategies, particularly practices around authors' "self-archiving" various version of an article in digital repositories and dissemination of "author's original" (AO) preprints before peer review online, there exists proliferation of many article versions online. In fact, as OA has grown and become more mainstream, many versions of a single research article can exist in multiple institutional or subject repositories online. Readers find these early articles more easily discoverable via searching the popular Google Scholar, and by using new tools such as Unpaywall (<http://unpaywall.org/>), a free service that provides enhanced discoverability and access to available repository versions of subscription articles (Chawla, 2017a). Alternately, the Open Access Button (<https://openaccessbutton.org/>) can assist readers unaffiliated with subscribing institutions in accessing the scholarly literature. The future of scholarly publishing is in some ways unclear, but it does include more OA of all types, enhanced collaboration, more online sharing of research results, and increasing accessibility to the data that underlies and supplements scholarly publications. Funders are increasingly mandating that authors and universities provide OA to the results of taxpayer funded research, even as there are fewer research dollars available than in the past. Research libraries are also undergoing seismic changes, and librarians are increasingly taking on consulting roles in scholarly communication and Open Access areas. In this complex scholarly publishing/scholarly communication environment, faculty, students, and researchers may be seeking information on products, systems, new modes of publishing, and other strategies so that they may be able to take advantage of the myriad opportunities that the internet is providing to share the results of research. Communication of research findings to the public via the internet has become an expectation of funders, universities and readers, and psychological science has many opportunities to reach larger audiences of interested readers than in the days when print materials could be accessed on site in public research libraries or via interlibrary loan by request of the reader from their public libraries. Moving beyond Open Access specifically, "open" is becoming the norm and expectation of a global focus on open science/open research. Important initiatives such as UNESCO's (2021) Recommendation on Open Science, adopted by the General Conference of UNESCO in November, 2021 and the National Academies of Sciences, Engineering, and Medicine's (2022a) Roundtable on Aligning Incentives for Open Science have begun to set the tone

for an open science future. Along with Open Access to the publication, researchers will need to meet expectations around "open" practices throughout the research lifecycle. With the array of tools now available and so many current changes to various parts of a research cycle that progresses from initial data collection to publication (in all of its forms), there are various impediments and slower uptake of certain parts of the workflow when it comes to qualitative research (as compared to the more fast-moving situation in areas of quantitative research). While a move to open does not follow the same trajectory in all subfields, it is important to start to move in new directions and for each researcher to find what will work in order to take advantage of Open Access and open science strategies that can increase impact. Some describe the future as one of open science (also known as open research and open scholarship) which will go beyond OA principles and practices). Not all disciplines and fields will move to an open future at the same pace, and many will find more intractable challenges than others. Prosser et al. (2021), in a study of the policies of psychology journals describes some of the challenges more inherent in qualitative research in the move to open in areas of social psychology. The move to open in psychological science will continue apace and will require study, analysis and innovation in order to reach goals of global dissemination of disciplinary research as well as the setting out of expectations around the sharing of research results in a discipline-specific manner.

### **Some History and Background of Scholarly Publishing/Open Access in Psychology**

As a precursor to today's focus on accessing research publications at the point of need via the internet, the traditional psychology literature had to first make the transition from print to online. The transformational move from print to electronic dissemination of research information was messy and chaotic at times, but at this point it can be said that most of the research level journal literature in psychology has been moved to the online environment, accessed either free or via library or personal subscriptions on the internet. Many traditional aspects remain, such as the specific field differences in scholarly communication practices that continue on. The standards for scholarly communication (as defined by ACRL) in psychology will continue based on field traditions and transitions through evolutions in technology as well as various factors such as a continued emphasis on assessment of scholars and universities. The wheels of change turn slowly in the promotion and tenure systems and cultures of most universities, many of whom have adopted an "audit culture" that has added increasing pressure to a system that requires faculty to demonstrate

impact. The traditions of scientific communication within disciplinary culture, particularly in the case of some new behaviors such as sharing preprints (which existed in the paper world in some disciplines and made the transition easily to the online situation), predate the internet. Over time, it is assumed that some scientific communication in the electronic realm might promote the development of more similarities in the way disciplines behave online. Studies about the way that various disciplines approach the newer aspects of scholarly communication and Open Access have shown that there is no “one size fits all” and that there is still great variety in the way disciplinary scholarship is funded and disseminated to readers and researchers. Severin et al. (2018) concluded in a study that analyzed all of the existing discipline-specific studies on “open access publishing practices and barriers to change” that:

Over the last three decades, scholarly publishing has experienced a shift from “closed” access to OA as the proportion of scholarly literature that is openly accessible has increased continuously. Estimated OA levels for publication years after 2010 varied between 29.4% and 66%. The shift towards OA is uneven across disciplines in two respects: first, the growth of OA has been uneven across disciplines, which manifests itself in varying OA prevalence levels. Second, disciplines use different OA publishing channels to make research outputs OA. (p.1).

While psychology appears in some large-scale bibliometric (and other) studies of amount and type of Open Access, for example, there seem no large surveys of current psychology faculty and other researchers that would assist in painting a picture of how authors make their work OA, and why. More research into the scholarly communication behavior of psychological scientists would help to facilitate change in the system by allowing a true understanding of the pressures as well as the opportunities at play in the current scholarly communication and Open Access ecosystem in the discipline. It is not clear how psychology is positioning itself to move forward intentionally to take advantage of all of the ways to most effectively disseminate and utilize research results in this internet-enabled scholarly publishing environment. Psychology does not jump out as a leader among disciplines in opening up its literature to a wider swath of readers and researchers. The wheels of change have turned slowly. Psychology’s current focus on aspects of open science and reproducibility are positive and visible reminders of some aspects of a move toward openness. As for OA to the corpus of the psychology research literature, Psychology would not stand out as a leader, and has a long way to go.

Some early pioneers in the electronic communication space for psychology (and one of a “core group of enthusiasts” that are the key players in the early days of the

Open Access movement) include cognitive scientist Stevan Harnad, the editor of *Psychology*, a very early electronic peer reviewed journal introduced in 1990 (Kling & McKim, 2000). *Psychology* was started by Harnad in 1990 with support from the American Psychological Association and Princeton University, and was an early electronic journal that was associated with the successful Cambridge University Press-published journal, *Behavioral Brain Sciences (BBS)*. Harnad reported in 1996 that it was much more difficult to get authors to submit to the electronic *Psychology* than it was to the print counterpart *BBS*, and that *Psychology* was a “slow starter” (Taubes, 1996). However, in those early days of electronic scholarly publishing, Harnad (also affiliated with the CogPrints eprints archive he launched in 1997) and some others had started a revolution in publishing psychological science that still continues in today’s publishing space. It has taken many more years to realize some level of Open Access than Harnad and his colleagues could have imagined when they began innovating in the 1990s. Harnad always exhorted researchers to use “just a few keystrokes” to make their scholarly works free for readers online, and as many in the early OA movement, did not find uptake to be satisfactory no matter how much energy was spent on activism and advocacy.

Harnad was also the author of the famous “subversive proposal,” posted to a mailing list in 1994, that asked all researchers to make their papers freely available on the internet. At that time, Harnad had also been editing the aforementioned journal *Behavioral and Brain Sciences*, which included “open peer commentary,” and all of these were early efforts toward “open online access and interaction” (Poynder, 2014). At the time that the first issues of *BBS* were published, only one other scholarly journal, *Current Anthropology (CA)* was using open peer commentary, successfully at that, and that was the inspiration for *BBS*’s own open, post publication review concept (“Editorial,” 1978). To this day, *Behavioral and Brain Sciences* has enjoyed one of the highest impact factors in behavioral sciences (20.415, #1 in Behavioral Sciences and Psychology, Biological and #2 in Neurosciences (2015 Thomson Reuters, now Clarivate Analytics Journal Citation Reports). Harnad’s subversive proposal was more fully presented in the 1995 publication, “*Scholarly Journals at the Crossroads: A Subversive Proposal for Electronic Publishing*” (Okerson & O’Donnell, 1995). This “subversive proposal” is often referenced today in conversations around Open Access.

Besides the move of many publishers to embracing digital publication processes, for the most part, journal publishing has not really changed for hundreds of years as the vehicle for certification of scientific research results. Many articles in the literature describe the

process of scholarly publishing, providing valuable historical background information (Nosek & Bar-Anan, 2012). There is a long history to consider when discussing potential changes to the scholarly communication system of psychological science. The traditional systems of scholarly journal publishing have been with us for more than 350 years (Guedon, 2001). Since 1665, the *Journal des Sçavans* (France) and the *Philosophical Transactions of the Royal Society of London* (England) began publishing “with the intent to advance scientific knowledge by building on colleagues’ results and (to) avoid duplication of results, and established both the principles of scientific priority and peer review” (Larivière et al., 2015, p. 1). In this long history, authors have never been paid for writing and contributing scholarly articles to the literature, and publishers have taken care of the publishing process, often managing the peer review process. Since the advent of the internet, some of the publishing and sharing practices of scientists have been disrupted and transformed, but scholarly communication in psychology still has its focus on the publication of research results using traditional vehicles such as peer reviewed journals and scholarly book chapters. Some aspects of the publishing process may be considered anachronistic, and many experiments are ongoing, with and without publisher cooperation. Innovation is constantly pushing boundaries of the system that is ingrained and familiar to all faculty and researchers. Some are wary of the changes that the internet has brought to scholarly publishing/scholarly communication in psychology, some welcome innovations, and some see a role in pushing the envelope toward looking beyond traditional journal publication altogether. Those seeking new methods seek to ensure the rapid and wide dissemination of research results on the internet, with many also pushing for not only public reader access to psychology scholarship but to define Open Access to include optimal reuse and remixing of content. This definition of Open Access, sometimes called “libre Open Access” and carrying a Creative Commons Attribution (CC-BY) license allows the most reuse, sharing and innovation and facilitates the ability of researchers to build on previous research results (while still requiring attribution). The importance of licensing OA works is tantamount as the tenets of open science require liberal licensing in order to facilitate reuse of published research output, and works that are not licensed, or are simply “free to read” will not enable an open future that depend on machines and not human eyeballs. Creative Commons licenses, particularly the popular CC-BY attached to articles, books and other open works are necessary for maximum retention of author rights to their own works as well as to enable reuse of scholarly work. Where CC-BY will not work, there are a variety of other Creative Commons licenses

available for authors to use. As of 2022, these licenses have been available for 20 years (<https://creativecommons.org/>). It is no longer necessary for authors to assume that they will automatically need to sign away copyright to publishers, and every journal publisher’s website will have information for authors on these issues. As funders and universities are more focused than they used to be on authors’ rights retention, most university libraries and research offices would also offer consulting on these copyright and licensing issues.

Publication in scholarly journals forms the basis of important citation studies that identify and map a particular discipline but its output. By studying journal citation data in a variety of ways, it becomes easier to understand the structure and organization of psychology as a scientific discipline. Scientific and bibliometric analysis of the literature of psychological science within the larger ecosystem continues to demonstrate that “psychology is a hub science” and by 2000, seven hub disciplines could be identified and mapped based on a “similarity measure based on co-citations:”

Not surprisingly, given scientific specialization over the past century, contemporary sciences no longer originate from a single source. Instead, seven hub sciences can be identified: mathematics, physics, chemistry, earth sciences, medicine, psychology, and the social sciences. Yes, psychology emerged as one of the hub disciplines of science! (Cacioppo, 2007)

Creating these maps allows visualization of the importance of psychology to other fields. For instance, “public health, neuroscience, neurology, radiology, cardiology, and genetics are sciences that fall between psychology and medicine” on the map. A major study by Boyack et al. (2005) used citation data from one million articles published in 7,121 journals (both citing and cited journals, and more than 23 million references) that were published in the year 2000 and sourced from the former Thomson Reuters (now Clarivate Analytics) *Science Citation Index (SCI)* and *Social Sciences Citation Index (SSCI)*. The result was a “mapping of science,” based on the journals’ “citation interlinkages,” and demonstrated location of each scientific discipline relative to others around it. The impact of disciplines on other disciplines, and degrees of interdisciplinarity (high for psychology) is visible (Boyack et al., 2005; Cacioppo, 2007). As a follow up (in 2009) to Boyack et al.’s work, Yang & Chiu delved deeper into the “hub” of psychology, studying networks using citation records taken from the PsycINFO database over a 40-year span (1979–2009). Within psychology, it has been shown using journal citation studies that clinical psychology has been identified as an important “knowledge broker,” for other related areas of psychology. A knowledge broker is defined thus:

“a journal becomes a knowledge broker when it absorbs knowledge from one set of journals, integrates and transforms the knowledge, and disseminates the end products to another set of journals” (p. 349). It is interesting to note how the roles of new journals (in this case, APA journals), impact the other established journals. This work provides an update after a lengthy absence of other similar studies (since 1985) that specifically focus on psychological science (Yang & Chiu, 2009). Further work on clinical psychology and its subdisciplines studied the organization of the literature and citations in clinical psychology (another “hub”), and it was further demonstrated that the scholarly communication practices of the subdisciplines of clinical psychology do not readily cross boundaries and publication behavior is more insular than might be expected. As for the subdisciplines of clinical psychology, researchers tended to publish in the literature of their own subdisciplines, rarely venturing across boundaries into the other subdisciplines or even to outside literature. The subdiscipline of cognitive-behavioral psychology’s articles’ citations are most likely to cross boundaries out into the journal literature of more general psychology and other related fields (Kiselica & Ruscio, 2014). Studies that continue to analyze the structure of scientific communication within psychology and outside of its boundaries would be helpful for understanding exactly how and where collaboration is occurring, or where possibilities for interdisciplinary, cross disciplinary or transdisciplinary work exist today.

## Interdisciplinarity in Psychology

Interdisciplinary research is a target interest of funding agencies, and is a general trend in research. Funders are quite specific on this point: “In recognition of the promise that interdisciplinary research holds for addressing complex scientific problems with societal implications, the National Science Foundation (NSF) directs grant reviewers to consider a proposal’s plan to disseminate findings across disciplinary bounds in order to have a broader impact” (G. E. A. Solomon et al., 2016, p. 2). The 2015 book, *Rethinking Interdisciplinarity Across the Social Sciences and Neurosciences* discusses many of the pragmatic issues of actually doing research and publishing in the integrated space where disciplines come together. Aspects of the cultures of disciplines and fields in terms of issues such as co-authorship patterns must evolve with interdisciplinarity (Callard & Fitzgerald, 2015).

The field of Cognitive Science, considered highly interdisciplinary, has been the focus of recent studies that have focused on citation patterns in journals. One study focused on two of the highest impact factor journals, *Science* and *Nature*, which include content in areas of psychology. These high profile journals cover all fields of

science, are multidisciplinary and cited at a very high rate. A recent study of cited references by G. E. A. Solomon et al. (2016) focused on how interdisciplinary *Science* and *Nature*’s content is in comparison to the level of interdisciplinary research found in a representative disciplinary title, *Cognitive Science*. *Science* and *Nature* have such a wide reach that anything published therein is likely result in a higher “diffusion of knowledge.” However, in comparison to other fields studied (Cell Biology and Physical Chemistry), the field of Cognitive Science showed a high integration score (the relative degree to which one subject area’s journals—as defined by Web of Science—cite those of other subject areas, indicating a diversity of cited references). Using metrics such as Integration and Diffusion scores, developed by the National Academies Keck Futures Initiative can help to measure interdisciplinarity by assessing the diversity of a paper’s cited references. It must be noted that it is difficult to study interdisciplinarity and there are other available measures as well. The G. E. A. Solomon et al. (2016) study also demonstrated that, as measured by their cited references, the articles in *Science* and *Nature* studied within each of the fields “are not significantly more interdisciplinary than are those sampled in the disciplinary journals” (for instance, the journal *Cognitive Science*).

Bergmann et al. (2016), also focusing on the journal *Cognitive Science*, discussed another new metric for interdisciplinarity, based on co-author publication history:

A published article that has co-authors with quite different publication histories can be deemed relatively “interdisciplinary,” in that the article reflects a convergence of previous research in distinct sets of publication outlets. In recent work, we have shown that this interdisciplinarity metric can predict citations. Here, we show that the journal *Cognitive Science* tends to contain collaborations that are relatively high on this interdisciplinarity metric, at about the 80th percentile of all journals across both social and natural sciences. (p.1)

The Bergmann et al. (2016) study focused not on citation patterns but instead on whether scientists previously publishing papers in other domains were coauthoring papers together in *Cognitive Science* and looking at “coauthor publication history.” Scores on interdisciplinarity are then compared to other scientific fields and journals, especially within a group of cognitive science and neuroscience journals (Bergmann et al., 2016). Porter and Rafols (2009) looked at Neurosciences and five other research domains (all subject categories in Web of Science) to see whether science was becoming more interdisciplinary over the 30-year span from 1975 to 2005. Using a “combination of interdisciplinary metrics with science mapping enables us to characterize research interdisciplinarity with a detail not previously

available” (p. 740) and it was concluded that “science is indeed becoming more interdisciplinary, but in small steps. Research knowledge transfer, as evidenced by citation, draws mainly on neighboring fields. Only slowly do we see increase in the small proportion of sources from more disparate disciplines” (p.741), and “particularly striking is the extent to which research is now a team effort” (p. 740). In Neurosciences, it was also shown that there was a 90% increase over the time span in the number of authors per paper.

The emergence of a greater emphasis on “team science” is an important trend that follows (or creates an enhanced environment for) interdisciplinary research. Increasingly, teams have been dominating over solo efforts in research production in the sciences and social sciences. A study of millions of articles by Wuchty et al. (2007) showed that psychology, economics and political science showed the largest shift, and that, over a 45-year period “with regard to average team size, psychology, the closest of the social sciences to a lab science, has the highest growth (75.1%)...” (p. 1037) This study also showed that “there is a broad tendency for teams to produce more highly cited work than individual authors” (p. 1037). Organizations and conferences have emerged around the topic “the science of team science (SciTS),” for example, the International Network for the Science of Team Science (INSciTS).

Many recent studies of interdisciplinarity are important for psychology, and do seem to suggest that one of the personal costs of interdisciplinary research could be a lessening of a scientists’ productivity in terms of quantity of papers published, or even getting credit where credit is due for various parts of the research and publication process. While collaboration is a laudable goal for the advancement of science, in at least one study in biomedicine, there may need to be more conversation around incentives for researchers. The U.K. Academy of Medical Sciences studied this issue and found that “academic reward and recognition systems have failed to match the needs of team and large-scale collaborations” (p. 7), and another team at MIT has called for a new “science of collaboration” to look at all aspects of this complex phenomenon in practice (Allen, 2017). There are many issues with the effective design, incentivizing, management, and assessment of the elaborate environment of collaboration, whether global, national or even local. Making sure that scholarly communication practices keep up with the needs of researchers working in collaborative research environments will need to continue as an important focus of universities, consortia, and funders.

Suggestions for ways to enhance the reproducibility of published research (a major tenet of open science) include calls for more collaboration and team science,

and also for using team science with student training. This would ensure early experience with wide collaboration for students engaged in research. A working example of this concept, demonstrated by conducting replications with students in research methods courses in psychology is “The Collaborative Replications and Education Project (CREP)” (<https://osf.io/wfc6u/>). An example of team science and wide collaboration from the behavioral sciences is the “Many Labs” replication project, where “dozens of laboratories implementing the same research protocol to obtain highly precise estimates of effect sizes, and evaluate variability across samples and settings” (Munafò et al., 2017). Many Labs projects demonstrate results in replicability by “crowdsourcing dozens of laboratories running an identical procedure” (Klein et al., 2014, p. 151). The massive Many Labs 2 project involved participants from 36 countries and territories conducting “preregistered replications of 28 classic and contemporary published findings” (Klein et al., 2018, p. 447). The results of this study were published as a Registered Replication Report (as a single article) in the Research Practices section of *Methods and Practices in Psychological Science*, which is the home (after 2017) for APS Registered Replication Reports (<https://www.psychologicalscience.org/publications/ampps>). Another initiative, the Psychological Science Accelerator (PSA), led by Christopher Cartier (Ashland University, Ohio), brought together 170 labs on six continents that will allow researchers to collect data on a massive scale. Using a selection committee to make a final call on proposals after a vetting period, each submission to the PSA is considered based on “factors such as how important the research question is, what impact it might have on the field, and how feasible data collection would be” (Chawla, 2017b).

## Sustainability of the Societies that Serve Psychology

As the open availability of research materials grows, there have been concerns about the membership benefit of the society journal, and as the call for more openness grows, there is a concern that membership in scholarly societies may decline. For many scholars, the issue of the sustainability of the societies has been a concern. Recent reports analyzing largescale changes in how scholarship is to be monetized admit that there may be a “ripple effect for societies that subsidize other activities via their publishing revenue” (Mellon Foundation, 2016, p. 89). With other disruptions in the system due to changing modes of conference attendance to more virtual, and the lack of as much interest in receiving the society’s journal in the mail, or even online, Open Access is sometimes at issue. For many, the journal subscription was always



available online via the university library, further lessening the incentive of the journal subscription as membership benefit. Adding the move to an article-level discovery environment and the move of many learned society journals to the platforms of the largest commercial publishers, and it is obvious that societies had to view the increased opportunities for more visibility that are inherent in moving their publications to more open models, or to situations with limited (or no) embargoes. Some years ago, Willinsky explored these issues when writing about the Society for Neuroscience, “that, even if no one disputes the public good represented by the greater circulation of this knowledge, how can a journal be expected to offer free access to its content and remain financially viable?” (Willinsky, 2006, p. 9078). At that time, Willinsky had also called for the societies to collaborate more with each other, and possibly with the large research libraries (many of whom became Open Access publishers using platforms such as Open Journal Systems) as Open Access was expected to move forward and journal access would not provide the same levels of sustainability (Willinsky, 2004). The scholarly journal literature has been intertwined with the mission of the scholarly society, and the whole system is being disrupted as boundaries blur on the internet and journal publishing continues to consolidate toward a few very large publishers. Even large funder initiatives (such as the funder initiative “Plan S” currently emanating from Europe), with its lack of allowance for embargoes or closed access, will put pressure on society publishers. The value of the society will in the end be what its disciplinary community decides. Whereas learned societies and their publications have represented a necessary component of networking, an aspiration for researchers to publish in the society’s journals, and a meaningful connection to the discipline, it will be interesting to see whether norms around professional membership connections for faculty, researchers, students and practitioners remain a vital and integral part of the scholarly communication landscape.

The American Psychological Association (APA) is the largest professional membership organization for psychologists as well as the largest nonprofit publisher of psychology abstracting and indexing services (APA PsycInfo), monographs, journals, and other popular publications and research tools. The APA had 77,552 full members in 2015, a 4% decline for that year, even as more focus had been put on serious outreach to new and continuing members (American Psychological Association, 2016). Membership losses have been reported at APA in recent years. For instance, there was a significant decline of 7.6% in membership from 2010 to 2011. APA is not alone in its membership declines; the American Psychiatric Association, for instance, had a 7% membership decline from 2009 to 2012. However, the Association for Psychological Science (APS), saw a

16.3% overall growth from 2007 to 2011. This may represent growth in membership of a new generation of researchers in psychological science (Grohol, 2012).

Clements, taking the example of the restricted subscriber access to articles in British Psychological Society (BPS) outlets, offers arguments for wide public access to research results, and even likely attracting more writers to BPS journals and lessening the subscription burden on libraries. If the public and even practitioners have restricted access, there is also an “ethical imperative of using psychology to help others” (Clements, 2016). The fact the American Psychological Association developed an innovative Open Access, open data journal, *Archives of Scientific Psychology* was an early indication of the organization’s commitment to innovation and the wider dissemination of research results. Another new APA journal and platform, *Technology, Mind, and Behavior (TMB)* (<https://tmb.apaopen.org/>) is an Open Access, interdisciplinary, peer-reviewed journal published by the American Psychological Association. *TMB* publishes original work in the area of human–technology interaction with a focus on human behavior at the individual or group level. Committed to open science and transparency, *Technology, Mind, and Behavior* is part of APA Open: a new, interactive Open Access platform. Authors are empowered to dynamically present their research findings to immerse readers in ways going beyond standard PDF experiences.

### **Traditional Journal Publishing in Psychology and its Move to Open Access**

Even though Open Access publishing has grown rapidly, and a tipping point where there are more Open Access articles than closed (paywalled) has possibly arrived (Hook, 2021), libraries, readers and researchers are still dealing with the need to access a huge amount of traditionally published subscription resources. There are of course, many other ways that scholarly content is disseminated and published, including the traditional subscription route where costs are borne by libraries and their institutions. Today, articles are also sold by publishers in a pay per view environment where readers can “pay by the drink.” Familiar to researchers is the “paywall” that is encountered when the reader is asked to pay a fee to read or download the article, sometimes for a specified period of hours. In many ways, the paywall issue has fueled the Open Access movement because many readers cannot pay to read an article, especially because the buyer does not really know whether the article will even be useful at the point of discovery. If an article is not needed, there is no return policy. Some journals are also monetized by advertising revenue, but that model is not widespread in psychology.

Libraries have always spent a great deal of staff time, besides the funding via subscription revenue, on making journal articles easily accessible to institutional affiliates, whether in the days of print volumes, or now online in PDF format. Large FTE (full time equivalent number of faculty and students) institutions pay more, even as people wonder why the transition to electronic distribution did not mitigate some of the traditional costs that were inherent in the print-based system of production and distribution. Costs to libraries and institutions of the content from some commercial publishers are often deemed unsustainable. University libraries supporting OA initiatives via their institutional repositories and Open Access deals with publishers end up carrying added costs on top of their large journal outlays. Libraries are usually the responsible party in their institutions for the infrastructure costs as well as the staffing needs that OA initiatives require. Large research libraries also are carrying major responsibility for OA funding initiatives like *Subscribe to Open (S2O)*, where current large research universities continue to pay the higher subscription costs that are set at the by FTE level, while other universities with smaller FTE numbers pay less. This mirrors the traditional model where larger institutions pay more for subscriptions. With S2O, support of all subscribing institutions is needed in order to flip the title to all OA content. If universities cancel once a title becomes freely OA, the content would have to return to behind the paywall. With a move by the community of legacy subscribers to S2O, Open Access must be considered a price worth paying by university administrators determining levels of library budget support. S2O is emerging as a win-win for authors and a global readership as it is not based around the inequitable APC model. It is, however, not without some risk as a model that can be considered sustainable for publishers and libraries.

Libraries continue to have a major role in the ongoing transition to an Open Access future. In recent years, major controversies have erupted over how to monetize OA, and whether or not the transition to “author pays” via Article Processing Charges (APCs) will become the answer to the current “who pays?” dilemma. The fact that authors and departments and disciplines exist on a continuum of ability to pay remains a problem in search of a sustainable solution. This is a messy and transitioning time, requiring investment in a wide variety of approaches to OA. Some libraries also carry responsibility for administering and sometimes paying for institutional OA funds, and the Read and Publish (OA) agreements that are negotiated between libraries and publishers assist authors with paying APCs. Universities passing institutional OA policies and asking their libraries to implement them are considered to be signaling support for the added resources required to support

the development and staffing of repository efforts (and investments in open infrastructure) and associated outreach. Open Access outreach requires targeted and sustainable effort over time by both user services librarians, and the technical services colleagues with whom they collaborate on OA initiatives. Because psychology research spans many fields and traditions, Open Access and open data efforts require discipline-based OA expertise in implementation efforts. Alongside this work, libraries must make available the journal, book, and video collections required for researchers (or effective, seamless delivery mechanisms to ensure access to needed scholarly content). Adding financial support in some cases for OA funds that assist authors with paying article processing charges for OA (or sometimes hybrid) articles, and supporting efforts at building a community controlled (or community aligned) open infrastructure to support green OA initiatives further adds costs to sometimes under-resourced academic library systems. Libraries are paying for OA in support of a transition in the way scholarly publishing transitions to what seems sure to be an OA future. Librarians are a natural fit for this work with their knowledge and expertise in scholarly publishing, collection development, deep engagement with disciplinary faculty and students, and experience in both collection development and user services in research libraries. Some library leaders have proposed plans for supporting this “transition to open” that would ask academic libraries to set aside a certain percentage of their budgets for support of an open community infrastructure that would be built and aid in the transformation of scholarly communication. Lewis (2017) proposed the “2.5% Commitment,” where libraries would agree to the commitment that “every academic library should commit to contribute 2.5% of its total budget to support the common infrastructure needed to create the open scholarly commons.” While this support could cause some stress for already burdened libraries, intense discussion has ensued around the necessity of libraries taking on responsibility for support for development of new scholarly communication paradigms by contributing financial backing for this “values-based” commons.

The cost to library budgets via their institutions to at least one of the major commercial publishers, Elsevier, has been the focus of many protests, such as the Cost of Knowledge campaign and its “won’t publish” (with Elsevier) petition. The Cost of Knowledge boycott was started by Cambridge mathematician Gowers (2012) against Elsevier (<http://thecostofknowledge.com/>), and as of 2022 lists more than 20,000 signatories who have agreed not to publish, do editorial work, or referee for Elsevier. The Cost of Knowledge was a protest against Elsevier’s business practices, specifically high subscription prices, the “big deal” business model, and the

publisher's support for various legislative initiatives (Gowers, 2012).

In an evaluation by Heyman et al. (2016) of the effect of that petition on the future publishing habits of the 16,000 that had signed the petition agreeing not to publish, a study of the signatories from Chemistry and Psychology (500 signatories each) demonstrated that 17% of the psychology authors that signed the petition then went on to publish with Elsevier in the 4 years following the initiation of the campaign. The study took into account factors that affect authors' decisions on where to publish, such as issues of author order. In psychology, first and last author may be "typically reserved for the lead investigator and the supervisor or department head" (p.2). The signatories in psychology may have been coauthors, and not in the position to choose the publication outlet. However, for Psychology, even of the 46% that had coauthors, 26% of signatories were first author and 26% were in the last author position. (Heyman et al., 2016) It will be interesting to continue to watch how various actions by academics affect publishers (or whether they don't). It may seem that publishers are immune from this sort of action at this point, and they continue on without repercussions (except a temporary spate of negative publicity). These boycotts may not have had much of a real effect, particularly on the publisher's bottom line or rate of submissions from authors eager to publish in known high impact titles with name value.

A prominent example for psychological science is the petition and action aimed at the journal *Cognition*, an Elsevier journal ranked 11/85 in the Experimental Psychology category in the Journal Citation Reports (JCR) in terms of impact factor in 2015. With an article processing charge (APC) that some consider excessive levied at authors who want or need to make the publisher version of an article OA, those in the *Cognition* community started a petition to get that fee reduced by Elsevier (<https://sign.moveon.org/petitions/support-fair-open-access>). In addition, also at *Cognition*, there was a movement to require authors to make versions of articles (pre-prints and postprints) available "green" OA via author self-archiving in preprint servers such as PsyArXiv or presumably in OA institutional repositories that are available at most universities. Authors using a strategy for self-archiving also satisfy the requirements of institutional or funder OA policies.

As the practices of some commercial publishers have continued to raise the ire of researchers and librarians, along with boycotts of titles and other protest actions, some entire editorial boards have walked away from a publisher's title. One example is when the Elsevier journal *Lingua* saw its board leave, and ultimately form a new journal, *Glossa: A Journal of General Linguistics*, an Open Access journal published by OA publisher

Ubiquity Press. Sometimes, what has occurred is that when the board leaves, the publisher just goes ahead and forms a new editorial board, keeping the journal it owns in publication and leaving the field with two journals where the older title still retains some name value. Both journals may continue successful publication in the field, with likely many readers unaware of the situation that transpired. In these cases, the publisher develops a new editorial board and the former title continues to receive submissions and retain its place in the memories of many authors and readers. Those starting the new journal often wish a clean break and success for the new journal, but the old title still retains followers and reputation that may hinder evolution of the new title for some time.

In the case of *Glossa*, the newer OA journal, the editor who led the journal through the transition to OA, Johan Rooryck (also the director of Plan S from cOAlition S, <https://www.coalition-s.org>), discussed the issues with transitioning a commercial journal that had an impact factor to a diamond (no-APC) model that did not initially have a JIF. It took 5 years for the new journal, *Glossa* to start showing influence. As Rooryck stated:

And in many countries, researchers can only publish in journals that are in WoS and that have an IF. So this leads to the crazy situation that if you want to attract authors from those countries, you need to have an IF, even if you know full well that the IF is a completely flawed metric, and also that if you flip a journal from a commercial publisher to OA, you need to wait for five years to get that recognition. While the old journal you left behind, which was taken over by a new community, still takes advantage of the hard work of the previous community for five years after they resigned. This is what happened to *Lingua*: only now is it becoming apparent in Google Scholar's *h5* index for instance that the journal's papers in that journal are being cited much less than before the resignation of the editorial board in 2015. (Sondervan, 2022)

In another example, members of the European Society for Cognitive Psychology (ESCoP) learned that, rather than continue with the publication of their journal, *Journal of Cognitive Psychology (JCP)* (formerly *European Journal of Cognitive Psychology [EJCP]*), the society would start a new rigorously peer reviewed OA journal. *JCP* has been published by Taylor & Francis and the society wished to move toward more OA availability. It was not possible for the society to reach its Open Access goals by remaining with the current publisher. The journal would have reasonable publication charges and follow open science principles (Mathot, 2016). Taylor & Francis was amenable to the journal's new open science policy, including that the society had proposed adoption of the Transparency and Openness Promotion (TOP) Guidelines and other measures, and offered the option of an annual OA supplement. After discussion, the executive

committee of the ESCoP came to the conclusion that the compromises being offered did not jibe with the OA aspirations of the society for its journal, and the relationship with the publisher was severed. The new *Journal of Cognition* (*JoC*) took the place of the *Journal of Cognitive Psychology* as the official journal of the ESCoP. After April 1, 2017, the society owned the title (instead of a commercial publisher) and the full board of associate editors remains with the new title, which has a global focus, not a European one (Hartsuiker & Morey, 2017). After the first year of the transition, the journal was on a successful path. C. C. Morey (2019) gave an update on the European Society for Cognitive Psychology (ESCoPP)'s new journal, *The Journal of Cognition*. After publishing 45 articles in their first volume, and its first Registered Report, the editors felt that the initial feeling of risk at starting an OA journal has, in the 2 years since the journal's debut in 2017, seen the rise of OA publishing continue apace. *The Journal of Cognition* was already, by design, able to comply with Plan S. As more funders mandate OA, *The Journal of Cognition* reiterates the role of a scholarly society in ensuring rigor in published scholarship. With no motive for profit, scholarly societies can take on the publication of work of sound quality (C. C. Morey, 2019).

Academic libraries, historically the places that have made scholarly journal content available to faculty, students and sometimes the public have struggled for some time with sustainability of the status quo. Accessing (and licensing) rather than owning and archiving material has often reached somewhat of a breaking point. Prices to universities for commercial publisher content, reported to reach millions (even as libraries often fall under non-disclosure clauses about pricing) have resulted in strain and sometimes have necessitated major journal cancellation projects. Cancellation projects have become more difficult over years due to "big deal" bundling of content in packages. According to Nosek and Bar-Anan (2012), reporting on some costs of Elsevier subscriptions to journals alone, institutions paid, for example:

Purdue \$2.3 million per year (Westberg, 2012) and Washington University's School of Medicine \$1 million per year ("The Elsevier Boycott," 2012). Cutting access to journals is a major cost savings. In 2010, institutions such as Georgia Tech, University of Washington, University of California San Francisco, and Oregon State have each dropped hundreds of subscriptions in order to save hundreds of thousands of dollars per year (Peine, 2011), at the cost of reducing their researchers' access to the literature. (Nosek & Bar-Anan, 2012, p. 228)

In 2019, MIT Libraries reported on their Elsevier Fact Sheet that their cost for the Elsevier journals' subscription payment was \$2.7 million per year (K.H. Dunn,

personal communication, January 5, 2024). In 2020, MIT ended negotiations for a new contract with Elsevier (MIT Libraries, 2020). A few years later, not much has changed in terms of the cost of the big deals, except that the bundling together in some cases of the subscription cost with the APC costs in "read and publish" (RAP) deals. However, these RAP deals are more expensive than the traditional "big deals" (Schonfeld, 2018). After many, many rounds of cancellations in libraries, the big deals are still in place at many, and as RAP deals proliferate, some say the big deal is being replaced by the "bigger deal," and that this path is likely not sustainable. The largest traditional commercial publishers have found that OA can be a money maker. L.-A. Butler et al. (2023), in study that focused on Elsevier, Sage, Springer Nature, Taylor & Francis and Wiley, reports that "we estimate that globally authors paid \$1.06 billion in publication fees to these publishers from 2015 to 2018. Revenue from gold OA amounted to \$612.5 million, while \$448.3 million was obtained for publishing OA in hybrid journals" (p.2).

Things are starting to evolve, however. In a high profile move, University of California cancelled their Elsevier contract in 2019, and had hoped for a future "read and publish" deal that would provide support for the university's authors to publish OA (McKenzie, 2018, 2019). Two years later, the university and the publisher were back at the negotiating table signing a new Open Access agreement (Brainard, 2021a). With a continuing move of the entire system toward OA, more deals are being signed between universities and publishers that include OA publishing support for authors. While popular with authors seeking help with paying APCs, libraries and universities still struggle with the big bills levied by commercial publishers. There has been no relief for libraries of late from the increasing costs of "read" (access to the research literature for affiliated researchers) and "publish" (paying the APCs that are a struggle for the same communities).

Major stressors in the system have included the unsustainable outlay of institutional funds for commercial journals, and "publish or perish" pressures that focus on Journal Impact Factor (JIF) (Clarivate) for authors choosing outlets for their best scholarship. Faculty need access to all major journals as well as the more niche titles that represent their subfields. Psychology faculty and researchers may not even realize that their sought-after high impact journals of choice for their publications are tied to commercial publishers with their associated higher prices for subscriptions, pay per view options, and author fees. For their part, libraries have made subscription content available remotely from the faculty laptop or other mobile device, and readers may have lost the connection between the library and the journal content. Some may ask, "why do we need a library

any more?" The library is the middleman but may struggle with relevance in terms of being the go-to place for journal collections. That association of the reader of journal articles with the library may have been severed for most faculty and students at this point. The provision of seamless electronic remote access to the research literature, delivered on any device (at the article level) at the point of need, is a goal of academic libraries. However, it likely has removed the idea of the library and institution from being the providers of the subscription journal literature. Library support can erode as the primary connection to the researcher is lost.

Some libraries that subscribe to commercial publishers' offerings have become more invested in making sure that their university's authors do not sign away copyright to those same publishers, preventing them in many cases from making versions of their articles immediately available from the institutional repository. At the end of a part of the research process, where the institution (and its funders) have invested so much in the research, there is a need for the retaining of rights to do more with the results of the publication process. Many libraries are using the Liblicense Model License (2014) (and other licenses with similar provisions) in their negotiations with publishers in order to assert the right of university authors to have more rights to the content that they have produced and then provided to the commercial publisher that is selling the same content back to the university at sometimes unsustainable prices (Liblicense CRL). The license can set out expectations that the publisher will take a broader view that provides benefits to the author and institution (and possibly funder as well) that provided the content in the first place. This would include rights such as liberal self-archiving rights to deposit content in the institutional repository, for instance.

Major publishers of "must-have" journals bundle titles into packages, making cancellation of individual titles a challenge (or even impossible). Large science packages, the "big deals" may consume the library budget, causing concern and dismay among humanists and others about availability of monographs and single journal titles that often show lower use in today's usage numbers-driven assessment reports. In fact, by 2013, a study by Larivière et al. (2015) of 45 million papers indexed in in Web of Science from 1973 to 2013 demonstrated that five large commercial firms published 50% of scholarly papers, with the most consolidation seen in social sciences (70% of all papers from five publishers). In fact, in natural and medical sciences, Reed-Elsevier, Springer, and Wiley-Blackwell were named, and "three publishers account for more than 47% of all papers in 2013..." (p.3). The trend in the concentration of publishing in social sciences and humanities among a handful of publishers is even more pronounced. This increase in the proportion of scientific

output from a few publishers has been driven by the creation of new journals and due to publisher acquisitions of established journals. For psychology, the study results were dramatic, "with the top five publishers increasing from 17% (of papers) in 1995 to 71% in 2013" (Larivière et al., 2015, p. 7).

Commercial publishers do not have the same mission or motivations as the society publishers, and psychology's learned societies still have a very prominent place in the scientific communication system for the discipline. APA's mission and vision statement for its 121,000 members from the 2019 strategic plan (<http://www.apa.org/about/apa/strategic-plan/>) includes the following, reiterating the organization's major focus on impact. "This three- to five-year strategic plan—adopted in February 2019 by APA's Council of Representatives—enables us to focus the association's efforts toward maximizing the impact we can have on complex issues facing the field of psychology and broader society." Impact of psychological science's published or shared research would fit into the Plan's stated mission for the organization "To promote the advancement, communication, and application of psychological science and knowledge to benefit society and improve lives."

The scientific publishing system has been dysfunctional for a long time, with university and funder budgets unable to keep up, while commercial publisher revenues continue to rise. As an example, the evolution of profits of Reed-Elsevier (looking at the 1991–2013 period) shows profit margins continuing to increase. For Elsevier's Scientific, Technical & Medical division in particular, the profit margin has remained strong over time, for instance increasing from 30.6% in 2006 to 38.9% in 2013 (Larivière et al., 2015). Other commercial publishers also enjoy healthy profit margins. In fact, the unsustainability of the system which librarians knew well, may have been the impetus for some librarians, lamenting the "serials crisis" to look for a future where OA would provide a potential solution for the inability of library budgets to keep up with annual subscription price increases. Along the way, the serials crisis became an early motivator, but not the only reason that many libraries, librarians and academic faculty became driven to embrace OA (particularly of the "green (repository)" type). As time has evolved, institutional repositories disseminate many OA versions of articles published by commercial publishers. The connection of Open Access with a solution to the "serials crisis" has evolved and the two are not conflated as often at this point in time. At one time, OA advocates and librarians were at odds with many publishers over permissions to self-archive, but over time, the situation has normalized a bit.

For their part, some commercial publishers have diversified more by moving into development of other scholarly communication-related services like "research information management systems" (known variously as

RIM, RIS or CRIS) that provide a variety of research and reporting solutions for institutions (e.g., Elsevier's Pure), or altmetrics tools (such as Elsevier's Plum Analytics), or citation management/collaboration products for researchers (such as Elsevier's Mendeley). Publishers are operating in this space, and building analytics products as well to insulate against subscription declines. Simply trying to sell new journals will not work in the long term and is not sustainable as numbers of OA journals continue to rise.

There have been many proposed solutions, some radical, to fix the situation with journal publishing. For now, a growing chorus of stakeholders has been discussing the potential "flip" of the system from the traditional, subscription, closed access model to a worldwide adoption of an author or funder-pays model. Open Access is providing the publishers with yet another revenue stream. This worldwide flip away from the use of only library support, a disruption without precedent, is under intense discussion at present. The current landscape supports many types of publishing business models, from traditional to the most innovative, and the eventual end point remains to be seen. The possibility of a "flip" of the traditional system to a gold OA future has been discussed in many sectors in recent years. The very future of scholarship seems at stake, but in this new situation, it seems likely that publishers will still retain a revenue stream that will sustain them nicely (D. J. Solomon et al., 2016). Summaries from industry market forecasting reports allude to the future trends expected of gold OA, paid by APCs (Simba Information, 2016). In 2018, a press release from Simba Information that announced their report, *Open Access Journal Publishing 2018 to 2022*, stated that "once viewed as a threat by traditional journal publishers, the global push for Open Access (OA) to research papers has delivered a fast-growing revenue stream that will continue to scale upwards" and that since their first report on this topic in 2014, "we were decidedly less optimistic about Open Access publishing than we are today" (Simba Information, 2018). Clearly, there is another strong revenue stream with OA that may be more lucrative and allow for growth in the industry rather than continuing to see a dwindling number of subscriptions sold.

### **Coauthorship and Assignment of Credit in Psychology**

Every discipline and field has traditions and expectations around the types of scholarly outputs that are traditionally incentivized and rewarded in promotion and tenure, for instance. While most fields have a traditional mix of books and journal articles and even conference proceedings, in the future, psychology will determine how other

nontraditional outputs like open research data, code, and video resources (as examples) will be evaluated by universities and promotion and tenure committees. Publication venues for new types of research outputs will need to speak specifically to the needs of the disciplines. Alperin et al. (2022) mention that "in many disciplines (e.g., physical and life sciences, engineering, psychology, business), the peer-reviewed journal article is the gold standard and typical means for demonstrating productivity, as well as the quality and reach of one's research outcomes" (p. 172). Alperin et al. (2022) paint a picture of a slow moving situation for review, promotion and tenure (RPT) committees when it comes to incentivizing the publication of non-traditional research outputs (in psychology, anything outside scholarly books and peer reviewed journal articles), stating, "While there is no commonly accepted approach to research communication and activities, our findings suggest that current RPT guidelines found in the United States and Canada have not shifted to be more inclusive of non-traditional outputs. This is especially true for new forms of scholarship such as the production of data sets or the publication of preprints, both of which are mentioned in the documents of only a small percentage of institutions" (Alperin et al. 2022, p. 179). Outside of what is published in publicly available RPT guidelines, one hopes we can assume that committees and senior scholars advising early career researchers are setting out expectations that include new types of research outputs and are giving advice on how to best present non-traditional outputs at various points along the tenure track, in annual evaluations, or whenever evaluation commences. Some funders are setting out expectations about reforms to the system of recruitment and promotion, for example what is seen in the "OR4" project from the UKRN (UK Reproducibility Network). This project, part of the UKRN (2023) Open Research Programme, announced "the launch of one of the largest national initiatives in the world to reform how open research is recognized and rewarded when researchers are recruited, promoted and appraised."

Similar to the situation in many other fields, co-authorship rose in all areas of psychology during the years 1980 to 2013. In a study of 4.5 million articles from the social sciences that included psychology (taken from the Social Sciences Citation Index) Henriksen analyzed fields of psychology and determined that co-authorship is up in all areas of psychology. For 10 categories of psychology (not including Psychoanalysis Psychology where co-authorship is found less often), the percentage of co-authored articles rose from 1980 figures of 47.4% to 65.5% to 2013 figures of 82.2% to 92.1%. Throughout the 30-year time period, mean numbers of co-authored articles in the 10 total categories of Psychology went from 1980 numbers of 1.4 to 2.3 authors per article to

2013 numbers of 2 to 5.3. Psychoanalysis was once again an outlier with median number of authors per article most likely to be one (Henriksen, 2016).

In recent years, there has been more emphasis on the issues around co-authorship and assigning credit for an article as well as the difficulty that trends in multiple authorship in psychology and other sciences are causing. Conventions exist for placement of coauthors on articles in most fields. “In psychology, for example, the first author is usually (but not always) the researcher who has done the most work” (Chawla, 2015b).

Describing authorship conventions in psychology, C. Chambers (2017) describes the published order of authors (with numerous caveats and exceptions) thus:

The first-named author is usually the researcher who made the greatest intellectual contribution to the study and, again usually (but not always), the person who took responsibility for data analysis and much of the interpretation. Typically, the first author is also expected to take the lead in writing the paper and coordinating the drafting process with the other coauthors. After the first author, the next most important position is the last author. The last author, or senior author, is usually the principal investigator—the top dog who made the study possible either by holding the grant that funded it or by supervising the student that conducted it. (p. 164)

There have been calls over the years for the development of some kind of formula that would assign credit for various aspects of the authoring of a journal article, but there are no hard and fast rules for psychology. Many studies have discussed the need to determine how best to assign credit for authorship (Wagner et al., 1994). One example, now dated, comes from Winston (1985) who developed a weighted point system that would assign a number of points for the various tasks required to produce a scholarly article. For instance, points would be assigned for “conceptualizing and refining research ideas, literature search, creating research design...” (p. 516). The collaborators on an article would agree as a group that the contributor with the highest number of points would be senior author. Studies in the 1970s and 80s showed differing opinions on how to assign authorship credit, but “psychologists overwhelmingly believed that power and status should never enter into the determination of authorship credits” (Winston, 1985, p. 515). APA also makes resources available to assist with the issues of authorship, such as how to determine and negotiate authorship (American Psychological Association, 2018). Pruschak (2021), in a study of “what constitutes authorship in the social sciences” (which included psychology) discussed how social sciences fared in their adherence to the “Vancouver criteria,” the authorship criteria that were adopted by many journals, societies and disciplines in the late 1990’s. Pruschak (2021)

reiterates the tenets of the Vancouver criteria, published by the International Committee of Medical Journal Editors (ICMJE) in 1988 which stated that “authorship credit should be based only on substantial contributions to (a) conception and design, or analysis and interpretation of data; and to (b) drafting the article or revising it critically for important intellectual content; and on (c) final approval of the version to be published” (p. 2).

Bartle et al. (2000) detail the various issues of assignment of authorship credit in psychology, especially since the rise in multiauthored articles became more common after the 1970s. APA’s Ethical Principles of Psychologists and Code of Ethics gave direction to faculty and students seeking to properly assign credit especially when publishing collaborative works. Today, the discussion around assigning credit for the different roles of authors in collaborative writing of papers continues. Rather than leave author order to chance or one author’s understanding of prevailing conventions, systems and standards are being proposed to enhance transparency and consistency around actual practices. Standards could be adopted by societies, funders and publishers. McNutt et al. (2018), reporting in an article in *PNAS*:

recommend that journals adopt common and transparent standards for authorship, outline responsibilities for corresponding authors, adopt the Contributor Roles Taxonomy (CRediT) ([docs.casrai.org/CRediT](https://docs.casrai.org/CRediT)) methodology for attributing contributions, include this information in article metadata, and require authors to use the ORCID persistent digital identifier (<https://orcid.org>). (p. 2557)

In 2022, the National Information Standards Organization (NISO) formally recognized the CRediT taxonomy with publication of NISO/ANSI Standard Z39.104-2022:

The National Information Standards Organization (NISO) today announces its publication of the Contributor Roles Taxonomy (CRediT) as an ANSI/NISO standard, Z39.104-2022. The taxonomy, which was originally developed in 2014, describes 14 roles that represent the typical range of contributors to scientific scholarly outputs, and that can be used to enable recognition and facilitate transparency to the myriad contributions to research in our increasingly networked scholarly ecosystem. CRediT is already in use by more than 50 organizations, a majority of which are scholarly publishers, collectively representing thousands of journals. (NISO, 2022)

McNutt et al. (2018) also report on the recently created National Academy of Sciences webpage entitled Transparency in Author Contributions in Science (TACS) ([http://www.nasonline.org/about-nas/Transparency\\_Author\\_Contributions.html](http://www.nasonline.org/about-nas/Transparency_Author_Contributions.html)). The TACS page lists publishers and journals that adopt the CRediT taxonomy as well

as whether they commit to requiring ORCID iDs for corresponding and other authors. Publishers listed at this stage include the *PLOS*, *Nature Research*, and *Science* families of journals. Because all authorship conventions vary so much across and between disciplines, understanding how credit is conferred (and understood when it comes to markers such as author order on articles) is essential, especially in today's "audit culture" of university research, including reporting personal impact for promotion and tenure in psychology. Today's move toward cross—and interdisciplinary work compounds the issues with defining credit for individual work via the list of authors on an article because "order of authorship can vary by discipline, which poses problems in adjusting for shared authorship when scientists work in different disciplines or publish interdisciplinary work" (Ruscio et al., 2012, p. 141).

Some issues in scholarly publishing specific to psychology continue to resurface. Looking back at scientific communication in psychology from 50 years ago, it is found that psychological science has not been immune to various crises in its publishing practices. Garvey and Griffith (1972) analyzed the situation occurring with the psychological literature in the early 60s, and it is amazing how an analysis of the issues with the print tradition (with articles held in brick and mortar libraries) so evocatively describes a situation similar to today's, albeit missing the total disruption of the internet (Garvey & Griffith, 1972). Garvey and Griffith detail the existence of somewhat of a crisis in the early 60s, where only about 2000 scientists seemed responsible for the entire literature of psychology. The system of scholarly communication in psychology at this time has not appreciably changed—as a system—even if the tools have radically changed. Common aspects remain some 50 years later, now having moved online. These core behaviors that remain are the formal and informal ways scholars share ideas, the importance of scholarly societies, the need for robust peer review systems, the existence of preprints (or technical reports) for informal pre-publication sharing, a lag time from submission to publication in major journals, the long delay before articles would be abstracted in *Psychological Abstracts*, and the role of the major conference in the discipline for establishing reputation and networks (Garvey & Griffith, 1972). Journals were important for final certification of scholarship, brands mattered, and there was a desire for research to "speed up." Of interest in Garvey and Griffith's works of decades ago (written before the advent of the internet) is the description of the informal system of preprints in psychology, providing current information exchange but only to a niche readership. The situation was described in 1967 by Garvey and Griffith as "the chain of events in a fast-moving research area, may begin with publication lag being so great that current information needs are

unsatisfied. As a result, the exchange of preprints among scientists working in this area will increase" (Garvey & Griffith, 1967, p. 1012). Over time, this situation would eventually become formalized and possibly give rise to new scholarly journals. Today, we see preprint servers (such as PsyArXiv) emerging in psychology, adding the promise of sharing current research with any potential reader, researcher or practitioner via the internet around the world. How will this sharing affect established scholarly communication practices, or established journal outlets in psychology? Will the psychological science research community and an interested public respond favorably over time to pre-peer reviewed content circulating on the web? Will we see senior scholars using preprint servers differently (as they may not have to, or want to go the journals route)? Early career researchers may find using preprint servers a way to get work out ahead of early reappointment or promotion actions, or in grant applications. Adding impetus at this point in time is a sometimes overwhelming deluge of publications to discover and read in one's field, formal and informal, with university rankings and quantification of individual and institutional impact taking center stage.

For all academic fields, there are other guidelines with which editors and others in the publication process work. COPE (Committee on Publication Ethics), which was founded more than 25 years ago (as of 2022) publishes an established set of guidelines that are accepted by publishers, societies and others in the information landscape. (<https://publicationethics.org/>)

### **Information Overload and Inertia for Changing the Existing System**

The availability of a deluge of journal articles creates challenges for scientists in keeping up, whether for discovery and reading of the literature or for more requests for reviews of others' articles. More than 50 million scholarly articles have been published, but half of all of those articles have been published in only the last 25 years (Jinha, 2010). For many of us, our roles as authors, librarians, faculty members or publishers have included a close relationship to the print journal, and its associated systems of abstracting and indexing, access, reading, and preservation. Today, electronic access to scholarly journals from laptop, iPad or cell phone from outside the library or office is the norm. However, focus on peer review and journal impact factor remain. Studies have shown that peer review, for instance, is an element of the traditional scholarly communication system that faculty and researchers find essential for certification of scholarship (Michael, 2016a). Surveys of faculty and ongoing research by Harley et al. (2010) have provided a lot of data and analysis of the current situation with the



scholarly communication system that most academic faculty work within and many endeavor to maintain. These studies show a conservative posture about many existing systems, especially as they surround assessment of faculty scholarship.

There is no mistaking the fact that more research on this whole system of peer review and especially academic promotion and tenure is necessary in order to create a sustainable system for the future of scholarly communication in the various disciplines (Harley, 2013). Incentives also drive the system, and faculty may be loath to make the large-scale changes to scientific communication to a more open system that is certainly possible. Incentives may need to originate from senior scholars in a field as there are career concerns for early career researchers hoping to see change in the system to more “open.” Further incentives come from funder or university mandates which only become more common with a focus on the next iteration of “open,” the move from a central focus on OA (to the literature) to open science (sometimes referred to as “open research.”)

There are many new aspects to the ecosystem as of late. There has been a move to article-level discovery, new methods of measuring personal impact have emerged, and millions of authors have signed up for scholarly collaboration networks like ResearchGate or Academia.edu. Open Access journals utilize a variety of business models in comparison to the subscription model, while still maintaining rigorous peer review. That said, where there is money to be made from eager authors, the phenomenon sometimes known as “predatory publishing” has grown exponentially in this “gold” OA space. Unscrupulous operators work the internet, creating bogus journals that attract authors with low article processing charges and opportunity for quick publication. Some authors know that journals are bogus, but just need to get an article published no matter what the outlet (and knowingly choose to submit to a low quality journal title). Writing and researching for publication has become more complex, with the need to sift through a deluge of academic papers online in order to discover an exhaustive list of potential papers to read and add to popular citation management tools like EndNote (Clarivate), RefWorks (ProQuest) or Zotero (an open source option). Mendeley (now owned by Elsevier) is a popular product that adds collaboration, data options and even career networking to citation management. Strategies for discovering relevant scholarly literature have changed, as library search has added other new “web scale discovery” tools to the familiar abstracting and indexing services. Google Scholar (with its unpublished coverage criteria, covering everything it deems “scholarly” since its beta release in 2004) seems the most ubiquitous search tool. Its use is only growing

(Bohannon, 2014). Alongside the well-established databases that cover psychology, librarians have added Google Scholar to their lists of indexes and are well aware of how much it is used for discovery as well as its citation services.

The familiar online library catalog is beginning to be replaced on library websites by a web-scale discovery service’s “one stop shop” single search box that leads to journals, books, articles and all kinds of electronic subscriptions (and some OA content). There is a focus on the library website leading to collections using a “Google-like” user experience. Library collections may be more difficult to browse, with researchers finding the web providing a different kind of serendipitous article-level discovery of relevant research papers (with all of their various versions, some possibly OA). Paper journal volumes, in the past browsed within a single volume taken off the library shelf, have often been moved off to remote storage or recycled. The package of the bound paper journal has been replaced by vast online library discovery systems of tagged articles. It becomes more important than ever to understand how systems of scholarly communication (as defined by libraries) work in each discipline or subfield. There is no “one size fits all” to this system. One constant has been the need for each discipline to organize its scholarship within a current, constantly developing and easily understood set of parameters, enabled by useful systems and tools that can maximize the visibility of an individual’s scholarship as well as to showcase the collective work of a field. Individual scholars as well as the important publications of each field will need to find ways to continue to demonstrate impact and remain highly relevant to an increasingly cross-disciplinary culture.

For those readers needing to access the scholarly literature, which is now comprised of a global readership searching the internet for peer-reviewed scholarship, there has been an exponential growth in available journal articles and other digital content. In 2015, there were more than 28,000 scholarly journals worldwide, containing more than 2 million articles every year, with continuing growth of 3% to 3.5% each year (Research Information Network CIC, 2015). By mid-2018, *The STM Report: An Overview of Scientific and Scholarly Publishing* stated that “there were about 33,100 active scholarly peer-reviewed English-language journals... (plus a further 9,400 non-English-language journals), collectively publishing over 3 million articles a year” (Johnson et al., 2018, p. 5). Time spent discovering and reading relevant literature may continue to present a challenge as far as “keeping up” for busy scientists. In one study of trends in publication patterns in the neuroscience and psychology categories and from 2006 to 2015 using Web of Science and Journal Citation Reports

(JCR), the steadily rising number of papers can be seen. Also, and “neuroscience research related to psychology and behavioral sciences showed an increase in publication share over the survey period, and China has become one of the major contributors to neuroscience research” (Yeung et al., 2017). In a comprehensive overview of publication patterns that have evolved in brain science in recent years (2011–2020), including percentage of funded papers by field and funder, Simard et al. (2023) report that:

the number of papers has grown exponentially over the last 30 years, from about 600,000 papers in 1991 to more than 2 million papers in 2020. Within this exponential growth, brain research papers have grown at a faster pace than the general rate, particularly during the 90s. (p. 3)

Haslam et al. (2022), in a study of more than 780,000 psychology journal articles, detail the trends over time (1965–2016) in the “historical trends in the representation of neuroscientific concepts” (p. 519) in that corpus of scholarship. It was shown that “From the mid-1970s, the growing representation of neuroscience in psychology was linear. Proportions were highest among journals covering neuropsychology and physiological psychology and behavioral neuroscience” (p. 519). Further, as part of this study, the authors created a dictionary of 522 neuroscientific terms. The creation of current dictionaries and ontologies for behavioral sciences is seeing renewed effort of late. In 2022, the National Academies of Sciences’ Committee on Accelerating Behavioral Science through Ontology Development and Use produced a Consensus Study Report, *Ontologies in the Behavioral Sciences: Accelerating Research and the Spread of Knowledge* that thoroughly examined the issues that are hampering current research processes due to the lack of consistent controlled vocabularies that could allow the development of a disciplinary approach to ontologies that would adequately cover the domain and serve open science. Some of the benefits of developing ontologies for the behavioral sciences is listed in the report as:

we examine how they (ontologies) can help scientists to, for example, link results from diverse research, communicate clearly about complex concepts, more rapidly identify significant knowledge gaps, formulate novel questions, test clear hypotheses, establish whether results can be reproduced, and retrieve and apply scientific knowledge for diverse uses. (National Academies of Sciences, Engineering, and Medicine, 2022b, p. 14)

It may be surprising to some that subscription journals with *no* gold OA option are still emerging from major publishers. One example is *Nature Reviews Psychology*, which debuted in 2022. The *Nature Reviews*

*Psychology* website gives some rationale for the emergence of yet another journal: “The number of primary research papers in psychology published each year is staggering—by a conservative estimate there were 245K in 2020, which is a 30% increase from 2018 and a 50% increase from 2016. In this context review articles have an important role to play. Reviews offer a concise and balanced overview of a subject, situate a large body of work in context, build connections, and identify new angles” (Richler, 2021). The editor explains:

Through market research ahead of this journal launch, I learned that 29% of all psychology review articles and 44% of review articles published in psychology review journals are cited more than 10 times two years after publication. However, of the ~181,000 research articles in psychology and cognitive science published per year, only 8% of the research output are reviews. It is my hope that *Nature Reviews Psychology* will act as a key agent in driving the field forward by commissioning and publishing syntheses of the literature on key interdisciplinary topics that inspire and support future research.” (Springer Nature, 2021)

While no paid OA option exists for this journal, there is a green self-archiving (in a repository) option for any author with a 6-month embargo that carries no cost to the author.

For psychology, the “information explosion” has produced some distinctive challenges for authors and researchers, such as the enormous growth in the number of cited references in articles, a practice that has pros and cons, and is tolerated by editors and reviewers. Rather than just keeping up, the exponential growth of the research literature in psychology has altered author behavior and publisher expectations around issues of increasing rate of citations, for instance. Some have called for an end to the practice of excessive or gratuitous citation lists, citing a tradeoff between writing and pages of citations in articles with strict page limits (Adair & Vohra, 2003). Once again, electronic publication would seem to allow for less strict limits on pages or other aspects of a print environment. However, boundaries are needed. The number of self-citations has also been of interest to psychology, especially as it relates to possible effects on the important journal impact factor (Anseel et al., 2004). In a study of referencing practices in psychology journal articles and how authors view the articles they cite, it was seen that authors tended to view self-citations as very important to the paper (outside of other reasons; Safer & Tang, 2009). Kacem et al. (2020) compared disciplinary rates of self-citations (where authors cite their own articles) in 15 subject areas, calling for more transparency and consensus around the bibliometric and impact implications of self-referencing. With the popularity of metrics such as *h*-index, the use of self-

citations in both appropriate and inappropriate ways (p. 1158). In this particular study, Psychology had a low rate of self-citation (3%) compared to Engineering, for instance (58%) (p.1160). Studying self-citation practices is an interesting aspect of the impact calculations of the journal literature and needs to be understood from a disciplinary perspective to understand its implications for authors and for building on of their research ideas.

Another individual behavior of psychology authors is the use of “correction notices” which are issued by authors post-publication. Three psychology journals containing the highest number of correction notices in the Scopus database from 2010 to 2018 (*Psychological Science*, *Frontiers in Psychology*, and *Journal of Affective Disorders*) were studied to understand why notices were issued. While many notices identified inconsequential errors, this work emphasized the need to understand what actions should be taken when corrections must be made to the literature (Heyman & Maerten, 2020). With versions of articles acceptable, this may be a case where a corrected version of record (CvOR) could become part of the record of publication for the article.

The incidence and analysis of retractions in the literature seems to have become a more common topic of interest. In the past, it was difficult to keep up to date on retractions in one’s field. It is now possible to follow retractions very closely online. The popular Retraction Watch blog is replete with announcements and analysis of recent retractions in psychology as well as other issues that may affect scholarly publishing in psychology. In recent years, notwithstanding some high profile cases of retractions in psychology, particularly of social psychologist Diederik Stapel, with a reported a spectacular 58 retractions as of 2015, (49 of them between 2013 and 2014), psychology has experienced a large increase in the rate of retractions in recent years (Oransky, 2015). A database for retractions, the Retraction Watch database (including more than 18,000 retractions on its launch date), for the first time makes it possible to discover all of psychology’s retractions at once (Retraction Watch, 2018). A search for retracted articles in the Center for Scientific Integrity’s Retraction Watch Database (<http://retractiondatabase.org/>) in subject category Psychology in June, 2022 returned more than 100 results. In a presentation at AAAS, Oransky (2020), listed the common reasons for retraction, many of which are familiar to psychology as issues: “Duplication (“self-plagiarism”), Plagiarism, Image Manipulation, Faked Data, Fake Peer Reviews, Publisher Error, Authorship Issues, Legal Reasons, Not Reproducible” and also reported on the issue of journals not always identifying retracted articles so that a large number of articles continue their path to discovery

without being identified as retracted (Oransky, 2020). One of the goals of an open science workflow with rigorous standards around reproducibility and replicability would hopefully reduce the incidence of retractions in the psychology literature. In September, 2023, the Center for Scientific Integrity (the organization behind Retraction Watch) and CrossRef (<https://www.crossref.org/>) have joined forces in continuing and enhancing the work of exposing and tracking retractions in the scholarly literature. As Hendricks et al. (2023) explains that “an agreement between the two organisations will allow Retraction Watch to keep the data populated on an ongoing basis and always open, alongside publishers registering their retraction notices directly with CrossRef.”

One of the more onerous aspects of “keeping up” in an age of tens of thousands of journals is the need for researchers to keep up with the new and existing journals in their subfields. Once established, scholars know the core journals but for early career researchers, especially, who need various publication options, choosing a journal to fit the work may be a challenge. Tools for prospective authors have emerged in this space to assist in choosing a journal that fits a research topic. Some would insist that early career researchers seek out this advice from senior scholars or their own advisers. Examples of these “recommender services” come from publishers and other vendors. Even as various initiatives and individuals call for moving away from traditional Journal Impact Factor metrics, “publisher neutral” Clarivate (producer of Journal Citation Reports which releases new JIF numbers each year) offers a way for potential authors of research articles to use their data to choose a journal by using their free tool, Master Journal List Manuscript Matcher. This free tool, using journals indexed in the Web of Science allows users to search by research topic which assists with the selection of a journal that may be a good fit. Clarivate mentions that there are now 42,000 active scholarly journals publishing in 2018 alone, and there has been accelerated growth in recent years (Wilkinson, 2022). With so many journals available, one wonders how early career researchers (solely, or in teams) especially are choosing publication outlets for their work; whether they are choosing a journal based on faculty advisors’ recommendations primarily, or whether they are using tools provided by publishers and others (such as Clarivate). Most authors would likely have a journal in mind as an outlet for their research results, but more study would be informative regarding exactly how authors choose their preferred outlet, and whether OA status, green OA options for easy repository (zero embargo), APC cost for publishing (and availability of university or funder support for paying that APC) are

determining factors, and in what order of preference. Or, is it really impact factor, or other “prestige markers” that are the top priority? One major international study that began in 2015, but continued after the pandemic, is the *Harbingers* study. An early phase of this study sponsored by the Publishing Research Consortium from 2015 to 2018 looked at these questions:

Are early career researchers the harbingers of change? Will digital natives who embark on a career in research, carry the new information-seeking behaviour into the workplace with profound change to scholarly communication? Or will they, recognising their position as apprentices and reliant on guidance from mentors, be cautious and less adventurous than established colleagues? (CIBER Research, 2018)

The results of this study indicate many expected results such as: “The sole goal for most appears to be publishing in top ranked journals (irrespective of publisher, open access and audience). Publish more and higher is their clarion call” (p. 9). This research continues on in “*Harbingers 2*,” an international study of how the pandemic affected early career researchers, including “scholarly communication behaviors and attitudes” (CIBER Research, 2022).

Many new tools are available now to assist authors in matching their draft articles to the most appropriate journal publication outlets. Tools have been developed that are attempting to assist authors in matching papers with appropriate journals, or allowing the comparison between potential publication outlets. One tool that is building the capacity to suggest journal titles based on particular attributes chosen by the author is the Cofactor Journal Selector Tool (Sharman, 2016). In 2010, members of the Association of College and Research Libraries Psychology/Psychiatry Committee combined information from the major tools, Ulrich’s Periodicals Directory, Elsevier’s Scopus, and Thomson Reuters Web of Science in an attempt to create a type of “core journal list for psychology” (Paynter et al., 2010). This study has not been updated.

Commercial publishers are now making tools available where an author can search by keyword, draft title, some selected article text and other factors in attempts to find potential journals across the publishers’ lists of thousands of journal titles to which to submit draft articles. Springer Journal Suggester (<https://journalsuggester.springer.com/>) and Wiley’s Find a Journal service (<https://authorservices.wiley.com/author-resources/Journal-Authors/find-a-journal/index.html>) are two such examples. These tools and others like them also help authors wade through an increasingly lengthy list of journals, whether Open Access, traditionally published, or those that contain a mix of both subscription and OA articles (hybrid).

## Innovations in Peer Review in Psychology

Regardless of innovations and disruptions to scholarly communication in psychology, the importance of peer review remains. Innovations in peer review were summarized in a report commissioned by the Wellcome Trust in 2015, with major trends identified. This analysis was an attempt to inform the research community about the issues with peer review in a current scholarly communication landscape that focuses more and more on evaluation of researchers and institutions as evidenced by publications in high impact journals. This study reiterated the importance that the research community places on the “*principle* of peer review” and that the issue of the “*practice* of peer review” is instead at issue (Research Information Network CIC, 2015). With the number of articles submitted to journals in the range of 3 million per year (and with a reviewer spending approximately 6 hr per review), it may be obvious that the system may be overburdened (Jubb, 2016). Peer reviewers are not paid, and this part of the publication process must be managed, and can be a challenging part of the editor’s role. Difficulty in finding reviewers with appropriate expertise for a deluge of article submissions, dissatisfaction with non-publication that can sometimes be due to the appearance of one negative online review can all lead to publication delays. This, in turn, can lead to issues with the currency of the psychological science literature.

Even with robust peer review systems in place, and an emphasis on high impact journals for career advancement and reputation, there is evidence that “the fraction of highly-cited articles published in non-elite journals increased steadily from 1995 to 2013. While the elite journals still publish a substantial fraction of high-impact articles, many more authors of well-regarded papers in a diverse array of research fields are choosing other venues” (Acharya et al., 2014, p. 1). This study, using Google Scholar Metrics (<https://scholar.google.com/scholar/metrics.html>) also found that, due to accessibility of the research literature, more researchers are citing “work published everywhere,” and over time a larger percentage of citations are going to articles in non-elite journals where “elite” was defined as the 10 most cited journals in each of 261 subject categories reported by Scholar Metrics.

Many studies have shown how peer review is valued by scientists. However, there is room for improvement, according to studies of researcher attitudes (Mulligan et al., 2013). There are also issues with time lag and other negative consequences of a sometimes lengthy review process (for authors and journals) when the result is often “revise and resubmit” (Cochran, 2016). Journals, editors and researchers alike need to be able to speed up the publication process in these high stakes times, and all delays are more difficult to manage. While much is changing,

there is always an emphasis on the need to maintain robust peer review systems.

Peer review systems and practices are currently undergoing many innovations and experiments. For instance, *European Journal of Neuroscience* publishes full, bylined reviews attached to articles. According to the journal, “Open reviews, the argument goes, are more thorough and constructive—and the rich scientific debates they reveal can be a valuable educational tool” (Vlasits, 2017). The editors-in chief state in an editorial that “we believe this is the future” (Foxy & Bolam, 2017; Vlasits, 2017). The first experiments in open peer review, such as the one *Nature* trialed in 2006, were not pursued due to low uptake. Things have evolved, as we even see the announcement that Elsevier has added an open peer review option to all of their journals as of 2020. This option will be phased in, and follows the successful 2014 pilot (with five journals) of their “Publishing Peer Review” reports trial which demonstrated that many reviewers (from many different fields) were happy to have their reports published and have their names revealed. Elsevier also reports that the results of surveys show that open peer review does increase the quality of review reports. Elsevier gives published reviews their own DOIs, allowing those reviews to be “counted” as a type of publication output and included on CVs, for instance (Pool, 2017). In 2023, the Society for Neuroscience’s journal, *Journal of Neuroscience* announced that, going forward, it would “move away from the “traditional” peer review process that it has pursued since its inception, to a progressive “open” peer review model” (Kastner, 2023, p. 8074). Journals will need to carefully monitor the reactions of reviewers and readers to this new transparency around the review process (which has always been somewhat of a black box).

Many psychological scientists looking to publish in newer OA journal titles such as the funder-supported title *eLife* will find a different type of openness around peer review, and also a practice of reviewers discussing the paper with each other, synthesizing the reviews, and then publishing the review alongside the paper. Many of the working scientists that review for *eLife* sign their reviews (Vlasits, 2017). In January, 2023, *eLife* has introduced a further innovation to peer review, where “at any point following peer review, authors can choose to have their Reviewed Preprint published as a regular journal article (known as the Version of Record) to mark the end of the publishing process” (<https://elifesciences.org/about/peer-review>). As another incentive, the Publons service (<https://webofscience.help.clarivate.com/en-us/Content/publons.html>), which partners with many publishers, has created a profiling service where reviewers can receive credit for completing reviews. Another newer initiative from the journal *Collabra*, will pay reviewers a

small fee (a part of the APC) for their work, whether the article is accepted or rejected. *Collabra*, a title initiated in 2105 by University of California Press, aimed to include articles from many disciplines, including behavioral sciences (Chawla, 2015a). *Collabra* has “become a brand for our Open Access program of journals at UC Press, over time.” *Collabra: Psychology* is the official journal of the Society for the Improvement of Psychological Science (SIPS). With an esteemed editorial board, “*Collabra: Psychology* and SIPS are excited to unite in a shared mission to improve psychological science, and scholarly communications broadly, through policies that support transparency, openness, diversity, and rigorous, ethical scientific research practices” (University of California Press, 2017). As of 2020, all papers published in *Collabra: Psychology* “will also have the reviews and decision letters published alongside the paper” (University of California Press, 2020).

Researchers in psychology will find many types of peer review processes going on in traditional subscription journals, the established OA journals, and the innovators that are moving toward new systems of publishing and journal certification systems. In 2016, one of the most interesting peer review trials of an innovation in the discipline involved publisher BioMed Central’s OA journal, *BMC Psychology*. The goal of this trial was focused on the need to reduce publication bias using a “results-free” peer review process where reviewers do not see outcomes (as they do not have access to the results or discussion), but instead focus on approach and methods. At the end of the review process (when results and discussion are made available), the same reviewers would expect that the “accepted” articles’ results and discussion would not “deviate unjustifiably from the stated aims and methods. We believe that this could help reduce publication bias by basing the decision to publish purely on the scientific rigor of the study design” (Grant, 2016).

*PLOS ONE*, “the first multidisciplinary Open Access journal,” includes many articles in psychological science. *PLOS ONE* is also a pioneer among new models of peer review, and now many of the OA “megajournals” follow its practices. The *PLOS ONE* model features the type of peer review where each article is reviewed by editors and reviewers for technical soundness, not for the potential impact of the publication to the field. Each article’s assigned Academic Editor is responsible for the peer review process. The expert readership weighs in with post-publication feedback, adding to the impact of the article to its field (*PLOS ONE*, 2017b). Taking open peer review a step further, the title *F1000Research* uses immediate publication “with no editorial bias” and a transparent peer review process that includes post publication commentary and availability of open underlying data (*F1000Research*, 2017). *F1000 Research* was launched in

2013 by Vitek Tracz (creator of BioMed Central). Tracz felt that “peer review is sick and collapsing under its own weight” and that issues such as anonymous review leading to delayed publication were just some of the issues with the traditional practices (Rabesandratana, 2013, p. 67). Tracz, Executive Chairman at F1000, has continued the evolution of visionary F1000 Research’s focus on open research and new methods of publication, by partnering on Wellcome Open Research in 2016, and then in 2017 adding Bill & Melinda Gates Foundation’s Gates Open Research (and others). F1000 Research was acquired by Taylor & Francis Group in 2020 and vows to continue its mission (Lawrence, 2020).

Another innovation in peer review, the use of “cascading (or portable) peer review,” where an article’s reviews are passed, upon rejection at a first choice journal to another title in the same publisher’s list of journals is in use by some major publishers. This option is somewhat controversial in terms of how well it serves a particular publication that may be “downstream” from the journal of first submission. Convenience is one positive for authors, saving them time and trouble in investigating a new publisher and publication outlet. Management of the review process within a publisher’s stable of journals is also attractive for publishers. In one example of cascading peer review in neuroscience, it is stated:

The Neuroscience Peer Review Consortium (<http://nprc.incf.org>) is a cross-publisher transfer alliance covering some 40 journals that forward reviews upon authors’ request, but take-up is small. Some publishers think that cross-publisher transfers reflect credit on them as good citizens; but as another said, ‘why would I want to transfer an author, and the work we have put into a paper, to another publisher?’ Even when they are willing to make reviews portable, the manual intervention in editorial management systems may be a disincentive. (Jubb, 2016, p. 17)

The NPRC (Neuroscience Peer Review Consortium), on its website (<http://nprc.incf.org/>) has 60 + members as of 2022 and includes journals such as *PLOS ONE*, *PLOS Biology*, *Neuropsychopharmacology Reports* and *Psychological Medicine*. Open to any journal indexed in Medline, there is no cost to join the NPRC. Clearly this is a successful and growing initiative that can facilitate the moving forward of manuscripts that may have been rejected at one outlet to other members of the consortium in a collaborative manner.

Where some major publishers already have cascading peer review systems in place (while others have decided not to do so), Elsevier was awarded a U.S. Patent for their version, labeled “Online peer review system and method” (described as the “proprietary waterfall system”). Much debate ensued online over the necessity and

potential negative consequences of patenting a peer review system (Aspire Scientific, LTD, 2016).

Peer reviewers have been challenged by the evolution of the article itself. An article may no longer be a familiar text document. In many cases, the article “package” contains both text and published supplementary data. Over time, in some publications, the article text became less significant if the reader lacked access to all of the linked supplementary material. With the increasing prevalence of outbound links to sources of data sets, journals still had to vouch for the credibility and quality of the supplementary material, and that caused delays and issues for already overburdened reviewers. For example, in 2010, the *Journal of Neuroscience* announced that it would no longer include, host or review supplementary data alongside articles, citing time lag as busy reviewers were encountering a larger amount of data to review. Supplementary data could be hosted on an external site, with a pointer from the article (Maunsell, 2010). Peer review currently continues under intense discussion and remains as an essential (but fraught) piece of the scientific communication system for psychology and all disciplines. As practices and tools continue to change, the underlying importance of peer review remains.

There are issues with how to best peer review research data. With the trend in growth of openly available research data (both underlying data deposited in repositories and supplementary materials to formally published journal articles), peer review of data has become a larger issue for researchers, publishers, and especially for reviewers that may need guidance on how to complete an effective review. With practices still developing, peer reviewers of research data will need very specific guidelines on the various aspects of this process (Carpenter, 2017). This issue has become even more critical as many new government and funder mandates include open data as an integral tenet of open research/open science, and all stakeholders will need to develop best practices around peer review of research data.

## Digital Object Identifiers (DOIs) for Every Article

Digital Object Identifiers (DOIs) are unique persistent identifiers for objects such as research outputs (<https://www.doi.org/>). An improvement that has really revolutionized scholarly publishing is the integration of DOIs into every article and most research outputs, allowing persistent access and an end to the dead links common in bibliographies of research papers in the past. In fact, lengthy or not, reference lists accessed online now include actionable persistent links such as DOIs (Digital Object Identifiers) that create an enhanced environment for the

reader that allows direct linking through to available background reference papers. CrossRef is only one of the 11 (as of 2022) DOI registration agencies ([https://www.doi.org/RA\\_Coverage.html](https://www.doi.org/RA_Coverage.html)). Many will recognize another, DataCite, often used by data in repositories. Rather than returning to online indexing and abstracting sources, library databases, Wikipedia references, or Google Scholar, readers now click through from one article to another seamlessly (with publishers and libraries working on new ways to identify university affiliates away from library sign on). This easy access to full text is especially true for the growing corpus of OA articles easily accessed by anyone wanting to read or use them. Papers that have been made OA, and the widespread adoption of DOI links on most articles make this system more effective for all researchers and readers. One large seamless system of interlinking content, with as much content as possible available to be clicked through by the largest numbers of potential readers and researchers is coming to fruition, albeit slowly and not including all literature, obviously. Most of the links seen in Wikipedia, for instance, use CrossRef DOIs. It is estimated that “CrossRef has registered 67% of all DOIs in existence” (Himmelstein et al., 2018, p. 15). One anecdotal issue with DOIs is that some researchers feel that any article with a DOI is then “certified” as an authentic piece of scholarship, somehow has an imprimatur placed on it, or that it confers some sort of peer review. This is not the case, of course. The DOI (assigned by a registration agency) simply provides a unique and persistent identifier for articles (and other research outputs), is clickable in online versions (resolving directly to the article) and is now required if available for citations using APA Style. This requirement for use of citations formulated with DOIs in APA Style has likely made DOIs more well known to readers and researchers of the psychology literature. All publishers now need to use DOIs and so this persistent identifier on citations is becoming ubiquitous in the scholarly publishing landscape. The availability of DOIs (from CrossRef or DataCite, for instance) has enhanced the discovery process for researchers, particularly because these persistent identifiers are now being included on all research products, whether articles, chapters, data, or even preprints. Using DOIs in citations ensures fewer broken links and lost access to cited content. The seamless online environment facilitates search and discovery (and thereby research) via this web of DOIs, thereby enhancing easy access for all who surf the web looking for scholarly information in psychology or other fields.

A related development in making citations in articles more visible, more searchable and likely more citable by other researchers is a recent initiative whereby publishers have worked together to agree to make all references of

articles, including their DOIs openly available. If the article is subscription-based and behind a paywall, all references will still be “separable” (able to be accessed and analyzed without having to access the article), open and visible (and machine readable) for use by researchers. This initiative, entitled “The Initiative for Open Citations I4OC (<https://i4oc.org/>) is a collaboration between scholarly publishers, researchers, and other interested parties to promote the unrestricted availability of scholarly citation data.” Publishers enable the realization of this work via their assignment of DOIs through the CrossRef service. Clearly, the scholarly communication landscape is enhanced by all publishers in all disciplines linking articles, making all research products (including this amazing wealth of citations) discoverable and usable. Data citation practices have also evolved and improved due to the addition of persistent identifiers to other products of research (including code). The Publication Manual of the American Psychological Association (2020a), 7th edition lists how to cite data sets on pp. 337–338, which would include DOIs. DOIs are just one of a growing list of persistent identifiers (PIDs) that create more accuracy and seamless operation for an international research ecosystem. Other “PIDs” include ORCID (<https://orcid.org/>) for individuals, and ROR (<https://ror.org/>), for institutions. There was even a popular conference dedicated to PIDs (PIDapalooza; <https://www.pidapalooza.org/>). The effective use of PIDs for research outputs (DOIs), funders (ROR), institutions and organizations (ROR), and individuals (ORCID iDs) is a foundational element of a seamlessly linked and effective scholarly research ecosystem.

### **An ORCID iD for Every Researcher**

Publishers have now integrated persistent IDs such as those from ORCID into their workflows. In addition to persistent identifiers (DOIs) for publications and other products of research such as data sets, it is now a fact that authors also need to be correctly identified and linked to their outputs in this new research environment. The use of unique, persistent digital identifiers now extends to the researcher, many of whom are expected to register for the ORCID iD (<https://orcid.org/>) by their publishers, funders or universities. It is now common for researchers to be asked for their ORCID iD when using various systems in the research ecosystem such as grants submission databases. The use of researcher identification systems (especially ORCID) to disambiguate one researcher from another with similar name makes discovery and attribution more accurate. An important development for scholarship has been the development of one major open and portable author identification system that authors across disciplines and countries can

use. A single persistent ID and profiling system that is used by researchers, universities, publishers, grant funding agencies and others creates a worldwide network of researchers and papers, all with accurate author details. Many researchers, institutions, funders and publishers (all members) are now working with ORCID, a not-for-profit organization that serves the research community in an open and transparent manner (ORCID, 2017). An added bonus is the ease of use of ORCID's systems, and even early career researchers can become part of the research environment by registering for an ORCID iD at [orcid.org](http://orcid.org), which takes only about 30 seconds to accomplish. Automated features that can automatically add papers discovered by Scopus, CrossRef, and DataCite (for data and contents of some institutional repositories), for instance, make updating one's ORCID profile very easy and may someday be able to spin off a current CV for a researcher at the point of need. Some libraries and librarians are also involved in institutional implementations of the ORCID iD, adding librarian expertise to these new scholarly communication initiatives at the institutional level. Many institutional members work with ORCID to integrate their various university systems in an ORCID implementation, allowing seamless transfer of author profile, funder and publication information (and more) into various processes. This saves faculty time by automating linkages and scholarly communication processes and adds an important new piece to the researcher ecosystem being built by universities today. In time, all systems in use by psychology researchers will likely be requiring the ORCID iD, whether for grant or publication submission, or for adding to university faculty profiling or current research information systems. The ORCID iD has become an integral part of every researcher's individual profile and more and more universities expect that faculty and even graduate students will have an ORCID iD that is connected to their university affiliation information and/or university profiling systems. These persistent IDs are important also to the Research Information Management systems (RIMs) that many universities are building in an attempt to create a research ecosystem that is useful for the institution's researchers and works for all stakeholders in an interconnected system. RIMs make use of PIDs like ORCID iDs, ROR, and journal and data DOIs, along with repository IDs like PMCIDs to create more seamless university research information systems.

There is an international element to PIDs, and ORCID disambiguates authors and is useful for correctly connecting author and research output. As the global information landscape evolves, author lists become longer, and the sheer number of researchers writing for publication grows exponentially, there has been a need to ensure correct attribution of authors. This can be

accomplished via use of the ORCID iD, which is available to all researchers in every discipline. In fact, it has been stated that China's Ministry of Public Security estimates that "1.1 billion people, that is, roughly 85% of China's population, share just 129 surnames" (Tran & Lyon, 2017, p. 172). This is an illustration of the difficulties that funders, publishers and other researchers may have with ensuring correct attribution of scholarly work. The ORCID iD is currently in use (as of June 2022), by more than 14 million researchers worldwide (<https://orcid.org/statistics>). Other researcher identification systems, such as Scopus Author Identifier (Elsevier) or ResearcherID (Clarivate) now work with ORCID. As a reminder, all authors of psychology papers, books, and all recipients of funding will need to have an ORCID iD. The useful ORCID profiling system allows an author to have a public-facing profile that can be automatically updated with each new article published (or grant received). With this automatic updating available, as well as publisher and funder uptake of ORCID, all researchers will likely need and want to have an ORCID iD. Many researchers include their ORCID iD on their email signature line and in other places where they want others to have easy access to the information on their ORCID profile.

## The Continuing Growth of Open Access

Opening up access to the peer reviewed results of research articles and data has been an unprecedented public good, thanks in part to the powers of the internet (and some changes to traditional publisher permissions) to disseminate information to all corners of the globe. Research funders have made a significant impact by mandating OA to the products of funded research. Whether a researcher unaffiliated with the subscription riches of a well-endowed university, a reader needing access to research articles and data, a practitioner not associated with a research institution and its collections of books and journals, or a young person interested in learning more about psychological science in order to pursue a career, increasing the options for free and Open Access to research results in a benefit to research and to society. Most readers can't or won't pay the high prices that commercial publishers charge to access single articles and many publicly accessible research libraries now limit the time that the public can access electronic subscriptions on site in the library building. For many cash-strapped researchers, and even those who object to paywalls on principle, accessing needed scholarly articles can be an incredible burden. For whole areas of the globe, subscription-based, traditional scholarly research publications are out of reach. One of the only questions left is not when, but how to continue to evolve an OA



environment that reaches the goals of wide dissemination of research to all that need to access or discover it. It is impossible to calculate the impact of the lack of access to the scholarly literature that faces many readers around the world.

There is one major initiative that provides an alternative for the research literature needs of developing nations. The multifaceted program, Research4Life (<https://www.research4life.org/>), made up of five programs including Hinari (Research for Health) is managed by the World Health Organization (in partnership with publishers and other organizations) and delivers free or low cost access to the scholarly peer reviewed literature to “researchers at more than 11,500 institutions in over 125 lower- and middle-income countries.” Major psychology-related publishers are partners in Hinari, for example, and include the American Psychological Association, Springer Nature, SAGE Publications, U.S. National Institute of Mental Health (NIMH), Taylor & Francis, Society for Neuroscience, and others. As of 2023, there were 125 countries, areas and territories where Hinari delivers free content from a long list of scholarly publishers (<https://partnership.who.int/hinari>). The more ubiquitous availability of mobile phones in many regions of the world (but certainly not all) has brought OA content more directly to users. Open Access (and open science initiatives) speak to all stakeholders’ interests in moving forward toward a more equitable world as part of initiatives such as the United Nations Sustainable Development Goals (SDGs) (<https://sdgs.un.org/>).

Open Access has arrived, and is now considered to be here to stay, or even “inevitable” and shows growth in all areas (Lewis, 2012). As of 2013, with numbers now obsolete, a study of availability of scholarly publications estimated the numbers of openly available English-language papers at about 27 million, or about a quarter of all online scholarly publications including articles, conference papers, and dissertations (Khabisa & Giles, 2014). Taking into account all versions of papers that are freely available to read on the internet (including papers that authors have self-archived or paid traditional subscription journals to publish as OA), the figure may rise much higher. In studies carried out by the Science-Metrix consultancy for the European Commission claims that researchers can “search the internet for any research article published in 2011, and you have a 50-50 chance of downloading it for free” (Van Noorden, 2013, p. 386). There is an upward trajectory of OA materials easily found with an internet search. Morrison, whose blog, *Dramatic Growth of Open Access*, announced in a December, 2018 post that 2018 was the “best year yet for net growth of Open Access” as measured by numbers of open access documents that can be discovered in online repositories and aggregators (Morrison, 2018b). By

2020, H. Morrison (2020) described the upward trend in all major services adding OA content: “Analysis of quarterly and annual growth for 39 indicators from 10 services reflecting Open Access publishing and archiving (Internet Archive, Bielefeld Academic Search Engine, Directory of Open Access Books, bioRxiv, PubMedCentral, PubMed, SCOAP3, Directory of Open Access Journals, RePEC and arXiv) demonstrates ongoing robust growth beyond the baseline growth of scholarly journals and articles of 3 – 3.5 per year. Growth rates for these indicators ranged from 4% – 100% (doubling). 26 indicators had a growth rate of over 10%, 15 had a growth rate of over 20%, and 6 had a growth rate of over 40%.” Clearly, the experience of hitting a paywall (with prices that can reach about \$41 U.S. dollars per article) when searching for and discovering scholarly publications may be evolving in a positive direction. A global audience is now able to discover the literature of psychology, often from the convenience of home, or on a mobile device at the point of need. This vastly extends the reach and usefulness of the psychological science literature. Obviously, it is in the interest of all authors (and their publishers) looking to reach more readers to work for the Open Access and public accessibility of the discipline’s literature. With all of these studies, it is difficult to count numbers of OA articles at scale, due to the numerous formats, types, and modes that encompass OA. While some count only those with clear licensing, such as Creative Commons licensing (<https://creativecommons.org/>), others count anything “freely accessible.” Most count only “non-pirate site OA” and do not address the millions of articles available to the world via sites like Sci-Hub and LibGen. Some have referred to Sci-Hub as Black OA, or a pirate site. Some don’t consider articles on personal websites or academic social networks (like ResearchGate and Academia.edu) as OA. So, as we walk through the numbers, only major trends can really be seen, not necessarily any agreed-upon granular result for “how much OA, and where is that OA for psychology.” Some articles attempt to categorize all the modes of OA and where the articles are located. Kurata et al. (2022) demonstrate not only the current number and type of modes that involve OA but how the percentage of each mode are growing and changing all the time. Clearly, OA is certainly common for articles on the web. Ten modes of OA were analyzed in this study:

10 implementation modes: Gold, Hybrid, Delayed, Bronze, Subject Repositories, Institutional Repositories, Personal/Institutional Websites, Academic Social Networks (ASNs), Others, and Web Aggregator. Overall, 56.5% of all sampled articles in 2013 were available for free on at least one website in 2015, while 61.7% of all sampled articles in 2018 were freely available on at least one website in 2020. Concerning

implementation mode, ASNs had the highest frequency (44.4% in 2015 and 56.0% in 2020), followed by Subject Repositories (35.0% in 2015 and 39.6% in 2020) and Gold (24.1% in 2015 and 37.4% in 2020). (Kurata et al., 2022)

It is possible to study OA article numbers no matter where they exist. In a study using an Unpaywall data set (<https://unpaywall.org>), and the logs from the Unpaywall browser extension (that millions use to find OA copies of paywalled articles), “based on the OA status of 70 million journal articles published between 1950 and 2019,” H. Piwowar et al. (2019) found that, in 2019, 31% of all articles are available as OA, and if this trend continues, 44% of all journal articles will be available as OA by 2025. This included all types of OA, whether gold (journals route), green (repository route), hybrid (subscription journals making some articles OA), and bronze (articles that are free from the publisher site with no license information available)—not only the publisher (gold) output studied by others.

The *STM Global Brief 2021 Economics & Market Size* (STM, 2021; using data from Delta Think), in its executive summary, stated that: “Open Access publishing is growing much faster than the underlying market with revenues projected to increase at 11.5% and output at 12.5% (compound annual growth rates) from 2019 to 2022.” Clearly, there is not only growth, there is strong revenue growth, and the transition will continue from reliance on library subscriptions as that sector shrinks as university library budgets fail to keep up and authors and funders have stepped up to pay for certain kinds of gold OA.

The COVID-19 pandemic has been a disruptor, but also an accelerant for Open Access. Delta Think, in their *News and Views OA market update 2021*, reports that “the Open Access market has had an exceptional year of growth in 2020. The effects of Covid-19 and exchange rate changes have compounded OA’s underlying strong growth.” Further, it will likely be another 18 to 24 months before we gain sufficient distance to observe any changes to underlying trends” and “COVID-19 has therefore served to boost the Open Access market.” Of interest, the highest boost was for individual OA articles in hybrid journals (Pollock & Michael, 2021).

There are many studies that attempt to show definitively not only the growth of OA, but the tipping point, where the number of OA articles surpasses the number of articles available from publishers (subscription articles). In one study using Dimensions data (coming from Unpaywall). Dimensions broke OA down into recognizable categories: Green (repository route), Bronze, Gold, Hybrid, all OA, and Closed. Dimensions interlinks coverage of preprints, supplementary data, and published articles, this service can show the provenance of an

article through its versions and linking to other research outputs. Hook (2021) reports that analysis of Dimensions (from Digital Science) data can demonstrate that OA has already surpassed the 50% mark, “While we have seen the percentage of OA increasing rapidly in recent years, especially in countries like China, Germany and the United Kingdom, it was not until 2020 that more outputs were published through OA channels than traditional subscription channels globally.”

It would be difficult to find any study that would demonstrate anything besides a growing trend toward more OA. The question is just what type of OA and who pays. The green OA solutions (participation in open repositories, usually via self-archiving Accepted Manuscripts (AMs) or other pre-publisher versions) are essential in the system to provide equity where funding is less available, waivers are not present, and equity is top of mind. Green OA continues on, even while publishers (commercial and nonprofit alike) make their decisions about how to continue on sustainably, whether and how to move to full OA, or to retain remnants of legacy subscription systems.

The Open Access publishing landscape is complex. The growth of OA repositories, numbers of articles flowing into those repositories, and numbers of new OA journals (and the articles in them) shows no signs of slowing. As an example, the two most popular OA “mega-journal” outlets, *PLOS ONE* and Nature’s *Scientific Reports* published a total of 38,088 articles in 2015 alone; 27,488 articles for *PLOS ONE* (down 9.3% from 2014) and 10,600 articles for Nature’s *Scientific Reports* (up 169.4% from 2014) (Wakeling et al., 2016). By 2017, *PLOS ONE* published 21,139 articles and *Scientific Reports* published 24,827 (Björk & Korkeamäki, 2020, p. 1083). These are by far the most prolific of the types of titles that psychological scientists are considering in the mix of journal publication options. Psychology is heavily represented in these megajournals (and other OA journals) and in repositories of all types. Authors need to understand their publication options, as well as their rights as authors in terms of sharing their work widely, and publishers and libraries need to find their places in a new landscape and adjust accordingly.

In fields of psychology, all types of OA have been introduced and are working effectively to disseminate scholarship to a global audience. Open Access journals, hybrid subscription journals that contain a few OA articles in each issue, fully OA monographs, and author self-archiving of legal, post peer-reviewed versions of post-prints (authors’ accepted manuscripts) in both institutional and subject/disciplinary repositories as well as the existence of many more “author’s original” preprints on the web have all become commonplace. A discussion of all of these methods of making articles and conference

papers OA will often illustrate the difficulty that authors face in decision-making about their choice of publication outlets as well as online dissemination and OA publication strategies

In an age of open research, authors will need to make decisions around Open Access publication; whether they will publish traditionally and self-archive, whether they will choose an OA journal with or without APC charges, whether they will want to publish with a disciplinary society, or whether their personal publication goals will be about impact factor and other accepted markers of prestige. In some cases, they will look to their libraries and institutions for funding for APCs. In such a complex OA environment, it would be recommended that institutions, via their libraries and/or research offices make information and consulting available for time-stretched authors that need customized OA solutions that deliver the type of dissemination, visibility and impact that they desire, and in many cases, that funder or institutional mandates require.

Decision-making by authors as to choice of publication outlet of course is key. For early career scholars, learning the traditions of the corpus of literature in the field is key and advice is needed from mentors and advisors, some of whom may not be aware of new methods of marketing work or using open science strategies. It is paramount for psychological science to ensure that researchers are empowered to use all available open science strategies to make the literature more visible to other scholars and the public. Engagement with publishers on OA and other associated issues may be more effective if done by established scholars. Senior scholars with a solid knowledge of new publishing paradigms and new ways of looking at author impact are essential to upending a model that may be somehow stuck in the past. With traditional forces at play in promotion and tenure decisions (like impact factor), there may be little room for early career researchers to create change. Regarding the situation in the United States, one study of early career researchers (ECRs) shows that “while not all ECRs knew about the scholarly communication practices of their mentors, advisors and supervisors, their assumption is that the practices of their senior counterparts are much the same as their own, except, possibly, in regard to social media and sharing” (PRC-CIBER, 2016, p. 27).

Often, in the academy, the college or university library has taken up various Open Access roles related to development of institutional repositories, services related to author self-archiving of articles (green OA), and assistance with making supplementary data widely available from the institutional repository. Librarians, especially the subject specialist librarians of research universities, provide consulting for psychology faculty and researchers around strategies for making their works OA, both

from the institutional repository and also from other available services such as disciplinary repositories or preprint servers. Some psychology faculty members and others have stepped into roles as OA advocates, or as developers of new tools or policies that increase OA to the discipline’s scholarly literature. Researchers that want to maximize their use of OA strategies for publications and data may want to start with the university’s psychology librarian, scholarly communication librarian, institutional repository manager, or scholarly communication department of the library.

Beyond Open Access, there will be continuing development of the tools and services that will enable a truly open science/open research focus for psychological science. In fact, psychology as a field may step out in front in open science practices and principles with appropriate leadership and skill sets.

### **Institutional Open Access Policies Passed by Faculty**

Many universities have passed OA policies, usually by the vote of faculty governance bodies such as university senates or faculty councils. Institutional OA policies, particularly the popular “Harvard style” policies seek to ensure the ability of scholars to share their work via the retention of some rights to share and post accepted versions of their work out of the institutional repository. The development and passage of institutional OA policies such as the popular “Harvard model Open Access policy” (<https://osc.hul.harvard.edu/modelpolicy/>) can be seen as a popular statement by faculty at universities that OA is necessary and expected for wide impact. Open Access policies help to preserve author rights to self-archive accepted manuscripts of research articles on the internet without fear of reprisal while increasing the amount of a university’s scholarly available to a global readership. While Harvard was the innovator, the institutions and funders of other countries are now passing similar types of “rights retention” policies (Rumsey, 2022).

Having a university OA policy lets publishers and others know that the university retains the rights for its authors to self-archive “accepted manuscript (AM)” versions of their work in the institutional repository (even before or after having signed a copyright transfer agreement) with the institution retaining only the nonexclusive right to make the works widely available on the internet via the institutional repository. Many universities in North America have passed OA policies, including Harvard, MIT, Rutgers, University of California, and almost 100 others as of this writing (June, 2022) that make up the membership of COAPI (Coalition of Open Access Policy Institutions; <https://sparcopen.org/coapi/>).

COAPI, an organization of North American institutions passing and implementing OA policies ensures the availability of a welcoming community focused on developing and maintaining best practices in this area. The number of universities passing policies, developing institutional repositories, and the number of articles in these repositories continues to increase each year. This type of repository-based OA, often called “green Open Access” carries no cost to authors and often results in final author versions (usually authors’ accepted manuscripts) of published articles being widely available on the internet to a global readership. A comprehensive book entitled *Open Access*, authored by Peter Suber, one of the world’s most recognizable experts on this topic, provides an excellent introduction to this topic, and is freely available on the internet (Suber, 2012). Suber (at Harvard) has continued to provide leadership for OA and is an invaluable resource on the topic.

Many institutional OA policies are misunderstood to require that every article be made OA in an OA journal, thereby requiring either publication in a fully OA journal that charges APCs or, in the case of an article being published in a traditional journal, the requirement to pay for this hybrid publication. Many U.S. institutional OA policies are focused instead around green OA, and as subscribers to the traditional journal literature, many institutions do not expect or desire that any author will pay that commercial publisher to make an article OA at the publisher site. This “green OA approach” also preserves academic freedom, allowing for authors to publish in the journal of their choice, whether closed or Open Access, only stipulating that an OA version of the article, usually the version that is the author’s Accepted Manuscript (AM) be deposited for global dissemination, free of charge, in the institutional repository

Not only found in North America, OA policymaking is an area of growth around the world. There are more OA policies being passed all the time by universities, other research institutions, and funders. Internationally, as of July, 2022, there are more than 1,100 OA policies and mandates listed in ROARMAP (Registry of Open Access Repository Mandates and Policies) (<http://roarmap.eprints.org/>). The number of funders mandating OA to the publications of their grantees has only continued to grow. Likely, many psychology researchers that write for publication do fall under university or funder mandates. It is important to ensure that authors pay attention to this important aspect of their scholarship and make plans to comply with all OA mandates.

For the creators of works of scholarship, the articles, conference proceedings and other works contributed without expectation of payment, OA policies stipulate that the author self-archive each article in the institutional repository, ensuring the works’ discoverability by

readers on the open web. Some repositories also employ automated processes that crawl the web (or target other aggregated sources of OA content) in search of articles authored by the university’s faculty that can be added to the institutional repository. Often, implementation of the policy is carried out using the expertise of the university library and its librarians. Librarians, especially subject specialists holding positions in research libraries are able to share information effectively with departmental faculty on how OA works within the disciplinary context. These conversations allay faculty concerns that may arise when OA comes up. Even without a policy in place, many university libraries provide consulting on author strategies for making the results of research OA. Even retrospective works may be able to be self-archived in the institutional or disciplinary repository, and librarians can consult with faculty and others on those possibilities. Many faculty authors are interested in marketing of their scholarly works to more communities and to new readers outside of those in the usual niche areas served by subscription publishers. A goal of any researcher looking to increase the impact of his or her published work would be to make sure that each and every research output is deposited in one or more repositories for wide dissemination. As for institutional repositories, this can include anything the author considers their scholarly output, and a DOI will be assigned to each work, facilitating sharing. An author may choose to participate in a disciplinary repository (like SSRN, for instance), a relevant preprint server (PsyArXiv), and an institutional repository all at once while sharing early works legally. Some participate also in scholarly networks like ResearchGate. While conversation tends to focus on the cost of OA to the author or funder, green OA does not carry cost to the researcher.

For the reader of the works of psychological science, whether researcher, practitioner or the public, passage of university OA policies have resulted in more access to this material. This is especially true where faculty and researchers take it upon themselves to commit to making sure each of their works of scholarship is available online via the self-archiving of a legal version of it (such as an Accepted Manuscript [AM] in the institutional repository at the time of acceptance for publication, or by publishing in a fully OA journal [or book]). For those affiliated with universities that have top tier electronic subscriptions, there is often a great dismay upon leaving the university and being cut off from its subscription access to the research literature. Once a researcher becomes unaffiliated with a university and its research library or becomes a practitioner, access to the subscription research literature that was formerly taken for granted becomes an issue and is often turned off, even for alumni. We do not know who the readers of the

scholarly literature are, and public access ensures that anyone will be able to read (and build upon) the articles, conference papers and other scholarship that enhances the reach of psychology. An important goal of university OA policies would be to gather the scholarship of a university together to showcase it and make it available on the internet. Departments and schools (or other academic units) of a university can make their collective works available online in an aggregated manner so that any reader or researcher in the world can access this corpus. The aim of these institutional policies is to ensure expanded access to the research outputs of universities, creating visibility and impact for the institution and its faculty and students. With a continuing and expanding emphasis on diversity, equity and inclusion (DEI), universities are also seeking ways to increase their societal impact, and having their research output available to anyone that wishes to access it via OA begins to break down some barriers to equitable access to research results. No longer should anyone be locked out of important psychology research material due to lack of university affiliation or geographical location.

Public as well as private funders have also instituted OA policies, and university policies complement these nicely. Universities will also likely want to maintain stewardship over the research data generated along with the publication, and funders have, in many cases, moved toward mandating that the data underlying the scholarly work also be made OA. One helpful resource where a researcher can see the requirements for OA by funders is the Sherpa Juliet database (<http://v2.sherpa.ac.uk/juliet/>). Failure to comply with OA policies now comes with consequences for future funding from the agency for any university and/or the principal investigator (PI). Many funding agencies in the past only encouraged OA and are now have moved to mandating it. Researchers will now find future funding in jeopardy if there is a lack of compliance with certain funder mandates. All researchers will need to understand OA strategies and potential costs (and sources of funding for those costs) as well as noting various compliance rules before beginning funded research. This will ensure that OA will be possible if it is stipulated, even if grant funding has run out or other issues surface. Not all psychology scholarship is funded, of course, and this does not impact the need to comply with the university OA policies in many cases as well. Open Access policies passed by universities may also create an environment more focused on “open” in terms of university practices around publications and research data. Focusing on “open” in all aspects of psychology research and publication, including data, will create a new environment based around transparency that will produce positive change in the impact of the

discipline’s scholarly output. Psychology may have been noticed as an early adopter of open science strategies, moving on from a focus only on OA to publications. Also at play is a continuing expansion from public access (“gratis”) to the results of research to the type of true OA (sometime labeled “libre”) that carries open licensing (CC-BY-type) and allows reuse and remixing of content. Many funders are now focused on this type of liberally licensed OA.

### **Green Open Access: Author Self-archiving and the Repository Route**

Authors publishing in traditional subscription journals need to share their work, and many want to or have to (due to funder or university mandates) deposit a version of their article in their institutional or disciplinary repository. These repositories are crawled by Google and other search engines, making the content available on the web. The majority of traffic to article versions in digital repositories comes in from search engines, particularly Google Scholar, and not as frequently by readers and researchers visiting the repositories directly. This wide online availability on the internet (via a Google search of author or targeted keywords) ensures easy discovery by anyone doing simple web keyword searches.

Publishers vary greatly on how and whether they accommodate this “green Open Access” (repository route) for their articles. A look at the database, “Sherpa Romeo: Publisher copyright policies & author self-archiving” ([www.sherpa.ac.uk/romeo/](http://www.sherpa.ac.uk/romeo/)), which is searchable by journal title or publisher name turns up examples of self-archiving policies for publishers of psychology journals. These policies on self-archiving would range, for example, from more OA-amenable publishers like American Psychological Association (APA) and Association for Psychological Science (APS), whose rules (according to Sherpa Romeo) allow authors to self-archive and share accepted manuscript versions (as well as unrefereed preprints)—to the journals from some commercial publishers, an example being Taylor & Francis with *Psychological Inquiry* that requires a 12 month embargo (delay) before the author’s accepted manuscript can be made available online. *Psychological Inquiry* is also an example of a hybrid journal that has an OA option for the publisher’s version of record (VoR), and charges \$3,085 (plus any local taxes) to publish the final version as a fully OA article. Of course, unless mandated by a funder, this payment of APC is optional. Traditional publishing without payment can be pursued, followed by deposit of the Accepted Manuscript (AM), free of charge, in a repository (green OA). Hybrid journals, a popular option for commercial publishers, offer a mix of some traditional subscription content and some

articles that have been made OA in the same issue. The articles have been made OA, alongside other traditionally published articles because the author, funder or university has paid an APC (article processing charge). APCs are highest for commercial publishers at this juncture. This is a pain point for libraries already paying subscription prices for these commercial journals, and terms such as “double-dipping” have come to identify the practice of charging for both subscriptions and author-side payments (APCs) as well. Currently, individual institutions as well as whole countries have pushed back, requiring “offsetting” agreements or other accommodations for managing the costs inherent in the system. Currently, in the transition to OA, some of the “read and publish” deals or “transformative agreements” do include hybrid OA. Most funders are also not as amenable to hybrid OA, preferring fully OA journals or authors’ depositing Accepted Manuscripts (AM) online via green OA. In fact, the oft-discussed Plan S, comprised of funders, also has a green “repository route” to accommodate those authors that prefer (or need to choose) that option. For those in areas closer to the social sciences or humanities, green OA may offer the best option at the best cost (free) when relief from APCs is not available from funders. Information on green OA, including rules on versions to be shared and embargoes can be found on an individual journal’s website, usually in “Information for Authors” sections, or through a search of the Sherpa Romeo service (<https://v2.sherpa.ac.uk/romeo/>) which allows search by publisher or journal title.

According to Sherpa Romeo and the APA’s website, the default policy for sharing articles in APA journals classifies them as “Romeo green,” and no embargo or delay is listed for posting of the final author version (often the Word document after completion of peer review, the author’s accepted manuscript). APA Journals states:

Authors of articles published in APA journals—the authoritative document, i.e., peer reviewed publication of record—may post a prepublication copy of the final manuscript, as accepted for publication as a word processing file, on their personal website; their employer’s server; their institution’s repository; a preprint repository like APA’s designated preprint server, PsyArXiv; reference managers (e.g., Mendeley); and author social networks (e.g., Academia.edu and ResearchGate) after it is accepted for publication. Check with the editor of the journal to which you are submitting your manuscript to see whether they accept submissions of manuscripts that have garnered significant media attention as preprints.” (American Psychological Association, 2021)

There are conditions set by APA that do prevail when authors are posting their own Word document version of an article (after peer review) at the time of acceptance for

publication. According to APA, the following conditions would prevail:

The posted prepublication copy of the manuscript must carry an APA copyright notice and include a link to the authoritative document on the APA website using the article’s digital object identifier (DOI) that may be found on the first page of the published article, in the upper right-hand corner. Further, the posted prepublication copy of the manuscript must include the following statement:

©American Psychological Association, [Year]. This paper is not the copy of record and may not exactly replicate the authoritative document published in the APA journal. The final article is available, upon publication, at: [ARTICLE DOI]. (American Psychological Association, 2021)

This type of publisher permission for authors to be able to self-archive their own final accepted manuscript version (free of charge in this day of APCs!), making it OA on the web to readers and researchers worldwide, is a common scenario. It is a simple and easy process for authors to participate in their institutional repositories, or preprint servers or other services. Most publishers allow this posting with or without embargo, and with or without special conditions, but some are much more restrictive, issuing rules that make it more difficult for authors who wish to share their work online, and for readers who discover scholarly content and cannot read it without encountering roadblocks. There is less tolerance all the time for embargos, and it is difficult to explain the delay to someone who needs the information, especially of a non-proprietary version such as the Accepted Manuscript (AM). Many funders are now stipulating “zero embargo” in their OA policies, realizing that an Accepted Manuscript with a 12, 24 or even 4 year publisher embargo does not serve the needs of the funder to most rapidly disseminate the research results they have funded. While many universities make subscription content available to their affiliates (faculty, staff or students of the institution only), sometimes scholars forget about the legions of practitioners, budding scientists, unaffiliated researchers, students that have graduated, alumni of most universities, and readers around the globe who need to read the scholarly literature of psychology, and cannot access it online due to paywalls or issues of non-affiliation. For those ensconced comfortably in academia, a familiar refrain might be the “everyone who needs access to the material has it somehow.” This is not the case, and one can imagine how the reach of psychological science is impacted. The issue of “paywalls” has become the major roadblock (although there are others), and has led to much consternation, and even was the subject of a documentary film entitled, *Paywall: The Business of Scholarship* (<https://paywallthemovie.com/>).

In terms of an example from a commercial publisher publishing a society journal, *Perspectives in Psychological Science* is an APS (Association for Psychological Science) journal, but is published by the commercial publisher, SAGE. Unlike some of the others, SAGE has a liberal self-archiving policy and other OA practices that allow authors to share their work widely, possibly driving some traffic back to the journal and the publisher. Libraries would find SAGE to be the kind of publisher that facilitates the wide dissemination that authors and universities seek (Mullen & Ross, 2016). Although many worry about harm to publishers, in terms of subscription cancellations or other negative consequences, at this point, that has not been the case (Suber, 2016). In fact, various analyses, including one report from BernsteinResearch (Aspesi & Luong, 2014) are able to state that “11 years after the Berlin Declaration on Open Access, however, the rise of Open Access appears to inflict little or no damage on the leading subscription publishers” (p. 1), and that “OA funding may in fact be adding to the profits of STM” (p. 1). All major publishers now have OA options for authors and funders. Publishers are all also cognizant of the wide sharing of the research literature that currently exists (outside of established legal channels) that only continues to grow, and will deal with that somehow as time goes on.

There may be confusion over multiple versions of the same paper on the internet but there are clear methods of identifying versions in a repository, superseding an older version with a more current one, and finally linking to the version of record. It is true today that iterations of a single paper may have different DOIs, possibly causing concern or confusion. However, this is the expected scenario going forward. Each version of a paper needs its own DOI to identify that particular version for purposes of citation. Green OA, the “repository route” to OA makes papers available on the internet, often using an author version just before publication, the post-peer reviewed “Accepted Manuscript (AM).” This version may also be known as the “postprint.” Postprint versions, (accepted articles, post peer review), usually have the same intellectual content as the published version of record. Some authors whose articles have undergone revisions are reticent about depositing versions that may not be identical, word for word, to the publisher version due to copyediting, or other changes made in the final publication process. However, some authors prefer to self-archive their accepted manuscript version as their “best available version,” finalized as they prefer, with minor possible differences from the publisher-copyedited version of record. When self-archiving a work of scholarship, authors have control over the final iteration of their accepted manuscript, and they may add changes that have been made by copyediting to the deposited version

as they wish. Each version of the article has its own DOI and is citable as an individual research output. Repositories practice “version control” and are able to direct readers from a superseded version to the most current version of the article. This information can now be prominently displayed on the article’s cover sheet in the repository, directing readers via seamless linking to the publisher version of record (VOR). Most potential readers across the globe, however, will not have access to subscription versions, and will be able to access, use and cite the green OA version. This final publisher version may be imprinted with the Crossmark logo (<https://www.crossref.org/services/crossmark/>), indicating the most current authoritative publisher version. For those wishing to self-archive older papers, a perennial problem is lack of author access to their accepted manuscript versions at any later point in time. Those working with authors on self-archiving their papers know that it is easiest for authors to deposit their articles in the institutional repository “at the point of acceptance for publication,” because this is the moment in time when the author is most likely to have the article’s accepted manuscript right at hand for the simple deposit. It is possible now for repository managers or authors to retrieve the author’s accepted manuscript from some publisher manuscript submission systems (<https://openaccessbuton.org/direct2aam>).

The final published VOR, often in PDF is usually proprietary to the publisher, and authors are restricted from archiving this version in repositories or elsewhere on the web (unless they have paid an APC to the publisher to allow this posting in the case of a hybrid or fully OA journal). For traditional publishing, posting of the publisher’s VOR online is most often disallowed. A small proportion of journal publishers allow the VoR to be placed in an institutional repository in compliance with mandates (funder or institutional), or even shared legally and openly on the web. A 2009 study reported that at that time, “when it comes to self-archiving; more than half of authors think that publishers allow them to deposit the final PDF, whereas under 10% of publishers actually permit this—probably because of serious concerns about the long-term impact on subscriptions” (McCulloch, 2009). The Sherpa Romeo website used to include a listing in 2015 of “Publishers allowing use of their PDFs in Repositories” (Bailey, 2008). It is difficult to find that percentage that allow that use of the VoR today. One example of a publisher allowing publisher branded copies to be self-archived is PsychOpen (<http://www.psychopen.eu/>). Even with all of the rules about self-archiving of peer reviewed articles easy to find (in author instructions or in services like Sherpa Romeo), there is evidence that plenty of authors post versions of record to their own websites, or to other web services

(Björk et al., 2014). Sharing of articles in final version is common, even though disallowed by publishers where copyright has been signed over. Research culture is one of sharing with one's communities.

In fact, many publishers that do not allow publisher versions to be posted to institutional repositories do allow posting to personal websites. This often strikes scholars as somewhat confusing. While institutional repositories are widely available to those affiliated with universities, and the subject/disciplinary repositories (and scholarly networking services such as ResearchGate) also provide valuable visibility for authors that self-archive their work, studies show that many authors prefer to place their works on personal websites (Björk et al., 2014). While a popular option, using the personal (or departmental) website does not provide the preservation or migration of digital formats that digital repositories do. Repositories also employ a high level of search engine optimization (SEO), aiding discoverability of works more effectively than many personal or institutional websites. In a smaller 2009 study from Carnegie Mellon University that looked at faculty practices of placing electronic copies of their articles on faculty webpages, it was found that "publisher policy appears to neither influence the decision to self-archive nor the article version that is self-archived. Disciplinary norms are influential but not necessarily the driving factor" (p.225), and in this case, the university's psychology department showed one of the highest rates of providing access to full-text OA versions of articles on faculty webpages (Troll Covey, 2009). Online curricula vitae (CVs) have been studied to ascertain whether researchers are adding hyperlinks to openly available versions of articles, possibly furthering the reach of these articles. In a survey of European authors, in comparison to what publishers allow, there was not a significant use of the practice of linking to OA versions on online CVs (Kousha & Thelwall, 2014).

Whereas publishers, libraries, the public and other stakeholders are motivated to move to a more Open Access environment for scholarly journals, there is evidence that the scientists that actually write the articles and often sign them away to the publisher (only retaining some rights to share their own works on the internet) are a group that may prefer the status quo. Within the current system of scholarly communication, with established incentives and rewards in place, getting published in as high an impact journal title as possible is the key to career advancement, and is still the real or perceived route to promotion and tenure in many cases. Many authors don't necessarily want change in the system, especially if there is any career risk. They routinely sign publication agreement forms, often signing their rights away, and possibly only later want to make greater use of the works than what the

publisher allows. Other times, they sign an exclusive license. Most publishers (but certainly not all) contribute "rules" for sharing various versions on the internet on the aforementioned Sherpa Romeo service. Of course, some authors either do not understand what rights they are signing away, or simply don't pay attention to this final step in what may be a long publication process. Some authors simply post articles wherever they want, such as on personal websites or scholarly networking services, not even considering doing otherwise. Since they wrote the articles, they consider the work shareable. There is misunderstanding by authors over which versions of articles are allowable, and even questions about how to find information on how to share research publications on the web. Today's culture of sharing is so pervasive in practice that authors are sometimes shocked to find that publishers do not allow the wide sharing of articles on the internet. Sharing of the publisher proprietary branded version is, in most cases, not allowed by the publisher even if many authors go ahead and share widely anyway. There is a culture of sharing that may be especially strong in early career researchers, and authors may be used to the sharing culture of the internet, especially where no royalties are paid to them for journal articles. For many authors it seems natural to share articles with others. Ironically, there seem to be fewer rules around posting publisher copies on personal websites.

Publishers at one time were liberal with regards to author self-archiving, but in recent years, even though more publishers are known to be "green" according to Sherpa Romeo, a more restrictive environment may be seen, with longer publisher embargoes emerging and more rules attached to use of *any* version of an article, particularly in an institutional repository (Gadd & Troll Covey, 2019). This will necessitate the use of proactive strategies and workarounds for universities that want to showcase their scholarship or comply with funder mandates. Universities passing OA policies are setting out expectations for authors but also notifying publishers that they are retaining rights.

Plan S and other funder policies (such as Howard Hughes Medical Institute (HHMI)'s policy from October 2020), follow the policies of the Bill & Melinda Gates Foundation that require publishing articles that result from funding in fully OA journals (no hybrid journals). These policies also allow (for compliance) deposit of the Accepted Manuscripts (AM) without embargo (and with liberal publishing licenses) in open repositories (Else, 2020). Green OA is allowed and encouraged in many recent funder mandates, possibly due to calls for equity for authors in a new "author pays" publishing environment. Bosman and Kramer (2020) have studied the prevalence of zero embargos,



liberal CC licensing and rights retention in publisher policies, and show that publishers (such as SAGE) have not seen harm to the bottom line from green OA but they are more reluctant to offer liberal CC-BY license, possibly due to the possibility of loss of economic control over the article. With more funders falling under the umbrella of Plan S's policies, the concept of zero embargo on the Accepted Manuscript (AM) version may become more palatable and possibly become a more common repository practice, even as the CC-BY license types face a steeper road.

In psychology, time from article acceptance to publication could be 2 years, although some publishers now place "in press" articles online (Nosek & Bar-Anan, 2012). For authors of accepted articles, many will want to self-archive the author's accepted manuscript even before the publisher's earliest posting. By placing an accepted manuscript online, at a time before formal publication, early impact may be demonstrated. Many open repositories and other services disseminating "green" article versions can provide usage statistics, usually in the form of downloads from specific geographic areas. This type of alternative metrics service allows an author to create a narrative about a specific work, being able to suggest that impact may be demonstrated by charts and visualizations showing tens or hundreds of downloads from many countries (in a specific time period, for instance). It can be very compelling for an author to open up access to scholarship through making works (in early versions such as preprints or accepted manuscripts) freely available on the internet, and then to watch the reader traffic that ensues. Some universities deploy large real-time mapping visualizations that show downloads of institutional scholarship as it is happening, sometimes called the "pinging map." Depositing green copies of papers online as soon as they are accepted for publication accomplishes many goals for the scholar, namely getting the work out as soon as it is accepted, getting novel ideas date stamped, often before the final publisher version of record is made available. "Marketing" one's work this way can lead to conference invites as well. This allows early sharing of the DOI from the repository, and early download statistics can start to accrue. Self-archiving is also an effective way of marketing one's work online, as Google Scholar crawls repositories and makes papers available on the internet within a short time frame. When the published article becomes available, repository versions can link to that publisher-supplied DOI. Use of Google Scholar is a way of aggregating all versions of a scholarly work, with all OA copies as well as publisher copies often visible all in one place. Google Scholar is a freely available and effective search service for discovering OA versions of papers.

## Preprints in Psychology

There is continuing discussion around the use and value of early versions of scholarly papers (such as preprints) found on the internet. There is no denying the power of the preprint to move current research findings to the forefront as soon as they are ready to disseminate. Unrefereed early versions, known as preprints or "Author's Originals (AO)" are a topic of significant current interest to authors, funders, and publishers. This trend toward use of preprints was only been exacerbated by the COVID-19 pandemic. Interestingly, the choice of using preprints to disseminate scholarship has had a long history in psychology. Garvey and Griffith (1972) described how informal scholarly communication in the early 1960s included the practice of dissemination of preprints as a way to seek comments and feedback on research. Before the internet made sharing early versions of articles (allowable by most publishers) easy, psychological scientists used other means to distribute these early versions. "In 1963, for example, about half of the authors of articles published in major psychology journals distributed an average of 10 preprints" (p. 131) Further,

preprint distribution appears to serve both the recipient and the author. Over 60 per cent of those authors who distributed preprints received feedback that prompted them to modify their manuscripts. These modifications were not simply a matter of improvement in the grammar and style of the manuscript but, instead, involved significant modifications such as reanalysis of data, redefinition of concepts, etc. Consequently, preprint distribution is, for many authors, an effective means of obtaining independent evaluation of the scientific worth of their work. (p. 131)

This focus on getting completed articles (before peer review) out to colleagues in order to solicit feedback is now facilitated through disciplinary preprint servers and institutional repositories that serve to put "Author's Originals (AO)" on the internet so the sharing can be maximized. In this current practice, we see echoes of the scientific communication practices of 50 years ago. The Author's Original (AO) is just one version of a work that can exist along continuum, with clarity regarding versions provided for readers by the use of consistent NISO (National Information Standards Organization) versioning language terms (NISO/ALPSP Journal Article Versions (JAV) Technical Working Group, 2008). Currently, the NISO versioning language is being updated, with particular attention to the language around preprints. Use of standardized terms assists with the issue of the identification of versions of a particular work, where each article may have many iterations on

the internet. Institutional repositories often use the addition of “cover sheets” (often a PDF) on each article to identify the version of the article as well as to provide a link to any final publisher version that may be available to the reader. Many preprints exist only in this early version, and are never formally published. They exist, identified by their DOIs (or “handles”) online as a unique contribution to the research literature of a discipline or university. Preprints may be considered as Author’s Originals (AO) or “works in progress” on a scientist’s publication record. Surfacing preprints found online in dedicated servers on CVs and in promotion and tenure dossiers allows early dissemination and establishes credit for a particular research agenda.

The establishment of informal networks of scientists has been paramount throughout recent history in psychology, leading Garvey and Griffith (1972) to discuss the results of their study from 50 years ago that found that:

In other words, research ideas and problem development cannot be primarily influenced by the published channels of scientific information exchange. In a study of over 200 research efforts in psychology, we found that ideas for less than one out of seven originated from sources such as journal articles, presentations at national meetings, etc. Instead, the scientist relies heavily on informal networks of information exchange to keep abreast of current activities and the current views of the community on the value and relevance of specific research problems. (p. 128)

Where some publishers lament the extent of the sharing that goes on in scholarly networking platforms, such as ResearchGate or Academia.edu, it is important to remember that wide sharing was always the goal of productive psychological scientists. At this point, the most well-known preprint server is unquestionably arXiv, an integral part of the established disciplinary culture of physics, mathematics, computer science and related fields. An early innovation of the scientific communication systems in disciplines that use it, arXiv, developed in 1991 by Paul Ginsparg at Los Alamos National Laboratory and taken over by Cornell University in 2001, is now supported by more than 50 universities and is essential to the fields it covers. Its impact and value are unquestioned. In 2019, Cornell announced arXiv’s transition from its Library to Cornell Computing & Information Science (CIS; Cornell Bowers CIS, 2022). At one time, arXiv asked for support from universities that had many uploading authors (Björk, 2014). Still, even with more than two million papers in arXiv as of this writing (August, 2022), there are always questions raised about sustainability for all of these services, or the possibility of buyout by some commercial firm with interests of a different kind. It is noted that Elsevier has acquired both Mendeley and SSRN

(Social Sciences Research Network). Still, the preprint culture was solidified in the scholarly landscape by arXiv and now, 30 years later, is being established in multiple new disciplinary areas, many using names evocative of the original arXiv.

As for preprints, there are many who question why the successful model that arXiv represents has not translated more quickly, or more successfully to other disciplines- with the possible exception of bioRxiv (hosted by Cold Spring Harbor Laboratory), which is much newer and still much less populated, but has grown quickly. Even though the culture of social sciences supports fairly traditional scholarly communication systems, in 2016, SocArXiv was developed after the model of arXiv (Peet, 2016). SocArXiv was, in 2016, a new preprint server for the social sciences that is overseen by a distinguished steering committee and is partnering with the University of Maryland, the Center for Open Science and SHARE (a higher education initiative, <http://www.share-research.org/>; P. Cohen, 2016). In only a few years, preprints have become a recognized way to share early drafts of research results for many more disciplines than the original arXiv. The future of these innovations in scholarly communication (for those disciplines not accustomed to such sharing of early unrefereed versions) is still unclear. The impetus may be growing for change, and some publishers will innovate and provide options for authors. Other publishers may not evolve and continue with the status quo, not offering authors the choice to share their work more widely prior to formal publication. There may be other pressures on authors to use preprints. In 2017, the National Institutes of Health (NIH) followed the lead of the U.K.’s Medical Research Council (MRC) and as of March 27, 2017, began to allow preprints to be submitted as part of the grant proposal process. There was some contentious discussion during the decision-making process about the use of these “interim research products” and issues with use of non-peer reviewed papers in proposals. However, response from scientists has been positive (Vence, 2017b).

As online preprints continue to proliferate, there is an important new option in psychology due to the establishment and development of the dedicated preprint service, PsyArXiv (Center for Open Science, 2017a). PsyArXiv is described on its website as “A free preprint service for the psychological sciences; Maintained by the Society for the Improvement of Psychological Science; powered by OSF Preprints” (<https://psyarxiv.com/>). PsyArXiv was launched in December, 2016 and is one of the open source disciplinary preprint services made available by the Center for Open Science, run by its Open Science Framework (OSF) Preprints service. Center for Open Science (COS) is an established innovator in the open science landscape and continues to integrate with other services. COS grew, in its

first 4 years from a staff of two to an organization of 60 staff with an \$8 million operating budget, and its OSF software was used (as of 2017) by 50,000 scientists that are sharing their research methods and data (Winerman, 2017). By December, 2021, OSF had 400,000 registered users from around the world, and in 2021 alone, OSF users posted more than 2.6 M files (Pfeiffer et al., 2021).

PsyArXiv benefits from using an established service from COS. OSF is described on its site as “The OSF is a free open-source software project that facilitates open collaboration in science research. As a collaboration tool, OSF helps research teams work on projects privately or make the entire project publicly accessible for broad dissemination. As a workflow system, OSF enables connections to data, preprints, and data management and research planning that researchers already use, streamlining their process and increasing efficiency” (<https://help.osf.io/article/342-getting-started-on-the-osf>).

PsyArXiv is thriving, and describes its services thus:

PsyArXiv (psychology archive) is designed to facilitate rapid dissemination of psychological research. PsyArXiv is a creation of the Society for the Improvement of Psychological Science (SIPS) and the Center for Open Science (COS).

PsyArXiv allows scholars to post documents such as working papers, unpublished work, and articles under review (preprints), making them accessible to other researchers and to the public at no cost. Users can also upload revisions of their posted document and supplemental documents such as appendices.

Most journals in psychology permit posting of preprints, and for most journals you can find their policy at the SHERPA/RoMEO database. Before publication, articles are your creative product to do with as *you* please. If your article has already been published in a journal, be sure to check the journal policy on posting—for example, many do not allow posting of the publisher-prepared PDF, but do allow posting of the original author-formatted document. (PsyArXiv, n.d.)

It will be interesting to watch the progress of the PsyArXiv psychology preprints initiative: how many authors participate, how papers evolve to more final publication, and how the existence of preprints will interface with formal journal publication. PsyArXiv followed the launches of bioRxiv (operated by Cold Spring Harbor Laboratory), and ChemRxiv (established by the American Chemical Society). Two other new preprint services that opened alongside PsyArXiv are the aforementioned SocArXiv and also engrXiv for engineering. This is a rapidly developing phenomenon for many disciplines and the list of disciplinary preprint services run by OSF continues to grow.

As these services become more popular and proliferate, a proposal to connect and centralize preprint services in an initiative called “The Commons” could resonate in

an increasingly cross-disciplinary scholarly landscape. The proposal for The Commons states:

The Commons will connect preprint services in a community-based model. For the typical user discovery interface, The Commons will facilitate discovery of preprints on various hosted preprint services and guide users to engage with the preprint on that hosting service. (Nosek, 2017)

Along with this new emphasis on preprints, and earliest reporting of research results in many disciplines (including psychology), occasional discussions sometimes persist about a once debated topic, the “Ingelfinger rule” (Altman, 1996). The Ingelfinger rule developed traction as it forbade duplicate or prior publication of any research that would be submitted to a peer reviewed journal. How does this idea translate in an age of internet posting of research results, especially preprints? The number of publishers expressly allowing posting of preprints online has seemed to put this issue to rest. There may be added incentives and advantages for authors of having early versions of articles available for all to read on the internet. Preprints may catch the eye of journal editors seeking promising content for their publications. There is evidence that “preprint editors” in some fields are examining preprint servers to discover promising articles for possible publication in their journals, for example, as is the case with *PLOS Genetics* and BioMed Central’s *Genome Biology* (Vence, 2017a). Uploading articles to disciplinary preprint servers may be an effective way of marketing to editors seeking relevant articles for their publications.

Historically, this issue of whether posting papers on the internet was to be considered “prior publication” was addressed in psychology in an example from APA guidelines in 1996:

One of the most widely publicized Internet publication policies came from the American Psychological Association (1996, as cited in Kling & McKim, 2000) whose interim policy asserted: Authors are instructed not to put their manuscripts on the Internet at any stage (draft, submitted for publication, in press, or published). Authors should be aware that they run a risk of having (a) their papers stolen, altered, or distributed without their permission and, very importantly, (b) an editor regard such papers as previously “published” and not eligible as a submission—a position taken by most APA journal editors. In addition, after acceptance for publication, the publisher is the copyright holder. APA does not permit authors to post the full text of their APA-published papers on the Internet at this time, as developments in the on-line world cannot be predicted. The APA will, however, closely follow such Internet developments. The P&C Board will establish a task force in June 1997 to

investigate developments and recommend a longer term APA policy. (Kling & McKim, 2000, p. 1312)

This policy and practices certainly evolved. Many (if not most) journal and publisher policies today allow posting of preprints in repositories and other web services, and in some disciplines, there is an established culture around archiving preprints. Major psychology publishers *do* allow the posting of preprints. Some have some minor rules around the practice. APA is an example of a publisher that *does* allow preprints to be self-archived. As for permissions to post preprints on the open web, the Sherpa Romeo service lists APA's permission to post preprints, and the APA website lists this information:

#### APA Journals Internet Posting Guidelines

Update effective November 4, 2019

If a paper is unpublished, the author may distribute it on the Internet or post it on a website but should label the paper with the date and with a statement that the paper has not (yet) been published and is not therefore the authoritative document of record. (Example: "Draft version 1.3, 1/5/16. This paper has not been peer reviewed. Please do not copy or cite without author's permission.") Authors of articles published in APA journals—the authoritative document, i.e., peer reviewed publication of record—may post a prepublication copy of the final manuscript, as accepted for publication as a word processing file, on their personal website; their employer's server; their institution's repository; a preprint repository like APA's designated preprint server, PsyArXiv; reference managers (e.g., Mendeley); and author social networks (e.g., Academia.edu and ResearchGate) after it is accepted for publication. Check with the editor of the journal to which you are submitting your manuscript to see whether they accept submissions of manuscripts that have garnered significant media attention as preprints. (American Psychological Association, 2021)

These early, original articles, once deposited in an institutional or subject repository (or on a preprint server like PsyArXiv), do pick up downloads and citations and can serve to establish early authority, as well as provide a mechanism for authors to receive constructive feedback on early drafts. This serves the purpose of crowdsourcing informal review, and feedback can improve later drafts. The announcement that the third party open source platform service, Hypothesis, would partner with some of the preprint services of Center for Open Science (including PsyArXiv) to provide the ability for readers to annotate and discuss preprints was welcome. This valuable enhancement allows the community to provide constructive feedback on a preprint within the text (rather than in comments at the end), aiding efforts at transparency and collaboration in scholarly communication in psychology (<https://web.hypothes.is/blog/hypothesis-live-on-cos-osf/>). The use of Hypothesis has only grown, with

more than 5 million annotations integrated into research articles from its launch in 2011 until 2019 (Shaikh-Lesko, 2019). Another journal publisher of many psychology articles, PLOS, has specifically welcomed the submission of papers that have already been shared in preprint servers. PLOS also partners with the preprint servers bioRxiv and medRxiv which provide direct submission to the PLOS journals (including the new titles that debuted in 2021) and sees this as further support for open science (Hrynaszkiwicz, 2021).

Posting a preprint online also date stamps the article, aiding efforts at getting current work out quickly, as well as preventing "scooping." Being scooped would be one of the considerations researchers would consider when disclosing results before a paper is submitted for publication. However, a recent study of the rewards for publishing first demonstrates that the "risk of being scooped drives scientists to shoddy methods" and the mention of strategies journal publishers are using to mitigate some of the risk to researchers in this fast-paced race to publication include "PLOS journals, as well as the journal *eLife*, offers "scoop protection" that gives researchers the chance to publish their work even if they come in second" (O'Grady, 2021). This would be especially true for high stakes research in psychological science, such as during the COVID-19 pandemic.

Thursby et al. (2018) found a lack of research about how the disciplines view "prepublication open disclosure," and studied reasons and motivations as to why scientists do or do not share results before publication via posting of preprints (but also by using web postings or conference presentations to disclose). While psychology was not one of the nine specific fields analyzed by Thursby et al., for "scientific disclosure before publication," results showed that "across all fields, obtaining feedback is the most important," (p. 2) and that the motivations to disclose (and the timing of disclosure) varied across fields. In the disciplines, levels of competition and commercialization matter a lot to decisions to disclose, with lowest levels of both competition and commercialization found in social sciences and mathematics. Further, "not coincidentally, social sciences and mathematics have a greater degree of disclosure to general audiences than medical basic science" (p. 10) and "social scientists are the most likely to disclose at the conceptual stage" (p. 2). Seeking a greater understanding about how and when psychology researchers disclose research results before formal publication would assist publishers, developers of preprint services, and conference organizers in making services available that would attract those seeking to get their work out as early as possible to the widest potential readership in order to spur innovation and further research.

This practice of posting preprints has been the culture of some fields such as high-energy physics and computer

science, with their preprint server, arXiv, since the early 1990s. As of this writing, it remains to be seen whether the practice of sharing preprints online via repositories or services like PsyArXiv, for instance, will become standard practice in psychological science. It also depends on how much commentary and open peer review are desirable and acceptable as articles develop from preprint stage to more final versions. In psychology, with PsyArXiv still relatively new, it remains to be seen whether there will be an appetite for sharing non peer-reviewed versions of articles online. The emergence of PsyArXiv will also serve to demonstrate whether in psychology a preprint environment will behave like the established culture of arXiv's, or whether the discipline's researchers will instead stick to the publishing status quo. Authors posting papers on PsyArXiv are able to choose to license their work using the two Creative Commons licenses that the service supports, whether to put the work in the public domain, or to use the popular CC-BY license. CC-BY, which allows for liberal reuse of the work while requiring attribution, is the most popular on PsyArXiv so far. As of April, 2018, 57% of authors have chosen CC-BY, 29% have chosen CC0 (public domain) and 13% have not placed a license on their uploaded work (Moshontz, 2018). Where available, or in compliance with many funder policies, CC-BY is the most popular license, even though some experts feel that researchers may not be very familiar with exactly what it means or allows in downstream use. Adding an option for a more restrictive CC license may encourage authors to post longer form preprints that may develop into monographs later. These authors of longer form works can refrain from putting a license on their works in repositories or preprint servers, but this approach is less than ideal even if it does signal that the author wants to retain copyright while receiving feedback from the community on the content contained in a longer than customary preprint (in the case of the possibility of a resulting book contract). This allows early posting of book-length manuscripts, sharing the content with a community, or multiple disciplinary communities. While most book publishers would not consider an already posted manuscript, some publishers that have OA options (such as SAGE Open), do allow posting of a draft or early version of a possible publication before it is submitted for review. An important aspect that authors need to consider when using preprint servers is the licensing aspect. PsyArXiv covers this aspect well on their website, noting that many use the CC-BY license to retain attribution while allowing reuse and remixing (Moshontz, 2018). University libraries often have librarians on site available for consulting on copyright and licensing. Graduate students or other early career researchers may want to consult senior advisers before posting early research results.

Preprints in many disciplinary areas can often be posted by authors directly on the web (via preprint servers or various repositories) as they are not yet peer reviewed or in a "submitted" or "accepted" category, and therefore are not yet under the control of a traditional publisher. The term "preprints" can be problematic as the word has been used in different ways by some journals and publishers as a way to describe any version of an article as it exists online before formal publication. A reader might see use of this term to describe accepted versions that have not yet been assigned pagination or an issue number, or for papers that are submitted manuscripts under review (but posted online by the author). More recently, use of the term may be more universally identified and understood as the "Author's Original (AO)" (to use the NISO term) which has not undergone peer review by a publisher. Some articles will never end up undergoing peer review, but instead will remain online in preprint form, circulating and being read widely by interested readers and researchers. These preprints are cited with their DOIs in the literature of many disciplines, and that would be the expectation for psychology as well. Some preprints that have remained as such have become important papers in their fields. It did not go unnoticed that during the COVID-19 pandemic, it became commonplace to see research results that were published in preprints reported out in major media outlets and newspapers (usually with some wording about the source being unrefereed).

Not all posted papers go any further than the preprint stage. Preprints that never go on to more formal publication can still demonstrate informal impact through the counting of institutional and subject repository downloads and via the use of other alternative metrics that are available from preprint servers. In a study of articles that started as preprints in the bioRxiv server showed that "the number of citations to journal articles with preprints was 61% higher, the citation advantage continued for 3 years after publication... and that "articles with preprints had higher mean counts for all Altmetrics assessed (tweets, blogs, mainstream media outlets, Wikipedia and Mendeley)" (Fraser et al., 2020; Sherwood, 2019). In terms of the publisher's proprietary versions (including article versions such as "Proof" or "Version of Record)," recent takedown notices levied against university websites and scholarly communication networks by publishers (including APA) may make authors increasingly wary about posting the publisher's version of an article online. On the other hand, it may embolden those that want to share their work and don't want to be dissuaded or even threatened by the same publisher that was chosen for submitting the work. Distribution of takedown notices often gets attention quickly, and to avoid this scenario, authors may turn to depositing preprints in services and

institutional repositories, taking advantage of the more liberal publisher permissions that currently exist for preprints.

For now, many authors continue to deposit versions other than the allowable preprint in digital repositories and on websites. It remains to be seen whether recent actions by publishers to send out takedown notices when “illegally posted” articles on websites are discovered will make a difference and cause authors to abandon posting final publisher versions on the internet (and possibly switch to depositing earlier prepublication versions online). In a high profile example from 2017, the American Psychological Association (APA), began a pilot program that initially started by analyzing where final versions of five APA journals could be found posted illegally. APA then began sending Digital Millennium Copyright Act (DMCA) notices of infringement (takedown notices) to those sites that had posted these publisher final versions online. The program eventually expanded to all 29 APA-published journals. Universities informed their authors that they must remove APA articles that were posted illegally from university websites. The negative reaction from authors was swift. APA responded by refocusing their efforts away from sending notices to individual authors. Takedown notices instead went to pirate sites and popular scholarly collaboration networks such as ResearchGate and Academia.edu as well as to 80 universities (Mills, 2017). On June 16, 2017, McCook (2018) reported that:

the publisher had sent takedown letters-citing the Digital Millennium Copyright Act (DMCA), which enables internet users to protect their own content—to nearly 350 academic institutions (and 12,460 letters to piracy sites). The spokesperson told us the APA doesn’t plan to send any more letters to academic websites ‘at this time’. But the publisher is still discussing whether to rescind the takedown notices that academic sites have already received.

Up to now, there has been no successful way to manage the dissemination of scholarly articles in final publisher Version of Record (VoR) that occurs around the web. Takedown notices or lawsuits that target authors (or their universities) would seem to be a counterproductive strategy that could drive authors away from submission to certain publishers’ offerings and would refocus attention on a publisher’s posting guidelines. This kind of program is just not good for authors, libraries or readers’ relationships with publishers. This leaves publishers in a position where they may have no real recourse but to acknowledge the sharing of published scholarship that is going on. It leaves authors in a position where they may acknowledge that they *know* the rules (once they sign the copyright transfer agreement) but don’t necessarily *agree* with those rules and they want to ensure that

there is Open Access and wide sharing of the article’s version of record. The practice of posting articles on the web may just become so commonplace as to become unstoppable by any publisher or other entity. In any case, publishers will not want to resort to suing their own authors, and may also understand that some sharing may be driving traffic (and possibly some resulting impact) to their articles and websites. After all, added visibility of an article is always good for publishers and citing conventions will drive researchers to seek out the publisher version of record if it is accessible to them. If there is no subscription access, other versions will suffice. It is unclear, at this juncture, how article sharing (or in what form) will or will not create the kind of harm that would cause an end or an irreversible disruption to traditional scholarly publishing as it currently exists. To this point in time, there has been no harm shown to the publishers’ bottom lines from sharing of early versions. For now, authors will choose the type of sharing that suits their needs while wanting to have a good relationship with their publishers and editors. The current climate favors sharing via OA strategies in part because more funders and universities are mandating it all the time (<https://roarmap.eprints.org/>)

## Subject or Disciplinary Repositories for Psychology

Many psychology researchers have searched for scholarly publications or uploaded their own works to one of the few online disciplinary or subject repositories that are available for psychology. Unlike some other disciplines, psychology does not necessarily have an ingrained culture of participation in subject or disciplinary repositories, but works can be found across a few of the major repositories. Participation in subject or disciplinary repositories is another green OA strategy useful in the goal of wide dissemination of psychology papers.

Certain of the subject repositories have risen above the entire landscape of digital repositories not only in sheer size and volume of content, but in their centrality to certain fields as the gathering place for scholarship and collaboration. Studies have placed four major subject repositories in this position. SSRN (Social Science Research Network) is multidisciplinary but has prominence especially for law and economics scholars, PubMed Central (PMC) is the largest subject repository and the target of biomedical scholarship, arXiv has, since the early 1990s been central to physics, mathematics, computer science and other related fields, and RePEC is well known and used by economists (Li et al., 2015). None of these four largest subject repositories has a particular focus on psychological science, and some studies have shown that a higher percentage of archived OA

papers overall can be found in fields that have a dedicated subject repository. Such is the case with biomedical sciences, and also is reflective of the effects of NIH's mandate. PubMed Central has arrangements with many publishers for deposit of papers associated with NIH funding, and as of June, 2022 lists more than seven million publicly accessible full-text articles. Without a strong preprint culture feeding it, most papers in PMC are accepted manuscript versions of published articles or final publisher versions.

One available online repository of interest to some areas of psychology is SSRN. SSRN is often viewed as a collaborative, sharing site for researchers and their early abstracts and papers in social sciences disciplines, and currently (as of June, 2022) it holds more than one million research papers. SSRN is described on its website thus: "SSRN is devoted to the rapid worldwide dissemination of research and is composed of a number of specialized research networks" (<https://www.ssrn.com/en/>). One specialized research channel of interest to psychology is the Cognitive Science Network, which contains more than 26,000 papers as of June, 2022 as well as Psychology Research Network (also with more than 26,000 papers).

SSRN was founded in 1994 (SSRN was never strictly an OA repository *per se*) and as of May, 2016 is owned by Elsevier. The acquisition by Elsevier raised some questions about SSRN continuing with "business as usual." SSRN was developed by a small group of scholars whose backgrounds were mainly in economics and legal scholarship and it evolved as a business that offers various subscription services alongside its use as a repository of articles, working papers, conference papers and other scholarship. Over time, SSRN became one of the largest subject/disciplinary digital repositories, and is used by some researchers in psychology to upload papers. Eventually, SSRN was a corporation with a budget of more than one million dollars and more than a thousand volunteers were performing much of the labor (along with a small paid staff) (Björk, 2014). Still managed by Gregg Gordon, (formerly President & CEO of SSRN before the Elsevier acquisition), SSRN is, at this point (in 2022) still a heavily used networking, collaboration and research paper sharing site, especially for working papers and preprints in the social sciences and humanities (including content from the cognitive sciences).

One of the compelling aspects of SSRN is its use of rankings (of authors, papers, and institutions) (N. Cohen, 2008). In certain fields, like law, faculty may even worry about use of their institutional repository (IR) for a secondary deposit of articles, fearing a "dilution" of their SSRN downloads, which could create a resulting drop in the rankings. It has been demonstrated that deposit in the IR allows access to important scholarship

(especially early versions containing current research results) to readers that are outside the primary group served by the SSRN channel. Deposit in more than one repository service, such as in the institutional repository as well as in SSRN broadens readership and exposes the work to new readers and researchers (Donovan & Watson, 2012). It would seem advantageous for SSRN depositors to attract new reader traffic by moving outside of SSRN, especially since this practice does not damage SSRN rankings. There is no "rule" on where a given early version article can be deposited online and various channels have their own readership so multiple channels of dissemination of a researcher's work is possible. Preprints or accepted manuscripts can be deposited in multiple repository services online. A scholar may need to satisfy mandates by funders or universities by depositing accepted manuscripts or published papers in an institutional repository while still participating in a preprint server, a subject repository, or a personal webpage for a single paper, all at the same time. It is commonplace for multiple versions of a single paper to be available circulating on the web at any given time, and with many different DOIs.

Subject repositories and/or "eprint archives" for psychology may not have evolved to attain the level of visibility of arXiv, for instance, but the two archives do share a long and common history. An early eprint repository that focused on cognitive science, neuroscience and a few other related disciplines, CogPrints, was founded by cognitive scientist Stevan Harnad. CogPrints was launched in 1997 following the success of the eprints model that had been in place since the founding of arXiv for the use of the physics community by physicist Paul Ginsparg in 1991. Harnad wanted to extend the eprints model, which relied on author self-archiving of preprints and other papers to an electronic archive for cognitive science and related fields, even as he acknowledged the field differences that existed between physics/computer science and cognitive sciences in the sharing of unrefereed preprints. CogPrints was developed by Harnad based on software developed by Ginsparg at Los Alamos (Taubes, 1996). The CogPrints archive contains more than 4,000 papers, with more than 1,700 psychology articles included, and since the 1990s has demonstrated that cognitive science has had an eprint culture for almost as long as arXiv has served the physics and computer science community. CogPrints' content is still available online but is now permanently archived by the University of Southampton and is not taking new content.

Subject/disciplinary repositories can be considered complementary to institutional repositories, which serve a different mission of making a university's publications and research output discoverable-across all disciplines-and available to a global readership. Institutional OA

policies require and facilitate deposit in an institutional repository in order to showcase all of the institution's scholarship gathered together and made available to the world online from one repository. The institutional repository may extend services to other research outputs of the university's researchers (such as research data). Crawled by search engines such as Google (and all versions brought together in a single record in a Google Scholar entry), both institutional and disciplinary repository contents will be discovered by all searchers, while a much smaller group of searchers visit the repository itself to search for content. It has been reported that institutional repositories' contents are more discoverable than those of SSRN, for instance. A decade ago, one study demonstrated that SSRN content appears to searchers more slowly than papers in the institutional repository do, and represents different groups of searchers. Google keyword searches will pick up content in the institutional repository more quickly than searches of SSRN. The takeaway from this study is that using more than one repository strategy for uploading publications (such as depositing papers in SSRN and an IR) will achieve a greater readership than one or the other repository alone (Donovan & Watson, 2012). While this study focuses on Law scholarship, it would make sense that depositing a single article in more than one repository will only increase its visibility and reach potentially different groups of readers. These reader groups may be mutually exclusive and thus extend the outward reach of the work. Reputation of researchers is built within various digital communities if works are widely distributed through different channels. Each scholar will build networks this way.

It is not always a straightforward business for authors or others to ascertain whether publisher permissions allow or accommodate the deposit of papers into a subject or disciplinary repository. While many publishers make information about author self-archiving of preprints and other versions of article available on their websites or by adding information to the popular Sherpa Romeo service, it is often more difficult to find this information for subject/disciplinary repositories. Studies have shown that while many publishers expressly allow self-archiving on personal websites or institutional repositories, the permissions for archiving in subject repositories is more problematic and the number of publishers allowing deposit is lower. For example, in a study by Laakso (2013) of 1.1 million subscription articles published in 2010 (in accepted manuscript or publisher version), it was found that 80.4% could be uploaded (allowed by the publisher) to an institutional or subject repository (or personal website) within the first year of publication. Further analysis of this number showed that publishers were much more permissive about allowing the accepted manuscript to be uploaded to institutional

repositories (79.9% of articles) or personal websites (78.1%) than they were to subject repositories (only 32.8%). At the time of this analysis, only about 12% of articles available for self-archiving in repositories actually were being made available OA via a repository (Laakso, 2013). The practice of author self-archiving of non-proprietary earlier versions of articles or "green" OA has had a slow start but is the stated focus of most institutional repositories and OA policies. The continuing forward movement of green OA is still in the hands of authors and the research community and would grow much faster if authors would take the simple action of uploading their papers with a few simple steps, thereby allowing Google and other search engines to disseminate these works to worldwide readers. Many authors do not self-archive, which is not an onerous task, even as it takes very little time out of a busy schedule to deposit each scholarly work in a repository (enabling OA at no cost). Surveys by commercial publishers have reiterated researchers' preference for access to the proprietary publisher version of record, which of course makes sense unless they have no access to that, and then a post peer-reviewed accepted manuscript (AM) or other early version would certainly suffice. Funders also recognize that sometimes green OA versions must be allowable due to inequities in funding. A zero embargo environment would help level the playing field but still seems out of reach. Funders are beginning to demand zero embargoes to the results of research they fund. However, publisher reaction has been mixed to any move to ending embargoes on the author's Accepted Manuscript (AM) disseminated out of repositories or other free services, and especially to the publisher Version of Record (VoR; without payment of an APC). Any trend toward zero embargo has been increased by more discussion and implementation of authors' rights retention policies around the world (Rumsey, 2022).

Psychology also appears as a percentage of OA papers in repository collections in biomedicine, while not showing large percentages of OA papers archived in any particular subject repository. There is clearly not a culture of using one subject repository in psychology. In fact, in a large-scale study completed for the European Commission in 2014 that reported the availability of OA content by discipline, the category of "Psychology and Cognitive Science" did not show up in the top disciplines making papers available by either green (self-archiving in repositories) or gold (journals route) OA. However, in this large-scale study that used the Scopus database, Psychology and Cognitive Science was the second highest grouping in the "other OA category," showing a proportion of 43% of OA papers to total papers published. The authors defined "other OA" in this study as papers freely available to readers due to their availability on the



internet in services such as aggregator sites, “hybrid” articles (OA articles in subscription journals where the author has paid an article processing charge), or even articles found posted outside of publisher permissions (Archambault et al., 2014).

Overall, in all disciplines studied, this analysis reports that:

as of April 2014, more than 50% of the scientific papers published in 2007, 2008, 2009, 2010, 2011, and 2012 can be downloaded for free on the Internet. This is an important finding as only one year ago, in April 2013, the proportion of papers that was freely available was just a hair below 50% (49.54%) in 2011 and did not reach that mark for any other year. (Archambault et al., 2014, p. 2)

Open Access availability is increasing. It would seem clear that psychology is a disciplinary area that could really benefit from placing more focus on OA and setting a goal of ensuring at least public reader access to much more of its scholarship. Green OA is attainable for most papers (sometimes with embargo), and may be seen as an author responsibility if more of the disciplinary literature is to reach every possible reader. It is not clear whether having available a disciplinary or subject repository (like the major ones found in other disciplines [such as with arXiv for physics, for instance] would create more momentum). The aforementioned preprint server PsyArXiv has become a target for preprints in psychology. PsyArXiv will provide another vehicle for changing the OA culture in psychology. Even as psychology establishes a reputation for its leadership in areas of reproducibility and other areas of open science, will the discipline increase its uptake of OA self-archiving and publication practices or will it fall behind other disciplinary areas?

Some would rather see a focus on a move to more Open Access by focusing not so much on many versions of articles freely available online in subject, disciplinary, or institutional repositories, but instead to focus on more OA journal publication. Gold OA, the “journals route” is felt by some (for instance, by some funders in the United Kingdom) to be the gold standard of OA because rather than earlier versions such as author’s originals or accepted manuscripts, it is the Version of Record (VoR, proprietary publisher branded version) that is made available on the internet. Of course, publishers place the most restrictions on this Version of Record and that is the version most scholars would want to cite if at all possible. APA style, according to the 7th edition of the Publication Manual of the American Psychological Association (section 8.5, p. 258) states that:

Multiple versions of the same work might coexist on the internet, and you should cite the version of the work you used. Ideally, use and cite the final published version of a

work, (see Chapter 10, Examples 1-3). However, if you used the advance online version (see Chapter 10, Example 7), the in press version (see Chapter 10, Example 8), or the final peer-reviewed manuscript accepted for publication (but before it was typeset or copyedited; see Chapter 10, Example 73), cite that version. The final peer-reviewed manuscript as accepted for publication might be available from a variety of places, including a personal website, an employer’s server, an institutional repository, a reference manager, or an author social network. (American Psychological Association, 2020a)

When authors do cite subject repository versions, at least one study has focused on how these major subject repositories end up providing citations to the cross-disciplinary scholarly journal literature. It was found that there is indeed a lot of citation activity outside the primary disciplines served by the major subject repositories. This shows that subject repositories can be valuable vehicles for disseminating articles outside of the primary disciplinary groups (Li et al., 2015). These subject repositories are certainly not silos, but disseminate articles on the web for interdisciplinary searching.

There are many options for the scholar who wants to (or must) archive every article in one or more digital repositories using green OA, maybe too many. Many institutions have set out an expectation that all scholarly works must be self-archived (or harvested by automated methods) into the institution’s digital repository due to existing OA policies of the institution or funders. Authors will also want to participate in the repositories that represent their fields. The fact that scholars are in tune with the disciplinary communication norms of their fields may make the concept of deposit in institutional repositories seem redundant. It can be difficult to explain the purported value of self-archiving work in an institutional repository once researchers have aligned themselves with one or more of the disciplinary repositories or peer scholarly networking services. Many scholars may want to stick with, and affiliate with disciplinary (and not institutional) self-archiving solutions. Every scholar likely has chosen a preferred OA service (or sharing platform) that works and many are not eager to change behavior. The extra work (even spending the small amount of time required) of self-archiving with the institution often does not resonate in the same way as participation in the subject-based repository or other discipline-based solution. Busy researchers do not often see as much personal value to building a collection of work in an institutional solution that may not be part of a larger network. To aid researchers with populating their collections of scholarship in institutional repositories (IR), many means of automated harvesting of OA versions found on the web can be developed and leveraged. An institutional repository that only recommends

deposit by authors via self-archiving as papers are published will likely not find a large rush by authors to use the IR. However, a combination of easy deposit, an institutional OA policy, and automated harvesting of OA versions of articles from the internet would be a better solution.

Many institutions are involved in efforts now to aggregate all of the institutional repositories into a large scholarly network, creating a critical mass of freely available scholarly literature for the world's readers. These types of consortial or grass roots efforts to make a copy of all of the research literature in early versions available for the world's readers do begin with the robust development of each institution's digital repository of its research output. Various aspects of the value of scholars' self-archiving in the institutional repository include the gathering of the works of all of the institution's faculty together in one place (allowing discoverability and reporting of aggregated university scholarship), making university works visible for enhanced collaboration across the institution (and across disciplines), and making sure every work has an associated DOI so every article or book chapter can be listed in profiles such as ORCID's. Self-archiving by authors also ensures that the works of every scholar in the institution are curated and preserved over time (formats migrated over time) and provides full text online public access to the papers of every scholar via the institutional repository. One very important factor that authors may not always know is that publishers often allow self-archiving of the accepted manuscript of the paper (usually not the publishers' version of record) in more than one repository. Therefore, while an author may want to share papers in many ways, there is no limit on the ability of the author to participate in a variety of repositories or other collaborative solutions for any given paper in its preprint or postprint (Accepted Manuscript) version. In fact, making any paper available legally online may drive traffic to the publisher version, creating a win-win for readers, authors and journals/publishers. There are many strategies that authors can take advantage of and a currently emerging role of academic librarians is to consult with faculty on the various green OA options available to authors today. Authors are especially interested in OA solutions that don't carry the costs of the gold OA options, seeking instead these many green OA options for marketing their work and helping their scholarship reach new readers. For psychology, gaining more readers can only confer benefits to authors and to society. Practitioners would all have access to the latest literature. Institutions with OA policies in place do realize higher institutional repository self-archiving rates, and so this is considered one strategy that an institution can have in place in order to place an importance on the need to make institutional scholarship

freely available on the internet (to the extent possible). With pressure on institutions to take steps to rise in all of the various rankings, ensuring that all of a university's research output is freely available online may become a priority.

Looking at the average of all self-archived papers in psychology for the time period 2005 to 2010, Gargouri et al. (2012) reported that 28% of all psychology journal articles published each year could be accessed free on the web. The percentage of green OA for psychology has continued to grow in recent years. Martín-Martín, Costas, et al. (2018) also reported percentages of types (colors) of OA found across Web of Science disciplinary categories, including Psychology. For a large sample of openly available articles found to have full text links in Google Scholar, for Psychology, 57.8% of the sample were OA. By *type* (color) of OA, 2.8% of the sample was gold OA (published in OA journals), 4.2% were "Bronze OA," a category where all content is made freely available to the public online after a certain time period by the publisher (but usually with no open licensing information provided), and 18.9% of articles were green OA, found only in institutional or subject repositories. To compare these numbers to the Clinical Medicine category, for instance, demonstrates the large variability of results from one discipline to the next. It should also be noted that even subfields have great variations within a larger category. In comparison, the category Clinical Medicine had very similar total percentage of freely available articles (to Psychology), recorded at 56.9% of the sample. However, the types of OA show quite a different result. In Clinical Medicine, the Gold OA percentage was 7.5%, 22.3% were Bronze OA (a huge difference), and Green OA was 9.7%. Therefore, more biomedical researchers (than psychological scientists) are accustomed to publishers making articles freely available on their own platforms after a short time period (Martín-Martín, Costas, et al., 2018). Another study by H. Piwowar et al. (2018) analyzed a different data set (from oaDOI, a free service that "determines OA status for 67 million articles") that comprised three different sets of 100,000 articles each. This study estimated an overall OA proportion of the scholarly literature of 28%, and growing. In terms of looking specifically at psychology (in terms of its inclusion as a category in the NSF Specialties), this study showed that of 2,257 papers in the psychology sample, 1,586 articles are *not* OA (70.3%), 122 (5.4%) were "bronze OA" (the delayed publisher OA), 2.0% were hybrid, 4.7% were gold OA, and 397 of the articles were green OA (17.6%). Once again, comparing the Psychology sample in the H. Piwowar et al. (2018) study to the NSF category, Health, with a similar sample size of papers (2,121), a full 13% were bronze OA, once again showing a distinct

disciplinary difference in how the Health publishers make papers OA on their platforms over time. This one small example of bronze OA uptake by percentage demonstrates why discussions of OA cannot be a “one size fits all” treatment. Psychological science literature will have its own path toward Open Access. Those presenting information to mixed disciplinary audiences cannot make broad pronouncements about current or future directions that will resonate with all groups. For the reader or librarian accessing the medical literature, making one’s work green OA may not seem as essential as much of the current literature (except for the most recent 6 months) may already be available on the publisher platform, or in PubMed Central. If the bronze OA category grows in biomedicine, it still does not jeopardize the sale by publishers of the most valuable content in current journal articles. Only recently have these breakdowns in types of OA allowed researchers to see the differences in access by discipline. Each discipline and subfield can be said to have a certain “culture of Open Access behavior” which could be studied further. Understanding these specific cultures would be valuable to OA policy efforts, customization of approaches by funders, education of scholarly communication librarians, and to all efforts at understanding scientific culture in the disciplines. The OA conversation in the disciplines must be more nuanced in order to resonate with more authors and stakeholders. Including more nuanced conversations that include various stakeholders at disciplinary conferences, ensuring that the conversation resonates with researchers in psychology will be necessary to establish the best practices needed to move open science forward in an effective way.

Subject/disciplinary repositories are only a part of the picture for psychology. Only the largest subject repositories are great contributors to the volume of “green” OA articles on the web. Björk’s 2010 research on subject repositories does not show a huge emphasis on subject repositories in psychological sciences. He reported in 2010 that although 43% of all self-archived manuscript copies can be found in subject repositories, a full 94% of all of these can be found in arXiv or PubMedCentral. Björk compares subject repositories and institutional repositories and notes that the subject repositories lack some of the advantages that institutional repositories enjoy such as sustainable support from universities, an environment where more publishers allow self-archiving, and a trend toward OA policies promoting more self-archiving in the institutional repositories. Subject/disciplinary repositories (outside of the largest ones) may not be a growth area. For the largest repositories, other factors such as the role they have played for many years as part of disciplinary publishing culture may promote their

continued success. Those fields (which don’t include psychology) that rely on their subject repositories already had a working paper or preprint tradition prior to the advent of the internet, and of course, NIH created an upward trajectory for PubMed Central with their public access mandate. Funder mandates could make a difference for psychology archiving in repositories. SSRN, arXiv and RePEC were subject repositories that were natural extension of earlier disciplinary preprint culture of certain disciplines (Björk, 2014). However, scholarly communication in psychology did not develop in ways that promoted the natural growth of subject repositories and at this point, it would not seem that this would be an expected development in the future. PsyArXiv, with its set of open science services, may be the option that psychology has been waiting for, and may be one of the game changers for scholarly communication in the discipline. Signaling its establishment in the scholarly communication ecosystem, PsyArXiv preprints are now indexed (since 2021) in Europe PMC, “an open science platform that enables access to a worldwide collection of 38.6 million life science publications and preprints” (Levchenko, 2021). An issue for all services such as PsyArXiv is sustainability over time, and for those invested in that sustainability, the issue (as used as a recent theme of SPARC’s International OA Week), the desire for “Community over Commercialization” (<https://www.openaccessweek.org/>).

### **Scholarly Collaboration Networks: Featuring ResearchGate and Academia.edu**

The internet and the desire to share their work widely has also fueled the creation of the freely accessible online scholars’ networks that allow collaboration between researchers and combine a social networking function with availability of papers. Millions have signed on to services like ResearchGate (RG), Academia.edu and others. As of August, 2022, ResearchGate has 20 million scientists in its community, while Academia.edu boasts 188 million plus registered users. Many start their search for full text papers not with the library, or even Google Scholar- but with ResearchGate. These services may be known as “scholarly collaboration networks (SCNs)” or other names like “academic or scholarly social networks.” More research is needed to ascertain how authors and researchers use these services, how they figure into the calculus of search, and whether there is a decided benefit to uploading work to these sites. These sites allow social collaboration along with access to articles, including the many publisher-branded versions that are uploaded without concern for publisher copyright. Millions of articles can be found in these multidisciplinary services, and publishers also need to understand the

ramifications of the popularity of ResearchGate and Academia.edu and other similar sites. Usage statistics of works (including numbers of users from certain geographic regions of interest) in these services are of interest to both publishers and authors. A focus on the collaboration aspects of these services (such as Q&A features, which are little used) may miss the point that the main attraction may be the ability of researchers to not only connect with others, but more importantly, to upload and disseminate articles (many in proprietary publisher “version of record” format) and watch the subsequent citation and social media activity that results. Articles in PDF have been shared, and in the case of RG, copyright issues were, from the beginning, the responsibility of the authors. A compelling aspect of these two sites is the ability to market and promote one’s work via upload to ResearchGate or Academia.edu. This “sharing of full text papers” aspect has been considered a major contributor to the success of these sites. Authors are contributing their own content, not just following others’ work. Sites like Academia.edu have some highly productive “producers” in comparison to mere “viewers” of content (Ortega, 2016). A continuing issue is that authors continue to upload many proprietary publisher article versions, often violating the terms of the copyright agreements that they signed at the time of article submission. Many researchers do not know (and may not care) that uploading versions of record violates the agreements they likely signed with their publishers. Major funders, such as U.S. National Institutes of Health (NIH) are now supporting these sites even though these services continue to fill with proprietary content. Publishers have been seeking solutions that will allow a win-win for themselves and their authors with these very popular sites, and have moved to seeking syndication deals with them.

Academia.edu, even having a name that evokes “academia” is in fact backed by venture capitalists mainly interested in data mining. The enormity of the Academia.edu and ResearchGate communities allows for scale of collaboration, something otherwise not easily found in academia, or via the large network of subject or institutional repositories. Also, the scholarly collaboration networks often provide for researchers an invaluable collaboration platform where they may not only share papers, but ask research questions to the large audience, and receive answers that can spur new research directions or provide clarity on topics that are better discussed within a more scholarly online community. Some have likened these services to a “Facebook for academics” (Carrigan, 2016). Others see a whole new centralized online system incorporating all of the new elements of scientific communication that the web allows, pulling everything together into

something akin to a “Facebook for science” (Buttliere, 2014). With every new system proposed, there has to be a very compelling reason for researchers to spend any time in deviating from their established disciplinary scholarly publishing practices. ResearchGate has made great inroads into the scholarly community and is not owned by any commercial entity at this point. For many, that fact makes a difference, and at this point, ResearchGate is an established and desirable service for many academics.

In the case of Academia.edu, due to its name, it is possible that many of its users confuse it with an actual service based in academia. Quite the contrary, Academia.edu was founded by Richard Price in 2008, and by August, 2014, it had raised \$17.7 million from venture capitalists and had claimed 11 million users at that time who had uploaded 3 million papers (Van Noorden, 2014b). Academia.edu has attractive value-added services such as the practice of sending an email to an author with information about the keywords someone searched while discovering his or her papers, the search engine used, and the geographic area of the search. For some researchers this is very valuable information, for other busy authors, it may be construed as spam. In fact, one of the complaints that users have about these platforms is the constant email bombardment that ensues on registration. Some academics have warned colleagues that there are better solutions for posting academic work online, and asked others to delete their Academia.edu accounts. There was a backlash in 2016 after Academia.edu suggested that users might want to pay for a “recommender” service in which Academia.edu would “boost” certain papers on the site (Bond, 2017). Some enticing services that had once been free are no longer without cost and it is common now when hearing from Academia.edu with an enticing offer to find out information about traffic to articles available there to be asked to pay for this and other services via their “Academia Premium” service (which started in December, 2016). Since Academia.edu was founded by a philosophy professor at Oxford University with the goal of connecting authors to readers, it isn’t surprising that one recent study focused on the site’s use by philosophy researchers. Academia.edu is used heavily by social sciences and humanities scholars, but at least in this study in 2013, psychology was the 5th highest (out of 39 subject areas) listed “broad research interest” of users (Thelwall & Kousha, 2014).

ResearchGate is used by many scientists and studies demonstrate that it is well known (more than 88% of scientists and engineers in a recent study were aware of it, placing the site just behind Google Scholar). Along with Academia.edu as a commercial enterprise, ResearchGate (as of June, 2014) had secured \$35 million from investors

and claimed 14 million available papers. (Van Noorden, 2014b) By the fall of 2017, ResearchGate had reached \$85 million of venture capital (and other investor) funding. It is the most popular scholarly collaboration network and also boasts more traffic than even some of the largest publisher platforms (Harrington, 2017). The site “launched in 2008 with the stated aim of helping researchers to communicate, cooperate, and share information” and as of August, 2015 had a robust 7 million users. By April, 2017, the ResearchGate website boasted more than 12 million members. The site has a social networking side alongside its use as a platform from which to disseminate scholarly research articles from an author’s profile (which is a more popular use of ResearchGate).

Although there are few studies of how psychology and neuroscience researchers use ResearchGate, it is clear that there is robust usage across these disciplinary areas (Thelwall & Kousha, 2017). It would be useful to analyze, with a large-scale study, how ResearchGate and other similar services are being used specifically by psychological science researchers. Where ResearchGate allows collaboration and has its Q&A service for engaging researchers, different disciplines would be expected to respond differently. Publishers and vendors of psychology research literature would want to understand how ResearchGate and other services are engaging their authors, and how published papers or accepted manuscripts are being uploaded to these sites. For any discipline, it is interesting (and a value add) that DOIs are now provided by ResearchGate for any item, such as an author’s original contribution (such as a preprint), that does not already have one associated with it (Nicholas et al., 2016).

ResearchGate offers reputational metrics, 10 of which have been studied by researchers (beyond the oft-studied and well known “ResearchGate Score,” undoubtedly the most well-known of the available metrics that purport to measure a researcher’s reputation). There is a lack of information (and some say transparency) about the formulas used to calculate the various scores (Nicholas et al., 2016). One aspect of ResearchGate that is either compelling or off-putting is the regular communications that are sent to users to enhance engagement with the site. ResearchGate is not “out of sight, out of mind.” As for the reputational metrics and services, each discipline and university would likely view these differently. Each service a researcher joins represents a certain time sink, the most valuable commodity for most researchers. After funder and institutional policy, it remains to be seen how much more time can be invested by busy authors and researchers in these dissemination, networking and reputation management sites. ResearchGate has high usage and the wide uptake across disciplines and countries may

speak volumes about interest in reputational management but also how academics and other scientists seek collaboration and value the networking that happens within these services.

Another issue for these platforms is the sharing of scholarship within them, often running afoul of publisher rules. Publishers have had to grapple with the amount of sharing that goes on within these tools, and they have moved to try to regulate this somewhat by setting out rules about which versions of articles are allowed to be shared. In fact, in 2015, the International Association of STM Publishers created some general guidelines for the ResearchGate user community and has sought buy-in to these guidelines from various stakeholder groups, including libraries (Dylla, 2016). In one case, Elsevier sent 2,800 takedown notices to researchers who had publicly posted publisher versions of their articles in Academia.edu (Reller, 2013). With the large numbers of scholars using these services, this is a trend that is not going away. In a recent study regarding copyright compliance issues with ResearchGate, it was demonstrated just how often authors upload publisher-branded PDF versions of record, even when publishers allow other earlier versions to be uploaded legally. Authors infringe copyright often in using the “wrong version” of articles on the service. This may be due to authors’ not understanding versioning issues, or it may be due to complexity and diversity of publisher policies. With ResearchGate, authors are responsible for the copyright clearance, which differs from the situation with some other less popular services, such as the institutional repositories that often provide services around checking publisher permissions (Jamali, 2017). Another explanation for the popularity of posting publisher PDFs in ResearchGate would be, as most would agree, that the publisher version is the one that authors want to share most often, and they do. With major funders now backing ResearchGate, there is a bit of a mixed message for authors in terms of what can and should be shared. Readers also want to search for and find the publisher version. ResearchGate’s popularity speaks to the desires of researchers for broad dissemination of their work on a popular online open scholarly platform and this sharing anywhere possible will certainly continue unabated. Sharing is facilitated by the discovery of ResearchGate papers and is fueled by the use of Google Scholar for search (where ResearchGate can be indicated on papers). Previous studies have shown the importance of a rapidly growing ResearchGate corpus of papers for readers and researchers seeking accessible full-text of articles via online search (Jamali, 2017). ResearchGate papers are identified as such in Google Scholar searches and readers know the chance is good that publisher full text is likely to be available from the site.

ResearchGate, with its enormous popularity and healthy funding support, experienced some issues in 2017. It remains to be seen how the service will respond to the many challenges going forward. In what may be a boon for the institutional repository (which often checks publisher permissions), ResearchGate had begun to receive a series of communications from the international publishing community which asked it to remove proprietary material. When asking did not produce action, lawsuits went out against ResearchGate. Publishers (initially Elsevier, American Chemical Society, Wolters Kluwer, Wiley and Brill), for their part, formed a “Coalition of Responsible Sharing” to try to promote a culture of sharing of articles legally in ResearchGate. The International Association of Scientific, Technical and Medical Publishers (STM) had repeatedly (over a period of two years) tried to work with ResearchGate on the “legal sharing” of articles and issues of collaboration with publishers and has met with rejection. Following this rejection, takedown notices were imminent, and a lawsuit from Elsevier and also the American Chemical Society (ACS) was filed in Germany (Hinchliffe, 2017). Another lawsuit was filed in the U.S. (District of Maryland) in October, 2018 by Elsevier and ACS regarding massive copyright infringement of proprietary versions of papers (American Chemical Society (“ACS”) et al., 2018). Demands by Elsevier and ACS ended up requiring the removal of 200,000 files from RG in 2021 (ResearchGate, 2021). This was a massive takedown. It remains to be seen how the participating faculty and others react to these continuing issues, and if the original idea behind ResearchGate can continue as it was. ResearchGate goes on with business as usual for now. Authors accustomed to uploading publisher-branded PDFs in ResearchGate, and counting on ResearchGate to make the papers more discoverable while facilitating the sharing of those articles will now need to grapple with what the lawsuits and takedown threats mean. For all the authors of psychology articles, it may seem that ResearchGate may not be sustainable in the same way as it was before, in the way that it has facilitated a robust sharing and collaboration of scholars and their works across the globe. Who will win this tug of war over the sharing of scholarly information on an open internet where roadblocks are not easily tolerated? Researchers and the reading public want seamless online access to peer reviewed (and other) literature and they will use whatever service can facilitate discovery and access, and ResearchGate is certainly one enormously popular way to access the scholarly literature. It is also a compelling community of scholars to which scholars belong. A common scenario in scholarly search increasingly seems to be starting with Google Scholar and ending up with the paper in a library, or in ResearchGate, and if some are

not successful with the library or ResearchGate, it’s possible that a pirate site like Sci-Hub may be the next stop for those who are only seeking full text of paper to which they don’t have access otherwise. As of 2022, with appeals promised on both sides, this might be considered a dilemma for libraries and publishers as well, both of whom want the reader to have access to essential scholarly information. Researchers just want access to the literature and likely don’t care much about the *reasons* why they hit annoying paywalls. This is especially true for anyone not currently affiliated with a well-resourced university library. In 2022, the 2018 copyright lawsuit against ResearchGate concluded when the court in Munich ruled that “it is responsible for the copyright-infringing content uploaded on its platform” (Kwon, 2022). As court cases churn on, this does seem like a game changer for ResearchGate. While some have fought ResearchGate, others have tried to make deals with them. Publishers have seen the public relations implications of changing the resources on which authors have come to depend (and enjoy using to connect with others). What developed, after the copyright lawsuits concluded seemed somewhat of a “if you can’t beat them, join them” course of action. It has been noted that some publishers (Karger, Springer Nature, Wiley, Hindawi, IOP Publishing, and Rockefeller University Press (as of July, 2022) are now in content syndication deals with ResearchGate (ResearchGate, 2022). Subscription content from these publishers is available to entitled readers that find the articles on ResearchGate and selected OA journal content would be available OA. Publishers know that the opportunity to drive discovery of their articles via this channel that is used by millions of researchers (that was at times problematic for some of them) is just too good to pass up. In a move that will affect psychology researchers, “the American Psychological Association (APA) and ResearchGate have entered a partnership aimed at amplifying the reach and discoverability of APA’s journals by providing ResearchGate members with direct access to their articles through the platform” (ResearchGate, 2023). Open Access advocates may see this compromise position as not in the spirit of the original idea behind researchers’ sharing widely in ResearchGate. There is just too much data to mine and too large a community for publishers to ignore, and OA advocates may feel that publishers are negatively impacting the RG experience and its part in serving up full text papers. For all of those unaffiliated users, snippets will be all that they get, and full text versions of record will be moved back behind paywalls (if they are traditionally published subscription articles). Some users of ResearchGate likely see a compromise here, and others a “sellout.”

It remains to be seen, as more commercial publishers partner with RG but increasingly only allow small parts

of articles to be seen by searchers, whether the millions of users of ResearchGate will cease to find it a one stop shop discovery service for full text of articles from all scholarly sources. For affiliated users, academic libraries (who always struggle as the first place that faculty and students seek peer reviewed literature) may become a first stop for those used to finding PDFs of proprietary papers on RG. ResearchGate will make it as easy as possible for university-affiliated users to click through from RG, but know that it is the library that makes this possible. It seems that that content will become less available all the time to those not affiliated with a university with subscriptions to the big packages, and that everyone will use RG for discovery but not for access to full text OA content. Beyond ResearchGate and Academia.edu, many searchers find their way to Sci-Hub, known as a pirate site by some and by others as a convenient access point for all scholarly books and journals, available to anyone who needs them.

### **Outside the System: The Sci-Hub Phenomenon**

Much psychology literature is available to potential readers via popular crowdsourced sharing platforms and practices. There seems no stopping (by publishers) the sharing of PDF copies of scholarly articles online by communities of researchers on a global scale. Many people that want access to the research literature are not dissuaded by issues of copyright or piracy, and knowingly or unknowingly support the free sharing of information regardless of copyright protection. Widespread sharing of research papers takes place on social media platforms and recently there have been studies of this activity on sites like Facebook, Reddit Scholar (a subforum of Reddit), and by use of the popular Twitter hashtag #icanhazpdf. This peer to peer sharing goes above and beyond the very popular informal sharing that goes on via email, for instance. Peer to peer sharing centers around a few high volume websites that host the files, namely Avaxhome, LibGen (The Library Genesis Project) and Sci-Hub. These sites can be found in a simple online search in any search engine. Will readers and researchers use traditionally available channels such as interlibrary loan or will they choose convenience and just go to a crowdsourced site and get an article that's likely been obtained illegally? (C. C. Gardner & Gardner, 2017). Often in the news, Sci-Hub, and its founder, neuroscientist Alexandra Elbakyan have created a site where much of the content of commercial and other publishers has been made available illegally (according to publishers that own copyright to articles) since 2011 to searchers and readers worldwide. Lawsuits by Elsevier and the American

Chemical Society have not been able to prevent the continued growth of Sci-Hub and its partner site, LibGen. Sci-Hub has been referred to as "black OA" and "the pirate bay of science" but for many around the world it is likely a lifeline for access to research results that are otherwise out of reach.

Controversy erupts whenever discussion of the use of these methods of gaining access to research papers comes up, with some feeling that scholarly articles are meant to be read and shared in the open, and others acknowledging that the illegal nature of the free sharing of the property of publishers must be stopped. Larger issues involve the library and legal issues with how the content is obtained, which is often via use of user credentials outside of normal channels. Still, where researchers need access, it has been surprising to some the extent of the access that happens outside normal channels, and especially the fact that many who access articles via Sci-Hub are actually at affiliated institutions that have subscriptions, via their libraries, that allow legal access to that same content. This fact was surprising to some, that "everyone" is downloading articles from Sci-Hub even if they have access via other channels such as through research libraries (Bohannon, 2016b). Also somewhat surprisingly, Elbakyan has made available an immense data set of 28 million download requests from the server logs of Sci-Hub representing the time period September 1, 2015 to February 29, 2016. Using publisher DOI prefixes with this dataset allows one to see the content of many publishers of psychological science that are included in Sci-Hub, including major players as well as smaller presses (Bohannon, 2016a).

Sci-Hub may be considered a pirate site, but a study by Himmelstein et al. (2018) reveals a situation that is truly a game changer for scholarly communication in all fields. As of March, 2017, Sci-Hub was providing a huge number of readers and researchers with another mechanism for accessing all of the world's scholarly papers (mainly articles, but some other content as well) that are currently behind paywalls and restricted to subscribers by their publishers. Not as concerned with providing a complete repository of all scholarship (including OA), Sci-Hub has as its focus making available all recent papers that are behind paywalls. The service is monetized through donations, especially via Bitcoin. Sci-Hub makes available 85.1% of all articles currently available only from toll access journals. Its coverage of Elsevier articles was reported at 96.9%, and more than 90% for the American Chemical Society, Wiley-Blackwell, and Taylor & Francis (all part of a group of eight publishers that have more than a million articles represented). Sci-Hub's coverage of articles in the Psychology category (using Scopus data)

was determined to be 1.3 million out of 1.6 million (or 82.9%; p.7). Clearly, Sci-Hub is making available most of the peer-reviewed paywalled psychology literature. As a benchmark, the authors compared the University of Pennsylvania's subscription library holdings against the content available from Sci-Hub, and even though Penn had paid \$13.13 million on its electronic resources, it was determined that "Sci-Hub provided greater access to paywalled articles than a leading research university spending millions of U.S. dollars per year on subscriptions" (Himmelstein et al., 2018, p. 10). Another study by Maddi and Sapinho (2023) that analyzed the time period 2009 to 2020 found that: "Of the 12,088,681 non-OA publications, Sci-hub indexes 63%. Over the 2009 to 2020 period, the share of non-OA publications downloadable from Sci-hub increased from about 55% to more than 75%" (p. 5652). Sci-Hub activity also falls outside of the carefully connected research ecosystem that spins off scientific metrics and affects other aspects of a carefully curated publishing system that is governed by standards and industry traditions, and may actually be a factor in changes to the well-known OA citation advantage (Maddi & Sapinho, 2023). With institutions and their libraries spending millions of dollars on access to journal subscriptions from publishers, this issue is one that will continue to be of major interest to libraries and publishers, especially as they aim to combat continuing infringement activities of sites like Sci-Hub (Russell & Sanchez, 2016). Facilitating more availability of legal OA content will be one strategy that can mitigate some of the lengths that researchers need to go to in order to access articles. The research community of psychological science has everything to gain by making sure the products of research are available to every individual that needs or wants access. It is not only access that researchers want, but seamless, convenient, one-click access, which is just the type that Sci-Hub offers and publishers and many academic libraries do not. Sci-Hub appears to be an appealing "one stop shop" for convenient access to content for those that can't get access to scholarly publications, as well as those that could use other methods. It is currently unclear how libraries and publishers will (or won't) prevail against Sci-Hub. In 2023, in an interview with Elbakayan, it appears that the 2020 lawsuit in India that is playing out against Sci-Hub by a few publishers is taking its toll and that the most current papers have ceased being added to the site. Sci-Hub, as of 2023, no longer contains current material and if there is more OA all the time, it may not be as crucial for its huge audience (E. Cohen, 2023).

The earliest Open Access pioneers, now 20 years beyond the original statements like the Budapest Open

Access Initiative (BOAI) had always reminded scholars of the green (repository) OA option where all was required, as Harnad used to reiterate, was for every author to self-archive a copy of every article in a repository, to be discovered by Google Scholar or other internet means. This would negate the need for pirate sites, but the reality is that the green route does not provide such comprehensive results due to the lack of archiving by authors who may not prioritize Open Access in their own workflows. Even in universities that provide consulting and services around green OA self-archiving from their libraries and institutional repositories, many do not prioritize making their works OA, even though the benefits are clear and the process is simple and easy.

### The "Gold Road:" Open Access Journals and Psychology

While green OA refers to the "repository route," gold OA refers to the "journals route" to OA. The gold route is comprised of a long list of types of journals-based OA. Every stakeholder in the system of scholarly publishing today lives in a transitional time for publishing and the situation with Open Access has made it extremely complex and fast-moving. While libraries have long supported the funding of publishers, that system now includes authors and funders paying Article Processing Charges (APCs). It seems all ideas are on the table, and nobody is sure what the future holds, and where the sustainable funding will come from. There is much at stake with funders, publishers, societies, libraries, institutions and authors all holding key roles in the transition.

There are many fully OA journals (where all content in each issue is OA) available to psychology researchers for submission of their articles. A new (in 2023) fully OA entrant into the psychology landscape from a well-known OA publisher is *PLOS Mental Health* (<https://journals.plos.org/mentalhealth/>). PLOS is a publisher that only releases very small numbers of new journals, only publishes journals that are fully OA, and publishing activity is monetized by APCs. For institutions, a variety of partnerships and membership models are available from PLOS that will cover APCs for affiliated researchers. The current cost of publication for a research article in *PLOS Mental Health* is \$2,205. From their website, the journal is described thus:

*PLOS Mental Health*, a new Open Access journal for research that leads to healthier lives by improving discussion, interdisciplinary collaboration and understanding of all aspects of mental health in individual, societal, and community contexts...*PLOS Mental Health* is an inclusive, peer-reviewed, journal that aims to address challenges and gaps in the field of mental health research, treatment, and care in ways that put the lived experience of individuals and communities first. By uniting all stakeholders through rigorous,



open research, and increased visibility of the experiences of individuals and societies we aim to serve, we can further understanding, discussion, and action for mental health on a broader scale. (<https://journals.plos.org/mentalhealth/>)

Another important PLOS journal that would be of interest to researchers in cognitive science, neuroscience and similar fields would be the fully OA, high JIF journal, *PLOS Biology*, described in the Scope section as “*PLOS Biology* is the flagship PLOS journal in the life sciences...(<https://journals.plos.org/plosbiology/s/journal-information>).” *PLOS Biology*’s high JIF is an example of a fully OA journal that has, for some years held the top JIF for the category of Biology, demonstrating that OA journals can indeed have high impact factors.

Many fully OA journals carry article processing charges (APCs), but the majority do not. According to the Directory of Open Access Journals, a database commonly recommended by libraries for access to quality OA journals, in 2023, there were 13,000 + “journals without fees” out of 20,000 + total vetted OA journals ([doaj.org](http://doaj.org)). It goes without saying that many authors are finding for the first time that they must pay for Open Access publication in fully OA journals, or that they can choose that route (and pay hybrid costs) to make their articles OA in traditional subscription journals. Adding to the complexity are the deals made by publishers and libraries that allow for some of the APC costs to be covered by libraries or institutions as part of library/publisher negotiations. Some of these evolving deals involving the transition of hybrid (subscription journals with some OA articles in an issue) journals to fully OA publications involve what’s known as “read and publish” deals where the price of subscription is rolled into the price to publish and one deal covers both APCs and subscriptions. Journals that are moving from subscription to fully OA journals may be called “transformative journals.” This is an evolving environment where nothing is certain. Libraries may be experiencing more demand from researchers inquiring about publisher deals that can help pay APCs. Many libraries, in addition to administering OA funds, may make available webpages where lists of publisher deals that pay APCs and offer discounts can be accessed by authors seeking information on getting APCs paid. Some researchers seek these lists of deals so they can even choose a publisher based on those deals.

A very complex environment exists at present when it comes to scholarly publishing and access to the peer reviewed literature. Library subscriptions still pay for the cost of institutional subscriptions, and authors don’t pay to publish papers in the traditionally published journals (but often sign away their copyright in their articles to the publishers). Certain articles may be made OA for a

fee in an otherwise subscription supported journal (hybrid), or institutional memberships may be available from OA publishers to subsidize the APCs of affiliated authors (such as the case with BioMed Central, for example), and in many cases there are no fees to libraries or authors because publishing is subsidized by societies, libraries or others. Along with the growth of APC-funded journal articles, there has been interest in those journals that do not charge authors any fees. To find fully OA journals that carry no charges for authors, a researcher can search the Directory of Open Access Journals (DOAJ), using the drop down filter for “without article processing charges (APCs).”

These OA journals that do not charge readers, libraries or authors, are part of what’s known as the “diamond” category. Diamond OA journals are of increasing interest due to their lack of APC payments and subscription costs, which addresses issues of global equity for readers, authors and institutions. A large number of OA journals available in psychology belong to the “diamond” category. According to the Action Plan for Diamond Open Access (Ancion et al., 2022):

‘Diamond’ Open Access refers to a scholarly publication model in which journals and platforms do not charge fees to either authors or readers. Diamond Open Access journals represent community-driven, academic-led and -owned publishing initiatives. Serving a fine-grained variety of generally small-scale, multilingual, and multicultural scholarly communities, these journals and platforms embody the concept of bibliodiversity. For all these reasons, Diamond Open Access journals and platforms are equitable by nature and design. (p. 3)

### **A Library-published Diamond OA Journal: Pragmatic Case Studies in Psychology (PCSP)**

Many diamond OA journals are published by universities or their libraries. An example from Rutgers University, the author’s institution, of a quality diamond OA psychology journal that still carries no fees for readers, authors or libraries is the peer reviewed journal, *Pragmatic Case Studies in Psychotherapy (PCSP)*. *PCSP* is an Open Access, “peer-reviewed e-journal of systematic case studies & case study method articles” which has published 63 issues as of 2022, and has been indexed in APA PsycInfo for many years. Early involvement by the author (Mullen) facilitated discussions with APA about the indexing of *PCSP* at a time when OA journals were only beginning to be included in abstracting and indexing services. *PCSP* met APA’s strict coverage criteria. This was an example of a librarian subject specialist involvement in a library-published OA journal.

A team approach to library publishing including the faculty editor, library subject specialist, experts with the OJS software, support from the editor's school/department and the University Librarian created a solid team-based approach. Still, the dedication of the editor is absolutely essential to the journal's success, and editor Daniel B. Fishman of Rutgers University has been with the publication since its beginnings. *PCSP* had been published by the Rutgers Graduate School of Applied and Professional Psychology (GSAPP) and the Rutgers University Libraries since 2004 using Open Journal Systems (OJS) software, a popular open source journal publication system that by 2023 was associated with more than 30,000 journals (<https://pkp.sfu.ca/software/ojs/>). As of November, 2020, there were more than 830,000 PDF downloads of *PCSP*'s articles by a global readership (since it began publishing). In January, 2022, *PCSP* successfully transitioned from being a library-published journal to being published by a non-profit publisher, and retains its diamond OA status. From its new website (<https://pcsp.nationalregister.org/index.php/pcsp>), *PCSP* is described thus: "*PCSP* is a peer reviewed, open-access journal and database. It provides innovative, quantitative and qualitative knowledge about psychotherapy process and outcome. *PCSP* is published by the National Register of Health Service Psychologists ([nationalregister.org](http://nationalregister.org))." Further, in terms of mission:

*Pragmatic Case Studies in Psychotherapy (PCSP)* is devoted to advancing knowledge of clinical process of psychotherapy, clinical outcome, and clinical training/research through the innovative use of carefully crafted and peer reviewed clinical case studies. *PCSP* is published by the *National Register of Health Service Psychologists*, located in Washington, D.C., USA. It began publication in 2005 at Rutgers University and moved to the National Register in 2022. (<https://pcsp.nationalregister.org/index.php/pcsp/about>)

*PCSP* joined the other National Register journal, *The Journal of Health Service Psychology*. An interesting feature of *PCSP* is that "psychologists can obtain continuing education credits by reading a case study article and then answering questions about it. The psychologist pays for getting access to the questions and getting continuing education credits (needed for maintaining a professional license). In this way, the National Register can keep the articles OA but is also able to generate some income from them" (Personal correspondence with editor and Rutgers faculty member, Daniel B. Fishman). The reason for the move from library publishing was due to the need for funding eventual editorial succession for the journal, which will now have support from National Register as a pathway opens up for legions of new readers of *PCSP*. This is an illustration of the natural and

sustainable succession of a successful diamond OA journal from one organization to another.

Peer reviewed "diamond" journals that do not charge authors do not differ from other scholarly publications in the field and are subject to the same scrutiny as subscription publishers would be. Libraries are free to add them to collections, readers find them on the internet, and authors are able to publish without securing funding or paying fees. Open Access journals are included in all major abstracting and indexing services as long as they reach the benchmarks for quality set out by coverage teams responsible for content at the database producers. Library collections also strive to include openly accessible scholarly content. A quick look at the WorldCat database (<https://www.worldcat.org/>) in June 2022 shows that more than 733 libraries have added *PCSP* to their collections, demonstrating a significant global reach for this openly accessible diamond peer-reviewed psychology journal.

As with *PCSP*, an OA business model (even when charging an APC) can impact international dissemination for psychology journals. A look at the OA (and moving to more open research) journal *European Journal of Psychotraumatology*, which charged an APC of \$1,805 in 2022, demonstrates that downloads from China have increased by 525% since 2017, and is seeing authors from China submit 7% of its papers in 2020. In India, downloads increased by 700% over the 10 years (with only few submissions), and in South Africa downloads increased more than 1000% from 2017 to 2020 (Olff, 2020, p. 15). This journal may be able to maintain a more "reasonable" APC because of the subsidy from its owner, European Society for Traumatic Stress Studies (ESTSS).

Diamond OA journals in psychology do enjoy a wide global reach due to the fact that they carry no costs to readers, authors, libraries or institutions. An example of an innovative diamond OA journal can be seen with the relaunch of *Psicológica*, the journal of the Spanish Society for Experimental Psychology (SEPEX). *Psicológica* is published on DIGITAL.CISC, the institutional repository of the Spanish National Research Council in a "direct partnership between a society-owned journal and a publicly funded repository..." (Perakakis, 2022). This journal also includes a peer review overlay service, the Open Peer Review Module (OPRM), as well as other forward-thinking open science-related features. This journal could be a model for future innovations around OA journal publishing. The journal is supported financially by the Society (SEPEX) and the University of Valencia. In an editorial in *Journal of Personality* from 2021, the editors discuss their journal's policies for "transparency and open science" and detail expectations around: citation standards, data & analytic transparency,

research materials transparency, design and analysis transparency, Preregistration, registration, replication, registered reports, and open science badges (Wright et al., 2021, pp. 171–174).

There are many other ways that traditional subscription publishers are supporting Open Access without using the “author pays,” APC-based model. In one important example that is gaining traction is Subscribe to Open (S2O), pioneered by the high impact publisher, Annual Reviews. Subscribe to Open (S2O) is another way to open up the literature of psychology, but in this case, current subscribers continue to provide monetary support while the content is made open to everyone. Some wonder if subscribers will continue to subscribe as the content becomes free but support has been strong. As *Annual Review of Psychology* describes S2O on its website, “S2O is inclusive; it is applicable to all readers and authors, in all disciplines, in all countries” (Annual Reviews, 2022). While Annual Reviews started S2O in 2020 with a successful limited pilot, by 2023, *Annual Review of Psychology* will also join all of the other Annual Reviews titles in 2023 in being OA to a global readership that will expand due to wide library support of S2O ensures no author fees or paywalls for readers. So, far, S2O has been a successful approach and will grow, especially as concerns over equity continue to be a focus of the transition to OA. The issues with charging authors via APCs is unpopular and undesirable, and S2O, while still carrying costs to the legacy subscribers, serves to open up content globally while not charging authors for OA.

### Hybrid Open Access in a Time of Transition

Particularly problematic (in terms of monetizing journal article content in the OA space) has been what is known as “hybrid OA,” where individual articles in subscription journals are made OA by the commercial publisher who charges an APC payment to the author or funder to make that single article OA alongside other traditionally-published articles in that subscription issue. Björk (2017) describes hybrid as “hybrid Open Access is an intermediate form of OA, where authors pay scholarly publishers to make articles freely accessible within journals, in which reading the content otherwise requires a subscription or pay-per-view” (p. 1). Hybrid articles have been a problem for libraries paying subscriptions to commercial journals because of the “double dipping” issue, where some articles have been thought to be paid for by subscriptions and again by APCs. The transition of this system toward university libraries paying one fee that includes access to the journal contents as well as payment of APCs for that university’s affiliated corresponding authors (Read and Publish/RAP deals) continues as part

of a dizzying array of possible funding schemes to pay these APCs. Libraries may be negotiating subscription prices while authors or their funders are paying for the publication of the article. Invoices may go to authors, funders, or library or university funds. In some cases, there are waivers. Jahn et al. (2022) studied hybrid invoicing in articles published by Elsevier from 2015 to 2019 in the discipline, Psychology. Of 3087 OA articles, 57% of invoices went to the author, 40% of invoices went to “research funders or academic consortia (‘Agreement’), 2% of fees were waived (and 1% listed as ‘other’)” (p. 112). It is noted that articles invoiced to authors may still have found funding elsewhere (departments, grants, libraries, etc.). For all disciplines studied, most articles invoiced by Elsevier to authors were published under a noncommercial license while most articles billed under agreements carried the liberal CC-BY license. From 2015 to 2019, “Elsevier recorded growth in the uptake of hybrid OA: The number of hybrid OA articles published per year doubled, the number of hybrid journals with at least one OA article grew by 21%, and the share of hybrid OA articles relative to closed-accessed articles in these journals increased from 2.6% to 3.7% (p. 113).” While uptake increased over the time period, clearly the share of hybrid articles compared to closed access (toll-based) articles are a small percentage. With the funders’ Plan S initiative (launched in September, 2018) requiring publication in OA journals (or deposit in a repository with zero embargo), and no hybrid payments, those disciplines represented by the many funders involved will need to transform by deadline. While still ubiquitous (and profitable) in 2023, hybrid is at a transitional pivot point.

There is also a decided lack of analysis as well as a lack of transparency that prevents researchers at this time from understanding the effect of hybrid publishing on the Open Access landscape overall, and especially its effect on scholarly publishing in psychology. In one study of hybrid OA articles published from the year 2007 to 2013, there was a “strong sustained growth in the volume of articles published as hybrid OA...” (Laakso & Björk, 2016, p. 919). In this same study (of the hybrid OA journal article output for the major commercial publishers) for the Scopus journal category, Psychology, Laakso and Björk (2016) reported numbers of articles made OA in hybrid journals as 19 in 2007 with a steady rise until 2013, when the category included 471 articles. Overall, Björk (2017) reports steady growth of numbers in this hybrid category, stating that:

The number of journals offering the hybrid option has increased from around 2,000 in 2009 to almost 10,000 in 2016. The number of individual articles has, in the same period, grown from an estimated 8,000 in 2009 to 45,000 in 2016. The growth in article numbers has clearly increased

since 2014, after some major research funders in Europe started to introduce new centralized payment schemes for the article processing charges (APCs). (p.1)

In a study of OA market share by discipline, Björk and Korkeamäki (2020) studied articles found across disciplines that were fully OA (no hybrid/subscription articles included) at the time of publication, to report market share of OA in various disciplines (using Scopus data). The wide disciplinary differences in OA uptake are apparent. Disciplinary areas in this case were defined by Scopus categories, and it is instructive to look at Psychology here in comparison to other disciplinary areas. Scopus's category of Psychology is not included in Social Science, for instance. One can compare higher uptake categories like Medicine, for instance where 22.1% of all journals are OA journals, and 22% of all articles are OA articles, to Psychology, where 11.5% of all journals are OA journals, and 10.2% of all articles are OA articles (p. 1085). For this study, the authors also had to separate the results as being 1) published by the "Big Four: United States, United Kingdom, Germany and The Netherlands (where 63% of all journals indexed in Scopus are published), versus the rest of the world. Outside of the Big Four, there are less dramatic differences between disciplines as far as uptake of OA. Psychology ranks higher than biomedicine when the Big Four countries are not part of the equation (p. 1086). Also looking at highly ranked OA journals in each field points out disciplinary differences, and in Psychology, "highly ranked OA journals are quite rare in Psychology and Arts and Humanities" (p. 1087). Biomedicine, in contrast, had some of the earliest OA journal outlets and publishers as they were heavily monetized by funders (who also mandated early OA compliance, in comparison to the situation in Psychology (p. 1088). Still, Psychology as a discipline could put more of an emphasis on all aspects of OA, maybe through its societies, or via departments and schools in universities that want to disseminate its collective research output. Because the issues of global equity and costs to authors hampers gold OA, Psychology could pivot more toward green OA (via subject and institutional repositories), diamond OA journal development, and/or continue to increase usage of discipline-based preprint servers such as PsyArXiv.

Uptake of hybrid has not been high, but the majority of traditional journals, especially those published by commercial publishers now include some OA articles alongside closed access articles within the same issue. Funder requirements that will pay for hybrid, as well as new "publish and read" agreements between commercial publishers and libraries drive this proportion of OA articles higher. For instance, in psychology, OA articles paid for by author (or funder, such as Gates) can be found among

the articles listed in tables of contents from commercial subscription-based journals published by Elsevier, Wiley, SAGE, Taylor & Francis, and others. These hybrid journal titles, still funded mainly by subscription revenues, also have some author or funder-paid articles that are published OA within an issue. Most traditionally-published subscription journals now have a hybrid OA option. For example, the American Psychological Association has a hybrid option available for all of its subscription journals, and charges an APC of \$3,000 per article to publish the final publisher branded version of the article OA within a regular issue, published under APA copyright. Authors choose the traditional publishing route, or the Open Access option, for each article. For a small number of institutions only in Ireland (that are IReL member institutions), as of August, 2022, APCs will be covered by the author's institution (American Psychological Association, 2020b). This appears to be the first of APA's "read and publish" deals.

Many authors approach library scholarly communication specialists and others in the university library wanting to discuss how to support Open Access for their articles without incurring personal fees. This could be for fully OA journals or hybrid payments. In the case of fully OA journals, the fee payment is necessary as there are no subscriptions. For hybrid journals, the answer is not so straightforward because the green option is available for researchers (sometimes with embargo) and it is not necessary to pay the fee in order to get an article out on the web OA. Researchers want OA and so they ask about finding money for hybrid APCs. In fields that are not heavily supported by grant funding for APC payment (such as many areas of Psychology), and especially if there is a misunderstanding around a university's OA Policy (i.e., centered around green self-archiving via the institutional repository), there is certainly confusion about OA. APCs have changed the conversation, with authors having to learn where funding will come from and plan ahead in order to accommodate new modes of scholarly communication. The concept of having to consider paying APCs (of finding an entity to pay them) is a game changer for many researchers. Some say that authors in some fields have always paid publishers for some aspects of the publishing workflows such as page charges or color plates. Sometimes, these charges were significant for authors in certain fields. Other authors have never seen that situation and are, for the first time seeing invoices from publishers. Authors have not had to *pay to publish* in most commercial journals in the past, and in some cases (especially with hybrid journals) the OA option is proactively marketed to these authors at the time of submission. Likely most researchers are on board with Open Access, would like to see their papers disseminated this way, and many may also be confused by licensing options (and the extra payments

that some publishers charge for liberal licenses, such as CC-BY). An APC-based system will not work for those not funded by universities or funders, or for many in some of the social sciences and humanities. Some publisher pages on OA options are lengthy and insert what is a new category of issues with which to grapple for those researchers ready to submit to publish an article. Libraries and publishers answer many queries regarding author choices, probably none, however, more common than “where can I get money to make my paper OA?”

Over time, publishers will try different experimental methods to retain sustainability along with support for Open Access. While there is a transition to OA and a variety of ways to pay for it, authors may want to consult their librarians, and also the “Instructions for Authors” section of any journal’s website where they may want to publish. This way there will be no surprise fees at the time of acceptance for publication. Authors will want to plan early for paying APCs with grant funding is that is an allowed means of funding the APC. Many funders will cover OA costs for publication.

### Funder Support of APC-based Gold Open Access

For psychology researchers, granting agencies may now have new rules about the expectation of Open Access for the articles and data that emanate from funded research. Researchers need to understand the various fees and licensing rules that their eventual publications must take into account in order to comply with funder policies. Many funders pay for the cost of publishing either directly through a line item in grants (as does Wellcome Trust) or in some cases, the funders actually publish the journal, as is the case with the journal *eLife*. In an interesting development, funders are now also publishers. *eLife*, an OA biomedical and life science journal is actually published by the funders Howard Hughes Medical Institute, Max Planck Society, and Wellcome Trust. *eLife*, from its founding in 2012 to 2017 did not charge authors fees to publish, but when it had picked up traction in February, 2017, began instituting an APC of \$2,500. This approach was always part of *eLife*’s plan for sustainability in the Open Access market (D. Butler, 2016). In April, 2021, *eLife*’s funders, making decisions to support new forms of research communication, such as their work on the “Executable Research Article” and the service, Sciety (a service for evaluation and curation of preprints), increased their APC to \$3,000 (<https://reviewer.elifesciences.org/author-guide/fees>). Waivers may be available in some cases, but researchers may want to depend less and less on the availability of waivers for any given article.

In 2017, *eLife* introduced its first computationally reproducible article where the reader can turn on

executable features, and are described as articles that “blend the traditional manuscript with live code, data and interactive figures...” and “what makes reproducible articles special is that they can be viewed, edited and executed from within a web browser” (Maciucci et al., 2019). While *eLife* is peripheral to much of psychological science, it does include a neuroscience section, describing the content as: “*eLife* publishes research including brain function, neuronal circuits, synapses, sensory processing and motor pattern generation” (<https://elifesciences.org/subjects/neuroscience>). Many of the innovations in the article of the future will end up being applied to publications in more areas of psychological science.

Wellcome Trust has an OA policy for the research that they fund, and they provide funds to cover article processing charges. All Wellcome-funded articles must be made available in open repositories (Nosek & Bar-Anan, 2012). Wellcome also requires the use of liberal licenses on the paid up articles, using the CC-BY license, which even allows downstream commercial reuse (with attribution) (Wellcome, 2017). Starting in April, 2017, Wellcome-funded papers must be published in journals that comply with the new requirements (for licensing and deposit in repositories). The list of those publishers that are compliant with Wellcome rules include major psychology publishers such as the American Psychological Association (APA). APA states in online information for authors that they “comply fully with the open access requirements of UKRI, Wellcome Trust, and NIHR” (American Psychological Association, 2023). Wellcome Trust is one of many funders that publish research in many areas of psychological science (<https://wellcome.org/what-we-do/mental-health>). In 2016, Wellcome Trust rolled out its Wellcome Open Research, their own open research platform for publishing the results of Wellcome Trust-funded research. Wellcome Open Research has been popular with Wellcome authors, and after 5 years of development, it has been shown to be a successful strategy for Wellcome, with a continuing growth in numbers of articles published and “This growth has enabled us to continue to be the most used publication venue (by volume of articles) for Wellcome-funded researchers according to Europe PMC and Dimensions data” and on the open research front, “for the first time, Research Articles accounted for less than 50% of the total number of articles published on the platform, giving way for other outputs including Data Notes, Systematic Reviews, and Study Protocols (Hope, 2022).”

An example of a private funder with an OA policy that will pay APCs is the Bill & Melinda Gates Foundation, which also requires *final publisher versions* of articles supported by their funds to be made openly available at the time of publication. Interestingly, while an embargo period of 12 months on any paper was allowed between 2015 and 2017, after 2017, papers (and

data) must be made available immediately. The Bill & Melinda Gates Foundation's Open Access Policy also requires the use of the liberal reuse CC-BY license on the article and stipulates that all data that underlies the article also be made Open Access (Bill & Melinda Gates Foundation, 2021). Some publishers have had issues with this kind of policy, especially those from funders that do not allow embargoes (delays) on articles that report research that they've funded. Some publishers, like the American Association for the Advancement of Science (AAAS) and its flagship journal *Science* announced special accommodations for working with Gates as some of the funder's stipulations present challenges for this publisher and a few others. Gates signed on to pay AAAS a fixed sum of money (\$100,000) for the first year (2017) of the pilot in order to pay for Open Access publication of Gates-funded articles (Van Noorden, 2017). The Gates/AAAS pilot ended in June, 2018 after 26 papers (more may appear) had been published in 18 months (16 in the first pilot year) (Van Noorden, 2018). Obviously, the per article APC paid to AAAS was significant.

Concerns around double-dipping or the possibility that any single OA article may be paid for twice (by the subscriber and by the author) have been part of Open Access conversations. This has led to the advent of offsetting deals from commercial publishers anxious to allay any of these concerns about the monetization of any given article in a subscription issue. There is concern over the total cost of publication of a system that includes hybrid journal publication, and where universities and/or funders are paying for subscriptions as well as APCs. APCs for articles in commercial hybrid journals also tend to be higher than fees for article publication in fully OA journals. In general, commercial publishers charge the highest fees. Due to the concern over the double-dipping issue, many university funds do not pay APCs for articles published in hybrid journals. In the United Kingdom, where there has been a concern over the "total cost of publication" issue which takes into account the hybrid journal publishing taking place by commercial publishers, there has been a move to establish principles for publishers and academic institutions for negotiations around these offset agreements with an aim to reduce the additional cost of publication that is occurring (Guy & Holl, 2016). With the advent of more funder policies with "teeth," especially Plan S from cOAlition S (<https://www.coalition-s.org/>), as well as more acceptance of Open Access generally, more gold OA articles are being published.

Academic freedom has arisen in discussions of new funder initiatives requiring Open Access to funded research. Looking at the OA landscape going forward in all disciplines that rely on grant funding, there will be more change and disruption as mandates increase in strength. It is becoming clear that funders' patience with paywalls,

embargoes and other impediments to Open Access is running out. On September 4, 2018, Science Europe's Open Access consortium, cOAlition S, made up of 13 research funders from 13 countries (supported by the European Commission and the European Research Council) launched the "Plan S" initiative. The Plan consists of one target and 10 principles with the stated goal of "full and immediate OA to research publications" (<https://www.scienceeurope.org/coalition-s/>). The Bill & Melinda Gates Foundation and Wellcome Trust signed on shortly after the initial announcement, and the conversation also quickly made its way from Europe to the United States. This particular mandate, unlike others, does not offer accommodations for some of the usual requirements of subscription publishers. Plan S's key principle states:

With effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo (<https://www.coalition-s.org/about/>)

The announcement goes on to describe the rest of the requirements, stating that funders and universities (not individual researchers) would pick up the cost of OA publication, that the principles would apply to monographs as well (although it is understood that this part would take more time), and that the hybrid model would be disallowed. There is also language that supports the development of repositories and open archives. There was immediate reaction from stakeholder communities, especially in regard to the strong Open Access position of Plan S, and its emphasis on author rights and fully compliant open licensing. As Plan S moves forward, certain impediments currently existing in the system, such as embargoes, double dipping via hybrid and the "one off" rules of certain publishers that are considered roadblocks to self-archiving of accepted manuscripts will no longer be allowed. While those that view Open Access to the results of research as a goal for the dissemination of scholarly works on a global scale were emboldened and excited by the unveiling of Plan S, there were also faculty members and other stakeholders that considered Plan S as an affront to academic freedom. Funders would stipulate that authors could not publish research results in some of the most impactful journal titles (and highly regarded society titles), thereby potentially disadvantaging those authors from career advancement, awards or other aspects of the prestige economy. In a November 5, 2018 published letter entitled "Reaction of Researchers to Plan S; Too far, too risky: An Open Letter from Researchers to European Funding Agencies, Academies, Universities, Research Institutions, and Decision

Makers” (<https://zenodo.org/record/1477914#.W-9SWeJRdPY>), about 800 scientists (as of November 2018) laid out their concerns, such as the negative effect on learned societies that would occur if hybrid journals were banned as publication outlets, support of fully OA journals likely increasing the costs of the system, issues of the use of the liberal CC-BY license for every article, the too narrow mechanism required by the funders to achieve OA (“journals route only”), issues of preprints, and disciplinary differences in OA culture (Rabesandratana, 2018). Another letter with hundreds of signatures from supportive academics and other OA advocates followed the earlier letter that opposed Plan S (<http://michaeleisen.org/petition/signatures.php>). A strong statement of support and an implementation plan was the response to Plan S from the Fair Open Access Alliance (FOAA) (<https://www.fairopenaccess.org/>). FOAA, which includes member, Psychology in Open Access (PsyOA), is described as “facilitating conversion to fair Open Access of journals in psychology” (<https://www.psyoa.org/>).

The development and implementation of Plan S may signal somewhat of a tipping point for the change to a different kind of future for scholarly publishing, with Open Access to publications and to other research outputs now an expectation for research funding. The funders may increasingly make the OA rules, and publishers will need to adapt or risk losing funded authors. This potentially large disruption to the status quo will indeed include the major and minor publishers of psychological science research. In another move forward that will continue to spur innovation, cOAlition S (Plan S) announced in 2023 its ambitious plans to further their agenda toward open science with the publication of their proposal entitled, “Towards Responsible Publishing.” This proposal includes the following statement:

Our vision is a community-based scholarly communication system fit for open science in the 21st, that empowers scholars to share the full range of their research outputs and to participate in new quality control mechanisms and evaluation standards for these outputs. (Stern & Rooryck, 2023)

This new aspect of Plan S “wants all versions of an article and its associated peer-review reports to be published openly from the outset, without authors paying any fees, and for authors, rather than publishers, to decide when and where to first publish their work” (Liverpool, 2023, p. 238). When a major funder initiative introduces a proposal like this, publishers take notice. Still, at present (2023), the system is not there yet, and one wonders if it ever will be.

While Plan S initially caused much commotion in the OA discussion space, commercial publishers began to develop ways to accommodate it by beginning to transition their hybrid journals that would be disallowed once the Plan went into effect. To move their hybrid journals

closer to the fully OA requirements, publishers initiated “transformative agreements,” and libraries and institutions began to take part in advertising the fact that “read and publish” deals had been signed. This has been a bit of a game changer for the OA conversation between libraries and their researchers. This is how Björk and Korkeamäki (2020) describe transformative agreements:

A recent important development is also the push of several large library consortia to force major publishers to repack-age their big subscription deals to include automatic APC payments for articles published by their faculty in hybrid journals. Such deals are called transformative agreements or “publish and read.” (p.1091)

There are already several in place, in particular as negotiated by the library consortia for countries like the United Kingdom, the Netherlands, Germany, Austria, and the Nordic countries. In North America, university libraries also have become active in this respect” (Björk & Korkeamäki, 2020, p. 1091). Key points surrounding transformative agreements listed by Borrego et al. (2021) include:

The negotiation of journal licence agreements has shifted its focus from cost containment towards the inclusion of clauses in favour of Open Access. ‘Transformative agreement’ is an umbrella term that encompasses a continuum of contracts, ranging from traditional subscription licences that grant discounts in publication fees or vouchers to agreements allowing unlimited Open Access publication; Transformative agreements are more transparent than journal licences, allow authors to retain copyright, and make provisions to facilitate Open Access workflows; It is hard to assess whether transformative agreements are transitory or will perpetuate the current structure of the scholarly communication system. (p. 2017)

The deals negotiated between publishers and libraries (Read and Publish deals) that would cover the payment of APCs for institutionally affiliated authors went into effect and researchers responded. Quickly, libraries put out press releases and websites that advertised that APCs in hybrid journals or fully OA journal offerings from certain publishers would be “paid by the institution.” Researchers took notice, but may have misread these new deals to mean that the library has decided to pay APCs for faculty, and also only for a few publishers that the library may be “recommending” that authors publish with. Of course, this is not the case. Some authors feel there is a new signal of support from the library or institution in paying APCs when in reality there is just an integration of subscription funds with paid up APCs. Many libraries are finding that researchers are very happy about these deals, even as they are trying to promote their university’s more equitable green OA/institutional repository option. For now, the list of read and

publish deals will grow longer and cover more disciplines. These deals would theoretically increase the uptake of hybrid OA in subscription journals as they moved along toward the amount of OA that would satisfy Plan S funders. In 2022, after only a brief time, the publisher Cambridge University Press announced to cOAlition S funders (Plan S) the large increase in uptake of its hybrid option due to the deals it had made with university libraries: “The amount of new research published Open Access (OA) in Cambridge’s transformative journals (TJs) leaped by almost 70% in 2021. The update also shows that the programme exceeded its Open Access growth target for the year, playing an important role in Cambridge’s plans to transform the vast majority of the research publishing in its journals to OA by 2025” (“Cambridge Transformative Journals See 70% Leap in Research Published OA,” 2022).

More funders will require OA all the time. The members of the Open Research Funders Group (ORFG) “is a partnership of philanthropic organizations committed to the open sharing of research outputs. Collectively, the ORFG members hold assets in excess of \$255 billion, with total giving in the \$12 billion range” and “open research accelerates the pace of discovery, reduces information-sharing gaps, encourages innovation, and promotes reproducibility. The ORFG engages a range of stakeholders to develop actionable principles and policies that promote greater dissemination, transparency, replicability, and reuse of papers, data, and a range of other research types” (<https://www.orfg.org/>). A look through the membership of the ORFG shows many large potential funders of psychology-related research with a focus on open science. This would seem positive for a discipline that is moving in open science directions. A follow on to the *National Academies of Sciences, Engineering, and Medicine’s Roundtable on Aligning Incentives for Open Science* is the Higher Education Leadership Initiative for Open Scholarship (HELIOS), which is “a cohort of colleges and universities committed to collective action to advance open scholarship within and across their campuses. Leaders from U.S. colleges and universities have joined this community of practice, working together to promote a more transparent, inclusive, and trustworthy research ecosystem” (Templeton World Charity Foundation, 2022).

Taking mandates a step further, it has been suggested by Sever et al. (2019) that funders could mandate that all grantees post their research results first on a preprint server, allowing free dissemination of early research results to their communities. This approach is referred to as “Plan U” (for “universal”). In fact, The U.S. National Institutes of Health has accepted preprints from researchers as part of grant submissions since 2017 (Kaiser, 2017). Funders in the collective have certainly spoken on

the need for OA to the research they fund, and in many cases have been willing to pay APCs on behalf of their authors.

### Article Processing Charges (APCs) not Paid by Funders

There have been attempts by funders and others to understand just how authors are paying for APCs, both by funders and from other sources. Where does the money come from? According the 2020 report, *APCs in the Wild*:

APC funding is complex. Authors use a wide range of funding sources, often in combination. A survey of 1,014 Springer Nature authors (part one of this whitepaper) indicates that there is no dominant source of APC funding for authors publishing in either fully OA or hybrid journals. Authors are drawing on research funders, institutions, publisher agreements, and other sources (e.g. personal funds) to finance APC payments. Nearly half of respondents (47% of fully OA authors, 44% of hybrid OA authors) combine two or more of these main sources of funding in order to cover their APC. (Springer Nature, 2020, p. 3)

This is clearly a transitional time for the author burden (financial as well as the learning curve) around OA options. The administrative burden of publishing for authors has increased. Often, especially to those not familiar with OA options, the need for answers often comes at the 11th hr, when publication or acceptance is imminent.

There is some confusion for authors about the fully OA journals that must charge a fee, and the hybrid journals where there is an option to publish traditionally without paying. Many authors that choose a fully OA journal that is not free for them to publish in (or want to use a hybrid option in a subscription journal that is already monetized by subscription revenue) are faced with the need to pay an APC in order to publish (as a condition of publication). APCs range from very small amounts to \$5,000 or more per article. One 2022 study by Frontiers lists some numbers: “For fully gold Open Access journals of the 10 largest publishers, the weighted mean APC is U.S. \$2,371 and the highest APC is U.S. \$8,900; For hybrid journals from the 10 largest publishers, the weighted mean APC is U.S. \$3,410 while the highest APC is U.S. \$11,390. For a subscription article, the range of revenue is between U.S. \$4,000 and U.S. \$9,000” (Frontiers Communications, 2022).

The cost of APCs is all over the map and there seems no standard fee. For instance, the OA publisher Frontiers raised its APC for its fully OA title, *Frontiers in Psychology* from \$2,490 to \$2,950 in 1 year (2017–2018), an increase of 18% (Morrison, 2018a). In 2022,



Frontiers announced another APC rate change due to inflationary pressures: “As of August 2022, we will raise APCs by 9.32% to help partially offset the recent inflationary losses to the value of the dollar” (Frontiers Communications, 2022). Rises in APCs will remind librarians of unsustainable subscription price raises, but now the price increases will fall on authors and their funder if they have one. At the extreme end of this scale is the cost to publish in *Nature*, where outrage greeted the announcement of the new APC in 2021: “From 2021, the publisher will charge €9,500, U.S. \$11,390 or £8,290 to make a paper OA in *Nature* and 32 other journals that currently keep most of their articles behind paywalls and are financed by subscriptions” (Else, 2020, p. 19). This APC was reported widely, for example in *Forbes* (Salzberg, 2020). With pressure to move its journals to Open Access from the funder initiative Plan S, even with the highest APCs in the landscape, many institutions and funders paid these fees, allowing Springer Nature (2022a) to state: “Springer Nature’s national agreements, which alongside its institutional deals, now support researchers from over 2,650 affiliated institutions to publish OA, totaling an expected 41,400 + OA articles to be published a year, 10% more than any other publisher.”

This is an example of the revenue that traditional publishers can generate from OA, leading many to use the phrase, “Open Access is here to stay, but who will pay?” This plays out while the free option, green OA via repositories is still available in almost all cases. Publishers have a robust new revenue stream, but is it sustainable past the OA transition? Libraries, including the major research libraries supporting many OA programs and infrastructure (on top of supporting large subscription costs) may still struggle with budget cuts but now authors may be also feeling the burden of paying APCs to publish their research.

In order to pay APCs, authors may be able to use existing grant money, apply to departments or research offices, request any available library funding, or request a waiver from the publisher. Waivers are no longer as available as they once were for most authors, with the exception of some authors from low-and middle-income countries (Lawson, 2015). Many publishers do respond to author inquiries around waivers that may be needed due to personal hardship or geographic region. Many publishers have such programs, for example the PLOS Global Participation and Publication Fee Assistance (PFA) programs from PLOS (<https://plos.org/publish/publishing-faqs/>). Universities have, in many cases, instituted special funds (often referred to as OA Funds) to which authors can apply to receive funds to pay APCs for article publication. Whether an individual institution is a signatory of the principles of a solution like COPE (Compact for Open Access Publishing Equity), or has

developed another type of fund to assist authors in paying APCs, this is another avenue for institutions can support faculty authors that don’t have grant funding to facilitate the funding of individual OA articles. Some publishers will also point authors to lists of available university-based funds. Many of these funds set up to assist authors with paying APCs do not fund articles published in hybrid journals, instead they are more apt to pay for the APCs of fully OA journals where, without assistance, the university’s authors would not be able to publish at all in the journal of their choice. Most hybrid journals offer authors of accepted articles a choice of traditional publishing or the use of the OA option via the payment of the APC. A comprehensive list of university-based OA funds is available from SPARC (Scholarly Publishing and Academic Resources Coalition; SPARC, 2022a).

The success of the gold OA model, especially for the author pays model, will be contingent upon author attitudes toward this type of Open Access, how much authors are really willing to pay, and to what publishers (Tenopir et al., 2016). Funders cover a portion but many researchers are not funded and are left out of this system. The availability of funder support for APCs in all disciplines that have such support will also need to further evolve in order to assure funding for submitting authors. There are great inequities in the system for authors, whether geographic, disciplinary, or due to other factors.

How quickly this largescale change in scholarly communication, from a mostly electronic traditional subscription model where libraries pay subscriptions to a new model where most scholarship is funded by authors via their granting agencies or their institutions (at least for the sciences) is in large part dependent on the choices authors make and the needs that they have to share their work with the public, with taxpayers, or much more widely with colleagues. Will humanities find a sustainable way to participate in Open Access sharing of scholarly output? A corollary question is whether authors will choose the most liberal reuse licenses (from Creative Commons) for their work or whether they will want to go with more restrictive permissions if allowed by funders and universities. For those involved in funded research, those funders will likely demand liberal licenses.

### **APC-based Open Access “Megajournals” and Psychology**

While single OA articles in subscription journals have had issues with the discovery systems, the high cost (as compared to fully Open Access journals’ articles), and the double-dipping, the fully OA journals are more straightforward. The APCs of fully OA journals support the publication of those journals as they do not have

other funding streams, like subscriptions. APCs fund these journals. Fully OA journals can be single journal titles that have flipped from subscription to OA, or the many more that were born OA and have always been monetized by APCs. Often, these APCs are more reasonable than the numbers seen in hybrid commercial OA publication. A subset of fully OA journals that are of importance to psychology are the known as the Open Access Megajournals (OAMJs).

The future of the traditional journal is not clear, and there are many concerns relating to the sustainability of societies and other factors closely tied to scholarly publishing. The very future of journals has been a question as “nobody reads journals,” says science publisher Vitek Tracz, who has made a fortune from journals. “People read papers” (Rabesandratana, 2013, p. 66). Clearly, article-level discovery is here to stay, evidenced by popularity of the OA mega-journals (OAMJs) like *PLOS ONE* and Springer Nature’s *Scientific Reports* which publish thousands of articles in one single issue each year, all discoverable via Google Scholar and other search engines, and all published fully OA. OA megajournals are significant to scientific communication in psychology.

In fact, contrary to many disciplines where commercial publishers are publishing much of the literature, the proportion of the biomedical literature has actually declined in recent years due to author traffic moving to some of the mega-journals, particularly in the case of the non-profit *PLOS ONE*, which has published more than 30,000 articles in one issue per year (Larivière et al., 2015). There is likely no denial that the fully OA megajournals, beginning with the introduction of *PLOS ONE* in 2006 have disrupted scholarly journal publishing’s “business as usual.” With thousands of articles per issue, a business model funded solely by article processing charges (APCs) that may be considered “reasonable” (at least in comparison to commercial publisher APCs), and most importantly, a peer review model that only reviews for technical and scientific soundness rather than the more traditional peer review system that is utilized by high impact disciplinary journals. OAMJs also cover a wide span of subject areas in each annual issue rather than a focusing on any specific disciplinary or subfield niche. Popular examples well known to psychological scientists are *PLOS ONE*, *SAGE Open*, Nature’s *Scientific Reports*, *F1000 Research* (known for post-publication reviewing) and others. Collectively, the OAMJs flood the internet with many thousands of research articles, all Open Access, each year. This leads to rapid dissemination of current scientific research on the internet, all optimized for article-level delivery. A study by Wakeling et al. (2016), reporting sheer numbers of articles published each year showed that in a sample

of 11 OAMJs, 44,820 articles were published in 2015, an increase of 15% over the 2014 figure (33,995)-a figure representing 2.5% of all 2015 articles indexed in Elsevier’s Scopus database. *PLOS ONE*’s output is by far the highest in the category, while *Scientific Reports* is second in production. These were the only two OAMJs publishing more than 10,000 articles in 2015 alone. Certain of the OAMJs are more popular in one geographic region or another, for instance, demonstrating that there are distinctive characteristics to each of these publication outlets (Wakeling et al., 2016). For authors, the appeal of the speed of publication, the importance of OA for many committed researchers, the need or desire to be able to use liberal licensing as well as the the ability to share widely (all from well-known publisher brands) cannot be denied. However, Brainard (2019), reporting on studies of megajournals, pointed out some worrying trends for the *PLOS ONE*-type journals; that in 2019, traffic to these titles seemed to be declining some, speed to publication had lessened, and top journals (*Nature*, *PNAS*, and *Science*) were not citing articles in *PLOS ONE* as often as in the past during the time period 2008 to 2016. Brainard points out that “from 2013 to 2018, *PLOS ONE*’s output fell by 44%. Another megajournal, *Scientific Reports*, surpassed *PLOS ONE* in size in 2017 but saw its article count drop by 30% the next year” (Brainard, 2019). After a huge splash and high interest early on, this is all likely a course correction, and scholars will always seek out publication outlets that are the most appropriate fit for their work. The megajournals will be part of the landscape but will no longer be the most exciting game in town, certainly not for psychological science. As the “APC wars” continue, it is noted that the cost of publishing in a *PLOS ONE*-type journal is significantly less than the cost of publishing in a commercial hybrid journal. The many factors that make up choice of journal, even where an article-based economy has developed still can make or break careers due to established outlets expected for promotion and tenure. As a forward-thinking fully OA publisher, PLOS will continue to evolve and focus on other business models besides APC. (PLOS, 2023).

A search of Google Scholar (for those unaffiliated with a university’s databases), or a search of any subscription subject (or citation) database will include results from the Open Access Megajournals (OAMJs). The formal citation impact of OAMJs (as compared with traditional journals) will need continuing study over the coming years; some early analyses are available now. In terms of citation studies, outside of the elite journals, it appears that the OAMJs may be performing similarly to traditional journals in the same impact factor range, less vigorous peer review notwithstanding. This could demonstrate that it is possible for OAMJs to achieve similar

citation patterns using a very different system of peer review (reviewing only for scientific soundness and not eventual contribution to science) (Björk & Catani, 2016). With the major difference likely to be how promotion and tenure committees or national research assessment systems view the peer review status of the OAMJs, this phenomenon is here to stay. While some may have used the term “peer review lite” to initially describe how the OAMJs’ systems differ, it may not be well known that the peer review performed, for instance by *PLOS ONE* (after a paper passes a quality control check and the paper is assigned to an Academic Editor with relevant expertise), that “the majority of *PLOS ONE* submissions are evaluated by 2 external reviewers, but it is up to the Academic Editor to determine the number of reviews required” (PLOS ONE, 2017a). A further description of the peer review process used at *PLOS ONE* states:

*PLOS ONE* is a fully peer reviewed journal with a rigorous multi-stage editorial screening and assessment process. First, we undertake an initial in-house quality check to identify potential issues such as competing interest, compliance with ethical standards for studies involving human and animal subjects, financial disclosures, data availability, and other scientific and policy requirements...After passing quality control, each manuscript is placed with a member of the Editorial Board who conducts peer review and makes the decision to accept, invite revision, or reject the submitted manuscript. (<https://journals.plos.org/plosone/s/journal-information#loc-peer-review-at-plos-one>)

The newer type of peer review employed by the OAMJs has caused some added focus on the aforementioned issue of cascading peer review, especially as used by larger publishing firms that may be rejecting many otherwise good quality papers from elite titles with low acceptance rates. Studies have shown that many rejected papers find a home in the same publisher’s OAMJ (but this practice is not exclusive to OAMJs), and that the option to move the paper to the OAMJ is presented at the time of the rejection (Spezi et al., 2017). Average acceptance rates for OAMJs are often reported to be significantly higher than for traditional subscription publications. (Sugimoto et al., 2013). Journal Impact Factor (JIF) and acceptance rate are still values that may matter when conferring prestige on all scholarly journal titles. The OAMJs are no different, with widely differing impact factors and other characteristics that distinguish one from another.

There are not many sources that compare acceptance rates among journals (or publishers) in psychology. A welcome service for authors wanting to see metrics around acceptance rates and other publishing metrics that are not normally public-facing comes from Hindawi with its development of Hindawi Journal Reports. Along

with acceptance rates, decision time, and median time in peer review (as examples), traditional usage information is available for any article. (Hindawi’s Open Science Team, 2022). This is a far cry from what was available in the recent past for this type of publisher workflow information. A directory available at some academic libraries in print some years ago, Cabell’s Directory of Publishing Opportunities in Psychology and Psychiatry contained analytical information on psychology journals. That print product is now subsumed into a database that covers 18 disciplines (including Psychology) that is able to compare and contrast hundreds of psychology journals by various factors, including acceptance rate. Acceptance rates are used, (along with Journal Impact Factor) by many in academia as proxy for quality and elite status. Using Cabell’s data, it has been reported that OA journals in the psychology category (not only the OAMJs) have significantly higher acceptance rates than non-OA journals listed in Cabell’s. *PLOS ONE*, for instance, reported an acceptance rate of about 69% in 2012 (Sugimoto et al., 2013), and in 2017, reports an acceptance rate of about 50% (McCook, 2017). By comparison with the traditionally “elite” journals that are thought to rise above the rest in the general/multidisciplinary category, AAAS’s *Science* reports a rejection rate around 93% (Larivière et al., 2014). Before the phenomenon of OAMJs entered the landscape, it was once reported that rejection rates were very high for psychology authors, approaching 70% to 80% (Adair & Vohra, 2003). In comparison, rates are lower for biology (50%) or physical sciences (20%), and rejection rates were also predictive of citation rates. Historically, articles in the Experimental category enjoyed lower rejection rates and had a higher impact according to Social Sciences Citation Index (Rotton et al., 1993).

It has been difficult for various reasons to ascertain how the OAMJs such as *PLOS ONE* or *Scientific Reports* represent research literature in the various fields of psychology. Thus, it is not possible at this time to provide granular information on how these publications may or may not be affecting the dissemination of research results in psychology, especially how psychology would be represented in subject classifications focused on “science and medicine” or “biology and life sciences.” Each of the OAMJs seems to have a different disciplinary focus (even though they are all multi-field publications). One journal, *SAGE Open*, was an important entrant in the field of OAMJs, as it focused on covering more of the social sciences and the humanities with an accessible publishing model and a very reasonable APC (even for those without funding). Authors without funding could often afford a low APC (if that were an option) and would also be able to choose an OA journal option from a familiar publisher. *SAGE Open* (in 2015) had published 15.1% of its articles

under the category of “psychology.” However, *PLOS ONE*, in the same year published almost 5000 articles in the “social sciences” category. For *PLOS ONE*, in 2015, 94.6% of articles were assigned the PLOS subject category of “Biology and Life Sciences.” In a comparison of *PLOS ONE* and Springer Nature’s *Scientific Reports* using “proportion of journals citing the two largest OAMJs,” *PLOS ONE* had a higher percentage of articles in the Scopus “Psychology” category than did *Scientific Reports* (which focuses much more on physical sciences; Wakeling et al., 2016). *SAGE Open* (launched by SAGE Publishing in 2010) publishes all articles OA with reasonable fees, but also follows a model that works well for green OA institutional repository efforts. *SAGE Open’s* options allow for the needs of authors and universities. Currently, SAGE Open is moving into publishing OA monographs on its platform as part of the program “SAGE Open Long Form: Open Access Monographs.” SAGE will charge a reasonable book publishing charge (BPC) and the monographs will be published with the liberal CC-BY license. This is a forward-thinking and innovative way to be able to publish more long form works, monetized by reasonable APCs that may or may not work for the social sciences and humanities. It is still early days for OA monographs (but it’s another fast-growing area.)

Further comparisons between *PLOS ONE* and *Scientific Reports* demonstrate that both charge what would likely be considered “reasonable” article processing charges with *PLOS ONE’s* APC for most articles at \$1,805 and *Scientific Reports’* (APC) at \$2,190 as of June 2022. However, there are some subtle (or not so subtle) differences. In 2015, the Journal Impact Factor (JIF) for *Scientific Reports* was reported as 5.228 while *PLOS ONE’s* was listed at 3.057. Similar data in Journal Citation Reports for 2017 reports Journal Impact Factor for *Scientific Reports* at 4.122 and *PLOS ONE* at 2.766. The 2021 JIF for *PLOS ONE* was 3.752 and for *Scientific Reports*, 4.996 (Journal Citation Reports, 2022). *Scientific Reports’* JIF has been, from 2015 to 2021, higher than *PLOS ONE’s*. *PLOS ONE’s* strict open data policy may be an issue, and *Scientific Reports’* data policy might be seen by some as less onerous because it only asks that authors share data *upon request*, rather than having data availability as a requirement (except in rare exceptions). There also appeared to be a slightly faster time to publication for *Scientific Reports*. These two journals appear destined for comparison and are obviously both important to psychological science. Whereas Springer Nature has a large stable of other subscription and gold OA journals surrounding its *Scientific Reports*, the PLOS journals are monetized strictly by APCs, with 91% of all PLOS papers published in 2015 found in *PLOS ONE*. Only 9% of articles were split among six other PLOS titles (Davis, 2016). In 2017, PLOS published 7% fewer papers, and in 2018,

publication output was down another 11%. Also, in 2017, *Scientific Reports* “overtook *PLOS ONE* as the largest scientific journal” (Davis, 2018). Do the OAMJ’s have any dilution effect on the available disciplinary journals? Clearly, the OA megajournals are a phenomenon to watch when it comes to scholarly communication in psychology, and provide a good channel for articles that are a good fit for many aspects of the discipline, especially those that may be interdisciplinary.

## “Predatory” (Fraudulent) Journals and Publishers

As gold OA journals and articles proliferate, there are some that conflate OA publishing with the phenomenon of unscrupulous publishers. As more “predatory” (also known as bogus, fake, deceptive, questionable, or fraudulent) publishers and journals seeking submissions flood the inboxes of many academics, some attribute some of this growth to the rise of Open Access. Of course, there are many high status journals that are OA, some having the highest impact factors in their respective disciplines. It is not the business model of a journal but the quality of its articles, judged by the scientific community, that separates the wheat from the chaff. However, a recent concern has arisen that due to various factors inherent in the global scholarly communication system, some authors do, in fact, intentionally choose to publish in journals that have been labeled “predatory,” even paying the usually lower APCs themselves, in order to get published. These articles are showing up in the search results of PubMed, institutional repositories, and other places online (and are cited in other studies), possibly affecting the quality and credibility of the scientific record (Manca et al., 2017). It is not only the inexperienced author that may get caught up in fraudulent journals, but there have been reports of well-known researchers publishing their work in bogus or fake journals. There are various explanations for this, but it is unclear why experienced scholars would fall prey to predatory publishers (Retraction Watch, 2016). As it does appear that some researchers are choosing to publish in these fraudulent outlets, maybe universities and research departments would be interested in this phenomenon. One study analyzes possible rewards for publishing in predatory journals (Pyne, 2017).

The so-called predatory publishers often display distinguished editorial boards on their websites, when in fact board members may have no knowledge of their position at the journal. As of January, 2017 (when it ceased publication), there were more than 1,000 of these publishers recorded on Beall’s List, a now defunct service that tracked these journals and publishers. Some publishers may just be new, or from geographically

underrepresented regions and may be trying to break into OA publishing, but the vast majority are scam publishers. There have been many attempts to demonstrate how these journals will publish just about anything. To demonstrate the lack of rigor of peer review in a wide cross-section of OA journals, Bohannon (2013) sent bogus papers, papers that should be easily identified as such to large numbers of OA journals, and they were accepted. This sting operation, while somewhat controversial in its tactics, did point out a variety of nefarious business practices of many new bogus journals. This sting was followed by many others that showed similar results.

In order to get a handle on this situation, some fields have analyzed the predatory publishing landscape from a specific disciplinary perspective. Publishing lists of problem publishers for each field may serve as a means of warning for those scholars that may not be able to readily identify some of these publishers. As an example, in a study of predatory publishing in neuroscience and neurology, 87 so-called predatory journals were identified as currently active (in 2016) in neurosciences, and those journals published 2,404 articles between 2012 and 2016 (Manca et al., 2017). One can assume that these articles are now finding their way into the scholarly record of neuroscience. It would be interesting to track the trajectory of these articles to see their eventual citation impact.

An example from psychology illustrates just how clever the spammers have become. In a discussion of the offerings of the bogus publisher, American Research Institute for Policy Development and their title listed as *Journal of Psychology & Behavioral Science*, that title's location and description revealed the following:

...that address is also listed as the office for the *Journal of Psychology & Behavioral Science*, but it is the bogus version, also run by the ARIPD, and should not be confused with the real *Journal of Psychology & Behavioral Research*." Both fake journal URLs use the same format—an acronym for the journal immediately followed by "net.com" so be on the lookout for that elsewhere. (Weinberg, 2016)

Many faculty and other researchers in psychological science have likely received solicitations in recent years from the publisher, OMICS Group (or OMICS International). OMICS boasts a sizable list of more than 700 OA journals, such as the title, *Journal of Psychology and Psychotherapy*. A simple look at the content on the journal's website would suggest that the title is suspect (<https://www.longdom.org/psychology-psychotherapy.html>). The OMICS website even includes a definition of the term "psychology" alongside its long list of psychology journal offerings (OMICS International, 2017). However, OMICS garnered the distinction of being the first publisher to be sued by the U.S. Federal Trade Commission for fraudulent practices (Federal Trade Commission, 2016). Following a 2018

ruling against OMICS (located in Hyderabad, India) for U.S. \$50-million for deceptive business practices due to their acceptance of "nearly 69,000 articles in academic disciplines with little or no peer review," there was little enforcement of the ruling, but the reputation of OMICS likely suffered quite a bit as the number of articles published in the 2 years after the ruling fell by 40% (Siler et al., 2021, p. 563).

Early career researchers or those from certain geographical locations may especially vulnerable to these schemes that offer to quickly publish an article in a scholarly-sounding journal, or to present a paper at a familiar-sounding disciplinary conference. There have been many online guides prepared around this topic to help researchers identify quality publication outlets for their work. One high profile initiative, the product of publisher's groups and other interested organizations is a useful checklist entitled "Think. Check. Submit." (<https://thinkchecksubmit.org/>) which provides helpful information that can be used by authors to avoid the so-called "predatory" publishers. This tool gives all authors some guidelines to follow as they seek to ensure that OA journals under consideration are credible. Many universities likely recommend Think. Check. Submit. to their students, and they have recently released a brief video that may be useful ([https://youtu.be/kmHdR\\_hlG9Q?si=MwmOeeTBIZYgOxtR](https://youtu.be/kmHdR_hlG9Q?si=MwmOeeTBIZYgOxtR)).

Once there was money to be made from authors eager to publish or present their work at conferences, unscrupulous parties set up shop to collect that money as well. The phenomenon of fake/bogus conferences is also growing and many psychology researchers at all stages of their careers have likely been invited to present at meetings that may even have names very similar to well-regarded conferences. Researchers eager to present their work may fall prey to conferences that either do not really happen, or are not credible (Asadi et al., 2018). A related initiative to the aforementioned Think. Check. Submit., is Think. Check. Attend....a guide to avoiding the predatory conferences that seek to make money from from the fees paid to attend (Mostafa, 2019). There are also some infographics that would be useful around teaching what predatory (fraudulent) publishing entails. One example from Australia, entitled "Predatory publishing: A to Z elements" has been circulated (TEQSA, 2022).

It has been postulated that Open Access is the reason for the exponential growth of predatory publishers, journals, and conferences. While Open Access is now a popular business model, used in various ways by all types of credible publishers, it should not be conflated with the use of the internet for publication schemes that are fraudulent. In every discipline and field, researchers need to be aware of the situation. Conflating OA with predatory publishing muddies the waters as scientific publishing is

moving forward using OA methods of different types. In terms of global diversity, equity and inclusion, we see many fledgling OA journals from geographic regions where OA is new, or where publishing in English is a challenge, or where publishing support is nonexistent. It is wise to look carefully before judging or painting regional journals (for instance) as (so-called) “fraudulent” too quickly. Open Access is a business model here to stay, so a more constructive strategy may be to make sure all available vetting tools are available in the OA landscape. Instead of using “blacklists,” researchers will need to avail themselves of “whitelists” which contain credible lists of vetted OA journals in every field. One example is the Directory of Open Access Journals (DOAJ), which in June, 2022, listed 1,198 journals in the category of Psychology, up from 240 in 1998 (and more than 155,677 articles indexed in the Psychology category) (Directory of Open Access Journals (DOAJ), 2022). Another entrant into this space is “Predatory Reports,” the database that began following the ending of Beall’s List that was formerly known as “The Journal Blacklist” from Cabell’s International. Predatory Reports is described on its website: “Specialists analyze over 60 behavioral indicators to keep the community aware of the growing threats and to keep academia protected from exploitative operations” (<https://www2.cabells.com/about-predatory>). This database is likely not widely known as it is a subscription database only available in some libraries. It has not caused the uproar that Beall’s List sometimes did when journals and publishers were called out publicly, and those publishers would often respond. One would hope that the terms “blacklist” and “whitelist” will be retired from use, as these terms are considered offensive and inappropriate. It is important for researchers, managers of repositories and others to know that there is no definitive list of so-called “predatory” publishers. The term “predatory” may still be in wide use, possibly due to the popularity of the now defunct “Beall’s List” ([https://en.wikipedia.org/wiki/Beall%27s\\_List](https://en.wikipedia.org/wiki/Beall%27s_List)). However, the term is considered undesirable by many in the scholarly communication community because it has often been applied, for example, to journal start-ups from certain geographic areas that may only need more support in publishing. In many cases, the well-meaning may have been labeled in similar ways to the bad actors. As there is not one master list, there is also not a known list of fraudulent or deceptive publishers for psychology.

### Major Indexes Covering Open Access Journals and Articles in Psychology

The Directory of Open Access Journals (DOAJ) is a major index that thoroughly vets fully OA journals and

articles before they are included in the database. DOAJ is led by dedicated individuals long associated with OA, and is a resource trusted by the community that is not associated with any commercial entity. This index, a major arbiter of quality for OA journals from around the world does exclude journals and articles that use embargoes (delays on publication) and those that employ the hybrid model (where only some articles in a journal have been paid up to be OA). This index, which was established in 2003 has become a major source of OA content (journals as well as articles) and is included in many library catalogs and discovery systems. DOAJ also functions as somewhat of a trustworthy source list for OA journals, especially since it required all journals to resubmit extensive information about a lengthy list of publishing practices in order to make sure each title reached the more stringent benchmarks for coverage in the index. As of March 2015, the index had winnowed down its list of included titles due to this quality assurance process, and from then on, all newly submitted journals to DOAJ had to attain certain specific characteristics in order to qualify for inclusion. The quality vetting process includes analyzing each OA journal for peer review process, copyright, plans for access by users, revenue sources, archiving plan, and more. DOAJ completed its reapplication process in December, 2017, with all included journals having reapplied to be included in the index. DOAJ can now be considered as a quality database of fully OA journals. DOAJ carefully analyzed 6,359 reapplications and 2,058 were rejected, along with removing 2,860 journals during this process because they did not reapply for inclusion. This entire process removed 40% of all journals in the database (DOAJ, 2017).

APA PsycInfo is the major subject and disciplinary index for Psychology and has been for all of its (almost) 100-year history. This indispensable abstracting and indexing database which covers only content that is peer-reviewed is probably found in all academic libraries. It is one of the few agreed upon “must have” academic library resources. APA PsycInfo is human-indexed by a dedicated group of experts from APA and as such, differs from many other databases that do not have this comprehensive level of expert oversight in terms of its content. APA experts produce the thesaurus that underpins the index. APA PsycInfo is used for search and discovery of the scholarly literature in psychology and has, for its long history (beginning with print) been produced by the American Psychological Association in Washington, D.C. Any journal seeking coverage by PsycInfo must meet strict criteria for inclusion. APA PsycInfo is likely one of the most recognized and popular resources in any academic library. It was produced in print (as Psychological Abstracts) for 80 years (from 1927 to 2006) and so has a long history as a resource for

those looking for trusted scholarly articles in psychology. APA PsycInfo may now be utilized as well as a comprehensive list for quality for psychology journals (including OA psychology journals), and adds value by indexing all quality journal titles that meet its coverage criteria regardless of business model employed by the journal publisher. Open Access journals listed in APA PsycInfo are searchable alongside subscription journal content and all are chosen after a rigorous application process (using published criteria) for relevance to the disciplines covered, scope, peer review, quality of publication practices and more (American Psychological Association [APA], 2017). Since many subscription journals include some author-pays articles in various issues (hybrid), those articles are also included in APA PsycInfo, and the index now includes an indicator that identifies this OA content, and articles are searchable by this filter. There are many OA journals that meet and even exceed these coverage guidelines. As of June, 2017, APA PsycInfo included 190 fully OA journals in its coverage list, bringing added credibility and visibility to each of those titles. The list of journals covered in APA PsycInfo can be accessed at: <https://www.apa.org/pubs/databases/psycinfo/journal-coverage-list.pdf>. In June, 2022, the number of fully OA journals covered in APA PsycInfo had reached 280, which is approximately 12% of the index's entire coverage. (V. Arnett, personal communication, June 21, 2022). This is an indication of the important and upward trend of OA to the corpus of psychology literature.

More than ever in this time of information overload, there is value in having a vetted discipline-based abstracting and indexing service that uses human indexing and is responsive to the needs of researchers, searchers and authors. Looking at a very large-scale international survey of discovery that looked at the trend from 2005 to 2015 demonstrates that the use of abstracting and indexing tools is still valued in psychology (T. Gardner & Inger, 2016). Searchers find that some aspects of APA PsycInfo searching cannot be replicated easily by using other tools and methods. For example, searching for articles by type of methodology in APA PsycInfo adds value for the searcher and offers a contrast to the scattershot (and "all over the place") discovery process that a Google or Google Scholar search provides. APA PsycInfo, especially on certain platforms, would also be appropriate and necessary for psychology searchers completing systematic reviews (and other types of evidence-based reviews). Searching APA PsycInfo means a comprehensive search of all aspects of Psychology, with all peer-reviewed results from vetted scholarly journals. There are many options for those doing serious research in psychological science. Academic librarians and their libraries serve up the collections, tools and services that

facilitate research, and many libraries do include Google Scholar and other free tools as part of their suite of offerings. Besides APA PsycInfo, there are many library subscription databases (as well as freely available indexes such as PubMed) that index psychology content. Academic and research libraries usually pull these resources together in subject lists of databases that are accessed on site or remotely by university affiliates and sometimes also on site by the general public. All of these indexes would include access to a subject-based corpus of OA journal article content. At this writing, APA PsycInfo is not included as part of library webscale discovery services that use a single search interface (such as ExLibris Primo), and would be searched separately by library users. Unlike many databases familiar to library users that are not available to individual subscribers, APA PsycInfo can be accessed by individuals via personal subscriptions.

There are other sources that psychology researchers can use to vet journals for quality. Examples would be the publishers that are listed as members on the websites of the Open Access Scholarly Publishers Association (OASPA), the Committee on Publication Ethics (COPE), and the World Association of Medical Editors (WAME). According to the OASPA website, these three organizations "have collaborated in an effort to identify principles of transparency and best practice for scholarly publications and to clarify that these principles form part of the criteria on which membership applications will be evaluated" (Redhead, 2013). Interestingly, in 2017, there were so many recent requests for membership that COPE had to issue a statement that they needed to suspend membership applications for a brief time because of volume (Committee on Publication Ethics [COPE], 2017). Journals that have been added to research library collections or library discovery services have usually been vetted for appropriate quality before being added to collections. Coverage by *Ulrichsweb: Global Serials Directory* ([www.ulrichsweb.com/](http://www.ulrichsweb.com/)), another library database that indicates peer review status of a journal title, and coverage in all major citation and selective subject indexes such as *Web of Science*, *Scopus*, and many others accessed via research libraries indicates a diligent vetting process.

A major search engine for OA content, one used widely by faculty, students, practitioners and the public would be Google, or especially the heavily used Google Scholar. Google Scholar has become extremely prominent and heavily used in the landscape of scholarly search (including search that starts in a library), and even looking at a comparison with Google, "people working in psychology have a strong preference for Google Scholar" (T. Gardner & Inger, 2016). In an updated version of Gardner & Inger's report using input from more than

15,000 academic searchers (published in 2021), the continuing importance of Google Scholar is spelled out: “Google Scholar continues to be the dominant search engine used for journal discovery in the US and most European countries (p. 7),” and “it is only those in life sciences who value A&Is more than Google Scholar and this is likely to be down [*sic*] to PubMed. Google Scholar is rated as most important throughout the rest of the science subjects” (T. Gardner & Inger, 2021, p. 7).

Google Scholar provides a cross-disciplinary search of Open Access content, offering a selection of available versions of articles. Much psychology content may be discovered via a search of Google Scholar. With all available versions of an article (subscription and OA) displaying together on one record, searchers will be able to freely access the author’s manuscript, or if they are affiliated with a subscribing institution, they will be able to click through to access the otherwise paywalled content. Thus, Google Scholar is an excellent search engine for searching for OA content, and for checking to see if a free version of a subscription article has been made available by its author in an institutional repository or other service. The size of Google Scholar is still unknown, frustrating attempts to compare it with other citation databases. Unlike PsycINFO, Google Scholar is not transparent about its coverage; for instance, about its criteria of what it deems “scholarly” is not available. In fact, a Google Scholar search will also turn up articles from all publishers, and those deemed bogus or fraudulent would be included in results as well. One negative aspect is that Google Scholar searches do return results including articles in so-called “predatory” (fraudulent) journals, so the coverage is fairly comprehensive as far as all journals are concerned (without quality checks of any kind). Still, it is an indispensable one stop shop that is simple and easy to use, and returns results quickly (by simple keyword searches) that are on target. Google Scholar is a favorite of searchers seeking peer reviewed content.

It would seem a positive development for new search services to provide good alternatives to the comprehensive and popular Google Scholar. It is estimated that Google Scholar indexes 87% of all of the scholarly papers on the web, and a rough estimate published in 2014 showed about 114 million English language papers published (with approximately 100 million indexed in Google Scholar). The same study estimated that one in four scholarly papers overall are freely and publicly available on the web (Khabisa & Giles, 2014). It would seem to be important to include Google Scholar in any search for psychology content, particularly OA content. Use of Google Scholar has certainly become a quick shortcut and alternative to subscription databases for many searchers seeking scholarly articles from many sources, or free versions of peer reviewed articles that are

otherwise not owned by libraries (or are behind publisher paywalls). Many libraries partner with, and include Google Scholar alongside all of the other indexes and databases available to users directly from the library website. Libraries partnering with Google Scholar facilitate seamless access to subscription full text content. The value of Google Scholar as a freely available and easy to use discovery mechanism as well as a portal to a vast amount of OA content is an amazing value add to the scholarly communication system for psychology and all other disciplines.

For those seeking only openly available articles, there is no comprehensive solution for an article-based delivery system that would include *all* OA content. One category that is problematic for discovery in libraries and on the open web are the OA articles in hybrid journals that have been made OA individually as part of traditional subscription journals. These articles, having been made open OA through payments by authors (or funders) appear alongside paywalled articles in subscription journals. It has been difficult to study these random OA articles in the usual discovery systems or search results due to a lack of consistency around clear identification of the open status of these articles (Chumbe et al., 2015).

## Open Access and Research/Citation Impact in Psychology

One issue that has persisted in terms of Open Access is the question of whether publishing one’s articles OA increases the impact of scholarship. Many studies over the years have demonstrated that “Open Access increases research impact,” with only a very few studies refuting this assertion (McKiernan et al., 2016). These studies were at one time aggregated on a website produced by SPARC Europe entitled *The Open Access Citation Advantage (OACA)*. After updating these studies of OA citation advantage for many years, SPARC Europe declared that, “In 2016 SPARC Europe decided not to further update The Open Access Citation Advantage Service since the citation advantage evidence has now become far more common knowledge to our authors” (SPARC Europe, 2015). While opening a paper up to the global readership and removing paywalls would seem like an obvious way to gain citation advantage, there are a very few studies that refute the idea of “citation advantage” but the majority of studies show the distinct citation impact advantage for any researcher to make every work OA (either green or gold or both). Studies continue to analyze this aspect of OA, and to reiterate the citation advantage (Frontiers, 2021).

In one large study completed in 2016 of 3.3 million papers published from 2007 to 2009 (and indexed in the Web of Science), it was demonstrated that not only is



there a citation advantage due to OA, it is “green” OA (OA due to repository deposited versions of papers) that produced the maximum research impact. When broken down by discipline, “Psychology & Cognitive Sciences” (with more than 70,000 papers studied) also showed this OA impact, with the most impact for green OA articles. Hybrid articles (single OA articles in a subscription journal issue) were not included in this study. In terms of traditionally published articles, “publishing in paywalled journals is the least impactful strategy overall” (Archambault et al., 2016). Of course, depositing a copy of a paywalled article’s Accepted Manuscript (AM) in a repository online would greatly increase its dissemination to all of the readers without subscription access, and likely its research impact. In an earlier cross-disciplinary study (2005) of ten disciplines including psychology (replicating earlier studies of single disciplines), it was also found that making papers OA confers a citation advantage. All disciplines in this 2005 study showed an OA citation advantage, with psychology showing a 108% higher citation advantage for papers that are OA (in comparison to 36% for biology, for instance) (Hajjem et al., 2005).

Researchers must take note of OA strategies that can produce the most citation advantage for their papers. Institutions may promote the deposit of all university-authored scholarship in the institutional repository via the passage of OA policies in order to, in part, maximize the impact of the collective scholarship of all of its researchers. This strategy also reinforces rights retention for authors that enables them to make versions of their articles available online to interested audiences (via repositories or preprint servers, for instance). Another large benefit is to have not only lists of scholarship, but actually full text OA articles (in PDF or Word) available from the university for global download. Both individual faculty members as well as institutions benefit from passing OA policies and developing institutional repositories and associated services that promote maximal green OA. University researchers can easily see not only numbers of downloads but geographic location where a paper is being downloaded. This kind of usage information is very compelling, especially when the subject of study is most relevant to a specific geographic area. Librarians and departmental faculty often work together to implement services and tools based around OA policies, and in doing so, move a conversation incrementally out into the university to all university researchers in all disciplines. The conversation must be field-specific and not “one size fits all” in order to be successful (Otto & Mullen, 2019).

Traditional impact metrics, such as Journal Impact Factor (JIF) are heavily ensconced in academia. The JIF, a proprietary metric established years ago, has

relevance to psychology and all other science and most social sciences disciplines. This metric was first developed to aid librarians with collection development issues in a print age when cancellations always loomed large due to budget pressures. Debate rages over the JIF, but it maintains its followers in academia, and every year (usually in June) publishers, universities, editors and authors await the new annual JIF numbers to be reported in the *Journal Citation Reports (JCR)*, a subscription index produced by Clarivate Analytics (formerly Thomson Reuters). There are a few whole countries as well that focus on this metric as a proxy for journal quality. Outside of research assessment exercises that use JIF to rank journals (beginning with the U.K.’s Research Assessment Exercise (RAE) in 1986, for instance), some countries even pay cash incentives to authors that are fortunate enough to author an article that is published in a high impact journal. One author in China has reportedly been paid various sums up to the equivalent of \$165,000 for an article published in a high impact journal. One study reports that the average price of \$43,000 has been paid to a first author from China that was able to get an article published in *Science* or *Nature*. These two titles have received the largest cash rewards in China. Outside of those two high impact titles, payments were made for each eligible article based on its journal’s JIF. Smaller sums are paid in some instances even in the U.S by certain institutions. This type of incentivizing the publication of research results is not widespread and can be problematic (Abritis et al., 2017). In 2020, a new national policy in China, coming out of the science and education ministries forbade these cash rewards. Mallapaty (2020) reports that, “Chinese institutions have been told to stop paying researchers bonuses for publishing in journals, as part of a new national policy to cut perverse incentives that encourage scientists to publish lots of papers rather than focus on high-impact work” (p. 18). No discipline or journal seems immune to a focus on the impact of research output as measured by today’s Journal Impact Factor (Clarivate, as published in their proprietary index, Journal Citation Reports). Many a publisher features this metric prominently on its website and many email customers touting this year’s higher number. It is still the case that publishing in a high impact journal (as reported by Clarivate) can be the currency of tenure and promotion and contributes to reputation building in every STEM (Science, Technology, Engineering, Mathematics, and Medicine) and social sciences field.

In today’s article-level publishing landscape, the JIF has little meaning for evaluating the impact of an individual article or author in any particular journal. One major criticism of the continuing use of the Journal Impact Factor is that all articles in a high impact journal are

obviously not of equal quality, and many stakeholders are eager to move instead to article-level metrics along with metrics that evaluate the work of individual scholars such as *h*-index. There are also issues with the coverage list that Clarivate Analytics uses and there are constant calls for new journals to be added to the citation indexes and to the *Journal Citation Reports (JCR)*. In part, to mitigate the long period it takes to get coverage of many new journals that are of interest (and to extend the scope of coverage without issuing JIFs), the *Web of Science: Emerging Sources Citation Index* (Clarivate) has been available since 2015. Another issue with the JIF is that some fields have much higher impact factors across the titles within the discipline and so impact factor cannot be compared across different fields without normalization. Particularly for psychology, increasingly crossing into other disciplines and subfields, impact factors may be misunderstood as reported, with much lower numbers for some areas that cross more into social sciences areas, and highest for multidisciplinary journals like *Science* and *Nature* that reach a wide cross section of scientists. Quantitative comparisons can only really be understood by those in the same niche area of scholarship, normalization is necessary, and one field's metrics can be completely different from another's.

An added challenge for studying citation impact in psychology in the print era was the physical split on library shelves (the only place to access citation metrics) between social sciences and sciences in the citation indexes. In some cases, the indexes were even in different libraries on different campuses (science and social science libraries). In terms of citation analysis and metrics, the phenomenon of citation analysis and Journal Impact Factor (JIF) calculation began with the print citation indexes produced by the Institute of Scientific Information (ISI) and were the brainchild of the late Eugene Garfield. In the print-based past, where the indexes for citation analysis and Journal Impact Factor were found in massive runs of volumes on shelves, psychology could be a challenge for librarians and researchers. Psychology always straddled the two print citation indexes, Science Citation Index (SCI), and Social Sciences Citation Index (SSCI), along with the print Journal Citation Reports (JCR), the resource that reports Journal Impact Factor. The print JCR (and early digital iterations of that resource) always presented a challenge for psychology due to the split between sciences and social sciences, with content likely in both sections. Citation searching was often difficult for psychology researchers in the print era due to the need to search the Science Citation Index as well as the Social Sciences Citation Index for a comprehensive look at some fields of psychology. The print citation indexes (with their tiny print) were sometimes accompanied in

the library by large magnifying glasses for those that struggled to read the small tabular listings in the various sections of the long runs of the indexes. In the print days, the split between the disciplinary areas sometimes put different sections of the indexes in different physical libraries on the same or different campus. The index would finally move to online where all of psychology is searched in one file via Web of Science, and its companion, the online Journal Citation Reports (JCR). A very popular use of the citation indexes, whether print or online has always been the ability to do "cited reference searching," where an older article, or that one important seminal article on a topic that is right on target for a research query can be brought up to date by checking all papers to date that have cited that original. Cited reference searching can be very valuable for researching very niche areas of inquiry or extremely obscure topics.

JIF can be accessed for each year, or as a 5-year metric in the *Journal Citation Reports (JCR)*. This, however, is only true if a researcher happens to be affiliated with a research institution that provides access to the index. Comparing journals by JIF will not be easy for the researcher unaffiliated with a subscribing institution, and that author will depend on publishers' lists and journal websites. With tough competition for library funding of databases, not every university will have access, although *Web of Science* (and its companion, *Journal Citation Reports*) are considered standard -and many would say indispensable research library databases. Citation metrics and the JIF that began with Garfield at the Institute for Scientific Information are really entrenched in academia. It seems that no amount of trying to steer researchers, research offices and university administrations from a focus on traditional metrics such as Journal Impact Factor (JIF) has so far been successful.

Because it is not "business model" (whether a title is OA or traditional subscription, for instance) of a particular journal, but instead citation traction that determines Journal Impact Factor, OA journals can certainly attain top impact factors in many disciplines. This is a common myth around Open Access, the somewhat pervasive idea that fully OA journals are never high impact. The publication of the JCR 2021 (released in June 2022), showed fully OA journals showing up in more fields in top spots. JCR also reports percentage of "gold OA" in individual journal titles, allowing searchers to see whether journals are mainly traditional subscription titles that have not moved to publishing any OA articles, or whether at least a robust percentage of articles in a particular journal are being made OA (percentage of OA articles in a hybrid journal). Searchers will see many biomedical-related (and other areas that are robustly funded) in the top JIF journals. However, there are some major journals, such as the journal in the #4 position overall in the JCR (for all

journals in all fields), *New England Journal of Medicine*, showing zero percent gold OA, maintaining an extremely high JIF without having *any* OA articles. Because there is general consensus that OA increases research impact, one wonders whether much more citation impact could even be realized by these top JIF journals if they flipped to OA. The sustainability of the subscription only approach will be interesting to watch, as publishing in those traditional titles will also not satisfy funders' mandates for OA, such as those from cOAlition S/Plan S, or newer recommendations for U.S. agencies from the U.S. Office of Science and Technology Policy as part of the Nelson Memo, for example.

For JIFs for 2021, the "group" Psychiatry/Psychology has 16 categories that include more than 1,500 journals, and not many are OA. In the JCR category, Biology, three fully OA (and fairly new) journals, *PLOS Biology*, *eLife* and *BMC Biology* were in the top five for overall impact for a period of years beginning in 2013 (Clarivate Analytics, 2016). Biology has much more of an OA percentage of its literature than Psychology that is listed as OA. In the 2022 JCR, five of the top 10 JIF titles in Biology are more than 99% OA articles. While *PLOS Biology* is no longer listed at #1, it is listed at #6 in 2022, with the top 10 also listing *BioScience Trends* (#7), *eLife* (#8), *Biological Research* (#9), and *BMC Biology* (#10). All of these are OA journals, and the number of OA articles available to a global readership in Biology is large. Psychology provides another narrative that raises interesting questions about the commitment of the discipline to OA or to public access. For the main category, Psychology, no OA journals are in the top 10. For the category, Psychology, with 80 journals, the #1 listed title is *Annual Review of Psychology*, with only 1.22% gold OA articles, virtually no OA articles for the current year. How amazing that this journal will be completely OA when Annual Reviews flips it to all OA as part of their "Subscribe to Open" program in 2023. All articles then will be OA for everyone in the world as long as subscribers keep up their levels of support. It will be interesting to see the results, citation traction and JIF-wise, once the *Annual Review of Psychology* flips to OA in 2023. With an already #1 impact factor, numbers will likely increase more. As for *any* journal in that Psychology category having more than 60% OA, we don't see that until #21 on the JIF listing (out of 80 titles). *Social Cognitive and Affective Neuroscience* (Oxford University Press), with more than 99% OA, is at #21 out of 80. This is clearly very different than what can be seen for Biology with its OA percentages much higher and involving many more OA journal titles. At least this is an improvement from earlier JCR releases, such as 2016. For Psychology (all categories

in the 2016 JCR), fully OA journals did not show up until title number 93 (of the top 100), sorted by JIF. Psychology may want to focus on improving the number of OA articles in circulation, especially in terms of social impact and visibility of the discipline's scholarship. More focus on Open Access is definitely needed in Psychology if an increase in the proportion of scholarship that is OA is to be realized. There are really no impediments to this goal, with both gold and green strategies fully available. Psychological science, with its large current focus on open science would seem to also need to ensure that more of its published research literature is publicly available to a global readership, and full OA (with reuse and remixing rights) could be a goal.

There is positive news for some of the fully OA (not hybrid) titles. Two of the Frontiers journals, *Frontiers in Human Neuroscience* (JIF 3.209) and *Frontiers in Psychology* (JIF 2.323) are also the top two OA journals by total numbers of cites (12,836 and 14,320, respectively in 2016). By 2021, both OA journals showed a higher JIF, and an increase in citations to the titles. *Frontiers in Human Neuroscience's* JIF rose to 3.473, and its number of total cites to 28,005 in 2021. *Frontiers in Psychology's* JIF increased to 3.23, with 14,320 total cites. Clearly, OA titles are important in the list of impactful psychology journal titles, and have become more prevalent on top 10 lists. In the JCR, a useful metric is the percentage of gold OA articles in each journal, allowing comparison between disciplines to see just how few OA articles are in some of the top journals. Of course, many psychological scientists are publishing in the multidisciplinary titles such as those published by PLOS. The coverage criteria for Journal Citation Reports (and its JIF) is strict, and inclusion in this selective index is the result of a somewhat lengthy application and vetting process. For good or bad, some say that JCR only includes the "elite" journals of every discipline; many feel that inclusion in JCR has real meaning for a journal title. Others feel that the database should be much more inclusive, including journals from outside the United States and United Kingdom/Europe, for instance. For strictly OA journals in all categories of Psychology in the JCR 2016 (reported in 2017), out of 747 total journals, 36 are listed as fully OA. Total numbers of psychology journals as well as numbers of OA titles have grown since the last annual JCR. The publisher Frontiers, in analyzing the 2015 JCR listings for its psychology titles states "the results are more significant if one considers (that) Frontiers does not engineer the IF by setting a rejection rate, and instead operates an impact neutral peer-review process" and significantly, "Frontiers in Psychology was launched in 2010. In just 4 years, it has become the

largest and the 2nd most-cited psychology journal in the world” (Frontiers Communications, 2015).

Frustration with the singular use of JIF for evaluating the evolution of a journal title has incentivized some journals to take a broader view of their status, using other tools available from Google, or from subscription resources like Scopus (Elsevier) and Web of Science (Clarivate). In order to understand the impact of the first 10 years of the *International Journal of Psychology & Psychological Therapy (IJP&PT)*, the title was studied in the three resources. This case study of a single psychology journal, published in Spain, using the three major citation databases showed once again that “This analysis has highlighted the disparity of the results that each database offers on the same goal: to know by who, when, and how many times a particular article published in a given journal was cited” (Roales-Nieto & O’Neill, 2012, p. 474). Comparing and contrasting results in these three databases creates some level of confusion with those using the various metrics sourced from these resources to evaluate journals, articles and individual scholars.

Due to frustration over unchanging patterns of evaluation for promotion and tenure that rely heavily on impact measured by the JIF, a variety of statements worldwide have been issued asking for reform of systems of evaluation that are entrenched in academia. A prominent statement, the 2012 *San Francisco Declaration on Research Assessment (DORA)* (<https://sfdora.org/>) states that “there is a pressing need to improve the ways in which the output of scientific research is evaluated by funding agencies, academic institutions, and other parties.” DORA states the deficiencies in the JIF and the use of journal-level metrics in promotion and tenure decisions and makes recommendations for stakeholder groups in moving away from the JIF as a proxy for research quality. At least one journal has even included DORA on their information for authors. *Perspectives in Psychological Science*, on its website states that “The Association for Psychological Science is a signatory of DORA, which recommends that journal-based metrics not be used to assess individual scientist contributions, including for hiring, promotion, or funding decisions” (Sage Publications, 2022). On its website, while this journal warns about using certain metrics for evaluating individual authors or articles, they do provide a series of metrics for those that want to evaluate and assess the journal itself. Societies can also come out with statements that speak to the members, and set out expectations. The Linguistic Society of America (2020) published their “Statement on the Scholarly Merit and Evaluation of Open Scholarship in Linguistics” where they discuss the Society’s recommendations around the

field’s open sharing of publications, data, preprints, software and code (as examples) while also discussing implications for review, promotion and hiring (Linguistic Society of America [LSA], 2020).

Similarly, another well-known statement, the *Leiden Manifesto* offers a list of 10 principles to guide research evaluation and to combat what its framers see as “impact-factor obsession” (Hicks & Wouters, 2015). A major exercise that reviewed the uses of various metrics and indicators for assessing the U.K. research system produced a report entitled *The Metric Tide* (<https://responsiblemetrics.org/the-metric-tide/>). Another project, The Humane Metrics Initiative (HuMetricsHSS), in their values statement offers that:

while perverse incentives and harmful metrics exist across all disciplines, current evaluation systems are particularly ill-matched to the values that animate much research in the humanities and humanistic social sciences. We focus our efforts on these disciplines, with the understanding that the frameworks we create should and can be applicable to STEM (science, technology, engineering, and mathematics) fields as well. (<https://humetricshss.org/>)

Another statement, signed by institutional and individuals is the *Hong Kong Principles*, described on their website as “The Hong Kong Principles for assessing researchers were formulated and endorsed at the 6th World Conference on Research Integrity, June 2019 in Hong Kong” and that “these principles will help research institutions that adopt them to minimize perverse incentives that invite to engage in questionable research practices or worse” (<https://wcrif.org/guidance/hong-kong-principles>). Another important initiative with a focus on research assessment is CoARA (Coalition for Advancing Research Assessment), which states in its “Agreement on Reforming Research Assessment” (p. 2) on its website (<https://coara.eu/>):

Our vision is that the assessment of research, researchers and research organisations recognizes the diverse outputs, practices and activities that maximise the quality and impact of research. This requires basing assessment primarily on qualitative judgement, for which peer review is central, supported by responsible use of quantitative indicators. Among other purposes, this is fundamental for: deciding which researchers to recruit, promote or reward, selecting which research proposals to fund, and identifying which research units and organisations to support.

As for *The Metric Tide: Report of the Independent Review of the Role of Metrics in Research Assessment and Management*, one purpose of undertaking this large study was to compare the use of metrics and peer review and to make recommendations for moving forward. Peer review retains an enviable position in the research system

and the report states that “peer review, despite its flaws and limitations, continues to command widespread support across disciplines” and “metrics should support, not supplant, expert judgement” (p. vii). This report provides clear guidelines for the use of responsible metrics in evaluation and assessment, and the need to develop a “basket of metrics” that is appropriate to the discipline and subfield (Wilsdon et al., 2015). In addition to large differences in impact factor numbers between disciplines (with the need to normalize across disciplines for comparison purposes), there are also vast differences in what each discipline considers its research outputs. Some disciplines are heavily book-based, others publish research primarily as conference proceedings, still other as working papers. For the Unit of Assessment (UoA) 4, Psychology, in the REF2014 (comprising the areas of Psychology, Psychiatry and Neuroscience), the total of 9,126 submitted research outputs included: 10 authored books, 1 edited book, 16 chapters in books, 9,086 journal articles, 4 conference contributions, 4 website content items, 1 research report, 1 “other,” and 3 working papers. This list of output types demonstrates the similarity of the Psychology grouping to Biological Sciences, for instance, in terms of types of outputs, and how differently certain other disciplines represent their scholarly output (Wilsdon et al., 2015). Seeing a chart of the four top disciplinary outputs submitted by each individual researcher who is required to do so by the REF allows a snapshot into what type of research outputs are valued by U.K. researchers in the various disciplines for submission to the highly important research exercises. The results of REF2021 (reporting on 157 U.K. universities) are ready for analysis from its website at: <https://www.ref.ac.uk/> with summary information for UoA 4 found at: <https://results2021.ref.ac.uk/unit-of-assessment-summary/4>. There has been a focus on how to encourage interdisciplinary submissions. One comment made about the Unit of Assessment (UoA) category 4 for Psychology, Psychiatry, and Neuroscience was that:

we have explored how best to support and represent the activity undertaken by the neuroscience and psychology communities that will be submitted to UOA4. We are aware that there are some concerns over the differential tariff attached to this UOA. However, we are extremely keen to see unitary neuroscience and psychology returns to UOA4 – best reflecting the UK’s clear strength and growing interdisciplinarity in this area. (Iredale, 2019)

Some early career researchers have signed onto DORA and other initiatives. However, the JIF does not show signs of going away, and this is one reason that those that work in areas of OA (such as university OA policymaking) must continue to assure faculty authors that an institutional OA policy (or funder mandate) in

no way changes the fact that authors must publish in the journal of their choice. A researcher’s choice of journal publication is based on many factors, and certainly one of them would be JIF, reflecting the continued “publish or perish” situation that exists in academia today, most especially at the increasingly research intensive universities where rankings of all types are top of mind for faculty and administrators. When working on passage of OA policies and speaking with faculty across the institution, researchers often conflate an Open Access requirement for self-archiving of article-type scholarship (green OA) with a mandate to publish in OA journals. In addition, that may have connotations of paying to comply with institutional or federal policies (due to the commonly held notion that all OA journals charge APCs). On top of that, for many authors, OA has been associated with the media reports of the many bogus, fake (or predatory) scholarly journals. JIF is another imprimatur that authors and universities use to measure quality of outputs, even when it is not always the most appropriate metric. Keeping up with a deluge of journal titles (and an exponential growth of articles) as well as a variety of complex business models may be a challenge for busy academics. In terms of OA mandates of various kinds, the issue of academic freedom pops up occasionally, setting out the foundation that a basic tenet of academic work is the ability for a faculty member to choose the journal publication outlet unimpeded by outside factors, such as those imposed by funders around OA status of particular journals. For institutional OA policies that focus on green OA, the availability of the “opt out” or waiver from the policy for any specific article allays any such concerns. Authors find that even most commercial publishers allow a variety of green OA strategies around earlier versions of an accepted article. Librarians and funders provide consulting around OA strategies that can work for almost any article. Even in a journal without a JIF, or one with a lower number, publishing in OA journals or disseminating Accepted Manuscript (AM) versions via a repository or other similar service will still garner other types of demonstrable metrics (such as worldwide downloads). This is especially compelling when downloads come from areas where paywalled articles would not normally get disseminated to communities that are the subject of the study.

Journal Impact Factor (JIF) from Clarivate was the only journal level citation impact metric available for many years until, in 2016, Elsevier debuted the new journal level metric, CiteScore, available as part of the *Scopus* “basket of metrics.” Metrics are available for the more than 28,100 peer reviewed journals covered in *Scopus* as of 2023 from 7000+ publishers that cover 333 disciplines (Elsevier, 2023). CiteScore necessarily covers a longer list of journals than what is found in the *Journal*

*Citation Reports* (reporting JIFs), but time will tell whether CiteScore will pick up traction as a true competitor to the JIF. This metric is now visible on journal homepages and provides an alternative measure of journal-based citation metrics, especially for those many journals that do not have a JIF. One of the selling points of CiteScore was exactly that; that it covered a much larger number of journals than the more “elite” coverage of Web of Science. The metrics for journals listed in *Scopus* in the Psychology category can be searched from the freely available CiteScore metrics page (Elsevier, 2017). CiteScore metrics (using data from Elsevier’s *Scopus* database) for 2021 were released in July, 2022, allowing researchers to see trend data for a period of years on the citation impact of more than 20,000 journals and other publications. CiteScore values are freely available at: <https://www.scopus.com/sources>. Psychology and its subfields can be searched using a simple dropdown, and interestingly, above the well-known, high impact journal titles with the highest CiteScores, the #1 highest CiteScore listing under Psychology is *Psychological Science in the Public Interest, Supplement*, which is directly followed by the more expected *Annual Review of Psychology* (#2) and *Trends in Cognitive Sciences* (#3). The methodology and use of various filters and search strategies cannot be directly compared with those used to calculate the proprietary Journal Impact Factor for the same titles. Those interested in journal performance will find interesting and valuable information from looking at both Journal Impact Factor and CiteScore, but JIF will likely, due to its long history and focus of academia, still have the name value.

As the transition to Open Access continues, some of the journals with the highest impact factors are able to charge what many researchers feel are exorbitantly high APCs. The example of *Nature* is a common one, with its high impact factor, which is, in part (along with its high rejection rate) is said to justify an APC (2020) of \$11,500 for a single paper. Whether JIF will lose its relevance in a new world of article-level discovery and a more even playing field remains to be seen. The trajectory toward irrelevance for the JIF may already be happening, even though it is still a major focus of research assessment exercises and a cornerstone metric for evaluation of the journals used by faculty authors and whole departments and universities. JIF is still a proprietary metric and a subscription is required to do comparisons of impact factors between psychology journals. Journal websites now often list Journal Impact Factors in order to attract authors to higher impact titles. The announcement of the new JIFs each year is always an anticipated moment for many journals and editors. Within psychology, across the subfields, a researcher would have to expect a very wide range of impact factors and promotion and tenure and research assessment exercises would need to take

that into account (rather than use any one size fits all approach). The neurosciences and cognitive sciences numbers cannot be compared with the titles that lean more toward social science or even humanities. Many psychology journals, whether due to subfield, niche, or year of debut (or other factors) will not have a JIF (or a CiteScore). There is often a misconception that all journals will have these metrics.

Nothing has the history and reputational traction of Journal Impact Factor (JIF) which, regardless of DORA and other efforts, seems ensconced in academia worldwide (Niles et al., 2020). Now in its 8th cycle, the *Ithaka S + R U.S. Faculty Survey 2021* reports that “interest in open access is on the rise for American higher education faculty aged 22 to 44, while the journal Impact Factor continues to diminish in importance for most faculty” (Blankstein, 2022). Still, most faculty, early career researchers and publishers likely still see JIF as entrenched in academia in 2023. The reward systems of universities and subfields of most disciplines (except possibly humanities) are still focused on the high impact or prestige journals of each field.

Both Web of Science (Clarivate Analytics) and Scopus (Elsevier) provide an increasing variety of article-level metrics which scientists use to demonstrate citation impact for each of their works. These subscription indexes are likely consulted most often at the time of promotion and tenure actions in order to demonstrate research impact of the works of a particular author. While Google Scholar metrics are also widely used, there may be mixed reviews on the formal reporting of Scholar metrics in promotion and tenure actions due to the lack of transparency of the coverage criteria. Adding a next level (beyond only Web of Science and Scopus) of the various alternative metrics available would complete the information available on the impact of a work. All research metrics have different uses and audiences. Librarians in research institutions may be consulted for information around this complex area and some institutions are now hiring librarians with titles such as Research Impact Librarian. Universities may want to make sure that certain librarians and those in research offices are available to consult with faculty and other researchers who are eager to understand the complex basket of metrics available. With increasing accountability expected for university faculty and reporting systems becoming more popular, appropriate use of article and journal-level metrics make a difference in the success of individuals and universities in this increasingly competitive research environment. In terms of research impact, there are new tools and services emerging all the time. Concern continues to exist about which metrics to use for measuring research, and also about the issue of “gaming” of citation metrics (Patton et al., 2016). Challenges

continue to exist with the use of the widening array of citation tools to quantify impact of research for individuals, funders, publishers and universities. While Web of Science (comprised of Science Citation Index, Social Sciences Citation Index, and Arts & Humanities Citation Index) has been the long-established database, Elsevier's Scopus debuted in 2004, adding new tools and options for citation analysis to the mix. Web of Science (part of Clarivate's Web of Knowledge) also brought the psychology content together and now includes the discipline's content all in one completely integrated electronic index. Web of Science was challenged by the development of Scopus where Elsevier endeavored to create an index that was more inclusive in terms of content, hence to be considered less "elite" in its coverage while still employing a group of subject specialists to vet titles for coverage. At its outset, Scopus promised increased behavioral sciences content, more robust reporting of *h*-index, and a coverage list that included all of the titles included in Web of Science, as well as many more. As Scopus has developed, it has closed the gap in terms of years covered and metrics provided. Both Scopus and Web of Science offer different metrics and ways of presenting them, and both have criteria for coverage that presents a hurdle for some and an imprimatur of quality for others. "Cited reference searching" is also available in Scopus. Many publisher websites now also include "citing articles" information conveniently alongside research articles themselves. Some universities may not choose (or be able to) provide subscription access to both Web of Science and Scopus due to cost and also significant overlap between the two. Certainly, others feel that, at this point, both are necessary for current citation analysis and metrics purposes as well as for their usefulness in comprehensive cross-disciplinary search of the scholarly literature. Keeping an eye on the horizon shows new products emerging as competitors to the Elsevier and Clarivate products, for example Dimensions (Digital Science, <https://www.digital-science.com/products/dimensions/>), with its freemium model and expanded coverage. Dimensions has been utilized for many studies that focus on OA; how much, in what disciplines, what percentage of the literature, and much more.

Google Scholar is a very popular tool, not just for search, but for researchers that want to follow their citation impact. It has become a free and heavily used alternative to the traditional citation indexes for those without access to subscription products, or for those who simply prefer its well-known profiling features (and ease of use). Google Scholar produces its own available citation metrics that can be found in the "Google Scholar Citations" service. In terms of what it covers, Google Scholar pushes the limit for coverage of

everything that Google considers "scholarly" and does not publish its coverage index, creating a lack of transparency in some ways for the metrics it reports. Libraries partnered early on with Google and listed Google Scholar on their websites (at a time when only subscription databases existed on database lists), even as the index remained in beta (Mullen & Hartman, 2006). It is still in beta in 2023, and it has seemingly become essential and ubiquitous among researchers and readers for discovery of all types of research materials. It is still free, surprisingly, even as it provides immense value add to scholarly search. For citation metrics and profiles, Google Scholar is the next step for researchers and their promotion and tenure committees when works cannot be found in the more traditional citation indexes (Web of Science and Scopus), or when there is no subscription access to those institutionally subscribed resources.

For psychology, the products of scholarship included can be more wide-ranging than simply journal articles from high impact titles. Searchers using Google Scholar will find a much broader array of coverage of all kinds of research-related publications, including high quality traditional and OA journal publications as well as items such as blog entries or magazine articles. Many users appreciate the many features it presents, such as pulling together all versions of a single article in one place (pre-prints, postprints, versions of record, for example) and the possibility of searching across many subjects or disciplines at once (rather than searching a single subject's major index). Also, there is no fee for using Google Scholar on the web, which makes it the major discovery tool for connecting the world's researchers to available works, even works found in repositories or other Open Access vehicles on the web. Google Scholar is truly a gateway to finding scholarly OA content. What will happen to Google Scholar in the future? It remains essential, although somewhat mysterious.

According to Google Scholar, the popular Google Scholar Citations resource:

provide(s) a simple way for authors to keep track of citations to their articles. You can check who is citing your publications, graph citations over time, and compute several citation metrics. You can also make your profile public, so that it may appear in Google Scholar results when people search for your name...and your citation metrics are computed and updated automatically as Google Scholar finds new citations to your work on the web. (<https://scholar.google.com/intl/en/scholar/citations.html>)

The competition that exists with the citation indexes has ramped up both the number of metrics with which researchers need to grapple and as well as the number of various uses of these analytics. In recent years, and with continuing development of the three major citation

analysis databases, Web of Science (Clarivate), Scopus (Elsevier) and Google Scholar, researchers are presented with a variety of data and associated tools with which to analyze scholarly impact. With Web of Science once the only game in town, Scopus has continued to enhance retrospective literature (pre-1996) and other issues of coverage and at this point, can be used in direct comparisons with data in Web of Science. These databases, often accessed by academics through their university libraries (although many do not subscribe to one or both) are able to provide metrics for individual scholars such as *h*-index, as well as make available cited reference searching. Both provide search capabilities for users built on a quality-controlled corpus of scholarly publications. Comparisons cannot be made between disciplines using any of these tools in terms of metrics, without normalizing data. Certainly, an *h*-index of a biomedical researcher would differ greatly from that of a humanist. *H*-index is most often used for evaluation of particular individuals but sometimes is used in the aggregate (departmental *h*-index, for instance). *H*-index values differ greatly depending on the source of the data, a reason that many academics may have a preference for Google Scholar as its *h*-index values will be higher for any given scholar.

There have been calls for more cross-disciplinary comparisons of Web of Science, Scopus and Google Scholar. With an emphasis on metrics growing for individuals, universities and even entire countries, it is imperative that those performing evaluations as well as those being evaluated for promotion and tenure understand the strengths and weaknesses of each of these citation databases. Recent studies are making inroads in using the three major citation analysis databases for comparisons of research performance across a variety of disciplines (Harzing & Alakangas, 2016). Also, each of these resources has a different value to the various disciplines. The literature of psychology is well covered by these citation databases. While there have been many analyses comparing citations found in Web of Science, Scopus and Google Scholar, Martín-Martín, Orduña-Malea, et al. (2018) have provided a detailed systematic investigation of nearly two and a half million citations to a set of highly cited documents from 252 Google Scholar subject categories, including psychology. Across the subject categories, Google Scholar “consistently found the largest percentage of citations across all areas,” far exceeding that found in Scopus and Web of Science (p. 1160). However, the added citations found by Google Scholar were mainly from non-journal sources, such as dissertations, preprints, conference papers and more. Further, “the results suggest that as far as comprehensiveness in discovery of academic output, in all areas Google Scholar citation data is essentially a superset of Web of Science and Scopus,

with substantial extra coverage” (p. 1160) and that “the scientific impact of these unique citations themselves is, on average, much lower than that of citations also found by Web of Science or Scopus, suggesting that the Google Scholar coverage advantage is mostly for low impact documents. Taken together, these results suggest caution if using Google Scholar instead of Web of Science or Scopus for citation evaluations” (p. 1175). The specific findings from this study for psychology may be accessed at <https://osf.io/t3sxh>.

Expertise in citation analysis and comparison of tools can be found in every academic research library, especially among scholarly communication librarians and library subject specialists. A psychology or behavioral sciences librarian could provide discipline-based expertise to users of these products and would be a beneficial resource to faculty and others looking to analyze their personal or group impact. While librarians, especially in the sciences and social sciences areas have always had expertise in research metrics, this role may indeed become more primary, presenting a strategic asset to the university and its faculty.

In terms of research impact and citation analysis, the focus seems to be shifting and evolving away from the journal (the container) to the impact of the items within it (articles). It is understood that not all articles in a specific journal will have the same value or impact. The importance of the journal, the traditional vehicle or package, is still represented by the Journal Impact Factor (JIF) or Elsevier’s CiteScore, but today, the emphasis of discovery is often on the individual articles, each with a DOI, standing on their own. The move to an article-level economy where some journals (such as *PLOS ONE*) publish tens of thousands of articles in each single issue has caused disruption. However, disciplines protect and promote the high impact factor journals and publishing in one still confers career reward. This situation seems in no danger of abating, even as debates have gone on for years about the prestige of the so-called “elite” journals in a field. Particularly, in a situation where journals have become unbound in an article-level economy, searchers discover articles across a range of journal titles and peripheral subject areas, often using a search engine such as Google Scholar and “the most important literature is increasingly coming from a greater range of journals, not only the journals with the highest IF” (Lozano et al., 2012, p. 2144). Freely available discovery tools such as those from “Iscience” promised an “inclusive discovery platform aiming to index articles in all peer-reviewed journals, in all fields of research, in all languages and from all over the world” (<https://www.lscience.com/1findr/>). That index was discontinued due to low usage, and its producer, Elsevier, referred users to its Scopus and Mendeley products. New



free discovery services for research articles out on the web will struggle for attention now that Google Scholar is likely so integrated into a researcher's workflow. The internet availability of research articles has created a type of "democracy" for individual articles, where articles are found, used and cited outside of their traditional container, the journal. Larivière et al. (2014) stated that, even for "elite journals," the situation exists that "since the late 1980s and early 1990s, several new and some long-established journals have been becoming more important, whereas traditional elite journals, including *Science* and *Nature*, are publishing a decreasing proportion of the top-cited papers" (p. 653) and it has been demonstrated that "traditional 'elite' journals still have the highest citation impact, but other journals are also publishing an increasingly higher proportion of top-cited papers" (p. 655).

There are so many factors that impact citation rates of any given article. With the move to measuring impact of individual articles and authors, and in this age of ramped up focus on citation rates, it is important to consider issues that may affect how frequently psychology researchers cite individual works. One example from Stevens and Duque (2019) is the possibility that APA Style's requirement for psychology (as compared to the conventions that exist for biology and geosciences) that in-text citations be alphabetized by surname "biases citation rates." The study, published in *Psychonomic Bulletin & Review* reports that "we found that surnames earlier in the alphabet were cited more often than those later in the alphabet when journals ordered citations alphabetically compared with chronologically or numerically" and that "we suggest that journals using alphabetically ordered citations switch to chronological ordering to minimize this arbitrary alphabetical citation bias" (p. 1020).

Publishing is on the one hand, individual, (taking into account personal interest, rewards and incentives), and is also systemic. There are many factors, some out of the researcher's immediate control that dictate where one must (or can) publish, how a researcher's name appears throughout their career, and whether OA is chosen (or not). JIF is only one factor that can determine the outcome of a single publication's measures of success. In terms of who's publishing in OA outlets, Olejniczak and Wilson (2020) conclude that:

The OA publishing model succeeds in democratizing the products of knowledge producers, but the knowledge producers whose work is published as OA articles are not necessarily representative of the broader research community. The disproportionately larger numbers of OA articles from professors at elite institutions represent a challenge to the OA business model: to increase the representation of

scholars at a diversity of institutions backed by varying levels of research support among the OA literature. (p. 1449)

Niles et al. (2020) add that, regarding decision-making and rationale about submitting work that:

using an online survey of academics at 55 randomly selected institutions across the US and Canada, we explore priorities for publishing decisions and their perceived importance within review, promotion, and tenure (RPT). We find that respondents most value journal readership, while they believe their peers most value prestige and related metrics such as impact factor when submitting their work for publication." (p.1)

Niles et al. (2020) go on to mention the issue of the non-traditional publicly available outputs, including OA articles, stating:

The results presented here confirm that faculty perceive these publicly oriented outputs (e.g., blogs, pre-prints, and Open Access) as being far less important in the RPT process than other traditional research metrics and outputs. All this to say, it appears there is a continued need to hold conversations in academia about the nature of academic publishing and how publishing decisions are perceived in the RPT process." (p.11)

While the majority of faculty would likely agree with the values surrounding the need for the peer reviewed literature of psychology to be OA for the global readership, retention of author rights to use their own works as they choose, and for wide sharing, many would state that top impact factor (JIF) journals are not OA journals. They may not realize that traditional subscription journals allow repository deposit and dissemination. If an author pays the hybrid APC in a subscription journal, the version of record is liberally licensed. However, there is interest in the fully OA journals and many do confer prestige if a scholar is looking for that.

One study demonstrates gender disparities that may affect publishing output of psychology faculty. Mayer and Rathman (2019) studied the publication records of full professors of psychology in Germany and found that "female professors are less likely to publish in top ranked journals and are more likely to adopt publication strategies that are focused on producing book chapters in edited collections." Olejniczak and Wilson (2020), in a study of the U.S. research professoriate describe how it is indeed more often male STEM professors at prestigious research universities with robust U.S. federal funding and higher faculty rank that are most likely to have authored an OA article (p. 1429). There are differences across the broad disciplines in terms of who's writing OA articles, with scholars in the category of "Social and

Behavioral Sciences” more likely to work at public institutions, and that men are most likely to have authored at least one OA article (p. 1445). In discussions of equity issues around OA publication in academia, universities and funders must make sure to study the leveling of the playing field so that participation in publication of OA articles is understood, especially if Open Access is mandated. Analysis of diversity, equity and inclusion and the global Open Access participation in OA for the psychology literature must take into account the monetization of the corpus of literature, its accessibility to all authors and researchers (especially in the Global South), as well as other issues of science communication such as language and marginalization of non-English authors and readers. With the move toward open science/open research that has expanded the OA conversation, these issues of diversity, equity, inclusion and accessibility of research have continued to be a greater focus of many disciplines’ scholarly communication practices. One conference that targets these issues is the United Nations Open Science Conference, with its subtitle in 2023, “Accelerating the Sustainable Development Goals, Democratizing the Record of Science” (<https://www.un.org/en/library/OS23>).

Finally, as science is currently undergoing changes in the way research is carried out and its results communicated, there is evidence that two important aspects within psychological science, the literature of reproducibility, and the literature of open science are moving forward somewhat independently. There are issues at play of gender, diversity and collaboration. Murphy et al. (2020) state that “network analyses reveal that the open science and reproducibility literatures are emerging relatively independently with few common papers or authors. Open science has a more collaborative structure and includes more explicit language reflecting communality and prosociality than does reproducibility. Finally, women publish more frequently in high-status author positions within open science compared with reproducibility” (p. 24154). It will be important to make no strong statements that paint with a broad brush when the various literatures of open science are not moving in lock-step, but instead are retaining some of their own unique characteristics.

For psychology as well as all other disciplines, research evaluation practices have to evolve and expand to include more researchers and more products of research. When discussing the various statements that organizations stand behind, the focus on the Journal Impact Factor (JIF) seems stronger than ever. The “audit culture” is not diverse, equitable or inclusive; many are marginalized as rankings dominate funding and university aspirations. Senior scholars in psychological science and promotion and tenure

committees in schools and departments will need to determine if the situation will remain status quo. Hopefully, some of the lessons learned from the COVID-19 pandemic can be instructive in moving forward with an understanding of who participates—and who is rewarded—in our current research production ecosystem. Harle (2020) states that:

Many of the inequities which COVID-19 has exposed have been with us for a long time. Setting aside for a moment the very stark inequities in access to fundamental health services, and in the ability to maintain decent livelihoods, the pandemic has shown us how the ways in which we produce, communicate and use knowledge are riven with injustices and exclusions. And those injustices and exclusions extend to the ways in which different communities come together to agree priorities, and to generate and appraise evidence. They also extend to how that evidence is incorporated into decision making, policy and operational responses to a whole host of social, environmental and economic questions. (p. 1)

### Another Popular Metric for Evaluation of Individual Researchers: The *h*-index

Measuring journals against each other using impact factor did not satisfy those that wanted a metric to compare productivity of individual researchers. One metric that has developed traction in many fields for evaluation of an individual scientist is the *h*-index, proposed as “an easily computable index, *h*, which gives an estimate of the importance, significance, and broad impact of a scientist’s cumulative research contributions” (Hirsch, 2005, p. 16572). The *h*-index is felt to be a more effective indicator of an individual scientist’s total contribution, and takes into consideration quantity of papers as well as citation activity of those papers. Although developed as a measure of impact for an individual scientist, some have used a subset of *h*-index to compare journals. Google has used *h*-index as the basis for two of its popular metrics services. Google Citations, a service where individual researchers set up citation profiles, will display the *h*-index of an author. Google Metrics also uses a subset of *h*-index to compare journals (Antell et al., 2016).

Google Scholar also has developed a metrics resource where *h*-index is used for publications, and journals can be browsed by subject category (<https://scholar.google.com/intl/en/scholar/metrics.html#overview>). In Google’s Scholar Metrics, the category “Psychology” is listed as a subcategory under “Health & Medical Sciences.” Choosing the “*h5*-index” for any particular journal title displays highly cited papers from the last five calendar years in a publication. It remains to be seen, as time evolves, which metrics for both individuals and the journal publications that they choose will be most important to promotion and tenure committees, or for university or

funder reporting. For those that can use a variety of innovative metrics approaches (both inside and outside of rigid systems) there are many ways to leverage metrics in an individual's scholarly publishing behavior. Depending on motivation, some researchers are very engaged with demonstrating impact and using a quantitative approach to show the impact of their work. Others may learn to game systems to their advantage. When the metrics can be woven into a brief narrative that describes the impact of an article, it may be powerful. For instance, a researcher publishes an article about an issue in a certain region of the world, makes that article OA, and then uses numbers of downloads from the repository or preprint server from people and organization in that specific area, it can really resonate with P&T committees or funders. Narrative CVs can include this information. There is more interest all the time in the need for researchers and their schools, departments, and universities to demonstrate societal impact of scholarship through public engagement and other means.

There are many issues with use of *h*-index including the importance of the genesis of the data behind the calculation. Promotion and tenure (or hiring committees) will want to make sure they understand whether the *h*-index was based on data from Google Scholar, for instance, which has very broad coverage but no transparency in what is indexed, or instead from a curated disciplinary index such as PsycINFO, or from the wide-ranging Elsevier index Scopus. Of course, the values for *h*-index of scholars varies greatly across the disciplines and subfields, and this can be an issue in mixed discipline promotion and tenure committees that are focused on certain *h*-index benchmarks. In a cross-disciplinary study of Web of Science, Scopus and Google Scholar that includes *h*-index, Harzing and Alakangas (2016) found that "in the Web of Science, the *h*-index of the average Life Sciences academic is nearly eight times as high as for the average Humanities academic and nearly three times as high as for the average Social Scientist" (p. 797). Those using *h*-index should only compare within a disciplinary niche and make sure that individuals do not consider their *h*-index as the only measure of their impact. Like "top lists" of everything else, lists of psychology researchers with top *h*-index calculations are available (but not necessarily from credible or transparent sources) and have begun appearing on the internet.

Bishop has analyzed the use of "departmental *h*-index" as a predictor of eventual research funding from the U.K. Research Assessment Exercise (RAE). Could use of departmental *h*-index be a different approach to reporting impact for the next iteration of the exercise, the REF2014, (the U.K. Research Excellence Framework which was to assess the quality of the research output of 154 U.K. universities) that was proposed at that time?

Bishop studied the research outputs from each of the 76 psychology departments that participated in the RAE for 2008 (using data from 2000 to 2007), utilizing an address search of data in the Web of Science, and concluded that this use of departmental *h*-index (not for every discipline, however) was acceptable as an alternative to the use of the journal impact factor as an indicator of impact for this type of U.K. funder research assessment exercise (Bishop, 2013). One complication for psychology in use of bibliometrics for these large assessment exercises is interdisciplinarity and how it affects reporting of aggregated metrics. For instance, the REF2014 had 36 Units of Assessment (UoAs), including a grouping of Psychology, with an expert sub-panel working on each UoA. The psychology grouping (UoA 4) included Psychology, Psychiatry and Neuroscience. Each of these areas would have different *h*-index profiles and other differences in terms of strict use of bibliometrics for assessment, pointing to the value of employing expert peer review panels in any type of evaluation that would assess impact appropriately for any area within (or on the periphery of) psychology. Use of the *h*-index has other benefits in evaluating research groups working in niche areas. Ruscio (2016) has reported on the advantages of *h*-index for analyzing citations and productivity, stating that:

In addition, *h* is a transparent, reproducible, and objective measure of scholarly impact. This has the potential to reduce many kinds of bias that can influence judgments and decisions. It also affords the opportunity for systematic, quantitative evaluations, or comparisons. Unlike the more subjective reading of a CV, for example, one can explicitly select an appropriate reference group and sampling technique to obtain comparison data to help interpret the *h*-index. (p. 906)

Ruscio (2016) was also able to study a grouping of social psychologists to demonstrate the robustness of *h*-index when used as a citation-based metric for evaluation purposes of an individual. Strategic use of *h*-index by researchers, funders and university departments in areas of psychological science has been discussed, but not extensively. Ruscio et al. (2012) provides a comprehensive look at 22 citation-based indices which might be useful to psychology and concludes that "the most attractive measures include *h*, several variations that credit citations outside the *h* square, and two variations that control for career stage" (p. 123). In two separate 2012 studies examining *h*-index and psychology faculty in U.S institutions, Ruscio and Prajapati (2013) presented comparison studies of *h*-index calculations resulting from the use of citations gathered from both PsycINFO and Web of Science, and also offered a method of how one might compare an institution's psychological sciences faculty with peers in other disciplines. In the first study of *h*-index results (of 204 randomly selected psychology professors from 185

U.S. psychology doctoral programs) between the two indexes, it was demonstrated that similar results in terms of comparable scores could be obtained from both PsycINFO and Web of Science. In another larger study of 1750 university-affiliated U.S. psychology faculty, it was shown how one might examine norms on *h*-index for psychological scientists by rank (assistant, associate, full professor). Ruscio and Prajapati (2013) recommend the use of PsycINFO and Web of Science (and not Google Scholar) due to the comparatively more robust and vetted data behind these major indexes. It is likely that many agree that, at this time, while Google Scholar is convenient, the coverage and messiness around its coverage, the lack of a public API that would allow more robust analysis, and the lack of refinement of its tools does not allow replication with other data sources or trusted results in comparison studies in the case of psychology.

The word “impact” has taken on various meanings when it comes to scholarly communication in any given discipline. While impact has taken on more and more of a quantitative meaning in recent years, with long lists of available metrics, and a few taking center stage (Journal Impact Factor [JIF] and *h*-index, for instance), it is interesting to consider which scientists have made the most impact to psychology. The impact of a person is never easy to quantify, but there are some whose reputations and work stand the test of time, with a few whose fellow scientists consider the most impactful. Sternberg (2003) edited a book that serves as a reminder that there is much more to impact than sheer numbers. *The Anatomy of Impact: What Makes the Great Works of Psychology Great* is a work that brings together a number of experts in the philosophy and history of psychology (as well as other distinguished psychologists), each of whom contribute a chapter on a single scholarly work by a preeminent author. Each chose a work of “monumental impact” and analyzed why “the work was so successful in terms of influencing the field” (p. ix). Further, it is stated that “the ultimate goal of any publication in psychology (or anything else) is to have an impact-to make a difference to a field” (p. ix). This book succeeds in defining impact differently than it is often discussed today through the use of examples of seminal works in psychology and what they have come to mean to the field over time. With a focus on open science/open research, DEIA (diversity, equity, inclusion, and accessibility), citizen science, and societal impact, psychology will have to grapple with new ways of measuring and demonstrating impact that can be reported in assessment exercises and promotion and tenure contexts. There is enough traction to continue that work. Psychological scientists are challenged to continue to find ways to effectively measure the impact of publications as well as

the collective work of individual scientists. Particularly at this point in time, new methods of assessing impact are needed and will be welcomed by the community. Current methods produce pain points as the discipline focuses on societal impact and DEIA issues (especially when it comes to promotion and tenure).

### **Beyond Articles: A Look at the Impact of Open Access Monographs**

For studies analyzing the Open Access citation or research advantage for scholarly monographs, no such aggregation of positive studies results as is available for articles. However, there have been some analyses and suggestions of how the book literature might be studied for impact, and even if online usage is positively affected and enhanced by OA, a citation advantage is more difficult to ascertain (Snijder, 2016). Snijder also remarks on an issue that is starting to infiltrate academia, and that is the existence of a newer “audit culture” that attempts to assess productivity or research impact of university faculty:

Lastly, if the importance of bibliometric analysis as a proxy for research quality is growing, it is vital to understand if there are significant dissimilarities between articles and monographs. Identifying specific differences between journal articles and books and the factors that underlie these differences will enable a comparison of scholarly impact of monographs and articles based on sound principles. (p.1873)

The interest in studying ways of opening up the monograph literature of psychology to more widespread audiences via OA is ongoing even though there is evidence that publication patterns of psychology faculty authors are changing. Trends toward more journal article publication and the publication of fewer books in Psychology was demonstrated in a study of U.S. social scientists published in 2022 (Savage & Olejniczak, 2022, p. 7).

The Clarivate Analytics-produced index, Book Citation Index (a part of the Web of Science Core Collection) provides citation information (including “cited reference searching”) for books that were produced from 2005 to the present. As this corpus of material continues to develop, studies will likely analyze the citation patterns of books. As more fully OA books (that use book processing charges/BPCs) to fund publication are made available, it will be possible to consider metrics for books in the same way as for articles and conference proceedings. As far as OA citation advantage for books, in time there will be ways to quantitatively describe the impact of books because some commercial and other scholarly publishers (including university presses such as the Luminos platform from University of California Press, <https://www.luminosoa.org/>) have moved to offering an OA “author pays” model that levies BPCs in

order to publish. While BPC amounts vary tremendously, using the example of Luminos, “the baseline \$15,000 publishing cost is broken down into manageable amounts for the researcher, the university, the library, and us” ([https://www.luminosoa.org/site/for\\_authors/](https://www.luminosoa.org/site/for_authors/)). Fees are certainly lower for nonprofit publishers than they are for commercial presses. Commercial publishers also charge BPCs (Book processing charges) and CPCs (Chapter Processing Charges) in their OA programs for books. The commercial publisher Springer maintains webpages where authors can access lists of potential funders for OA books as well as book chapters. Springer Nature’s page, “Funding for Open Access Books” may be accessed at: <https://www.springernature.com/gp/open-research/funding/books>.

It is early yet to see what kind of uptake and subsequent citation impact can be expected for the author pays book programs, especially at the high fees that some charge. Established university subvention and Open Access funds will find the high BPCs of the commercial publishers challenging and overwhelming and it remains to be seen whether (and from where) other funding will be available to authors interested in providing wide OA to their books. A useful addition to guides for authors of books in psychology would be the creation of a list of potential funding sources where OA funding assistance could be sought. The situation with OA monographs is fast evolving, and a report from the British Academy for the Humanities and Social Sciences announced that the United Kingdom Reference Exercise Framework (REF) in its 2027 iteration would include an intention to extend an OA requirement for articles to include those research outputs published in books or other long form scholarly works. (British Academy, 2018). In a move toward inclusiveness of all discipline and fields, funder initiative Plan S published its statement and policy on books and chapters entitled *cOAlition S statement on Open Access for academic books* (Plan S, 2021). The Plan S statement on OA to books is comprised of these recommendations:

All academic books based on original research that was directly supported with funding from cOAlition S organisations should be made available open access on publication; Authors or their institutions should retain sufficient intellectual property rights to make their academic books available OA and to allow for re-use; Academic books should be published open access under a Creative Commons license; Any embargo periods on academic books should be as short as possible and never exceed 12 months; and cOAlition S funders should financially support Open Access of academic books via their funding schemes and open access publishing business models via dedicated arrangements. (Plan S, 2021)

Other funders such as U.K. Research and Innovation (UKRI, 2023) will support books and book chapters as

well, stating on their webpage, “On 28 November 2023, UKRI is also launching a new ring-fenced, £3.5 million fund, dedicated to supporting OA costs for monographs, book chapters and edited collections within the scope of our new policy.” This is a very big game changer for a challenging area of OA in terms of the funding of OA books and chapters where book processing charges (BPCs) can reach into the tens of thousands of dollars. It looks like funders might pay, and that would certainly open up exciting options for researchers with funding to publish their monographs OA in Psychology, and for publishers looking to vastly extend the reach and impact of their books.

Universities and research offices may want to add funds for OA monographs as a category alongside traditional subvention funds which are charges levied usually by university presses as a condition of publication. Funding support for books is common for humanities in research institutions. Extending funding options for humanities books to OA monographs would make sense to a certain level, and maybe universities could cap that support at a “reasonable” amount. BPCs may also have to become less expensive to combat “sticker shock” for all disciplines where authors wish to publish their monographs OA. Many publishers have OA books, and as with APCs, the price of BPCs is really all over the map.

Many psychology researchers decide to submit chapters to edited books. Book chapters in edited works have often been problematic in terms of citation impact and discoverability and many are behind a paywall. Books and chapters need DOIs to be thoroughly integrated into university systems like Research Information Management Systems (RIMs) and faculty profiling systems. Many publishers are adding these persistent identifiers to book materials. DOIs also facilitate wide discoverability of monographs and chapters. Bishop (2012) described the situation in a blog post entitled “How to bury your academic writing.” She describes the lack of citedness and visibility of book chapters and suggests that “researchers who write book chapters might as well bury the paper in a hole in their garden” (Bishop, 2012). Open Access has been mentioned as one method that can be used to mitigate the visibility problem of chapters, particularly by using green OA strategies. There are many considerations and strategies that might be used for ensuring more visibility for book chapters (Dunleavy, 2017). As book chapters are still an important and valued vehicle in psychology, both authors and publishers may need to expend more effort on the discoverability of these works (<https://www.springernature.com/gp/open-research/funding/books>). Chapter Processing Charges (CPCs) are a natural next step from APCs for articles, especially in disciplines like psychology where

chapters often provide a form of article-level scholarship and are found in many edited volumes. Publishers, funders and authors would want to provide OA and its resulting impact to their works that are published as individual book chapters. Springer's webpages demonstrate the impact of OA on their books:

Our Open Access academic books and chapters on average receive 10 times more downloads, 2.4 times more citations, and 10 times more online mentions compared to non-OA books. Open Access books can have a more geographically diverse readership, reaching on average 61% more countries than non-Open Access books. (Springer, 2022)

Even though not included in easily found sources of "rules" around green OA self-archiving by authors in repositories (such as those found in Sherpa Romeo), publishers have taken note of the marketing effect of allowing single chapters to be self-archived in institutional repositories or scholarly networking services such as ResearchGate. Adding book chapters alongside other works in collections of articles in repositories allows these works to receive individual DOIs (assigned by the repository), and these persistent identifiers (PIDs) allow the chapters (especially if they don't already have an assigned DOI) to participate more fully in the article-level economy that is promoted by seamless linking via PIDs on the internet. Chapters with associated DOIs also facilitate inclusion in services that take advantage of the DOI environment such as Google Scholar. Book chapters now appear in publicly available Google Scholar Metrics profiles alongside books. In one study of U.K. academics (using the LSE PPG dataset), it was shown that, in psychology, the proportion of total cites (from various sources) to U.K. book chapters published from 2010 to 2013 was 5.5%. This same dataset showed that "book chapters are almost completely uncited in psychology and economics" (Bastow, 2014, p. 11). The ability of book chapters to have a chance to perform in the same Open Access and citation impact environment as journal articles will be a game changer for publishers and authors seeking to bolster the situation for book chapters and the citations to them. For those subfields where books and book chapters are prominent for promotion and tenure (P&T), this can help level the playing field.

As for discovery of OA books and book chapters, they can be found on publisher websites as well as search engines such as Google Scholar, or other services such as ResearchGate. A specific search engine for OA books is the Directory of Open Access Books (DOAB, <https://www.doabooks.org/>) which lists more than 53,000 "academic peer-reviewed books" as of June 2022. With funder support and libraries adding these books to their

collections and discovery services, this will be a rapidly growing part of OA to scholarly literature. It would behoove any author of an academic book in psychology to investigate options for making a book OA. With BPC pricing all over the map, many funders now providing support, and universities wanting to find ways to surface more social sciences and humanities work as Open Access, there are more options all the time. It is still a major challenge to realize a future where more of the academic book literature can be made OA. When the funder initiative Plan S began to mention support for books, it really pushed the conversation about OA to book materials. The time may have come for broader conversations of this aspect of Open Access, and to begin with the chapters, to recognize the need for OA to these materials that are "counted" as article-level scholarship in some "book chapter" fields. The August 25, 2022 Nelson Memo from the U.S. Office of Science and Technology Policy (OSTP) also included book chapters in its recommendations, stating in its section entitled "Peer Reviewed Scholarly Publications:"

Federal agencies should update or develop new public access plans for ensuring, as appropriate and consistent with applicable law, that all peer-reviewed scholarly publications authored or co-authored by individuals or institutions resulting from federally funded research are made freely available and publicly accessible by default in agency-designated repositories without any embargo or delay after publications...(and) Such scholarly publications always include peer-reviewed research articles or final manuscripts published in scholarly journals, and may include peer-reviewed book chapters, editorials, and peer-reviewed conference proceedings published in other scholarly outlets that result from federally funded research" (A. Nelson, 2022, p. 3).

While there has not been much discussion of scholarly peer-reviewed video resources in psychological science, the quantity of citable video may not be large, but there is a solid history of using video in certain areas of psychology. Two subscription publishers, JoVE (Journal of Visualized Experiments) and the American Psychological Association (APA) have produced video collections focused on psychology content that are well known in research institutions, and accessed via their libraries. JoVE's Psychology collections include educational videos that cover Behavioral Science, Experimental Psychology, Cognitive Psychology, and Social Psychology (<https://www.jove.com/education/psyc>). APA has produced video resources in Psychotherapy for many years, and these subscriptions are also available from many research libraries at institutions that focus on psychotherapy. APA PsycTherapy is a well-known source of streaming video of actual therapy sessions useful for counseling and

psychotherapy programs (<https://www.apa.org/pubs/databases/psytherapy>). SAGE Video: Psychology Collection is another focused resource (<https://learningresources.sagepub.com/video/psychology>). Other large video collections found in academic libraries that include documentary films, for instance would have content of interest. Of course, the world of online presentations from psychology organizations and conferences can usually be found from websites of organizations of interest. There is a massive amount of conference material, recorded webinars and other information related to psychology that appears on YouTube as well. It is challenging to study impact in formats beyond articles, and alternative metrics (altmetrics) may provide some insights on usage to creators who license their content for sharing with others.

Many psychology students are still required to lug around heavy print textbooks for their courses, or to struggle with various online textbooks that are bought, leased, or made available via course reserve systems. There are many features, but there are many issues as well. Switching to Open Educational Resources (OER) from vetted sites (or faculty authoring these resources) saves students money as well as provides some sort of answer to the rapidly rising costs of textbooks. In universities, one measure of impact that can be demonstrated from open textbooks would be numbers for courses that have adopted the textbook. This metric can be sourced from Open Syllabus (<https://opensyllabus.org/>), which can be searched by specific book, author, or broad subject category. Psychology is large category in this index. If at all possible, using open textbooks and other OA materials makes access easy for students, and faculty may be incentivized and supported to create these materials by their university administrations and libraries. One example of this type of initiative is the Rutgers Open and Affordable Textbooks program (<https://www.libraries.rutgers.edu/teaching-support/open-and-affordable-textbooks-program>). For an example of a library guide that provides access to a selection of open textbooks available for psychology, please see the author's (Mullen) online guide: <https://libguides.rutgers.edu/psych/OERs/OpenTextbooks>.

### **More Public and Social Media Engagement for the Research Results of Psychology**

New audiences outside the expected niches are interested in reading scholarly articles, and this includes many interested members of the public, policy makers and of course in psychology, practitioners. There have been calls for scientists to engage more with the public, and reporting of research results via the news media would be one way that funded research results could be disseminated

further to taxpayers and other readers of the popular press (Begg, 2016; Carrigan, 2016).

There have been many calls for the need to translate psychological science research results, whether in journals, books or other formats to materials that can be used by the wider public. With the capacity to address many societal and medical issues, strategies for translating research results to content that is more useful to the reading public have been put forth. With the added vehicles of Open Access and the wide reach of the internet and mobile devices, the public has never had so much ability to take advantage of the availability of educational content (Kaslow, 2015). For psychological science, the advantages of this added accessibility have the potential to educate many readers, to spur innovation and to further research into areas important to the health and well-being of the public.

Research impact via Open Access can also happen using publicly accessible vehicles such as Wikipedia. Wikipedia is likely a first stop for many, especially at its main page for psychology at <https://en.wikipedia.org/wiki/Psychology>, with its large reference lists to scholarly sources, many OA. Citations to OA research articles are an integral part of Wikipedia articles and inclusion of links to those freely available articles in Wikipedia references creates major diffusion of research information to readers worldwide. As of 2016, there were 5 million articles in English Wikipedia (and 35 million in the other hundreds of languages). Wikipedia is a first stop for millions of searchers and has become the top choice for those seeking medical information online, for instance (Lammey, 2016). It is likely that this is the case for psychology as well and as a very heavily used open encyclopedia, Wikipedia serves as a gateway for the dissemination of scholarly information about psychological science. With a lot of public reader traffic going to Wikipedia, there have been repeated calls for all academic authors (and publishers) to contribute content and to add OA links to all articles in the popular online encyclopedia. Many articles in reference lists are paywalled, creating roadblocks for information seekers. One way that the results of scientific research could be surfaced to the public would also be through inclusion of direct links to OA versions of peer reviewed articles in reference lists at the end of Wikipedia articles. Links to open content facilitates access for readers but also serves to increase visibility and resulting research impact for authors:

Controlling for field and impact factor, the odds that an OA journal is referenced on the English Wikipedia are 47% higher compared to paywall journals. These findings provide evidence that a major consequence of OA policies is to significantly amplify the diffusion of science, through an intermediary like Wikipedia, to a broad audience. (Teplitzkiy et al., 2017, p. 1)

Adding to the possibilities that the internet provides for enhancing citation effect via Open Access are the very positive uses of social media for publicizing scholarly work (Carrigan, 2016). Many scholars may see some of the more popular social media platforms as lacking in scholarly credibility, but after researchers became aware of the potential of services like Twitter (now known as X) to rapidly send out research results (for instance, by the well-known practice of depositors tweeting out their newest paper from the preprint server arXiv), they may not want to miss such valuable visibility. In some cases, this rapid online communication has greatly increased the wide dissemination of very current research, especially in the case of the timely articles and other outputs available from preprint servers. It has become clear that in order for the widest dissemination of research results, services like Twitter and Facebook which have been extremely popular among academics, are part of a mix for marketing early articles that also includes more scholarly channels. In fact, it seems many agree that “Twitter isn’t the only social media platform around, but it’s worth noting that it is a favored channel for a wide-spectrum of those working with scholarly output” (Michael, 2016b). Researchers can share mini-posters from conferences on Twitter via the hashtag “#TwitterPoster.” An example from the psychology department at University College, Dublin that organized their own unofficial virtual poster session full of “flip-book mini-posters” became a trending hashtag on Twitter (M. Morrison et al., 2020, p. 1069). Strategizing around incentives, rewards, and processes for enhancing the conference experience (as well as making its very valuable content available to interested parties) will be imperative for all organizations who value in person, online, and hybrid conferences.

There is some evidence that Twitter may be favored for sharing research articles, in comparison to Facebook. In a 2020 study of articles published in PLOS ONE between 2015 and 2017, psychology-related articles comprised 2.9% of article output (compared to the largest percentage, Clinical Medicine at 50.7%), “Twitter (TW) consistently shows a higher coverage for every discipline, ranging from the highest in Psychology, where almost every paper was distributed on Twitter (94.2%, 1,583), to the lowest in Chemistry (44.4%, 150)” (Enkhbayar et al., 2020, p. 759). As for Facebook, Enkhbayar et al.’s (2020) analysis shows:

that, at least under these idealized conditions, more than half of all Facebook engagement takes place between users and therefore is not counted by the POS (public-only shares) approach. This shows that working with public-only pages captures only a subset of the research-related activity that happens on the platform. (p. 764)

The evidence is inconclusive as to the importance of Facebook for the sharing of research articles related to Psychology. Clearly, sharing goes on, but just how much is not clear. There are examples of possible scale seen on various sites, including, for example, Reddit (<https://www.reddit.com/>). M. Morrison et al. (2020) mentions that “science is already distilled successfully on social media on a large scale. The “reddit.com/r/science” community posts single-sentence summaries of new findings (linked to study abstracts) for an audience of over 24 million subscribers” (p. 1070).

Scholars now have many means to self-promote and the use of social media is becoming commonplace. Brief guides on getting started using Twitter in university research settings are available, and the use of these services does not require a high learning curve or much time spent in composing brief tweets in order to share current articles (Mollett et al., 2011). Crew (2019) offers “10 tips for tweeting research” that include:

Don’t be afraid to promote your work, have a clear sense of purpose for why you are on Twitter, if you’re going to tweet about something controversial, plan it out, tap into your community, the more you post, the more followers you’ll attract, the more followers you have, the broader your audience; use hashtags wisely; take a cue from young researchers; take control of your research group’s updates; and familiarize yourself with your institution’s social media guidelines.

At this juncture, in 2023, the future of Twitter (X) for short form informal scholarly communication is uncertain. Many academics are leaving Twitter, finding that the acquisition by Elon Musk has changed the platform too radically. Brembs et al. (2023) discuss the importance of scholarly societies’ reclamation of the public square for scholarly discourse, especially using the opportunity that having a Mastodon instance presents, and in terms of Twitter, state:

Twitter is not the only case where scholars are struggling with a public good in private hands. In scholarly publishing, scientists and the wider public are similarly exposed to the whims of a few large corporations. It is worth remembering that a key rationale of the Open Access (OA) movement was to reclaim the public commons and to allow scholars themselves to be in charge of the governance of knowledge production and circulation. (p. 3)

While Twitter (X) is centralized (and now privately owned), Mastodon is a decentralized social network and centers around topics, themes or industries. As the situation with Twitter began to change, many academics tried Mastodon (Perez, 2022). Time will tell if psychology and its many subfields will find Mastodon a useful place for



scholarly sharing, and if it will have the reach that Twitter enjoyed at one time. There is a wide-ranging conversation at present with social media options if Twitter (X) has run its course for academic discourse but there is no frontrunner at present. In addition to Mastodon and others, Carrigan (2023) suggests academics may want to consider Bluesky (<https://blueskyweb.xyz/>), also a decentralized site where there are “a range of custom feeds that academics have created for different fields and disciplines.”

Longer treatments, including entire books have been written on how researchers can use the power of many social media services to market and promote their work, receiving valuable feedback along the way (Carrigan, 2016; Mollett et al., 2017). The advent and uptake of social media has been a boon to the wide sharing of research. Open Access strategies facilitate this dissemination. Alongside reporting of traditional impact via established metrics, researchers are interested in the “attention” that sharing work widely can bring to published work. Studies of sharing via Twitter, Facebook and Mendeley show at least more attention to openly published articles than those that are published in a closed access manner (Wang et al., 2016). Savvy researchers promote and market their scholarly work for greater impact using proven strategies that work with various social media (Mollett et al., 2017).

In a sense, there are methods that any author can use to market a publication, drawing attention to it. These methods are not time-consuming, but can create visibility and added sharing with other scholars and with the public. Enhanced visibility may lead to invitations to present the work at a conference, may attract media attention, or could drive many more individual readers to the article, whether the article is shared as an early version online (preprint) or whether the final published version is shared in more conventional ways. Psychological scientists Weinstein and Sumeracki (2017) provide an example of the many invitations to speak (and other opportunities received) as a result of engaging on Twitter and publishing a blog. Of course, for the busy academic (especially those on the tenure track) the perennial question is one of time spent on one activity (or one platform) at the expense of more traditional scholarly activities that may be required for promotion and tenure. Still, it seems the responsibility of every scholar that wishes wide dissemination of their work to take responsibility to market every research output in ways that are relevant, appropriate and acceptable to their disciplinary community. Articles that have already been made OA are much more easily and widely marketed to various audiences in the many available platforms by sharing the article’s DOI widely.

Some studies indicate that Twitter (X) may not draw readers the way one might think. Less enthusiasm for the

actual level of engagement that Twitter users experience may be a concern. It has been reported that “A review of 1.1 million Twitter links to scholarly articles found that half drew no clicks, and an additional 22% attracted just one or two. Only about 10% of the links received more than 10 clicks, according to a recent study in the *Journal of the Association for Information Science and Technology*” (Brainard, 2021b).

Strategies for author marketing of publications are very useful as a complement to the efforts of publishers. Using green or gold OA strategies have a proven track record as far as increasing research impact. Authors of scholarly monographs may also need to focus on marketing to lay audiences. Snijder (2016) concludes that studies of monographs’ increasing usage when made freely available may also be tied to increased activity on social media, particularly Twitter(X):

The results identified very little overlap between Twitter usage and citation behaviour; it seems reasonable to hypothesise that the factors affecting citations of books do not play a significant role in tweets about books. Therefore, the probable reason that Open Access is a significant influence on book citations does not necessarily apply to Twitter mentions. Nonetheless, it is possible to conclude that making books freely available has some positive impact on the number of tweets. Lowering the access barrier does indeed lead to more attention, in line with the effects for discoverability and online consultation found in the 2009 experiment. (p. 1871)

In terms of the most popular referrers to scholarly articles, Twitter (X) and Facebook, there is some evidence (from one study) that attention in the form of social media referrals toward scholarly articles accumulates quickly in the first week after publication, and then dissipates. This does show that Twitter and Facebook visitors to scholarly articles do result in actual clicks on those publications (Wang et al., 2016). Wider impact of these practices is not clear at this time. Researchers are analyzing whether the wide dissemination through tweets (by authors or others) and the enhanced visibility that Twitter makes possible does actually affect citation impact, as measured by various new (alternative) metrics.

More metrics (or different ones) are required for assessing impact of social media participation. Outside of traditional citation metrics, alternative metrics, or “altmetrics” have taken on more prominence, at least informally, with many publishers (as well as repositories and preprint servers) adding altmetrics indicators to individual articles. Altmetrics are thought to provide a much more well-rounded picture of the impact of an article, allowing for information to be presented about how readers use and engage with articles, books and other products of scholarship. Services like Plum Analytics

aggregate resulting metrics from social media through measures of attention that are demonstrated as clicks, downloads, likes, shares, captures to citation management services, and more. This information allows an author to create a narrative of alternative types of impact that may tell a more complete story of a particular work's meaning to the discipline as well as to the community and reading public.

Publishers are now also using many new products and strategies to both market articles for visibility as well as provide new visualizations of impact using altmetrics. Utilizing new services for assisting authors in marketing their work online in order to reach more readers and potentially increasing impact, for example, Kudos (<https://www.growkudos.com/>). Kudos reaches out to authors proactively with information about an article's traction and traffic. On its site, Kudos states in its information targeting authors:

Wherever you publish or share your work, use Kudos to help achieve 23% higher growth in full-text downloads: Open up your research so new audiences can find and understand it. Track the most effective networks for getting your work read, discussed and cited. Learn where to focus your efforts to make best use of your time. Improve the metrics by which you are evaluated. In its information for publishers, Kudos states: Increase publication performance and strengthen author relationships. Authors are increasingly sharing their work, often within private networks. Publication usage is being fragmented, putting subscriptions at risk, and publishers are being cut out of the picture in terms of understanding and building on new modes of scholarly communication. Kudos provides tools and intelligence to help you connect with authors after publication, collaborate with them to maximize publication usage and impact, and reclaim lost usage.

In 2022, the American Psychological Association teamed up with Kudos, suggesting that authors may want to take advantage of the free service (<https://www.apa.org/pubs/authors/kudos>).

It has become commonplace to see visualizations of alternative metrics (altmetrics) data on articles, preprints, and entire journals. Where traditional metrics such as article citation counts or journal impact factor are not appropriate or are unavailable, the ability for authors to see the use of their research around the world has become a desirable aspect of publishing one's work and then depositing it in repositories that offer altmetrics services. Adding altmetrics reporting to publisher services has added value to what publishers offer to their authors and readers. Publishers focus on author services in order to establish better relationships and increase the possibility of more submissions, while hopefully enhancing brand loyalty among the pool of potential authors.

With the development of altmetrics, scholars as well as promotion and tenure committees have seen new ways of demonstrating impact. A narrative about an article's impact can be drawn by looking at the aggregated measures of attention that an individual work is attracting. Whether new metrics showing internet downloads or Twitter (X) followers, for instance, will matter to evaluators in a given university is not yet known. As authors become more savvy about marketing their publications online, those using traditional practices may miss some opportunities to reach a larger readership on a global scale. Many are using scholarly collaboration networks as well as various repository solutions for internet dissemination of their scholarship (and data) and these authors now expect and enjoy using various altmetrics to see uptake in various ways. Of course, many studies have demonstrated that OA increases research impact, and so making one's work OA and then marketing it via popular social media would seem to be a winning strategy for dissemination of scholarly work on a global scale (SPARC Europe, 2015).

Beyond Open Access strategies and the use of social media, it is necessary for authors to think of all of the factors that make their work more visible and discoverable. If an article has robust and accurate metadata and a well thought out title, that article is more likely to be discoverable by search engines and indexes. Authors have many options and also can also employ a long list of strategies to aid in the discoverability of their publications. Planning for Open Access is necessary for the article to attain maximum readership following initial discovery. Another way to establish a scholarly presence and create visibility for one's work is through sharing ideas on a blog. Blogging is now an established part of our digital reading and writing culture, allowing ideas to be shared with interested audiences. Separating out quality scholarly and academic blogs from the deluge of other blogs on the internet can be daunting, and many potential readers stumble upon blogs by searching the content in a hit or miss fashion using Google or Google Scholar. Outside of discovering blogs through professional associations, networking with colleagues, or links from other information sources, at least one discovery service, ACI Scholarly Blog Index was an aggregator of scholarly blogs across all disciplinary areas. The index (originally produced by ACI) was discontinued in 2018 but all of its content is now available from ProQuest (Newstex, 2022). All of the blogs included in this service were individually curated by researchers and experts in the disciplinary or topical area. Searching ACI Scholarly Blog Index, via an institutional or personal subscription, surfaced high impact blogs, and is indexed in major library discovery tools such as OCLC WorldCat, ProQuest's Summon, EBSCO Discovery Service, and others. Blog entries by

leading scholars and thought leaders are now an important part of primary source, current awareness scholarship, and are often cited in peer reviewed journal articles. Major libraries opted to subscribe to the ACI Scholarly Blog Index, thereby showing interest in including blogs in the search, discovery and access resources offered to researchers as part of the suite of subscription offerings

### **Beyond Open Access: Open Science/Open Research in Psychology**

Beyond Open Access to publications, psychological science is moving quickly toward open science, also described with the more inclusive term “open research.” No longer will a text publication suffice, but will need to make open all of the products of research. This evolving environment is a challenge for universities and libraries building tools, services and infrastructure to enable open science. An example of a high level workshop and proceedings bringing stakeholders together in an attempt to coordinate efforts and forge a path forward was the National Academies of Sciences, Engineering, and Medicine’s Roundtable on Aligning Incentives for Open Science which held its first meeting in February 2019, and by its fourth meeting on November 5, 2020 had published a proceedings volume that offers “information and other resources that could be used by researchers, research institutions, research funders, professional societies, and other stakeholders interested in fostering open science practices” (National Academies of Sciences, Engineering and Medicine, 2021). Hales et al. (2019) provide an excellent overview of the open science-related methods for producing “more accurate research claims,” and “ongoing changes at the institutional level to incentivize stronger research” (p. 13). Moving to an open science/open research future is not without its challenges for individuals, research groups and organizations and it would seem that a thorough and comprehensive end to end education in all aspects of the scholarly communication workflow would need to be offered to undergraduates in upper level psychology programs.

Moving forward, the tenets of open science can be taught with undergrads, preparing the researchers of the future in psychology to be prepared to understand the issues, to expect to be responsible in the conduct of research and to be proficient in using available tools in research process workflows. Strand and Brown (2019) recommend practices for teaching open science practice and principles to undergraduates. One resource is entitled *The Turing Way*, described as: “The Turing Way is an open source community-driven guide to reproducible, ethical, inclusive and collaborative data science. *The Turing Way: A handbook for reproducible, ethical and*

*collaborative research* (Turing Way Community, 2021) sets out its definition of open research as:

Open research aims to transform research by making it more reproducible, transparent, reusable, collaborative, accountable, and accessible to society. It pushes for change in the way that research is carried out and disseminated by digital tools. One definition of open research, as given by the Organisation for Economic Co-operation and Development (OECD), is the practice of making “the primary outputs of publicly funded research results – publications and the research data – publicly accessible in a digital format with no or minimal restriction.” To achieve this openness in research, each element of the research process should: *Be publicly available*: It is difficult to use and benefit from knowledge hidden behind barriers such as passwords and paywalls. *Be reusable*: Research outputs need to be licensed appropriately, so that prospective users know any limitations on re-use. *Be transparent*: With appropriate metadata to provide clear statements of how research output was produced and what it contains (Summary section).

This online and evolving book from Turing Way is collaboratively developed by its diverse community of researchers, learners, educators, and other stakeholders and further provides the description that “open research aims to make each of these elements open: Open data, open source software, open hardware, Open Access, and open notebooks.” The Turing book also proposes a definition for “open scholarship” that extends open research into areas of “open educational resources, equity, diversity and inclusion, and citizen science” (Turing Way Community, 2021).

Practical guides to how to integrate open science workflows, starting at the beginning of any research project (either as an individual or as part of a collaborative research team) are emerging. An article that describes “Ten Strategies to Foster Open Science in Psychology and Beyond” lists various products and services that are available as open tools to aid collaboration or collaborative authoring (Alessandrini & Byers-Heinlein, 2022). One example offered that helps with the use of R Markdown for collaborative writing and submission to psychology journals (pp. 16–17) is “papaja.” Papaja is described on its site as “papaja (Preparing APA Journal Articles) is an R package that provides document formats to produce complete APA manuscripts from R Markdown-files (PDF and Word documents) and helper functions that facilitate reporting statistics, tables, and plots” (<https://github.com/crsh/papaja>). A manual for papaja is available from Aust and Barth (2021). Universities and research teams can develop step by step instructions for researchers that lay out a seamless open and reproducible workflow from initial ideas and data collection all the way through to open publication of

research results. This would ensure the integrity of the process from the beginning of a research project to the point where it is time to formally report results.

## Funders Mandating Open Access to Research Data

In recent years, funders in the United States and abroad began to mandate that the research outputs resulting from taxpayer funded research be made publicly available. Beginning with the NIH in (2005) and moving forward in 2013 in the United States with the White House Directive (also known as the Obama Directive), the federal funder situation evolved to encompass any U.S. federal agency that distributes more than \$100 million in research and development funding each year (Stebbins, 2013). The list of those funders who were affected was lengthy and included funders that had not previously dealt much with Open Access, including the various issues surrounding green OA and repositories. There was some scrambling by federal agencies to get up to speed by deadline. At that time, publishers moved quickly to develop the CHORUS service which focused on solutions for funder compliance. CHORUS has more than 100 members and signatories including the American Psychological Association and the Association for Psychological Science (CHOR, Inc., 2017). At almost the same time, a university solution (SHARE) focused more on institutional repository self-archiving (green OA) was being developed to include a notifications service when a research output was made available (Association of Research Libraries [ARL], 2013).

While OA requirements of federal funders began to affect more researchers in most disciplines, the biggest game changer was the issuance of the Nelson Memo in 2022. On August 25, 2022, the U.S. White House Office of Science and Technology Policy (OSTP) issued the *Memorandum for the Heads of Executive Departments and Agencies* on the subject, “Ensuring Free, Immediate, and Equitable Access to Federally Funded Research” (<https://www.whitehouse.gov/wp-content/uploads/2022/08/08-2022-OSTP-Public-Access-Memo.pdf>). Unlike the previous OSTP memo (known as the “Holdren Memo”) that only affected funders with more than \$100 million in annual research and development expenditure, the Nelson Memo applies to *all* federal funders, and directs them “to develop a plan to support increased public access to the results of federally funded research, with specific focus on access to scholarly publications and digital data resulting from such research” (p. 1). With a deadline of December 31, 2025 for updating plans, agencies will need to grapple with the Memo’s directive to “to make publications and their supporting data resulting

from federally funded research publicly accessible without an embargo on their free and public release” as well as follow other guidance in the memo to enable greater openness, transparency and public access. There is an allowance for deposit of funded articles in repositories (green OA), as well as the payment of APCs, in order to comply with the memo. The Nelson memo supports both gold and green OA. Game changers will be the elimination of embargoes on published articles and requirements around open data. Many more researchers in all fields of psychology will now be subject to compliance with new rules regarding OA to scholarly publications and data due to the Nelson Memo. The continuing issuance of funder requirements for OA to research results, not only from the United States, will certainly increase the availability of the psychological literature, and now research data as well (to the extent possible), to a global readership. Assistance for researchers that need to comply with the Nelson Memo and other funder mandates will come in part from research offices and libraries. In the coming years, some of the challenging areas for multiple stakeholders will be the need to develop open data strategies, the need for more rights retention for authors (to their publications and other research outputs), and the removal of embargoes in order to fulfill the funders’ desires that scholarly works and data be disseminated quickly and broadly (A. Nelson, 2022). Certainly, the agencies that must now develop plans to include how to make research data open and reusable will have a daunting task in recommending ways to do that, whether via dedicated disciplinary data repositories, institutional solutions, or by use of generalist repositories. At this time, there are many agencies that are consulting widely on how their researchers and ensure compliance on the data side of “open,” and what and how much research data will be allowed to be kept closed due to privacy, human subjects issues, or other complex issues on the road to an open science future. With various listening sessions and reports produced by various stakeholders, one productive aspect of the discussions around the Nelson Memo has been the discussion of disciplinary differences in OA and open science. A comprehensive 2023 report to the U.S. Congress from OSTP (on financing mechanisms for OA publishing) includes information on disciplinary differences, including minor references to Psychology, and explains the need for the different expectations for various disciplines:

Different disciplines have different expectations around how much and how often a researcher should publish, influenced by a variety of factors including level of funding, length of publication (such as the length of an article versus that of a monograph), and other domain-specific norms. Different fields of research also have differing delays between submission of a

manuscript and completion of the peer review process, which may also impact the volume of publications by discipline (OSTP, 2023, p. 35). Many of the large U.S. federal funders currently under the earlier directives, as well as the ones that will fall under the Nelson Memo are supporting psychology research. The APA Science Directorate has listings of external funding opportunities available in psychology, beyond what APA offers (American Psychological Association Directorate, 2018). Also, the database, Grants.gov is a searchable resource useful for discovery of psychology grant opportunities. On these lists, common funders include National Science Foundation (NSF), National Institutes of Health (NIH), Department of Health & Human Services (DHHS), and Department of Defense (DOD). These agencies are all examples of the lengthy new list of funders that have new rules with regard to Open Access availability for publications and data with which authors of the scholarly literature must comply. Another popular grants/funding database is Pivot-RP (Ex Libris, 2022). Pivot will likely be a familiar name to those in research universities that search for funding opportunities. A comprehensive list of these new federal funders' OA requirements with links to their implementation plans may be found at <http://data-sharing.sparcopen.org/>

Not only U.S. federal funders, but also private funders are developing more robust Open Access requirements as a condition of funding. While data policies and OA mandates used a strategy of positive encouragement in the past that was not focused on compliance, more funders are moving to penalize researchers or institutions that do not comply. This has resulted in increased compliance and more open data, but there is still room for improvement. NIH and Wellcome Trust have both withheld funding from those that have not complied with the OA policies of the funders for previous work (Van Noorden, 2014a). Compliance is not a given, even with policies having more “teeth.” With more and more funders, both in the United States and abroad mandating that the publications and data emanating from funded research be OA, there is at least one study of more than 1.3 million articles whose OA status has been analyzed to determine whether these publications have actually been made OA as required by their funders. Larivière and Sugimoto (2018) were able to demonstrate that rates of compliance with OA rules (for 12 selected funding agencies), even within psychology (p. 484), for instance, “vary greatly by funder” (p. 483). While some disciplines reach nearly full compliance (as seen in biomedicine, clinical medicine and health research), other disciplines' rates of compliance are much lower. As for lower rates of compliance, “although researchers cite norms and needs within disciplines as a reason not to comply with open-access mandates, we believe that the funding agency is a

stronger driver of Open Access than is the culture of any particular discipline” (p. 483). More study is needed to understand how (and how often) funded research is being made OA (as mandated) in psychology.

Researchers seeking funds from certain U.S. federal funders will need to make plans up front for complying with the new OA rules. The Obama Directive was followed up in 2015 by a letter sent to all research offices of the Association of American Universities (AAU) and Association of Public and Land-grant Institutions (APLU) which stipulated that research data must be made publicly available (to the extent possible) and offered advice to universities on compliance with new rules (Vaughn, 2015). The NIH had added a mandate requiring OA to research data they fund as of January, 2023 (<https://sharing.nih.gov/data-management-and-sharing-policy>). The announcement of the 2023 NIH Data Management & Sharing Policy (National Institutes of Health, 2023) required research offices and libraries to ramp up services for faculty so there will be no future risk of loss of NIH funding due to non-compliance with policies in place. Practical information for researchers will make compliance less onerous. A 2022 article in *PLOS Computational Biology* entitled “Ten simple rules for maximizing the recommendations of the NIH data management and sharing plan” is an example of the straightforward information that will be useful to all disciplines with any NIH funding (Gonzales et al., 2022). Also, the U.S. National Science and Technology Council (2022) released a useful report entitled, *Desirable Characteristics of Data Repositories for Federally Funded Research* which gives guidance around the issue of selection of appropriate data repositories, and seeks to set out some expectations that would work for most agencies. The report states:

A key element of the required data management plans is specification of the digital, online, public access data repository or repositories researchers will use for preserving, maintaining, and providing access to Federally supported research data. While some agencies designate specific repositories to be used for particular types of data (e.g., genomic data, topographical data) or a particular type of research (e.g., Arctic research, social sciences research), for much Federally funded research, the selection of a suitable repository is delegated to the researcher or their institutions. (p.1)

Adding OA to research data on top of the previous sole focus on text publications was a game changer for authors, publishers, and universities. Research universities had to grapple with the research data management issue more seriously and monitor compliance at the local level. A focus on the research data that underpins published scholarship is a foundation of open science. The NIH directive and its follow-on Data Management &

Sharing Policy promises to continue to open up the psychology literature and its associated data to researchers as well as the public (and more of the practitioner community) that needs access to it. For psychology, there is a need to ensure that research data is openly available online for reuse and replication of studies (within certain parameters relating to privacy, of course). One issue with which psychology grapples involves problems with replication and reproducibility of research results (both publications and data). Opening up research data for innovation and reuse will add needed transparency to future research. This is an area of scholarly communication that needs to evolve in order to add clarity around aspects such as privacy issues, data citation practices, and licensing of data. While the issues may be somewhat different for those engaged in qualitative research, open data will still need to be a priority in order to avoid missed opportunities for impact and visibility. Branney et al. (2023) discuss the need for open science to qualitative research in psychology, arguing that:

it is crucial that open science practices do not exclude qualitative research (even inadvertently), and we encourage qualitative psychologists to reflect upon how they can meaningfully engage with open science, in a way that makes sense for their research approach, epistemology, and methodology. Although open research practices may have initially emerged in response to concerns relevant for quantitative research, we understand the core tenets of open research to be around ensuring that all research is transparent, collaborative, rigorous, and accessible,

Each discipline will have different practices in aspects of public and Open Access to research data, and the psychological science community will develop and share best practices in this dynamic new area. Universities and researchers are partnering with commercial and nonprofit data management services (such as Figshare, <https://figshare.com/>), as well as a variety of domain and institutional repositories (such as Inter-university Consortium for Political and Social Research [ICPSR] and local university repositories) to develop solutions for archiving of data as required by funders, some putting a focus on the entire lifecycle of the data (Inter-University Consortium for Political and Social Research (ICPSR), 2017). The need for information and assistance in preparing research data management plans is going to become more necessary as more funders require them. Writing data management plans may be new to many researchers and many university libraries and research offices provide guidance and services in this area. This is skill set that will need to be added to scholarly communication education for researchers. A useful addition to the literature would be discipline-specific information on writing data

management plans for psychological science, but there are some general guides available in the literature that provide tips for novices to the process (Michener, 2015). One useful book with practical information for psychology is *Managing your Research Data and Documentation* by Berenson (2018).

Many universities (usually via their libraries) are utilizing their institutional repositories to share, store and preserve research data. These digital institutional repositories have a mission that includes gathering, preserving and disseminating institutional scholarship and are able to ensure the availability of research data over time. Institutional repositories can link text publications and other research products to any supplemental and/or underlying data. Universities may one day decide that rather than just focusing on institutional OA policies that mandate public access to publications such as peer-reviewed article scholarship, that the research data produced at the institution must be publicly accessible on the internet as proof of funder compliance as well as for increased visibility and for demonstrating institutional impact. It is a question open for discussion as to why universities have moved to develop OA policies that target publications, but they have not yet developed similar policies around curating and preserving the research data that emanates from the institution's funded research. Developing such open data policies would allow more focus on the development of university solutions for managing and preserving research data, while ensuring university compliance with funder policies stipulating open data. The university is responsible for ensuring compliance (rather than the PI in most cases) and faculty and other researchers are in need of services and solutions for managing research data. University policies around research data would raise visibility of the need for discipline-based university-provided in house or outsourced solutions (such as development of appropriate platforms and repository services) for the complex area of research data management. One would expect that this would come as more funder mandates come to pass and if universities put a priority on investing in open infrastructure and its staffing (including robust institutional repositories) that serve the needs of curating and preserving a wide variety of research outputs of any given university.

Alongside the aforementioned statement that OA increases research impact, studies show a citation advantage for sharing data as well (H. A. Piwowar & Vision, 2013). Other universities do not necessarily focus on their institutional repository solutions, but instead have developed a suite of services (often as part of the library) that includes assistance with use of research data management tools and services such as the popular free, open

source DMPTool (<https://dmptool.org/>) that has been used by many thousands of researchers to create data management plans.

Data policies have also been developed by publishers. An early adopter that is home to many psychology-related articles, PLOS developed an open data policy in 2014 (Bloom et al., 2014). By 2016, 60,000 articles in the PLOS journals were sharing open data sets, and PLOS has made available some useful examples in an Open Data Collection (Lowenberg et al., 2016). Where there are no data policies per se, some editors do not want to review papers where the data are not freely accessible. One high profile case for psychology involved a consulting editor for APA's *Journal of Experimental Psychology: Learning, Memory, and Cognition* (where there is no formal open data policy), making the decision to reject papers where data are not open, or there is no reason stated for the lack of transparency (Naik, 2017). Ubiquity Press's *Journal of Open Psychology Data* (<https://openpsychologydata.metajnl.com/>) publishes "data papers," and describes those articles as "a publication that is designed to make other researchers aware of data that is of potential use to them for scientific and educational purposes." Each paper describes methods used to create the dataset, discusses reuse potential and provides a link to the data set in an online data repository. Research articles might refer readers to the complementary data paper. As the focus on open data evolves, publishers will need to provide clarity around issues of open and transparent data for studies where there are no privacy or other such concerns to prevent this. Open data is a major tenet of the emerging open science movement, and psychology, with its current focus on reproducibility, is on the forefront in the development of disciplinary policies, tools and practices. In fact, a major new publication, *Open Science by Design: Realizing a Vision for 21st Century Research* (National Academies of Sciences, Engineering, and Medicine, 2018), mentions psychology as a major force for open science, stating "New standards for data and code sharing in fields such as biomedical research and psychology are making it easier for researchers to reproduce and replicate reported work, strengthening scientific rigor and reliability" (p. 1). For Psychology, many articles and collections of articles have been made available on the emergence and integration of open science principles and practices "post replication crisis." One resource is an entire topical issue of *Zeitschrift fur Psychologie/Journal of Psychology*, Volume 227(4), October, 2019, pp. 233–307, entitled *Open Science in Psychology: Progress and Yet Unsolved Problems*. It is beneficial to have these resources available as well to use as teaching materials for students in the discipline. Another idea for increasing engagement between faculty and students around a "journal club"

idea focused on open science and reproducibility is the "*ReproducibiliTea*" concept where people gather in universities for tea and regular discussion around an article (ReproducibiliTea, 2022).

A relatively new concern for those producing and creating organization around research data, as well as for those researchers wanting to use the data of others is the climate of legal uncertainty and the many questions researchers may have about intellectual property rights as they relate to research data. Particularly, issues of copyright, trade secrets, patents and Creative Commons licensing all come into play. It is useful for all who deal with rights surrounding research data to have an understanding of these issues. An article by Carroll (2015), "Sharing research data and intellectual property law: A primer" covers the issues thoroughly.

It may be difficult to find information on research data management that is specific to the discipline, and there cannot be a "one size fits all" approach to this topic. More information and published examples are needed about how research data is managed and curated in specific subfields. Specific strategies and practices would be welcomed, such as the Borghi and Van Gulick (2018) analysis of research data management practices and perceptions in the field of neuroimaging. Although best practices are developing, psychology is still a long way from realizing a high level of access to open data. Even though the funder environment and the culture of the discipline may be moving more toward "open" when it comes to data, managing, curating and preserving that data may be still a work in progress for the profession. A 2015 survey of faculty in all disciplines showed that 90% still managed their data on their own computer (Wolff et al., 2016). In more recent years, with funders taking a stronger stance around open data, and the increasing availability of information and infrastructure for researchers providing more options and assistance, the situation is certainly improving.

Research data management is complex in psychological science, but there are excellent examples of guidelines and specifications available for review by researchers and others interested in the development of appropriate programs. For example, the recent publication of recommendations from initiatives of the German Psychological Society (Deutsche Gesellschaft fur Psychologie, DGPs) sets out clear guidelines for managing research data that are specific to psychological science. Issues such as storage of primary data, clarifying what constitutes a "trustworthy data repository," the use of DOIs for identification of data, the need to request support from third party funders, data privacy and copyright, rights of data sharers (to use embargoes, for instance), and duties of the secondary users of data are covered. In terms of trusted repositories, solutions such as PsychData or a

“developed university repository” are mentioned (Schönbrodt et al., 2017). Those repositories that are able to fulfill 16 requirements may be assessed by experts and receive the “Data Seal of Approval” (<https://www.datasealofapproval.org/en/>) after a peer review process.

Another aspect of Open Access and open licensing involves use of the research literature itself as the object of study. Sarma (2017) goes on to:

use the phrase *scientific literature text mining* to refer to data analysis of the scientific corpus, rather than the data sets that are produced by research studies. One can think of scientific literature text mining as representing a full-fledged generalization of review articles, systematic reviews, and meta-analyses whereby sophisticated tools from the modern data science toolkit are utilized to extract novel insights from the scientific corpus itself. (p. 2)

Products that are popping up in the TDM space allow valuable analysis of the literature. Access to ProQuest’s (2021) product, TDM Studio facilitated a study described as, “A student researcher from UC Berkeley analyzes 6 peer-reviewed psychology journals to quantify concerns raised in the replication crisis.”

## Replication and Reproducibility

The evolving scientific discipline of “meta-research” is important and pertinent to the future of research in psychological science, and has as its purpose the improving and evaluation of research practices and scientific publication. Meta-research can be categorized into five major areas: Methods, Reporting, Reproducibility, Evaluation and Incentives, and those areas cover “how to perform, communicate, verify, evaluate, and reward research” (Ioannidis et al., 2015, p. 2).

Some issues for scholarly communication in psychology surround the replication of research results. A novel and innovative study is often of more interest to an editor than a redo of previous research that sets out to provide evidence of reproducibility. The rise of open data practices in psychology holds promise for increasing the ability of scholars to replicate the scientific studies published by others. The availability of the data behind the research creates the transparency needed to ensure the validity and usefulness of research results (McKiernan et al., 2016). As a reminder of the current state of some of the threats to reproducibility, Bishop (2019) states that:

we know how to formulate and test hypotheses in controlled experiments. We can account for unwanted variation with statistical techniques. We appreciate the need to replicate observations. Yet many researchers persist in working in a way almost guaranteed not to deliver meaningful results. They ride with what I refer to as the four horsemen of the

reproducibility apocalypse: publication bias, low statistical power, P-value hacking and HARKING (hypothesizing after results are known). (p. 435)

Publishers have responded to the need for new types of articles that focus on reproducibility in various fields, including psychology. In 2019, Cambridge University Press launched a new OA journal, *Experimental Results*, that addresses issues of reproducibility. *Experimental Results* is described on its website (<https://www.cambridge.org/core/journals/experimental-results>) as:

*Experimental Results* is an Open Access journal providing a forum for experimental findings that disclose the small incremental steps vitally important to experimental research; experiments and findings which have so far remained hidden. Such results often go unpublished due to the traditional scholarly communication process, in which only a select group of experiments are chosen to make up the narrative of a single paper. Articles for consideration in *Experimental Results* include validation and reproducibility of existing findings, null results, supplementary findings, improvements or amendments to published results, as well as results that could be of importance, but for whatever reason, the researcher has not followed a particular line of questioning to produce a full narrative for a traditional paper (Flaherty, 2019). A section of *Experimental Results* is entitled “Psychology and Psychiatry.”

A review article entitled “Replicability, Robustness, and Reproducibility in Psychological Science” (Nosek et al., 2022) provides a comprehensive overview of these areas of open science. The background provided allows a jumping off point for those in the discipline to address challenges and plan for moving forward. An earlier book, *Psychological Science Under Scrutiny: Recent Challenges and Proposed Solutions*, includes contributions about issues and proposed solutions around reliability that have had to be addressed over time in the discipline (Lilienfeld & Waldman, 2017).

Replication studies have not been common in psychology. Today, those scientists wishing to undertake and discuss replication studies have more options than in the past, and can use blogs, preprint servers, and may decide to use a publication outlet that welcomes (and even solicits) replications, such as *F1000 Research* (with its Preclinical Reproducibility and Robustness channel) or Nature’s *Scientific Data*. Psychology has an interesting example of collaboration and replication found in APS’s *Perspectives on Psychological Science*. The publication seeks nominations for replication of influential articles and the original author is engaged with the scientists doing the replication, and offers perspective on the result. The final results are published as a type of article called a “Registered Replication Report” (RRR)”



described at <https://www.psychologicalscience.org/publications/replication> (“Go Forth and Replicate!,” 2016).

In psychology, even fabrication of research results has been a topic in the news media. In recent years, as researchers pursue the question of replication and of reproducibility, there is not always an easy answer to getting at the “truth” of the findings. When popular outlets such as the *New York Times* and *Scientific American* picked up on the study known as the *Reproducibility Project: Psychology* (Center for Open Science, 2016), of which the results and analysis was subsequently published in *Science* in 2015, many took notice and an article in *Scientific American* even labelled the issue “Psychology’s Credibility Crisis” (Horgan, 2016).

The original 2015 article in *Science* by the Open Science Collaboration (OSC) stated that “we report a large-scale, collaborative effort to obtain an initial estimate of the reproducibility of psychological science” (Open Science Collaboration, 2015). This study involved conducting replications of 100 studies in three psychology journals (*Psychological Science*, *Journal of Personality and Social Psychology*, and *Journal of Experimental Psychology: Learning, Memory and Cognition*) and mainly covered the subdisciplines of cognitive and social-personality psychology. The researchers examined five indicators and OSC concluded in a 2015 research article summary that “a large portion of replications produced weaker evidence for the original findings despite using materials provided by the original authors, review in advance for methodological fidelity, and high statistical power to detect the original effect sizes” (p. 943).

Some studies paint a more positive picture. In a study of 100 top psychology journals (using 5-year impact factor), Makel et al. (2012) provided an analysis of replications that showed a replication rate of 1.07% with an increasing number of replications being published over time. Results demonstrated that:

contrary to previous findings in other fields, this study found that the majority of replications in psychology journals reported similar findings to their original studies (i.e., they were successful replications). However, replications were significantly less likely to be successful when there was no overlap in authorship between the original and replicating articles. (p. 537)

Following the OSC study of reproducibility, in some areas of psychology, response was swift. In *Science*, a published comment that followed (Gilbert et al., 2016, p. 1037-b) insisted that “the data are consistent with the opposite conclusion, namely, that the reproducibility of psychological science is quite high” and that “OSC’s data clearly provide no evidence for a ‘replication crisis’ in psychological science.” *Science* went on to publish the original authors’ response to that comment, concluding

that “OSC2015 provides initial, not definitive, evidence—just like the original studies it replicated” (Anderson et al., 2016, p. 1037-c).

One study revisiting the results of the aforementioned Open Science Collaboration initiative, (Reproducibility Project: Psychology) listed “publication bias in the psychological literature” as one factor in the Project’s “failure to replicate many target effects.” Etz and Vandekerckhove (2016) explain that:

We conclude that the apparent failure of the Reproducibility Project to replicate many target effects can be adequately explained by overestimation of effect sizes (or overestimation of evidence against the null hypothesis) due to small sample sizes and publication bias in the psychological literature. We further conclude that traditional sample sizes are insufficient and that a more widespread adoption of Bayesian methods is desirable. (p. 1)

There are other factors affecting reproducibility, for instance small sample size and low power. Button et al. (2013), analyzing the situation for neuroscience, “show that the average statistical power of studies in the neurosciences is very low. The consequences of this include overestimates of effect size and low reproducibility of results” (p. 365). Others concur that in the Reproducibility Project: Psychology’s findings, various explanations, for instance, small sample size may account for some of the low level of replication found in this large-scale project, and that the headlines that result from such a study informing the scientific community about a “crisis in psychological science” may be unnecessarily alarmist (Patil et al., 2016). In fact, some feel that rather than a crisis, the last seven (or so) years of improvements that have followed the decades when experimental psychologists were largely unaware of the problems that existed with data collection and analysis can be looked at very positively. A series of important events that began in 2010 to 2012 created a level of large-scale awareness and a series of changes that can be said to have led to “psychology’s renaissance” (L. D. Nelson et al., 2018, p. 512).

Errors in statistical calculations and reporting are also found in the psychology literature. Bakker and Wicherts (2011) present the results of a study and offer some ideas and recommendations that would help to remedy this situation:

In order to study the prevalence, nature (direction), and causes of reporting errors in psychology, we checked the consistency of reported test statistics, degrees of freedom, and p values in a random sample of high- and low-impact psychology journals. In a second study, we established the generality of reporting errors in a random sample of recent psychological articles. Our results, on the basis of 281

articles, indicate that around 18% of statistical results in the psychological literature are incorrectly reported. (p. 666)

Recommendations for establishing best practices to reduce “misreporting of statistical errors” include the need to follow closely the rules for reporting as set out in the *Publication Manual of the American Psychological Association* (Bakker & Wicherts, 2011, p. 676). At the time of the Bakker & Wicherts study, APA rules followed the 6th edition of the *Publication Manual of the APA* (2010). The current *Publication Manual of the APA* (at the time of this writing) is the 7th edition (2020) and the rules for reporting results may be found in the section of the manual entitled “Numbers” (American Psychological Association, 2020a, pp. 178–188).

Even with the publication of corrective guidelines about the use and misuse of *p*-values, for instance, by the American Statistical Association in 2016 (and many other such guidelines published over the years), the problems of “misuse of statistical procedures and poor methods has persisted and possibly grown. In fields such as psychology, neuroscience and medicine, practices that increase false discoveries remain not only common, but normative” (p. 2) and that “many prominent researchers believe that as much as half of the scientific literature—not only in medicine, by also in psychology and other fields—may be wrong” (p. 2). In fact, for many years (since early exhortations about increasing power published in 1962), studies in psychology have suffered consistently from low statistical power (Smaldino & McElreath, 2016).

The prevalence of statistical reporting errors in articles in psychology journals has been studied by other researchers and shown to be high (Nuijten et al., 2015). The availability of helpful new automated tools that have been created in order to efficiently carry out the work of checking statistics comes with some notes of caution about effects on researcher and journal reputation. One of those tools is the free, open-source R package and web app, “statcheck” (<http://statcheck.io>). Statcheck “automatically extracts reported statistical results from papers and recalculates *p*-values” and works very well for psychology because APA reporting style requires reporting statistics in a consistent manner (and accuracy of the tool is decreased for those statistics that do not conform to APA statistical reporting conventions; Nuijten, 2018).

In a study using statcheck that included psychology articles from four major publishers (two others would not allow the text mining necessary to do the research) constituting more than 50,000 articles and approximately 700,000 statistical test results, Hartgerink (2016) explains that “this dataset of statistical results and accompanying metadata can be used to inspect if specific papers include

potential statistical errors or for trends in statistical results over time” (p. 2). Following this extensive study of a large subset of the psychology literature, the results will be posted to PubPeer, “an online platform for post-publication peer review” (<https://pubpeer.com/>). This initiative to put all of the studies in PubPeer will open up all of the articles to scrutiny and possible correction if needed. So far, reaction from researchers has been mixed. Hartgerink suggests that publishers might want to run the statcheck algorithm on all papers before publishing (Chawla, 2016a). There has been pushback against this use of PubPeer without having contacted authors, and also questions about the use of the statcheck algorithm. One German research society, the Deutsche Gesellschaft für Psychologie (DGPs) has called for an end to this use of PubPeer (based on statcheck), citing concern for researcher reputation (Chawla, 2016b). In another study of statcheck accuracy, Nuijten found “statcheck to be very effective at flagging inconsistencies and gross inconsistencies, with an overall accuracy of 96.2% to 99.9%” (Nuijten, 2018).

Following the aforementioned analysis on the reproducibility of the scientific literature in psychology (OSC), Baker (2016) reported on a *Nature* survey that returned 1576 responses on a questionnaire focused on whether scientists feel there is a crisis in reproducibility in research:

The data reveal sometimes-contradictory attitudes towards reproducibility. Although 52% of those surveyed agree that there is a significant ‘crisis’ of reproducibility, less than 31% think that failure to reproduce published results means that the result is probably wrong, and most say that they still trust the published literature. (p. 452)

The same survey also revealed that “more than 70% of researchers have tried and failed to reproduce another scientist’s experiments, and more than half have failed to reproduce their own experiments” (p. 452). The survey also was focused on asking respondents to rate different approaches to improving reproducibility in science.

In 2011, a proposal labeled “Simple Solution to the Problem of False-Positive Publications” that listed six possible requirements for researchers, and four guidelines for reviewers that could possibly be remedies for some of the issues facing psychological science research and publication was put forth. These six requirements encompassed rules around data collection and reporting of experimental conditions, for instance, while not imposing a burden. The guidelines for reviewers, among other recommendations, would ensure that the rules for accepted practice would be followed (Simmons et al., 2011).

A survey by Fuchs et al. (2012) of 1,292 psychologists was undertaken to determine if they would support these requirements and guidelines, and in general, whether they

were open to change. While psychologists were found to be open to change, a majority of respondents did not support having hard and fast rules based on some of the requirements as a condition of publication. Respondents did consider the requirements to be standards of good practice even if they did not support all of them as conditions of publication. One requirement, that “authors must report all experimental conditions, including failed manipulations” (p. 640) did receive majority support as a condition of publication. A reminder was also issued that any sort of standards affecting the publication process must take into account the wide variety and diversity of psychological science research.

After more than a decade of focus on issues such as replicability, Vazire and Nosek (2023) asked in an article, “Is Psychology self-correcting? Reflections on the credibility revolution in social and personality psychology.” The authors discuss how the reform movement has improved the credibility of research in psychology. Clark et al. (2023) also point out, in a study of papers that were published between 1978 and 2021 (but did not replicate later) showed that psychology papers that fail to replicate are less likely to be cited. The authors “found consistent evidence that failing to replicate predicted lower future citations and that the size of this reduction increased over time” (p. 1) and that “these findings suggest that the publication of failed replications may contribute to a self-correcting science by decreasing scholars’ reliance on unreplicable original findings” (p. 1). Psychological research practices can be improved and if so, will lead to an increasing ability to replicate findings. A high degree of replication is possible (when the discipline follows very prescribed techniques), and this fact needs to be communicated widely. To illustrate this, Protzko et al. (2023) completed a prospective test based around the work of four coordinated laboratories that would demonstrate a high rate of replication (if all best practices are followed) that achieved a very high 86% success rate.

Outside of current studies and controversy surrounding them, effective scholarly communication in psychology depends on a discussion of what gets published (and where) and what has impact. The research community will decide its direction in order to continue to build on credible research results. Achieving a degree of transparency and openness is integral to the research process if reproducibility of results is a goal. In 2018, The American Psychological Association came out with the news that they have created a new position for an Open Science and Methodology Chair, a position that would “work with its authors, reviewers, editors and publications board to understand and develop best practices for the evolving landscape of open science in psychological research” (Mills, 2018). Clearly, there is momentum in

the move to openness for the publication and sharing of research results (including data) in psychology.

Incentivizing open research and publication behavior is one way to ensure that researchers prioritize openness in practice. Nosek et al. (2015) mention that universities, funders and publishers provide different incentives for researchers focused on impact, and there is little coordination of effort toward openness. Some early career researchers have been willing to speak out about the benefits of practicing open science even while needing to succeed in the current academic environment with its existing system of incentives and evaluation practices (McKiernan et al., 2016). At least one university has written an explicit statement in an advertisement for an available position that seeks to attract candidates who practice and will practice open science behaviors. The statement from the department of psychology at Ludwig-Maximilians-Universität (LMU) München reads (translated from German), “Our department embraces the values of open science and strives for replicable and reproducible research. For this goal we support transparent research with open data, open material, and pre-registrations. Candidates are asked to describe in what way they already pursued and plan to pursue these goals” (Schönbrodt, 2016). In a May, 2018 update, LMU’s psychology department now uses an explicit hiring policy statement in all of its professorship job advertisements. Currently, “if you want to join the LMU psychology department as a professor, you should better have some open science track record” (Schönbrodt, 2018). In the United States on March 21, 2018, Southern Methodist University (SMU)’s Department of Psychology adopted an “open sciences practices policy for conducting research in the department” (Holden, 2018). The policy recommends preregistration, data sharing and uploading preprints and states that “adopting the policy will be viewed very favorably by the chair and faculty members’ efforts to adhere to the policy will be recognized in their annual reviews.” Another example comes from University of Oregon, where the psychology department moved to incorporate open science principles into its hiring practices, and had also integrated open science into teaching of both graduate students and undergraduates. In the hiring process, the department developed language that it adapted from the aforementioned LMU language (and the language listed in job advertisements in the 2016 SIPS conference) to signal to candidates that: “Our department embraces the values of open and reproducible science, and candidates are strongly encouraged to address in their statements how they have pursued and/or plan to pursue these goals in their work” (National Academies of Sciences, Engineering, and Medicine, 2021, p. 10). The University of Oregon is also working to

integrate open science into promotion and tenure activities. In 2022, beyond hiring, The University of Maryland's psychology department moved to include open science practices in its core criteria in tenure and promotion review (SPARC, 2022b). There is no mistaking that every early career researcher (as well as senior scholars) will look to their departments and universities for tools and services that maximize Open Access and open science of all research activity.

The OA status of publications presented on a candidate's dossier has come into play of late in promotion and tenure actions in some institutions. Certain universities are moving toward requiring OA for all faculty (and in some cases, graduate student) publications, via availability in the institutional repository for all materials being submitted in promotion and tenure actions, or for reasons of compliance with funder mandates. In listing examples of universities that are moving toward openness in this way, Shieber and Suber (2017) explain:

When the institution considers faculty for promotion, tenure, awards, funding, or raises, and when it reviews their publications as part of this process, then it should limit its review of their research articles to those on deposit in the institutional repository. Or it should use the institutional repository as the mechanism for submitting articles for use or review by internal committees.

An example of this trend may be found at Indiana University-Purdue University Indianapolis (IUPUI) in the United States, where open practices found their way into promotion and tenure guidelines. This factor puts a focus on the importance of providing wide availability of the institution's scholarship as part of researchers' priorities (Odell et al., 2016). However, recent research into the content of 850 review, promotion, and tenure (RPT) protocols has shown little mention (5%) of Open Access in guidelines published by institutions (Fleerackers, 2018). There appears little real incentive for today's scholars to put a priority on making their work OA, at least in terms of formal university promotion and tenure guidelines.

There are other coming pressures that will affect all researchers. The U.S. National Institutes of Health (NIH) is increasing its focus on the need for all grant submissions to demonstrate scientific rigor and reproducibility. This follows on earlier initiatives that promoted discussions about reproducibility in psychological science, such as the 2011 example where the National Institute on Aging partnered with the Association for Psychological Science and the NIH Office of Behavioral and Social Science Research (Desoto, 2016). Importantly, NIH's 2016 to 2020 strategic plan states: "NIH will take the lead in promoting new approaches toward enhancing the rigor of experimental design, analysis, and reporting" and also will focus on "ensuring compliance with policies for Open

Access to the published literature and data sharing" (National Institutes of Health, 2016, p. 35). NIH's Grants & Funding webpage (<https://grants.nih.gov/reproducibility/index.htm>) describes scientific rigor as "the strict application of the scientific method to ensure robust and unbiased experimental design, methodology, analysis, interpretation, and reporting of results. This includes full transparency in reporting experimental details so that others may reproduce and extend the findings" and that "the NIH plans to require formal instruction in rigorous experimental design and transparency to enhance reproducibility for institutional training, institutional career development, and individual fellowship applications no sooner than 2017."

In recent years (since approximately 2010), it has been observed that open science practices by researchers have been improving, and an article that describes this important evolution is described in *Annual Review of Psychology* in an article entitled "Psychology's Renaissance" (L. D. Nelson et al., 2018). Even though improvement can be noted, there is still a way to go for psychological science to realize a high level of open data sharing. One incentive might be the possibility of a citation advantage for data that is shared openly in digital repositories, and in one study, Colavizza et al. (2020) describe a citation prediction model for articles in PLOS and BioMed Central journals that demonstrates an advantage for research articles that link to data in repositories via a persistent identifier (p. 12). Towse et al. (2021) describe the situation where "overall, few research papers directly link to available data in many, though not all, journals" (p. 1455) and offer practical recommendations for improvement in open data practices (which the authors also call "public data-sharing") across Psychology and social science (p. 1455). This study not only described the low prevalence of open data across subdisciplines of Psychology (95% nonexistent in the sample) but also the many issues discovered around completeness and lack of reusability of available data sets (such as lack of robust metadata, and file formats that are not accessible; p. 1464). The seven steps that form recommendations (which are each fleshed out with practical information) from Towse et al. (2021) include:

Use of third-party repositories (to help maintain data Findability as part of FAIR); Fully describe the dataset (to improve its functionality and interoperability); Journals could provide clear, practical open data guidelines (to improve data quality, especially interoperability and reusability); Authors should ensure a long-term accessible version of their data (to improve reusability); Provide clarity about the authoritative version of data (to ensure credibility of data and its reusability); Remember that there are ways to share sensitive data (overcome obstacles to sharing data); and Standardize how open data is identified at a journal

level (signposting the invitation to provide data and emphasise findability). (pp. 1466–1467)

The FAIR Principles have been a foundational background set of principles of open science since 2016, and include:

guidelines to improve the Findability, Accessibility, Interoperability, and Reuse of digital assets. The principles emphasise machine-actionability (i.e., the capacity of computational systems to find, access, interoperate, and reuse data with none or minimal human intervention) because humans increasingly rely on computational support to deal with data as a result of the increase in volume, complexity, and creation speed of data. (FAIR Principles, 2022)

Another consideration in the move to open science is the issue of authorship of open data and how it is viewed and incentivized by funders, journals, and even promotion and tenure committees. How is authorship of open data as a research output valued in terms of impact? If reward was to be conferred on open research data as it is for books and journal articles, that would certainly incentivize more data sharing. If sharing is mandated, such as by funding agencies (such as by the National Institutes of Health), then certainly the authorship should be credited and rewarded in evaluation systems (Springer Nature, 2022b).

Tedersoo et al. (2021) studied data sharing from a disciplinary perspective across nine disciplines (in articles from *Science* and *Nature*) and showed that “Although data sharing has improved in the last decade and particularly in recent years, data availability and willingness to share data still differ greatly among disciplines” (p. 1) and that researchers could be more motivated to share data if there were more tangible benefits such as “recognition, or bonus points in grant and job applications” (p. 1). This study reveals issues that may impede data sharing, certainly for some in psychology, even as citation rates for open data sharing are higher. Results from asking the author why there was no sharing (when data weren’t available) was presented. In the study, psychology, along with social sciences and humanities (compared to natural sciences, for instance) showed the data were not made available upon request most often among the disciplines studied. Upon inquiry as to why data could not be shared, “psychologists pointed most commonly to legal or privacy issues” (Tedersoo et al., 2021, p. 5). It is not acceptable or productive anymore to simply ask the author(s) to share their data. This approach will also not suffice for satisfying funder or publisher mandates. Each discipline and field will need to set out expectations for data sharing as well as specific best practices and easily accessible mentoring and instruction around how and where to do so. Frank discussion around the valid concerns of researchers should be a

regular topic in universities and professional meetings. The issues with open data availability impact all areas of reuse and reproducibility as well as the integrity of the published record of psychology.

Another study that sought to determine whether data sharing practices are becoming more open and transparent looked at articles in all issues for 2012 of 4 APA journals (*Emotion*, *Experimental and Clinical Psychopharmacology*, *Journal of Abnormal Psychology* and *Psychology and Aging*). Authors of the total of 394 papers were all contacted and asked to share their data, and only 38% of authors were willing and/or able to share their data. In fact, that APA’s Ethical Principles of Psychologists and Code of Conduct stipulate how data is to be shared in psychology journals (Vanpaemel et al., 2015). Bosma and Granger (2022) reiterate the importance and relevance of the of APA’s Ethics Code, and state that:

Open science practices provide promising approaches to address the ethical issues of inaccurate reporting and false-positive results in psychological research literature that hinder scientific growth and ultimately violate several relevant ethical principles and standards from the American Psychological Association’s (APA’s) Ethical Principles of Psychologists Code of Conduct. (APA, 2017)

Bosma and Granger (2022) also have their list about ways to accomplish better adherence to the APA Ethics Code that includes:

Preregister Studies and Study Protocols, Make use of Data Repositories, Manage and Archive data using Nonproprietary File Types, Share Code, Adhere to the APA Publication Manual and Journal Article Reporting Standards (JARS), adopt statistical reviewers as part of the review process; and Implementation and Use of Public Data-sharing Policies. (pp. 570–573)

Some reviewers also began to take a strong stand on open data, and stated that after January, 2017, they will reject papers if underlying data is not available for the process, or an adequate explanation has been given if it can’t be. Scientists are adding their names as signatories on the Peer Reviewers’ Openness Initiative, which hopes to increase transparency in psychology (Morey et al., 2016; Naik, 2017).

As in many other disciplines, there is not a single major disciplinary research data repository at present that is dedicated to psychology. APA maintains a list (<https://www.apa.org/research/responsible/data-links>) and some universities do as well. However, many disciplinary lists that mention specific data repositories common in other disciplines would point the researcher to the popular generalist repositories for public deposition of data if there is no accepted data repository for the discipline (as is the

case with psychology). The journal *Nature Scientific Data* maintains a list at: <https://www.nature.com/sdata/policies/repositories#general> where the popular generalist repositories such as Figshare (<https://figshare.com/>), Dryad (<https://datadryad.org/>), Open Science Framework (<https://osf.io/>), Zenodo (<https://zenodo.org/>) and others are listed. On this list, neuroscience repositories are listed and may be useful to some psychological science researchers. For any researcher, depending on university affiliation, many institutional repositories may be the first best stop in seeking a repository for open data. Institutional repositories and librarians that specialize in research data curation and management may be available to assist affiliated authors and researchers with strategies for making data available Open Access.

Hahnel (2022) adds his recommendations for achieving better metadata for every dataset. These recommendations include the need to:

encourage researchers to title their dataset as they would a paper; for institutional librarians being recruited to curate metadata for outputs before they're published; more training for academics on the benefits of making their data more discoverable by making it more descriptive; services offering curation; marking up existing metadata using related information openly available on the web.

Hahnel, CEO and founder of Figshare offers this list of generalist repositories that are all part of a collaborative grant:

We recently received funding as part of the NIH GREI (Generalist Repository Ecosystem Initiative) project to improve the generalist repository landscape and collaborate with our colleagues at Dryad, Dataverse, Mendeley Data, Open Science Framework, and Vivli. This community of generalist repositories has witnessed first-hand the rapid growth of researchers publishing datasets and the subsequent need for guidance on best practices.

Hahnel then adds:

For publishers, there is a huge opportunity to aid the researchers in data publication. Most policies require data publication at the point of publishing the associated paper. While the paper will always be the context and interpretation, the machines need metadata around the objects sourced either from the papers directly—meaning linkages between the two are of the utmost importance—or encouraged by editorial staff before the outputs are made public. (Hahnel, 2022)

An example of an integration of a generalist data repository solution (Figshare) into the manuscript submission system for convenience of researchers that need to share

data comes from *Nature Neuroscience*. This journal has seen a successful uptake of data sharing by its authors during a pilot period (April 2022 to June 2023), where they saw “an overall improvement in data sharing practices for the papers published in our journal. The percentage of published papers linked to the data underlying the results increased from 52% in 2021 to 58% and 71% in 2022 and 2023, respectively” (“How We Promote Data Sharing,” 2023).

One wonders whether it will be funders who will supply the needed leverage, with many seeing mandates such as the NIH's mandate of 2023 (NIH Data Management and Sharing Policy), or journals (as a condition of publication), or universities who may develop their own mandates around data that emerges as a research output from their labs or other researcher spaces. Another challenge for this environment where the desired end (open data) is somewhere on the horizon for Psychology is due to the many stakeholders and players in the open science ecosystem that must work together to provide an interconnected set of services and infrastructure that any researcher can access, and find useful and easy in terms of participation. A complex environment provided by an array of stakeholders that includes repositories, various types of psychology publishers, peer reviewers, funders, providers of persistent identifiers (such as Crossref and DataCite), and Open Access/scholarly communication library services (as well as mixed incentives for the researcher) can be a dizzying situation. Complying with various mandates and promotion and tenure guidelines only exacerbates the length of the researcher's path to publication. In the university, it is not always clear where an author can seek assistance with any of these services or the infrastructure running them (if they are available at all). Libraries in research universities not only provide relevant services but consulting can be made available from librarians with wide-ranging expertise in OA and scholarly communication services. Whether assisting researchers with literature search, managing research data, creating robust services around metadata, or exploring OA strategies, librarians are leveraging their long experience with scholarly publishing and the research process. It also helps to have strong voices from senior scholars or active junior scholars that are innovating and speaking and writing on new paradigms in OA and open science.

Much of the new focus on open science will affect the research practices of early career researchers going forward. All researchers, but in particular, the early career researchers will need to keep up with all new scholarly publishing paradigms. That group can learn strategies for marketing early works, can follow the impact of their work in new metrics services and collaborate globally via

new communication modes. For those early career researchers interested in Open Access and related areas, there are ways to engage. One global conference that has focused specifically on engaging early career researchers (ECRs) with “open” is OpenCon, a 3-day annual conference that has alternated between the United States and Europe, providing an opportunity for intense learning and collaboration about Open Access, open data and open education (SPARC, 2017). In recent years, OpenCon (<https://www.opencon.community/>) has hosted many regular community calls to continue its work in engaging ECRs around important issues of the day, whether Open Access or open science. Early career faculty will find hitting benchmarks for numbers of articles to publish higher than in the past (Savage & Olejniczak, 2022). With pressure to publish, and more articles required for promotion and tenure all the time, early career researchers will need mentors and advisors that help to ensure that they are using the most impactful methods throughout their research process, making all results of research including data and possibly methods and code as well OA. When it comes to this group, in one 2016 survey from Digital Science about open data, “62% of early career researchers said that they would welcome more guidance on compliance with their funder’s policy” and it was stated that there is assistance available at many institutional libraries: “Librarians have become an indispensable source of knowledge around all things to do with data, code and policy; cementing their role at the heart of the research institution as key facilitators of the research process” (Digital Science, 2016).

### **Guidelines, Standards, and Incentives for Open Research in Psychology**

There are many examples of the move to more open research practices now evident in the scholarly communication landscape for psychology. In terms of coalescing around shared standards, the example of the eight standards (and three levels) that make up the Transparency and Openness Promotion (TOP) Guidelines (<http://cos.io/top/>) demonstrates evidence of action by the scientific community to tackling issues such as reproducibility and data sharing. The TOP Guidelines are described on their webpage as “transparency, open sharing, and reproducibility are core values of science, but not always part of daily practice. Journals, funders, and scholarly societies can increase reproducibility of research by adopting the Transparency and Openness Promotion (TOP) Guidelines...” The eight standards are citation standards, data transparency, analytic methods (code) transparency, research materials transparency, design, and analysis transparency, preregistration of studies,

preregistration of analysis plans, and replication (Nosek et al., 2015). A recent 2021 addition from Center for Open Science (COS) is the TOP Factor (TOPFactor.org), which measures how individual journals are implementing the TOP Guidelines. An example for the Association for Psychological Science (APS) journal, *Psychological Science* can be seen at: <https://topfactor.org/journals/psychological-science>, and another journal with a high TOP Factor is *Advances in Methods and Practices in Psychological Science (AMPPS)*. The list of signatories to the TOP Guidelines (over 5,000 journals and organizations until the end of 2020 when the list was complete) demonstrates participation and support by psychology publishers and journals for the ideals proffered in the Guidelines. Acknowledging disciplinary differences is paramount in this area and journals reporting the research results of psychological science will need time to reach a level of data sharing that, for instance, economics has achieved thus far (Nosek et al., 2015). Collaboration between publishers, authors, and other stakeholders will be necessary in developing the trust that will ensure that everyone in the system understands what needs to be made open and when, and how articles, data, code and other results of research will be produced and shared. The Association for Psychological Science (APS) and the Society for Personality and Social Psychology (SPSP), along with many individual psychology journals, are some of the signatories on the TOP Guidelines, and are utilizing some of the standards in their publications. The American Psychological Association (APA) announced in 2020 that it had become a signatory to the TOP Guidelines (Center for Open Science, 2020).

Another example of a publisher setting out expectations and policies around open science can be seen with *Behavioral and Cognitive Psychotherapy (BCT)*, a title from BABCP (British Association for Behavioural and Cognitive Psychotherapies), which has set out a “Research Transparency Policy” that stipulates that “research articles should contain sufficient information to allow other researchers to understand and replicate findings. We have therefore implemented a Research Transparency Policy to make, where possible, evidence, data, code and other materials that underpin the findings openly available to readers” (Salkovskis & Thwaites, 2021, p. 1).

Another online platform for publishing contributions in psychology (with an emphasis on European psychology) is PsychOpen from Leibniz Institute for Psychology (ZPID). “PsychOpen supports the preregistration of studies as well as the publication of research data, replications, and research syntheses.” PsychOpen has the channels PsychOpen GREEN where free publications are available, and PsychOpen CAMA (Community-Augmented Meta-Analysis) which is an “infrastructure

to collaboratively compile the findings from primary studies to facilitate meta-analytical syntheses of these data” (ZPID, 2023). PsychOpen also publishes OA journals in Psychology, and in their call for new journals on their website (<https://psychopen.eu/call2023/>), describes the Institute as, “ZPID is a publicly funded research support organization for psychology, and is committed to furthering Open Science” and “PsychOpen GOLD is an open access publishing platform for primary research in psychology and related fields. Currently, 15 journals are published by PsychOpen GOLD.”

There will likely be many new services that can facilitate the development of open research practices for psychological science. Keeping guides and lists updated may be a daunting task for those advising researchers regarding workflows best practices. In the future, it is possible that the discipline will really coalesce around major workflows and services expected by institutions, journals and funders. One thing that nobody seems to have enough of is time, and doing things right the first time and creating efficiencies in the system will have major benefits for all stakeholders. New workflows create more burden for busy researchers, and there has to be a payoff in terms of impact for these services to gain traction in the community. Getting research out fast is a major motivator.

Some journals proudly display badges to signify compliance with open practices. An early example of a journal using open scientific practices and extending incentives such as badges to authors for using them was *Psychological Science* (Association for Psychological Science; Eich, 2014). Instructions for authors for manuscripts accepted after January 1, 2014 indicated that three badges were available: Open Data, Open Materials, and Preregistration. The APS webpage also publishes lists of recipients of badges, and full information for earning them (Association for Psychological Science, 2016). As for results, when *Psychological Science* started the badges program in January, 2014, about 3% of articles included open data, and by the first half of 2015, that rate had risen to nearly 40% of articles. This was not the case for other psychology journals in the comparison group of publications without badges where incidence of open data was still low. Also, before badges, and in the comparison group, the study found that there was little actual sharing of data that was complete or usable (Kidwell et al., 2016). As of the July 2018 issue of *Psychological Science*, readers could see 13 (out of 15) articles in the issue had received the data badge. Interestingly, it has also been suggested that an author may want to display badges on their curricula vitae (CV) as a way of signaling their use of open practices (in addition to the presentation of badges on the published paper alone) (Aarts, 2017). In 2021, the National Information Standards

Organization (NISO) published its recommended practice on reproducibility badging that can be used to reward the sharing of data and methods across research output types (<https://www.niso.org/publications/rp-31-2021-badging>).

In another response to a new scholarly communication landscape in psychology, the APA introduced a new and innovative OA journal in 2013, *Archives of Scientific Psychology*. This innovative publication covers all areas of psychology, and uses a unique approach that is summarized by seven attributes: all articles are openly available via the internet for all readers worldwide, the description of methods used in each study is freely available on the internet, and the authors have made the data available (after agreement by the journal’s review committee regarding usage) for verification of results. Two versions (one for scientists and one for the public) of each article’s Abstract and Method section are made available for readers. Two abstracts are prepared, one for retrieval of the scientific article and one that is written in nontechnical language for the public, and the Method section also includes a brief nontechnical summary. Comments by scholars and the authors’ responses to them may also be published alongside the article (Cooper & VandenBos, 2013). While this approach includes time spent on presenting the material in the article for a lay audience (and this is a laudable contribution), it will be interesting to see whether this extra step is meaningful for researchers and faculty authors that generally write and publish for promotion and tenure, not for communicating with the public. At least one study of promotion and tenure criteria shows that engaging with the public effectively around one’s scholarly work does not necessarily help to advance an academic career (June, 2018). This may be changing. Discussions are increasingly taking place around the new recommendations from funders (such as the U.S. OSTP Nelson Memo) for the need to ensure increasing access by the general public to the peer reviewed scholarly literature. Funder mandates that focus on accessibility of public access to research will continue to enable important conversations about the need to maximize the usefulness and accessibility of the literature. That will mean expectations around public engagement and accessibility (such as the need for lay summaries) on articles.

The APA’s *Archives of Scientific Psychology* became the first adopter of the JARS (Journal Article Reporting Standards), published in 2011 (Cooper, 2011). Authors submitting articles to this publication complete a questionnaire version of the JARS, including detailed information on rationale, method, results and interpretation, and the Method section of the article links to it. Updated JARS (for qualitative and quantitative research) were published by APA in 2018. JARS information is made



freely available from multiple APA-related sites (Kazak, 2018). *Archives of Scientific Psychology* was the first APA journal to require sharing of research data by all authors (Cooper, 2011). APA Journals now utilizes a specific data repository to make data associated with this publication available (<https://osf.io/view/apa/>). Clearly, the publication of *Archives of Scientific Psychology* used a groundbreaking new approach to OA, open data and other open practices, and serves as a model and an experiment to see how authors will respond and how soon other journals will follow suit.

As for the JARS, newer standards for psychology from the APA continue to provide important guidance for authors, reviewers and editors around reporting of research results. One important new standard is JARS = Race, Ethnicity and Culture (JARS-REC): Information Recommended for Inclusion in all Manuscripts (<https://apastyle.apa.org/jars/race-ethnicity-culture>). Ledford (2023) describes guidance set out in the JARS-REC:

These measures include the need for authors to acknowledge the impact of the racial and cultural histories of the communities being studied, and to state how the ethnicity and culture of the researchers themselves could influence results. The guidance also calls for reviewers to evaluate and address the potential of a study to be misused in ways that cause harm. And it includes statistical considerations, such as the need for analyses to account for potential over- or under-sampling of different groups.

Availability of open data is necessary to combat fraud and to allow replication and reuse of research results. In a 2011 case of scientific fraud, it is felt that the lack of openness and availability of research data can be listed as a factor that contributed to the large-scale misconduct carried out over a period of years by the Dutch social psychologist Diederik Stapel (Wicherts, 2011). In a review article, Gross (2016) examined the many issues with scientific misconduct (described as encompassing fabrication, falsification and plagiarism) that involve all disciplines, including psychology.

The prevalence of questionable research practices (QRPs) by research psychologists has been the focus of a recent study and was found to be “surprisingly high.” Interestingly, “relatively high rates of QRPs were self-reported among the cognitive, neuroscience, and social disciplines, and among researchers using behavioral, experimental, and laboratory methodologies (for details, see Data Analysis in the Supplemental Material). Clinical psychologists reported relatively low rates of QRPs” (John et al., 2012, p. 529). Another study of Dutch researchers across the scientific disciplines focused on questionable research practices but also on the incidence

of the more serious category of fraud found that also found that “more than half of Dutch scientists regularly engage in questionable research practices, such as hiding flaws in their research design or selectively citing literature” and “one in 12 admitted to committing a more serious form of research misconduct within the past 3 years: the fabrication of research results” (de Vrieze, 2021). More open and transparent publishing practices would likely bring some of this to light, especially the comprehensive end to end open science workflows leading up to, and ending in OA publication to articles and supporting research data. Wicherts (2021) suggests that in terms of improving practices by researchers:

Much of the advocacy and awareness has been driven by early-career researchers. Recent cases show how preregistering studies, replication, publishing negative results, and sharing code, materials and data can both empower the self-corrective mechanisms of science and deter questionable research practices and misconduct. (p. 153)

The issues of transparency and reproducibility are not unique to psychology but will need to be addressed going forward. Open source tools, such as the open lab notebooks in daily use by scientists create a culture of openness, and many are in use or development today (Buck, 2015). In 2021, when the popular Jupyter Notebook had been around for 10 years (from its beginnings as the IPython Notebook), Perkel (2021) provided a description that “computational notebooks combine code, results, text and images in a single document, yielding what Stephen Wolfram, creator of the Mathematica software package, has called a ‘computational essay’” (p. 156). Other alternatives to Jupyter notebooks mentioned include Observable, Reactor, and others. There are challenges with notebooks available on GitHub not executing, and some are not easy to use for collaborative work. Interesting use cases for computational notebooks may be to create open educational resources (open textbooks) utilizing multiple notebooks that use Jupyter and R Markdown since they “permit the interweaving of narrative text, code, and figures, and have the ability to export static and dynamic output formats” (Alessandroni & Byers-Heinlein, 2022, p. 15). Early adopters of open lab notebooks in the biomedical sciences (such as [openlabnotebooks.org](https://openlabnotebooks.org)) have published reports laying out the benefits and challenges of using these tools, where discussions continue around the need for expectations and incentives around open science while continuing to study implications around being scooped, availability of the time needed to support use of open notebooks, and working effectively with collaborators in teams using open lab notebooks (Schapira et al., 2019, p. 6). More reports on how open lab notebooks are used in psychological

science would be beneficial to the conversation on how this aspect of open science should be taught in universities and used by researchers in a consistent manner.

PLOS has created the *Open Source Toolkit* to stimulate discussion and curation around the use of open source hardware and software in research (“Open Source Toolkit: A Global Forum for Open Source Hardware and Software Research and Applications,” 2017). Wills (2019) describes the impetus for changes to scientific processes in psychological science that arose from the Replication Crisis and how the discipline moved through working with the Free and Open Source Software Community resources to truly transform open science practices. Tools and services evolved that allowed open science to take hold, and that “psychology has a long history of using closed-source platforms, perhaps most notably the proprietary data analysis software SPSS...” but that use of SPSS has been declining steeply, as the use of R increases. Wills details the benefits of using and teaching R for psychology, and mentions his own example of open educational resources (OER) for undergraduate psychology students entitled *Research Methods in R* (<http://www.andywills.info/rminr/>).

There is increasing use of GitHub in many science disciplines, for example in neuroscience. “GitHub.com, a hugely popular website for collaborative work on software code” allows scientists to post data and others to add to that data (Perkel, 2016). Of course, the 2018 acquisition of GitHub by Microsoft (Microsoft News Center, 2018) may have caused some open source advocates to move in a different direction. Tools are now available to both facilitate the peer review of code and enhance the reproducibility of reported scientific findings right from the article. Code now can be cited with its DOI, and the platform Code Ocean is in use by researchers in psychology to share results in an open manner. This useful value add to scholarly publishing has been trialed at some Nature Research journals:

Code Ocean is a computational reproducibility platform that aims to make code more readily executable and discoverable. The platform, which is based on Docker, hosts the code and data in the necessary computational environment and allows users to re-run the analysis in the cloud and reproduce the results, bypassing the need to install the software. (Pastrana & Swaminathan, 2018)

At present, Code Ocean is also being used by other publishers of psychology content, such as Taylor & Francis, where the Code Ocean widget is being integrated into the article, allowing readers to run the code right from the article (<https://codeocean.com/press-release/taking-the-journal-article-to-the-next-level-taylor-francis-partner-with-code-ocean>). The first two psychology journals from

Taylor & Francis that will integrate Code Ocean into articles are *Comprehensive Results in Social Psychology* and *Journal of Social Psychology*.

Code Ocean has built a solution to the need for computational reproducibility in psychology and delivered a practical and useful tool to the researcher and reader. There may have been a lack of use of the type of “container” technology (such as Docker) in psychology and scientists at Code Ocean have detailed step by step instructions for the use of the technology that underlies the platform (Clyburne-Sherin & Green, 2018). There are other examples of “standardized platforms (that) allow researchers to run each other’s software-no installation required” and that support “notebooks and conventional scripts in Python, R, Julia, Matlab and C, among other languages.” By 2023, Code Ocean, described as the “world’s first Reproducible Research Cloud” will allow academic research labs to:

be able to do more than publish – they will also be able to import and build upon data and other critical information from computational research performed by other teams and institutions, and will have greatly enhanced capabilities, including collaboration, data analysis, and the ability to store their data in a cloud-based service. (Code Ocean, 2023)

Interestingly, for those concerned about preservation of the published products of research, Code Ocean “compute capsules” are archived in the well-known collaborative preservation project of libraries and publishers, CLOCKSS (Perkel, 2019, p. 248). The psychology article of the future will likely be a much enhanced package that ensures a heightened ability for readers and researchers to replicate and assess the results of research in real time.

For the reporting of research results in publications to reach maximum potential, it is important to provide clear citations to enable reuse and reproducibility. There have been calls for publishers to enable better citation for software. A key to improving all aspects of communication open science is the citing and credit given to the development of software. Katz and Murray (2021) discuss the work of a cross-stakeholder group of publishers, researchers and scholarly communication services that have been developing guidelines around issues of software citation and credit. This group, the FORCE11 Software Citation Implementation Working Group expects that these guidelines will be adapted to the specific needs of each community. CHORUS, following the guidance of FORCE11, provides a webpage, *The Software Citation Policies Index*, where the policies of many publishers around software citation may be found (<https://www.chorusaccess.org/resources/software-citation-policies-index/>). Often software is mentioned in the body of a publication, maybe in the methods section, but is not always cited in the references (Katz & Murray,

2021). Psychological science may weigh in on this issue beyond what's currently available in the 7th edition of the Publication Manual of the APA. Some research libraries, (e.g., at MIT) include software as a category in their guides to citing sources (MIT Libraries, 2022).

### **Publication Bias, Excess Success, and Preregistration of Studies in Psychology**

In diverse fields of cognitive science, evidence exists for the prevalence of publication and selective reporting biases (Ioannidis et al., 2014). Ioannidis et al. provide analysis of the many studies of reported bias and offer some possible solutions to these problems. One example of an important issue is the existence of the persistent trend in the United States where most published studies report positive results. The worsening trend of the increase in the publication of positive outcomes, when studied across disciplines and countries, points out the psychology/psychiatry has one of the higher rates of increase (Fanelli, 2012). With replication an issue, there is an issue with the “canonization of false facts” and calls for more publication of negative findings. Interestingly, new journals have cropped up that just focus on negative findings, for instance *PLOS ONE*'s Positively Negative collection. Negative findings might also at least be published online as preprints just to get them into circulation (Nissen et al., 2016). However, formal publication of negative findings, the aspiration of these new journals, have not necessarily found success. One such publication, Elsevier's *New Negatives in Plant Sciences* was discontinued after the publication of only 12 articles (“Editorial,” 2015; “Publisher's Note,” 2016). Bias against the publication of negative results has many possible explanations, and needs continuing analysis. Increasingly, the article submitted to the journal must reach perfection, even aesthetically, while competing in an ever crowded field of submitted papers in an ever increasing “publish or perish” environment (Giner-Sorolla, 2012). As to the question of why it is so difficult to publish negative results, there are many issues such as the attraction of proving theories correct, more excitement by journals in publishing positive findings, putting a positive spin on less than positive findings, and the prevalence of the common “file drawer effect.” These issues are all under scrutiny (Couzin-Frankel, 2013). Once again, a return to open practices and more sharing of all research results, including negative results, is possible now via the internet and only needs cultural and disciplinary practices to evolve (alongside the electronic). Beyond negative results, it is important to study carefully all issues that result in “unpublishable research results” and the important disciplinary differences that render

important research unfit for publication and relegated to the “file drawer” (Tsou et al., 2014).

In one study that analyzed experimental psychology papers published in the journal *Science* from 2005 to 2012, an example of “excess success” was found, showing that 83% of published articles with four or more experiments had positive study results (Francis et al., 2014). This was similar to the study in *Psychological Science* of a 4 year grouping of articles containing at least four experiments that showed 82% positive results (Francis, 2014).

In a follow up article (to Francis' study on “excess success”), van Boxtel and Koch (2016) focused on one particular article (their own), which had been flagged by Francis. In an example of the value of this type of analysis, van Boxtel and Koch (2016) stand behind their original study, which had been the focus of earlier independent replication. Wide availability of the literature and of these studies in a more open scholarly publishing landscape (and making sure to ensure more open data availability) can continue to keep these issues on the front burner and allow other scientists to respond both formally and informally.

There are many initiatives developing at present that are working to combat problems such as publication bias by using new methods of peer review or modifications to the commonly existing steps in the formal publication process. More open processes help to create new opportunities for enhanced scrutiny of the research process. Preregistration of research studies is one strategy currently being used in psychology. An example of a journal incorporating preregistration is *Cortex* (Elsevier), where, for empirical articles, “Registered Reports,” includes a review of initial manuscripts before data collection commences. Following an “in principle acceptance,” the study will commence exactly as registered, and then a re-review process precedes formal publication (C. D. Chambers, 2013). Beyond Registered Reports, *Cortex* added another article type, Verification Reports, which is a “format focusing specifically on computational reproducibility and analytic robustness” and will demonstrate “whether the claims in previous studies are justified by their own data” (C. D. Chambers, 2020, p. A1).

As of January, 2019, 156 journals (many in the behavioral sciences) had adopted the use of Registered Reports (sometimes referred to as RRs). A list of hundreds of these journals is available from <https://cos.io/rr/#journals>. Funders may be able to use RRs as well, especially those funders that want to promote transparency and reproducibility in research (Munafò et al., 2017). The journal, *Nature Human Behavior* makes the registered report format available to authors and “a prerequisite for publication is that authors agree to share publicly

their raw data, as well as their materials and any code (through deposition in a suitable repository or inclusion as supplementary material)" (p. 1) and "by offering the registered report format, it is the journal's intention to support the research community's efforts for transparency, reproducibility, and open sharing" ("Promoting Reproducibility with Registered Reports," 2017, p. 1). The adoption of more open practices coupled with Open Access to all results of research in the eventual publication process creates an optimal result for the scholarly record. Importantly, APA's *Journal of Personality and Social Psychology* includes information on preregistration as part of its extensive Open Science guidelines (<https://www.apa.org/pubs/journals/psp/?tab=4>). Another example comes from the *Journal of Health Psychology* (Marks, 2020) which sent out an editorial with the journal's policy, including "preregistration of studies and analysis plans" and "*JHP* will publish papers where authors indicate the conducted research was preregistered with an analysis plan in an independent institutional registry (e.g., <http://clinicaltrials.gov/>) of studies involves registering the study design, variables, and treatment conditions" (p. 731). This journal also requires data sharing via Figshare ([figshare.com](http://figshare.com)).

While an increase in preregistration strategies helps, this does not necessarily mitigate the issue of underreporting findings of results in published psychology research. In a study by Franco et al. (2016) in psychology, "the first to provide direct evidence of selective underreporting in psychology experiments" (p. 8) which compared the final reported results of research published in corresponding journal articles using preregistrations and publicly available data available from the *Time-sharing Experiments for the Social Sciences* initiative (<http://www.tessexperiments.org>), where it was found that "published papers diverge substantially from research protocols, with extensive underreporting of outcome variables and experimental manipulations" (p. 11). The findings of this particular study report that the authors:

find that about 40% of studies fail to fully report all experimental conditions and about 70% of studies do not report all outcome variables included in the questionnaire. Reported effect sizes are about twice as large as unreported effect sizes and are about 3 times more likely to be statistically significant. (p. 8)

Besides policies around preregistration for replicability, issues of open reporting of methodologies crop up. Crotty (2021) states that "data alone is not enough, and an enormous hole in the open science movement has been the lagging attention paid to the reporting of research methodologies," and "it does little to validate the quality

and accuracy of the dataset itself. If I don't know how you got that data, I have no idea if it's any good, and I certainly don't stand any chance of replicating it." Crotty (2021) goes on to describe the value of the service, protocols.io (<https://www.protocols.io/>) which is described on its website, in part, as "A secure platform for developing and sharing reproducible methods." In 2020, PLOS announced that they were working with protocols.io to introduce Lab Protocols and Study Protocols, and that these two new article types "are intended to address three issues familiar to researchers: the rigor and reproducibility of research, efficiency in getting feedback, and recognition for developing and sharing diverse research contributions" (Hrynaszkiwicz, 2020). As open research moves forward, "publications," whatever they will look like in the future will need to include more aspects of the research workflow, and publishers, institutions and the discipline will need to value and incentivize the sharing of all open research outputs. Open research methodologies will be a foundational element of a move to open science/research for psychological science.

Even though all of the new policies and workflows related to the evolution to a more open research create more workload for the busy researcher, expectations must be clear and set out as imperative in any university or other research setting (and by funders). Continued discussions around publication bias as well as reliance on authors to take advantage of the many strategies (such as preregistration of studies) to make as many of the products of the research process available in a publicly open and accessible manner will be advantageous in creating a more transparent and credible scholarly publishing environment for psychology. Chambers' 2017 book, *Seven Deadly Sins of Psychology: A Manifesto for Reforming the Culture of Scientific Practice* details the many issues affecting the research and scholarly publishing situation in psychology, including the issues of registered reports and the author suggests potential reforms. This particular book may be considered a "wake up call" for those thinking that there is little need for change in scholarly communication practices in psychology. There are some steps that psychology researchers can take to maximize the impact of their work using open research practices. In an especially useful article, McKiernan et al. (2016) spell out (and thoroughly describe) some of these practices such as: "publish where you want and archive openly," (p. 4), "retain author rights and control reuse with open licenses," (p. 6) and "publish for low-cost or no-cost" (p. 7), as examples. C. Chambers and Etchells (2018) further provide a strong statement that "Open science is now the only way forward for psychology," sketching out a more positive future for the discipline in terms of practices around openness.

## Conferences and Annual Meetings for Psychological Science

Engagement at disciplinary conferences and annual meetings is a crucial part of scholarly communication in psychological science. The future of conferences is not clear; what will emerge as the ideal format is a moving target. The COVID-19 pandemic turned the world of in-person networking upside down, but conferences and annual meetings remain a time-honored way of sharing of research results. With so much internet sharing, it is possible to circulate ideas and results as a way to try to attract interest from committees putting together panels. The invitation to speak at a conference is still important to careers in academia and to reputation. Today, there are many options available for early sharing of drafts of articles, even before (or alongside) first submission to a scholarly journal. It is possible to consider a range of sharing of ideas through a continuum that might include sharing tweets from a conference, sharing ideas in an online forum, participating in blog posting or commenting, presentation of initial results at a conference (in person or virtually), posting a preprint online and getting important feedback from interested scholars across the world, and finally, if appropriate, submitting to a peer reviewed journal in the field. The creation of new knowledge can form a continuum from early idea on social media to published journal article (Daniels, 2013). The open environment of the internet breaks down barriers and allows discussion by interested people that crosses disciplinary boundaries and invites a wide conversation. Invitations to present at conferences and to submit articles can be the result of this “self-promotion” on social/digital media platforms. Sharing via social media also promotes cross-disciplinary (and transdisciplinary) conversation and can lead to important new collaborations within institutions and with colleagues around the world.

Before the COVID-19 pandemic, an important part of networking and engagement with the research community of the discipline was the annual meeting or any number of more niche psychology-related conferences. While this holds true in a post-pandemic world, certainly the power of Zoom (<https://zoom.us/>), WebEx (<https://www.webex.com/>), and other virtual meeting services during lockdowns and other travel disruptions became part of every academic’s experience. As it became possible to consider travel to in person conferences again, discussions started to focus more on environmental consequences of travel, economic hardship for many that would otherwise wish to attend, family needs taking precedence, and mainly the fact that technology had improved to the point that many conference attendees simply preferred to attend from home.

A major discussion of every organization revolved around whether it was best to provide conference opportunities virtually, hybrid (online and in person) or online only. There are pros and cons with every modality, and strong advocates in every organization for each type of conference. While it would seem ideal to offer hybrid conferences so that every interested person can take part in the meeting, these conferences are complicated in terms of attendee pricing, creating the expected experience for each group, facilitating networking, and staying within budget. While technology provides a better experience than only a few years ago, it will take time for organizations to gain experience with offering hybrid conferences.

Before the pandemic, it seemed a truism that one aspect of scientific communication here to stay was the in-person annual meeting. That seems possibly still true post-pandemic, although its format and delivery will continue to change. Before COVID, even with reductions in travel funding and other impediments, the annual meetings of major societies and organizations were still attracting audiences to exhibits, presentations and social events. Before the pandemic, it appeared that in-person networking and attending presentations in person was still important in many disciplines (Mervis, 2013). Even though virtual conferences are likely now ingrained in the lives of all academics and all sessions can be attended online, there is evidence that, for now, the in person meeting provides opportunities for attendees that don’t necessarily translate into the online only environment. Large major conferences in psychological science, such as the annual American Psychological Association (APA) Convention, now having been held for 125 years, continue to be a draw. In recent years, attendance at the APA annual meeting had been holding its own, with no evidence of major drop-off even in this online age. Registration numbers for 2016 were almost identical to those for 2012, and although a bit higher, 2010 and 2014 were almost identical as well, demonstrating that the convention continued to be of interest to its many attendees (C. Won, personal communication, August 16, 2017). Post-pandemic changes are yet to be fully analyzed. Even as researchers move to online meetings, there are new and exciting in person conferences popping up that continue to attract audiences. For psychological science, there is even a new conference (which started in 2016 and grew in 2017) that focuses on many new aspects of scholarly communication and research practices in the discipline. Known as SIPS (Society for the Improvement of Psychological Science) with its 2018 meeting described as “SIPS 2018 is an action-oriented meeting, serving our mission to improve psychological science. There will be no symposia or keynote speakers: the meeting will focus on initiating and

conducting projects” (<https://www.improvingpsych.org/SIPS2018/program/>). This innovative meeting utilizes an Open Science Framework wiki at: <https://osf.io/ck28s/>

Information on SIPS conferences can be found online, such as the agenda for the 2023 meeting that was held in Padova, Italy that may be found at: <https://www.improvingpsych.org/SIPS2023/program/>. This dynamic forward-thinking SIPS conference includes training sessions, hack-a-thons, lightning talks, and unconference sessions that focus on topics such as metascience, improving measurement in research, replication, improving teaching and training, peer review, advancing data sharing and much more (Center for Open Science, 2017b). This is a conference that has been growing in terms of numbers of attendees, and as time goes on could attract even more scientists, librarians, and all of those interested in open science and moving this agenda forward for the discipline.

Some conferences and organizations have made the decision that, due to factors such as environmental footprint, DEIA issues, heightened disability awareness, or sensitivity to financial and family issues for members, that they will not return to hosting the large annual conference. M. Morrison et al. (2020) offer suggestions to increase the reach of online conference materials to wider audiences. In terms of impact and sharing of conference presentations (via recordings as well as sharing slides), posters and abstracts, the effects of the pandemic have required scholars to become more used to being recorded as they present at conferences and to make sure that the conference materials formerly only heard by a few audience members now be disseminated to researchers everywhere. Recordings of conference presentations may be held inside a dedicated conference site for paid attendees only, but otherwise may be uploaded to YouTube in the United States, or YouKu in China. Posters could be uploaded to Figshare and be assigned a DOI, allowing these to integrate into the scholarly literature as early research results (and to be discovered via Google Scholar). Many institutional repositories in libraries also contain the slides, presentations, and posters from affiliated researchers

## **The Role of Academic Libraries in Advancing Research Services and Open Science**

University libraries will have an important role in open science and librarians will be part of research services teams. Libraries continue to evolve from the bricks, mortar and print days through the lengthy and sometimes daunting transition to digital user services, and then into integrating OA materials into collections and web discovery. The next challenge will be to accommodate and

innovate services and infrastructure around open research. It is a time of transition and disruption for academic libraries. In this interconnected web of online research content, with all of it seamlessly hyperlinked with reader and researcher access as its goal, questions and challenges have emerged for another provider of current and older research material, the academic research library. The role of the traditional academic library was sometimes seen as gatekeeper, with its collection and preservation space reserved for the vast print book and journal literature, has certainly changed and evolved. Concerns may arise around the continued availability into the future of the curated research level library collections that cover psychology from its historical roots to the present day. With many titles online, the user experience of browsing in a niche area or subfield on the library shelves has certainly diminished, and even weeding of research collections (especially if dependent on numbers of checkouts or other quantitative approaches) may be haphazard. Electronic access to subscription literature via the libraries of institutions is today (not necessarily forever) still crucial to researchers, and all access must be remote and seamless from users' homes, via laptops or mobile phones, as well as on site at the university. Formats such as ebooks create disruption in libraries due to issues of sustainability (such as ownership vs. leasing) of these books in comparison to the well-curated research-level collections of hardcover print titles. Due to digital rights management (DRM) issues, psychology's ebook collections have become less shareable between libraries via interlibrary loan. Academic libraries, stewards of the comprehensive literature of psychology, need to be concerned with the continued availability of an explosion of research literature online, including quality OA materials.

Academic and research libraries struggle with redefining and prioritizing the development of collections, services and new tools to aid researchers in their efforts to pull together a targeted search result. Readers and researchers increasingly seek tools that gather together scholarship in personalized targeted ways. Whether the solution to organizing the literature and making it discoverable falls to libraries or internet search engines, readers need to separate the wheat from the chaff, and researchers (with ever higher bars to jump over for promotion and tenure) need to publish more often, and often in high impact journal titles. Psychology librarians are finding important new roles as partners in the research process with departmental faculty and university research offices in providing new scholarly communication services around OA, data services, use of research tools, consultation around citation metrics, provision of infrastructure for open science, and much more. “Many academic libraries and librarians are providing a

suite of new research services centered around research data management, digital humanities, research impact services, systematic reviews (and other evidence-based reviews services". OA solutions for university-generated scholarship, consulting around OA policymaking, development of institutional repository and library publishing services, digital scholarship, citation management tools workshops, scholarly networking services, open educational resources programming, and development of open textbooks. Provision of services around increasing OA to scholarship is now an established part of the mission of university libraries, and extends the mission of librarians to connect all readers and researchers with the scholarly literature that they need. Psychology librarians will find a particular role in making sure they are connecting authors with OA services that can extend the reach of psychological science to other researchers and the public. Many librarians provide discipline-based scholarly communication information and consultation to faculty, staff, and students. Many libraries have a focus on teaching scholarly communication topics such as OA strategies in their library instruction classes and in individual research consultations, even to undergraduates. Libraries' technical services departments now integrate OA resources into their cataloging, metadata, acquisitions, electronic resources, web services, and other functional areas. A focus on OA has required libraries to develop infrastructure around repositories and OA/open science.

Open Access is now part of the library. The corpus of openly available scholarship extends and complements traditional library collections even though it may be more difficult to capture, organize and make available to library users. This OA material must be made available alongside subscription content from the library. The future of the library depends in part on the ability for it to present a relevant, useful, organized, and easily discoverable collection to library users in the disciplines represented at the university. Academic and research libraries that are part of institutions that have psychology collections will require that collection development for the discipline include all relevant OA material. This requires the librarian building the psychology collections to be thoroughly informed on how all of the types of OA resources can be fully integrated into collections and services. Items in the collection must be chosen for quality, not whether the business model for a publication is OA or subscription-based. Whether a publication is available from the institution via subscription or allowed to be accessed freely from the internet is not a necessary distinction in terms of readers' need or interest. Open Access collection development is still in its infancy and something with which libraries are grappling. For a subject specialist librarian, this leveling of the playing field

between freely available scholarship and traditional subscription of purchased materials allows new opportunities to build collections without necessarily always having to pay. The challenge is in bringing *all* of this scholarship together for discovery by the university's readers and researchers (Mullen, 2011). A new role for librarians building research-level psychology collections is to ensure that traditional as well as credible, quality, vetted scholarly OA materials are organized, discovered, made accessible and delivered in ways that are most useful to researchers. Today, this discovery of the library's collection would be a one stop shop presented as a single search interface on the library's website where all of the library's resources are searched at once. Much thought goes into how to attract the library's community to start not out on the web but on the library website when seeking research materials. Of course, that is not always the case as searchers have their favorite ways of accessing research materials and many publishers today provide a single sign on approach (via institutional log in) to a university's subscriptions from the publisher's website. The library is still able to connect the research materials with the user in a way more effective than a search of the open web. A part of libraries' value for the user will be their ability to present a coherent "collection" of research materials for their constituencies, keeping the user from having to dig through a massive and continually growing corpus of material out on the web. The library can make available a meaningful and useful curated global subset of the available scholarship on the web. Subject specialist librarians also offer consulting services that can convey the most current ways to search, discover, and access targeted content. Changing roles for psychology librarians afford new opportunities for them to work more closely with faculty and students on scholarly communication issues. Librarians provide consulting and add value to the research landscape of the university by liaising with disciplinary faculty and students around issues and initiatives related to OA/open science, engaging with psychology-related research teams, or working across library units to consult on OA infrastructure or repository issues. Librarians are increasingly working on cross-stakeholder university teams that may include the research office or others involved in building a robust end to end institutional research ecosystem that is highly useful for all researchers.

Academic and research libraries (and librarians) find a natural fit with a continuing focus on the development of a useful suite of research and Open Access services. Scholarly communication, broadly defined, has always been within the purview of libraries, but now has come to signify a wide range of research services promulgated by librarians in their daily work as liaisons to departments, individual faculty members and researchers.

Librarians are able to synthesize knowledge of a complex basket of metrics, with information on OA and research data management issues. Many librarians work in all of these newer scholarly communication areas while maintaining their focus on traditional reference services using a distinct disciplinary focus where needed. Librarians, especially the subject specialists can contribute to the literature of the field of Library and Information Science (LIS) with scholarly communication-related studies focused on the disciplines served. Collaboration with departmental faculty will allow the conversation to resonate with disciplinary faculty and researchers. Traditional services such as reference, interlibrary loan, circulation of books, and in-person consultations with subject specialists are still important, but they exist alongside new services where departmental library liaisons now offer subject-specific advice on the use of OA strategies for faculty work and possibly participating in library-led publishing efforts, for example. Librarians partner with disciplinary faculty on open research teams and libraries provide innovative physical spaces for collaboration and teamwork. Research libraries facilitate OA in so many ways via the use of their institutional repositories for green OA services, electronic theses and dissertations (ETD) initiatives, library publishing and digital scholarship programs. Those libraries that have prioritized these services via development of infrastructure and expertise are well positioned to be leaders in research services going forward.

Many research libraries work to develop comprehensive institutional repositories (IRs) that ingest and preserve faculty scholarship (including all of the products of scholarship such as data), electronic dissertations, and a wide variety of other digital objects created at the institution. The institutional repository is focused on openness and collaboration with faculty and other libraries, and is crawled by Google and other search engines. Use of Google Scholar is a popular way that researchers access materials in IRs (rather than visiting the IR directly online). An institution's IR serves as a vehicle that enables open science and OA to publications and data, and is a valued service offered to faculty and students. The research library is also where the metadata expertise is found, and metadata experts and others provide leadership in the development of effective open infrastructure systems that facilitate Open Access and open science. The library and its librarians are key to the success of the open research agenda in the university. Academic and research libraries are focused on the creation as well as the dissemination of scholarship. A key component of open science is open data, and IRs are a natural home for some types of open data. The opportunity presented with the open science agenda of governments and private funders will be a very compelling one for libraries that

are ready for the challenge. This challenge involves development of infrastructure, policies, expertise, and vision. Research data management initiatives in libraries are evolving, and libraries and librarians are finding new and productive collaborations with other university offices such as the research office. Libraries, publishers, and vendors inhabit some of the same spaces and find some challenges and opportunities in collaborating with each other on Open Access or other important initiatives (Mullen & Ross, 2016). Some publishers, such as the APA, have had close relationships with psychology subject specialist librarians via groups such as library advisory councils that have convened to work on information sharing and product development. There are some challenges for libraries and publishers in the areas of green and gold OA, which will in some ways be pushed toward solutions through increasing funder and reader/researcher demands for OA to taxpayer-funded research. Increasing discovery of articles via inclusion of more and more articles in Google Scholar and other search engines creates a demand for individual articles. Enhanced discovery fuels demand. All of the new publisher and library services play out against a backdrop that includes pirate sites like Sci-Hub, which provides millions of users with access to proprietary subscription content worth millions of dollars. This access reportedly works in a way more seamless and simple than many university libraries' web scale discovery services (and database access) currently provides.

As library expenditures continue to be stressed by the costs of keeping up with commercial publisher bundles and many library users begin their research with Google Scholar or elsewhere on the open web, academic librarians seek closer relationships with their faculty, student, and community constituencies, wanting to ensure that research services can be customized and targeted. Psychology librarians network nationally as members of the Association of College & Research Libraries' (ACRL) Education and Behavioral Science Section's (EBSS) Psychology Committee, and on ACRL's Science and Technology Section (STS). Psychology/Behavioral sciences librarians interface with faculty, students, administrators, research office staff, publishers, vendors and others in order to ensure that psychology researchers have access to the most relevant and useful psychological science collections and services. Dolan's (2018) book *A Research Guide to Psychology: Print and Electronic Sources* provides a comprehensive treatment of the research literature of the discipline likely found in libraries with research-level psychology collections. Libraries can use this resource to ensure they are providing excellent library collections in psychology. Today, psychology librarians' roles in OA and open science often also expand from ensuring that the library is providing the research literature of the discipline to also include



new services such as consulting on OA publication strategies, helping faculty to identify strategies for paying APCs (or BPCs), providing information on funder requirements, assisting faculty with data management planning, working on open journal publishing teams, assisting with systematic reviews or facilitating implementation of institutional OA policies for individual scholars and whole departments or schools. However, there is need for more contributions in the literature to the topics of scholarly communication and Open Access that focus on the traditions and evolution of psychological science. Pulling this information on various scholarly communication topics together in an inclusive and accessible manner for all potential readers would create a more cohesive jumping off point for global discussions that could move the literature of psychology forward. There is no “one size fits all” when it comes to how the discipline will move forward with Open Access, open science, open data, metrics and how they are used for evaluation of scholars and other aspects of the complex landscape of today’s scholarly communication environment. Psychology librarians serving research needs in the discipline and its subfields anticipate demand for services and workshops that target the current needs of researchers in scholarly communication, Open Access, and open science/open research areas.

## Conclusion

This monograph has attempted to present Open Access, scholarly communication, and open science topics with a focus on one discipline, Psychology. This is its unique contribution to the scholarly communication literature. It would be extremely useful for all who are engaged in the “open” conversation to see a primer or overview of these topics for other disciplines. That would allow researchers to compare and contrast the norms, practices and opportunities for each discipline and field. One thing is clear; there can be no “one size fits all” but instead, each discipline and subfield must be part of the OA/open science conversation. The evolution of the scholarly publishing system, in place for hundreds of years, is underway, and there is room for many voices and agendas at this juncture. There is room for leaders in this conversation that are willing to demonstrate innovation in the research and publishing process. The many fields that comprise the discipline of psychology will determine their future scholarly communication/OA/open science landscape in collaboration with other stakeholder groups that include funders, publishers, institutions, and libraries. After so many years where there was little change in the way science was communicated, the vast potential and reach of the internet for sharing and learning opened new opportunities for authors, publishers, funders, and

universities seeking maximum impact for the work of their faculty. The issue of Open Access alone exemplifies the transformation and disruption of scientific communication and scholarly publishing. Often, there will seem two sides when discussing the best way forward. Whereas green OA seemed to have its beginnings as a more grass roots movement of sorts, with making their OA left to the authors themselves (with allowances from publishers in some cases), or Harvard-style institutional OA policies stating right up front that scholars’ works need to be made open to the world of potential readers, it remains only one strategy in place to increase the corpus of freely available online peer-reviewed material. With gold OA, a more grass roots approach to publishing journals could be seen in university library publishing of journals using one of many open source services such as Open Journal Systems (OJS), allowing journal publishing to emanate directly from academia, not just from commercial and other traditional publishers. University-published OA journals are often “diamond OA” journals that carry no charges for authors or readers, and can be added to the collections of other universities. Nonprofit and commercial publishers have increasingly published more and more OA articles, and much of the literature of psychology today (in 2022) is OA (but may not be openly licensed optimally for wide reuse). Currently, the commercial journal publishers are sitting right in the middle of the aforementioned “flip” of the system, offering paid OAs options, with article processing charges far from standardized and all over the map, from zero to more than \$11,000. Librarians working in scholarly communication roles or as institutional repository managers often sit in the middle of the system, promoting free and equitable green OA strategies by developing systems that implement institutional OA policies and facilitate easy self-archiving (and wide dissemination on the internet) of institutional scholarship by the university’s authors.

The “hybrid” model also exemplifies in some ways where the system still is now, with cash-strapped research libraries still negotiating complex subscription deals with commercial publishers while at the same time working to ensure that the research outputs that their authors produce are widely disseminated. Authors at subscriber institutions are paying APCs to those same publishers, providing another revenue stream that is outside of the subscription outlay but adds to institutional costs. Some of those package subscription deals have folded in institutional payment of APCs to create larger deals, known as the transitional Read and Publish deals. This is likely proving popular with authors in institutions that have these deals, but also may be promoting certain publishers to authors. This may be a temporary situation. The system is in flux and moving toward OA but it is a slow and

challenging pivot, easier for some than for others. Other publishers' offerings have only been monetized by APCs from the start, the fully OA publishers, such as PLOS. Megajournals have changed the landscape, where, even in psychology, many authors choose the more rapid and cross-disciplinary solutions of journals like *PLOS ONE*, or Springer Nature's *Scientific Reports*, which has taken over the top spot as "largest journal" with thousands of articles published in one annual issue. These megajournals help to subsidize the other high impact offerings of their publishers, and are able to offer to publish at what may be called a "reasonable" APC. In any case, some publishers in an APC-heavy environment may be seeking to maximize number of articles published, adding to a new focus for journals to publish more papers. This can lead to pressure on editors and peer reviewers even as the peer review system is already under strain. Some publishers seek a route that veers away from a reliance on APCs in part due to issues of equity for authors, and Subscribe to Open (S2O) relies on legacy support from universities and other organizations (rather than charging authors APCs) for continued funding as those publishers move their journals to fully OA.

Complicating matters in the complex OA publishing landscape are the different approaches taken by various nations and funders and instead of one size fits all, the situation becomes almost dizzyingly complex. All in all, a pervasive audit culture is taking over at universities in many countries, leading to "publish or perish" scenarios and a need to maintain established high impact publication outlets, no matter the cost. At this point in time, there seems to be no sure way forward. While there have been loud calls for change to the promotion, tenure, appraisal and hiring systems of universities toward incentivizing and rewarding OA and open science behaviors, the situation has seemed entrenched at times as the Journal Impact Factor (JIF) remains the holy grail for authors, institutions and publishers. There is talk of a "flip" of the entire system from subscription to Open Access, but there are still many concerns around issues like sustainability or inclusion of researchers from the Global South in this new system largely based around APCs. Funder initiatives like Plan S from cOAlition S work diligently for changes that move OA to research outputs away from this APC-based system. Too many researchers are shut out of the current system due to issues of language, resources, and other roadblocks. Discussions around the U.N. Sustainability Goals (SDGs) have folded in principles of a more open scholarly communication system in all disciplines (United Nations, 2023). Smaller societies may not be able to rely on OA or use it for sustainability and may need to partner with libraries or other supportive organizations in novel ways. The library community as well as publishers

and other stakeholders are currently discussing very intentionally how to increase diversity, equity, inclusion, and accessibility (DEIA) in many aspects of scholarly communication. There is a long way to go in addressing these concerns.

The copyright and licensing issues get increasingly sticky, and may be confusing to many authors and others who want to legally reuse work. Copyright remains a challenging part of the system for authors of scholarly works who sign away their works to publishers without expectation of payment. Authors are unsure of their rights to share as they publish their work. The complex rules surrounding copyright are not fully understood, or are not of interest to many academic researchers. Many working on Open Access solutions recognize the need for liberal reuse licensing, specifically the use of CC-BY, a Creative Commons license that allows any reuse of the content (with attribution) in order to spur innovation by maximal reuse and rebuilding of published text and data. This is another vital part of the OA conversation and academic libraries and their copyright and licensing specialists may be a vital piece of moving what many view as "real" Open Access out to a research community that needs the ability to do text and data mining of more of the research corpus. No longer on the horizon, but having arrived, disrupting the scholarly communication systems of psychological science once again is Artificial Intelligence (AI), in particular the Large Language Models (LLMs), exemplified in services such as Chat GPT (from OpenAI) and Bard (from Google). AI will transform many aspects of scholarly communication as it moves forward. At the time of this writing, in 2023, AI is a major topic of discussion in all organizations from all sectors. For scholarly communication in psychology, we can expect to see major changes, disruptions and opportunities for services like ChatGPT to greatly affect areas like teaching, scientific writing, peer review, and scholarly publishing workflows in psychology. Many innovations and experiments are underway with the eventual outcome unknown.

There does seem a dearth of information on how psychological scientists are using and participating in all of the newer scientific or scholarly communication tools, resources and practices. How are researchers keeping up at a time of information explosion with millions of articles online? Can AI someday provide assistance with search and discovery for overburdened scientists when there were almost 3 million articles published last year? (Brainard, 2023). Psychological science is moving out in front as a leader in open science/open research but still needs to focus on the lack of OA availability of the corpus of the discipline's research articles. The proportion is lower than many other disciplines. At this point, there is much speculation as to how psychology faculty, authors,

researchers, and graduate students are using these all of the internet-enabled scholarly networks/academic social networks. There must be a call for more studies on scholarly communication behavior based around both existing disciplinary norms as well as newly emerging practices that speak to interdisciplinary areas of interest to psychological science. At present, psychology does not jump out as a disciplinary area that has fully embraced or even become a trailblazer in any areas of scholarly communication, such as Open Access (of all types). Certainly, the opportunity is there. Large scale qualitative or quantitative studies would be needed to tease out the behavior of psychological scientists at the disciplinary and subfield level. This type of research would serve to inform researchers, funders, librarians, and publishers toward enhancing the scholarly and research environment that currently exists (and could be enhanced to a greater degree for psychology). More collaboration and partnerships between stakeholders, and time and space for discussion of innovation in open research should be promoted at all levels. The wide-ranging focus of psychology, with its myriad subfields and conventions (and a tendency toward interdisciplinarity) presents challenges in the putting forward of recommendations for practices that will resonate with all researchers and stakeholder groups. However, there is opportunity for all.

While the evolution to “open” of research practices in psychological science is underway, with journals, researchers, funders and institutions all participating at some level, there is much more work to do to realize a future that maximizes the use and reuse of the discipline’s collective and individual research output. There is opportunity for individuals and teams to collaborate across the stakeholder system as never before to develop an open research system that benefits individual researchers and institutions, but would also function as the main driver of a quest for true societal impact. As Nosek et al. (2022) state:

There is both substantial evidence of new behaviors that may increase the rigor and replicability of psychological findings and substantial evidence that more work is needed to address the structural, cultural, social, and individual barriers to change. So far, the driver of change has been the grassroots efforts by individuals and groups to improve research practices. Journals are leading change among stakeholder groups, with department and institutional practices for hiring and promotion showing the least evidence of change so far.

It behooves everyone in the system to get on board and participate in order to maximize the reach of psychological science research on a global scale through OA publication and other open sharing. Where there’s will,

there’s a way for psychology and open research. One could ask, “If not now, when?” The important thing is to keep moving forward into a more open and equitable scholarly communication and open science future for all of Psychology.

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