






Research Article

# Open Access Practice in Personality Research: a Bibliometric Perspective

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## ABSTRACT

The primary aim of this study was to investigate the structure and dynamics of current research in personality psychology, with a particular focus on open access (OA) practices. A set of 57296 research articles in personality psychology indexed in the Scopus database were analyzed based on their online accessibility: closed (39523), green OA (8770), gold OA (4506), bronze OA (2704), and hybrid gold OA (1793). Although the proportion of OA articles in the overall sample was relatively modest (31%), there has been a consistent upward trend since 2012. Notably, the most significant increase was observed in the proportion of gold OA articles, whereas the number of deposited articles (green OA), not otherwise freely available online, experienced a decline. The knowledge domain of non-OA articles in personality psychology can be broadly delineated into five clusters: (Big Five) personality traits, personality disorders, emotion regulation, Dark Triad/Tetrad, and psychometrics. The emergence of COVID-19 as a “hot” research topic resulted with significant differences in the knowledge domain of non-OA and OA articles. Co-authorship network analysis revealed that authors from Western countries act as the central hub in personality research, though this centrality diminishes when only gold OA articles were taken into account. Gold OA articles performed the worst on most impact and outreach metrics except one, significantly surpassed by green OA articles. As a takeaway, it may be said that although you may need a significant amount of money to do the research, you don't need it to make your research open and make an impact.

*Keywords:* personality psychology, open access, alternative metrics, bibliometric analysis

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## Introduction

The open science movement has brought about radical changes in scientific research over the past two decades. It emerged mainly as a reaction to constantly growing journal subscription fees and limited accessibility to scientific publications (Nabe & Fowler, 2012; Jones et al., 2013; Schiermeier & Mega, 2017). The main motive behind this movement was to make all society members able to freely access scientific results, primarily articles, but also data, methodology, reviews, educational material, and software. Nowadays, a growing number of research funding institutions requires researchers to make their results freely accessible both to other academics and to general public (Piwowar et al. 2018). This requirement refers particularly to the results of publicly funded research. After adopting several relevant legal documents related to open science in 2012, European Commission started to strongly support opening research for all. These endeavors resulted in the development of two comprehensive open science portals: Open Access Infrastructure for Research in Europe ([OpenAIRE](#)) and European Open Science Cloud ([OESC](#)).

The number of open science tools and services, aimed to support both sharing and finding free scientific knowledge, is constantly growing. These include, but are not limited to, various repositories for scientific publications (e.g., [PsyArXiv](#) hosted at [OSF](#)), primary data repositories (e.g., [Zenodo](#)), general open platforms (e.g., [ScienceOpen](#)), open educational resources (e.g., [OER Commons](#)), services for open evaluation (e.g., [Dimensions](#)), and even browser extensions (e.g., [Unpaywall](#)). Academic social networks like [ResearchGate](#) and [Academia.edu](#) are widely used for self-archiving research papers. However, the sustainability of this trend is uncertain due to possible legal issues concerning the archiving of articles without publisher's consent (Björk, 2016). The problem of accessibility to scientific publications is also reflected through the growing popularity of illegal services like [Sci-Hub](#) and [LibGen](#), which are basically peer to peer networks for sharing full-text articles (Greshake, 2017).

Open access (OA) is the most well-known aspect of open science, often wrongly equated to open science itself (Smederevac et al., 2020). It refers to

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providing free and open online access to scientific publications based on one or more of three typical OA models. Gold OA denotes publications that are published in journals that provide free online access to all of their articles but requiring authors to pay the article processing fee (APC). Most of these journals are listed in the Directory of Open Access Journals ([DOAJ](#)) (Gargouri et al., 2012). Hybrid OA articles are published in journals with subscriptions, but the authors also need to pay APCs to make their articles freely available for reading. Unlike the hybrid OA articles, bronze OA articles published in subscription journals lack open license information and are accessible only through the publisher's website. Availability of these articles are usually based on journal editorial decision, and it is often unclear for how long free access to these articles will be provided (Piwowar, 2018). Additionally, articles often become available on the publisher's website only after a certain period of time called the "embargo period" (Laakso & Björk, 2013). Finally, green OA refers to publications deposited to various institutional or disciplinary repositories. Publishers usually have clearly defined policies allowing authors to deposit their original manuscripts prior to peer review (pre-print) or even after the manuscript has been peer reviewed (post-print).

Bibliometric analysis can provide valuable insights into the practice of open-access publishing. Björk et al. (2010) discovered that, on average across all disciplines, the open-access availability of papers published in 2008 was 20.4%, with 8.5% falling under gold OA and 11.9% categorized as copies available through repositories and websites (green OA). Gargouri et al. (2012) conducted their study using two large samples - the first included articles with a publication year range of 2005-2010, while the second comprised articles with a publication year range of 1998-2006. Their results are similar to those of Björk et al. (2010). In the first sample, the average overall percentage of OA articles was 24%, and this remained steady throughout the period under examination. In the sample taken from 1998 to 2006, the average overall percentage was 20%, which increased from 14% in 1998, to 21% in 2006. According to the study conducted by Piwowar et al. (2018), only 28% of scientific papers were found to be freely accessible online. Many of these papers were found to be of bronze OA type, which is

surprising since this type of OA is underexplored in the literature, suggesting a need for further investigation.

Previous studies show differences in OA availability across disciplines. Chemistry and earth sciences had the lowest overall share of OA, while medicine, biochemistry, genetics, and molecular biology had higher rates of gold OA. Green OA was most prevalent in mathematics, social sciences, and physics (Björk et al., 2010). Research by Gargouri et al. (2012) found that social sciences, chemistry, engineering, and technology had the lowest percentage of gold OA, while biomedical research, clinical medicine, and health sciences had the highest. Piwowar et al. (2018) found that over half of the articles in biomedical research and mathematics were open access, while in chemistry and engineering, this proportion was below 20%. Green OA was found to be particularly popular in physics and mathematics, where more than a fifth of papers were available in repositories. Hybrid articles were most prevalent in mathematics (9.4%), biomedical research (8.1%), and clinical medicine (6.3%). The highest proportions of gold OA were identified in biomedical research (15.3%), health sciences (11.7%), mathematics (11.2%), and clinical medicine.

According to the study conducted by Gargouri et al. (2012), it was discovered that the percentage of OA articles in the field of psychology was 28% on average in the sample that included articles published between 2005 and 2010, while it was 25% in the sample that included articles published between 1998 and 2006. Six years later, Piwowar et al. (2018) reported a small increase in the proportion of OA articles, which was around 30%. More recently, Björk and Korkeamäki (2020) discovered that almost 40% of psychological journals included in the Scopus database and published outside the top four leading countries in scientific publishing (namely, the USA, UK, Germany, and the Netherlands), were open access.

Open science holds particular significance for the field of psychology, especially in light of the replication crisis it experienced over the past decade. This crisis originated with the findings of the Open Science Collaboration study (Open Science Collaboration, 2015), followed by numerous articles criticizing the use of questionable research procedures (Shrout & Rodgers, 2018). As a

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consequence, a credibility revolution ensued, prompting the adoption of improved standards for evaluating psychological science. These standards include focus on transparency and openness, requirement for preregistration of studies before conducting them, increased emphasis on direct replication studies, and application of stricter criteria for both quality and quantity of evidence necessary to support scientific claims (Vazire, 2018).

According to Atherton et al. (2021), personality psychology played a significant role in research credibility revolution. In the 1970s, there was a debate among authors about factors that determine behavior, such as personality traits or situations. This debate threatened to cast doubt on the whole field. However, it turned out to be good preparation for credibility revolution that would occur later. This is because researchers from the field of personality psychology adopted some of the norms and values that credibility revolution advocates, such as transparency of research methodology and sharing data. Furthermore, personality psychology plays a central role in various subfields of psychology, as evidenced by bibliometric studies (Yang & Chiu, 2009). Over the past decade, studies in the field of personality psychology have covered various topics, including different models and theories, social and partner relations, conceptual and theoretical frameworks of the Five-Factor Model, statistical analyses, and personality traits. Substantial interest has also been directed towards exploring well-being, motivation, emotions, perception of others, and the lifelong development of personality. Additionally, there has been noteworthy research on biological and medical aspects, including behavioral genetics and biological foundations of personality (Piotrowski, 2021).

To the best of our knowledge, there are very few studies that used bibliometric analysis to explore the knowledge domain within personality psychology (Allik, 2013; Piotrowski, 2021), and none of them have explored the specifics of open access publications. Furthermore, most of the similar studies in psychology were focused on citation analysis (Pajić, 2023), often focusing merely on the number of citations of specific journals, authors, or countries, and neglecting other relevant aspects of scientific communication, such as patterns of international collaboration or alternative measures of research impact, e.g.,

citations in policy documents or mentions in social media. Finally, most of bibliometric studies have been of relatively limited scope, focusing solely on specific topics within personality psychology (Chen et.al., 2019) or only on particular, often the most influential, international journals in the field (Allik, 2013).

A study conducted by Babić and Jevremov (2021) looked into differences in topic structures between open and closed access articles in psychological research. The study also analyzed trends in the number of OA articles across various subfields of psychology. Although the study found that personality psychology was not among the top disciplines with a high prevalence of OA, there was a noticeable growing trend in publishing OA articles. However, this research did not address other relevant questions regarding the specifics of personality research. One such query pertains to the prevalent research topics in personality psychology found in OA articles and their potential variations compared to articles available solely through subscription. This type of variability in the field of personality psychology may be expected due to its broadness, heterogeneity, and numerous relations with other disciplines. Themes in personality psychology primarily relate to social and medical disciplines, but previous studies reveal differences in OA type prevalence between these two disciplines (e.g., Gargouri et al., 2012).

### Current study

The current study is based on explorative bibliometric analyses and has two main goals. The first is to explore the trends in publishing research results in personality psychology under typical OA models. It is expected that the share of OA articles will show a growing trend as it was suggested by some previous research. The second aim is to analyze the differences between non-OA articles on one side, and OA articles of different types (gold, hybrid, bronze, green) on the other. These differences are expected in at least three aspects. The first is the structure of predominant research topics described by the most frequent keywords mentioned in articles of different types. The second aspect are differences in general outreach and impact of articles, measured by the number

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of citations and different alternative metrics, such as the number of shares on social media, number of mentions in online sources, and the number of captures in reference management software. Finally, the third aspect is differences in patterns of co-authorships on a country level which could point out variations in OA practice among the authors originating from countries of different economic and cultural backgrounds.

## Method

### Data Sample

The sample consisted of 57296 publications, 17773 OA and 39523 non-OA, published in the twenty-year period from 2003 till 2022. Publications metadata were retrieved in October 2023 from the Scopus database using *pybliometrics*, a Python wrapper for the Scopus RESTful API (Rose & Kitchin, 2019). The sample was limited to scientific articles (DOCTYPE(ar)) published in psychology journals (SUBJAREA(PSYC)) and having the term “personality” in the title, abstract or keywords (TITLE-ABS-KEY(personality)). Some of the articles were classified into two OA categories which means that they are available in some OA form (gold, bronze, or hybrid), but are additionally deposited in a repository. For those articles, only the primary OA model was kept, which means that in this study, green OA refers to articles that are not freely available outside a repository. However, the information on depositing gold and bronze OA articles was used to analyze the general trend in the practice of sharing pre-print or post-print versions of manuscripts.

### Data analyses

Bibliographic mapping is often used to visualize landscapes of scientific fields. Most bibliographic maps are created by identifying patterns of connections among elements that co-occur in documents using graphs to depict their mutual proximity and incidence by their position and size. Data from different fields in bibliographic records can be visualized, such as author names, subject descriptors, or affiliations. Additionally, various elements from



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references, including cited authors, cited journals, or cited documents, can also be depicted as nodes on a bibliographic map. Each of these components offers a distinct viewpoint on the structure of science (Noyons, 2001).

This research employed maps of coincidence among article descriptors, namely author keywords, to highlight predominant research topics. Keywords that frequently co-occur in articles are closely positioned on the map, suggesting clusters of research topics. The term "personality" was excluded from the analysis in order to create clearer map and more separated clusters. The maps were created for non-OA and OA separately. Co-authorship maps were used to visualize collaboration on a country level for each category of (non-)OA articles. These maps display relationships between countries based on frequency of collaboration among authors affiliated with them but are also used to explore differences in incidence of various OA practices among nations. Both keywords and countries are depicted on maps as circles connected by lines that indicate the strength of their connection. The circles size is proportional to the number of articles related to a certain term or country, and their color indicates cluster membership.

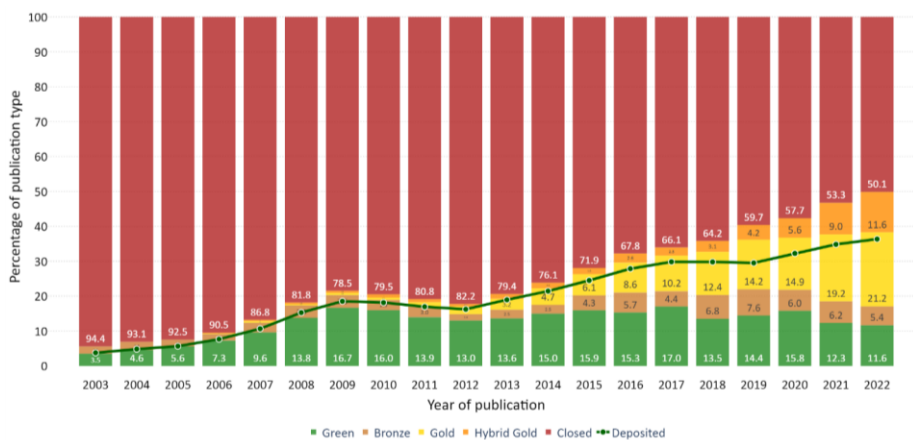
Bibliographic mapping is basically an explorative technique, much like other types of visualizations or the component analysis, for example. In that sense, a decision on the threshold value for the number of occurrences an element should have to be shown on the map cannot be fully objective. This threshold will always depend on the number of analyzed documents, but the main principle is to find a balance between the richness of information and clarity of the map, since they shouldn't be neither too cluttered, nor too sparse. Since the bibliometric distributions are known to be highly skewed (Seglen, 1992), it is actually possible to describe a large set of articles with a relatively small number of keywords. Based on several preliminary maps we generated using different criteria, the threshold was defined as the occurrence of a keyword (or multiple keywords) that, together with all of the more frequent keywords, account for at least 50% of the total number of occurrences of unique keywords in the sample.

Data manipulation, curation, and preparation for visualization were carried out using the *pandas* package in Python (The pandas development team, 2020). Bibliographic maps were generated in VOSviewer v.1.6.20 (Van Eck & Waltman, 2023a) using fractional counting for calculating link weights (Perianes-Rodriguez et al., 2016) and LinLog/modularity as a normalization method (Van Eck & Waltman, 2009; Van Eck & Waltman, 2023b). All additional graphs were generated using the *Plotly* (Plotly Technologies Inc., 2015) and *Matplotlib* (Hunter, 2007) Python packages. Due to high variability and skewness of most of the variables, Kendall’s Tau-B ( $\tau$ ) rank coefficient was used to analyze correlations, while ANOVA with Brown-Forsythe correction was used to analyze differences among the various categories of articles.

## Results

### Trends in publishing OA articles

Open access articles account for 31% percent of the total number of research articles published in the analyzed period in the field of personality psychology. Out of this percent, the largest proportion of articles were published under the green model (8770 – 49%), followed by gold (4506 – 25%), bronze (2704 – 15%), and hybrid gold (1793 – 10%). However, these proportions varies a lot across the span of twenty years as shown in Figure 1.



**Figure 1.** Trends in publishing OA articles of different types in personality psychology

Figure 1 shows the obvious growing trend of publishing OA articles in personality psychology. The share of OA articles in personality psychology has grown from around 5% in 2003 to almost 50% in 2022. The most intensive growth is within the group of (hybrid) gold OA articles. Although the trend of depositing articles in repositories is also showing an increase, it seems that the authors are depositing mainly articles that were already freely available online or became available after the deposition of pre-print. The initial growth in the number of green OA articles practically stopped in 2009 and since then the proportion of articles that aren't freely available in any other form is actually stagnating or even dropping. As for the bronze OA articles, it appears that the incidence of this type of OA depends on contextual factors. For example, a slight increase in the proportion of bronze OA articles visible in 2009-2011 can be attributed mostly to a single journal that was later discontinued (*Procedia - Social and Behavioral Sciences*), while the growth in the period after 2019 is probably the effect of specific editorial policies aimed at opening articles related to COVID-19 pandemic (e.g., *Frontiers in Psychology*).

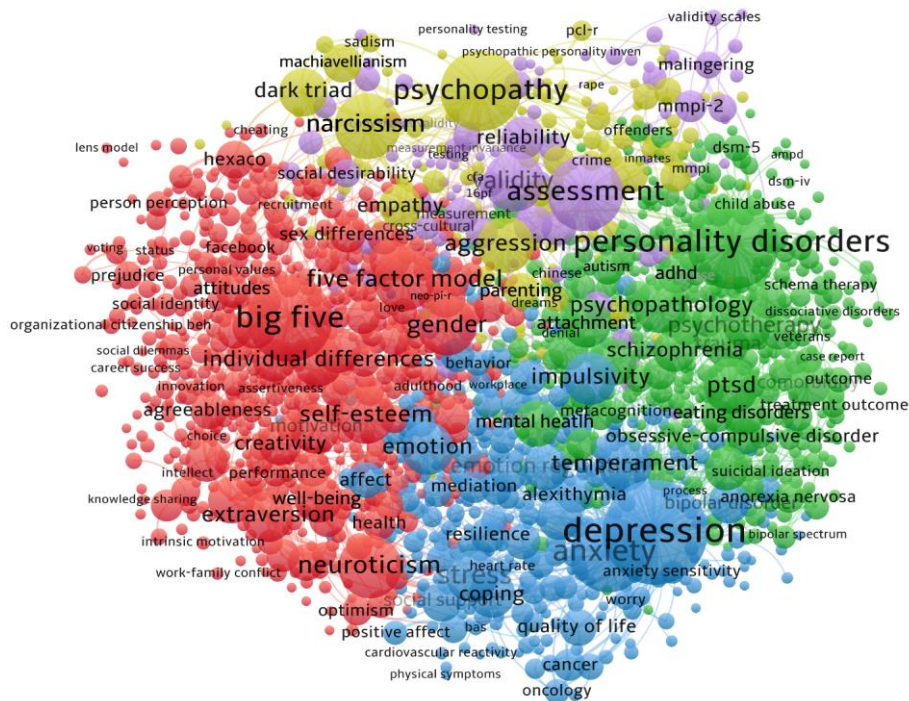
### Scientific landscapes of research in personality psychology

Since the numbers of OA articles in different categories were relatively small compared to the number of non-OA articles, the first two maps were generated for non-OA and for all OA articles together. Using the procedure explained in the introduction, threshold for the non-OA articles was set at 13 which yielded 1.510 different keywords. For OA articles of all types, the threshold was 8 occurrences resulting with 1.360 keywords displayed on the map<sup>1</sup>. Figure 2 shows predominant topics in research articles from the field of personality psychology not freely available online. Five distinct clusters emerge. The first one on the left (red) consists of topics related to the exploration of personality

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<sup>1</sup> JSON files for a more detailed inspection of the maps using VOSviewer Online (<https://app.vosviewer.com/>) are deposited in OSF repository (<https://osf.io/7mnwc/>).

traits in general, predominantly in the context of Five-Factor Model (FFM). All Big Five dimensions are visible on the map, with neuroticism being the most frequent. Individual differences are explored in various contexts, from well-being and general health, to motivation, social identification, internet behavior, prejudices, attitudes, and organizational setting.

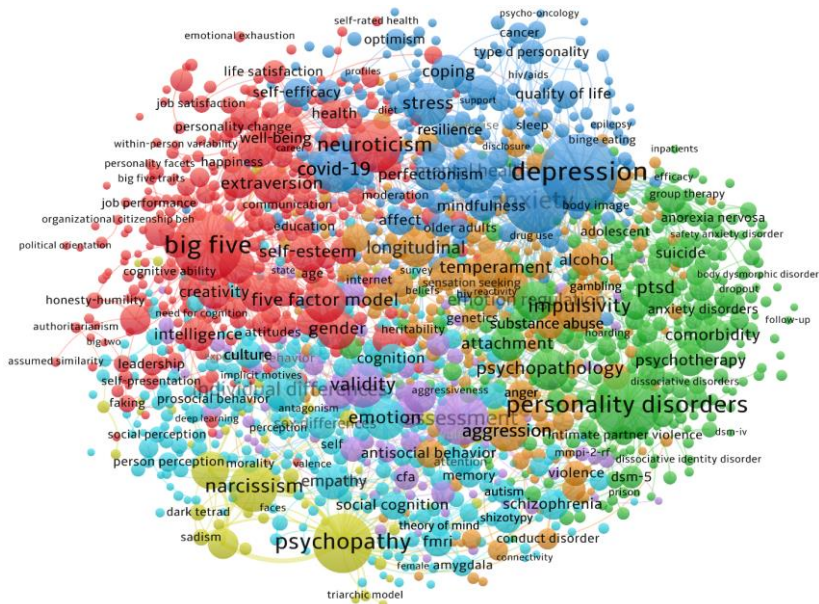


**Figure 2.** Co-occurrence map of author keywords from non-OA articles in personality psychology

Another large cluster on the opposite side of the map (green) incorporate topics related to various personality disorders. Most frequent keywords in this group of articles refer to different psychopathological phenomena, such as schizophrenia, PTSD, OCD, ADHD, eating disorders, suicide, and autism, but also to their treatment (psychotherapy) and prevention. This cluster is to a large extent interweaved with the third large cluster at the bottom of the map (blue) that encompasses topics related to emotional regulation and emotional aspects of mental health: anxiety, depression, impulsivity,

alexithymia, and stress. It is worth noting that, apart from the term “mental health” itself, the two most frequent terms connecting green and blue clusters are “temperament” and “bipolar disorder”.

Finally, two rather specialized clusters are positioned at the top of the map. Unlike the first three, these clusters are more homogeneous and almost singular in its thematic emphasis. The yellow one comprises of keywords related to negative personality traits and behaviors. The most prominent keywords in this clusters are traits of the so-called Dark Triad: psychopathy, narcissism, and Machiavellianism. It is worth nothing that HEXACO, as an alternative model to the FFM, is positioned more closely to the Dark Triad cluster. The violet cluster contains keywords from the articles with psychometric focus on personality research, both in the sense of validating existing instruments and constructing new ones: assessment, validity, reliability, and factor analysis. This aspect of personality research is particularly relevant in the context of growing popularity of cross-cultural research and research on measurement invariance of various psychological instruments.



**Figure 3.** Co-occurrence map of author keywords from OA articles in personality psychology

Figure 3 shows the co-occurrence map of keywords from OA articles in personality psychology. Although the five main clusters from the non-OA map are clearly present, some obvious changes are noticeable. First, COVID-19 pandemic emerges as “hot” research topic appearing at the intersection of clusters related to mental health and personality traits. This new node is most strongly connected to terms denoting common effects of the pandemic (stress, anxiety, depression) and possible ways of coping with them (resilience, empathy, extraversion, compliance, well-being). Another noticeable difference between the maps in Figures 1 and 2 is larger dispersion of nodes, i.e., lower density of the clusters. Although this may be attributed to a smaller sample of words and lower keyword occurrences, a change in the structure of prevailing topics is evident. For example, the terms “aggression”, that was clustered with the negative traits (Dark Triad), and “impulsivity”, that were closer to emotion regulation, now forms a completely new cluster of topics. This cluster is focused on different aspects of antisocial behavior, risk-taking, and sensation seeking (alcohol, substance abuse, gambling, violence).

Another noticeable cluster division is the separation of individual differences research from the personality traits (FFM) cluster, now forming a cluster of terms like “emotion” (not “emotion regulation”), “culture”, “social cognition”, “empathy”, and “sex differences”. Although it is not directly visible on the map, terms from this cluster have strong connections with COVID-19, which indicates that emergence of a new research topic have moved research focus away from the exploration of individual difference towards the cultural aspects of emotional responses to the pandemic. Finally, due to higher dispersion of topics in OA articles, an additional field of research is now more visible – neuroscience and cognitive aspects of personality (fMRI, attention, memory, theory of mind).

## Networks of international collaboration in personality research

Patterns of international collaboration in personality research were explored using the maps based on co-occurrences of country names in authors’ affiliations. Maps were generated for non-OA articles and all types of OA articles

separately in order to analyze both typical forms of publishing in different countries, and international diversity of personality research within each category of articles. Gold and hybrid gold articles were merged since the APC is required for both types of articles to be published. Figure 4 shows the collaboration networks for four categories of articles. The same threshold criterion was used as before, which means that each map shows at least 50% of the most productive countries in the field of personality research.

Collaboration networks clearly differ across different categories of articles, but basically show the predominance of Western countries. Patterns of collaboration in green OA articles is most similar to those of non-OA articles, although some of the non-Western countries emerge, such as Russia, Serbia, Poland, South Korea, and Brazil. The network of collaboration in research published in gold OA articles differs most from the other types of articles since Russia, Poland, and Ukraine are now among the most productive countries. Furthermore, additional countries appear on the map, mostly due to common cooperation with authors from Russia: Slovakia, Slovenia, and Croatia. Finally, the map of bronze OA also shows the slight skewness towards some of the most productive and most economically influential Western countries: USA, UK, Canada, France, and Germany.

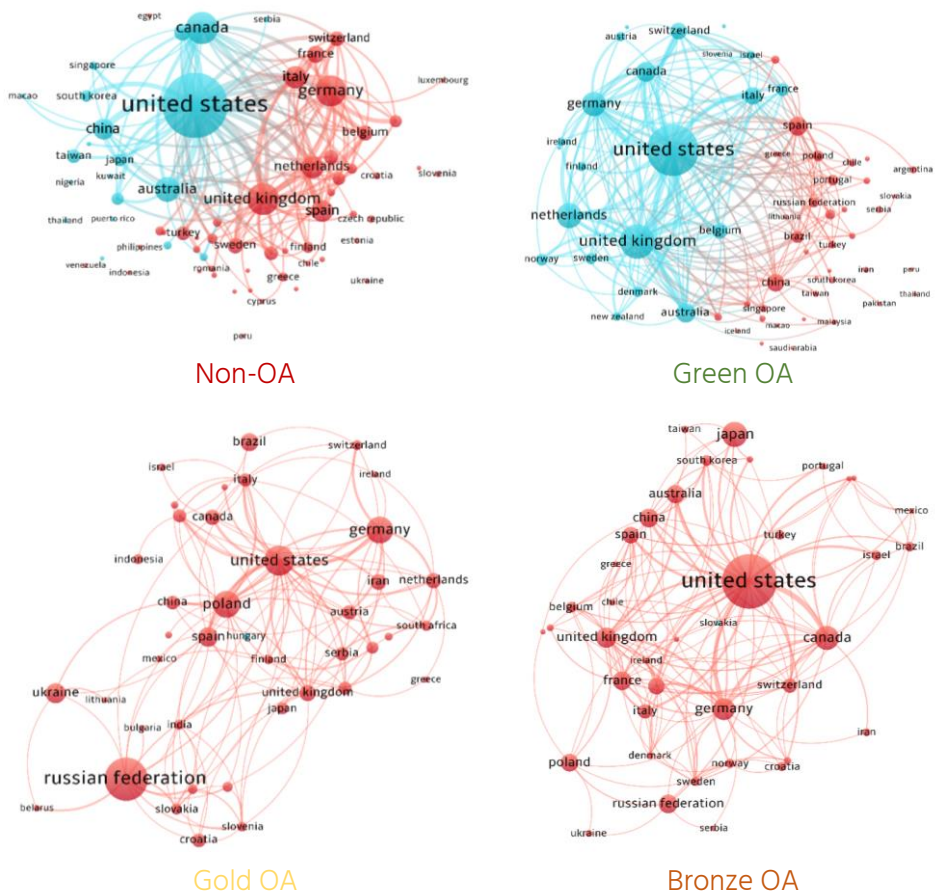


Figure 4. Collaboration networks and patterns of OA publishing in personality research

### Scientific impact and general outreach of personality research

In order to explore the impact of different types of articles in personality psychology, PlumX data were retrieved for all articles from the sample. These include number of citations in Scopus, number of citations in policy documents, number of captures (e.g., in Mendeley and similar reference management software), number of mentions in online documents (e.g., Wikipedia), and number of posts in social media. Due to large differences in subsample size and variability, we conducted comparisons using ANOVA with Brown-Forsythe correction for homogeneity. Additionally, in order to make citation windows



more meaningful and comparable, the sample was limited to the articles published after 2012 when the number of OA articles started to grow significantly, as previously shown in Figure 1. PlumX data were not available for some of the articles, so the total sample in this analysis consisted of 31555 articles, out of 31658 published after 2012. Results are presented in Table 1.

**Table 1**

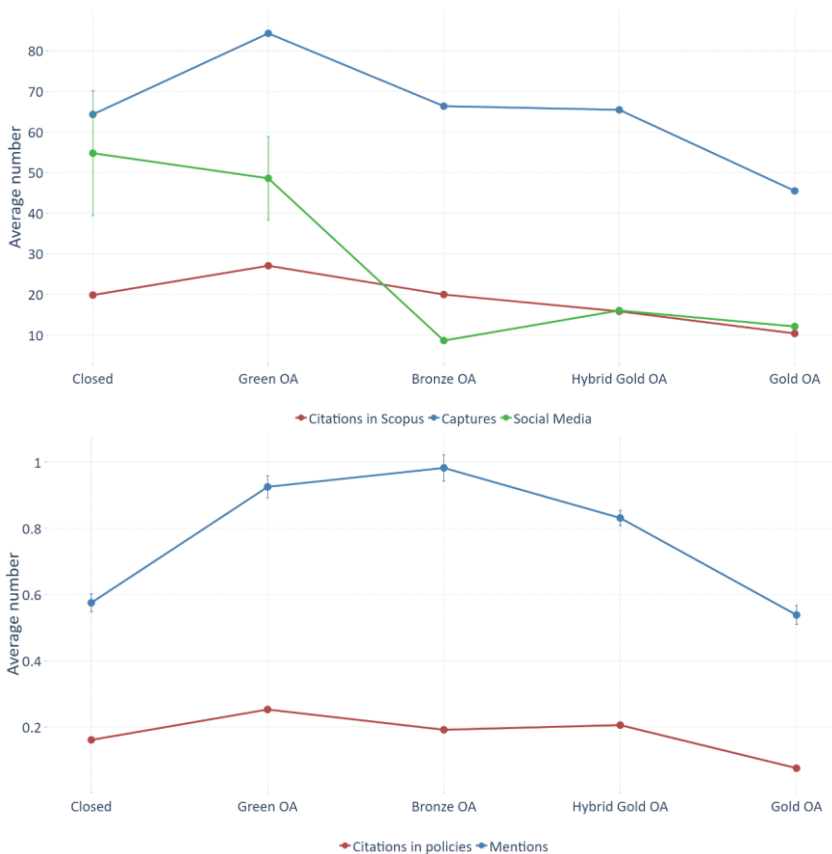
Statistical significance of impact and outreach among the articles of different (non-)OA type

	SS	df	MS	F	p
Citations (S)	684983.89	4	171245.97	105.52	<.001
Citations (P)	79.00	4	19.75	21.85	<.001
Captures	3.61*10 <sup>6</sup>	4	903859.71	95.89	<.001
Mentions	812.03	4	203.01	7.34	<.001
Social media	1.02*10 <sup>7</sup>	4	2.56*10 <sup>6</sup>	1.92	.104

*Note:* S – Scopus, P – policy documents.

All differences are statistically significant except for the number of posts in social media. In order to get a better insight into the patterns of these differences, graphs showing means and standard errors for each category was generated and displayed in Figure 5. The number of citations in policy and online documents are shown separately since value ranges for these variables were significantly lower compared to the other measures. Most of the articles have zero policy citations and mentions, 93% and 86% respectively. Gold OA articles have lowest means on all measures of impact and outreach, except for social media where they are second worst, scoring higher only compared to bronze OA articles. On the other hand, Green OA articles have the highest average citation rates in Scopus, as well as the highest average number of captures. As for the number of posts on social media, closed and green OA article have the largest mean values, but also show the highest variability which was probably the main reason why this difference was not marked as statistically significant. Finally, average numbers of policy citations and mentions show different pattern, since bronze OA articles are most often cited in policy documents.

However, these results should be taken with a grain of salt due to the high skewness and low median values of those variables.



**Figure 5.** Impact and outreach of the personality psychology articles of different (non-)OA type

Results presented in Figure 5 indicate that the number of captures and the number of citations in Scopus are highly correlated. In fact, all analyzed measures correlate significantly, but only the correlation between these two is practically significant ( $\tau = 0.64, p < .001$ ). Correlations between the number of citations in Scopus and other measures are negligible and practically

insignificant - social media ( $\tau = 0.13$ ,  $p < .001$ ), policy citations ( $\tau = 0.23$ ,  $p < .001$ ), and online mentions ( $\tau = 0.20$ ,  $p < .001$ ).

## Discussion

The main purpose of this study was to explore the open access practice in personality research. A set of 57296 research articles in personality psychology available in the Scopus database were analyzed based on their online availability: closed (39523), green OA (8770), gold OA (4506), bronze OA (2704), and hybrid gold OA (1793). The specific aim of the study was twofold. The first goal was to analyze trends in providing open access to articles by publishing in specialized gold OA journals or by depositing them in various repositories. The second aim was to explore differences among different types of articles from several aspects: predominant topics, patterns of international collaboration, and impact, measured both by traditional citation counts, and by alternative metrics, such as the number of captures or the number of mentions in online documents and social media.

Although the share of OA articles in the total sample is relatively small (31%), our analysis has shown that it is constantly rising. Two growing trends are noticeable. The first refers to the increase in the number of deposited articles (green OA) in the period 2003-2009, and the other to the increase in the number of articles made freely available by paying APC (gold and hybrid gold OA) in the period 2013-2022. The second one is particularly pronounced and may be attributed to the growing popularity of the open science movement in general, but also to changes in research funders' policies. For example, the European Commission adopted several relevant documents in 2012 that made all researchers receiving EU funds obliged to make results of their research freely available. Thus, almost 50% of articles in personality psychology published in 2022 are available in some form of open access.

Despite the obvious growing trend in depositing articles in repositories, one different pattern is somewhat perturbing. The proportion of green OA articles in 2022 has surpassed 35%, but this mainly refers to articles that are already available, or will be available upon publishing, via gold OA. In fact, the

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proportion of closed articles that are being deposited in open repositories is stagnating from 2013, and even decreasing from 2020, after the initial growth in 2003-2009. It seems that the emergence of gold OA and a growing number of journals providing gold and hybrid gold modes of publishing, have to some extent demotivated researchers to deposit manuscripts to (institutional) repositories. Moreover, this discouragement often comes from the publishers themselves, since they are constantly increasing the number of restrictions and conditions constraining the right to self-archive, while at the same time offer more options for paid OA (Gadd & Troll Covey, 2019). It could be said that this trend is a negative side-effect of the growing popularity of gold OA since most articles in personality psychology are still not freely available online in any form.

Bibliometric mapping has revealed five large clusters of topics in non-OA personality research. The largest cluster is made of keywords from articles exploring individual differences in various contexts, predominantly using the Five-Factor Model of personality as a theoretical paradigm. HEXACO seems to be gaining prominence, offering a new perspective by introducing the dimension of Honesty-Humility to the FFM and indicating a possible paradigmatic shift in personality psychology. The second cluster is focused on psychopathology and personality disorders, such as autism, OCD, eating disorders, and schizophrenia, while the third is consisted of topics related to emotional regulation and emotional problems, most often anxiety, depression, and stress. Finally, the fourth and fifth clusters are much smaller and more specialized, one focusing on the negative personality traits (Dark Triad/Tetrad), and the other on psychometric aspects of personality research, mostly on validation of psychological instruments in a cross-cultural context, but also on designing new ones. It should be pointed out that division of topics into different clusters does not mean that the authors are creating their own niches, doing studies within strictly bordered research settings or frameworks. Although this may be true to some extent for the "Dark Triad" and "psychometric" clusters, all topics in personality research are generally highly connected and interweaved, meaning that research problems in this field are usually comprehensively covered from various theoretical and practical aspects.

Bibliographic mapping of OA articles revealed a non-negligible change in the research landscape within personality psychology. Most prominent shift is the move of research focus towards the exploration of COVID-19 pandemic and its effects on mental health. COVID-19 has appeared as a hub connecting previously detected “personality traits” and “emotion regulation” clusters. Another noticeable change was the shift of topics related to impulsivity and aggression to a separate cluster, now including problems related to antisocial behavior, alcoholism, anger, and substance abuse. Research on individual differences have moved from the FFM cluster closer to the exploration of empathy and emotional reactions, again most often in the context of COVID-19. Finally, neuropsychological research of personality, previously not distinctively shown on the map, now came to light as a clearly visible cluster of topics. It is obvious that personality research in OA and non-OA articles show different structural patterns, which means that readers who are not able to access all available articles may be provided with different insights into research in personality psychology. It was already shown in previous studies that an emergence of new and “hot” topics may produce perturbations, not only in our perception of a certain knowledge domain, but also in research evaluation practice (Pajić, 2023).

The analysis of collaboration networks based on the number of co-authorships in different types of articles has revealed several interesting patterns. As it was expected, the knowledge corpus on personality psychology is mostly based on research conducted by the authors from highly developed and rich Western countries, exclusively or within multinational research teams. This is when non-OA articles were taken into account, but the situation is very similar in the groups of green, bronze, and hybrid gold OA. The most similar network to that of non-OA articles is the network of co-authorships in green OA papers. However, small but obvious differences between the two maps can indicate which authors are practicing depositing to repositories more regularly. Based on the nodes that appear on the second and not on the first map, those countries seem to be mostly outside Western Europe and North America: Brazil, Poland, Serbia, Russia, Singapore, Chile, and many others.

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Both collaboration network structure and the incidence of different countries significantly changes when co-authorships in gold OA articles are visualized. It seems that the authors from Russia and Poland most often choose to publish in gold OA. Also, some new co-authorships, not presented on the non-OA map, appear. For example, collaborations between the Russian authors on one side, and the authors from Croatia, Slovenia, Slovakia, and Bulgaria on the other. Another example is collaborations between the authors from the USA on one side, and the authors from Iran, Austria, Poland, and Serbia on the other. Although it shouldn't be marked as a common practice, this may indicate the authors from less economically influential countries are relying on their co-authors from richer countries to pay for the APCs. This is in line with some previous research in the field of personality psychology (Atherton et al., 2021).

Apart from the USA, highly developed countries, such as UK, China, the Netherlands, and Canada, are practically underrepresented on the gold OA map. Furthermore, some of the countries disappear completely, at least from the group of countries whose authors most often opt for publishing under the gold OA model. Most remarkable examples are Australia and France. It should be noted, though, that Scopus OA classification does not recognize so-called platinum OA journals that don't charge APCs, but still offer all articles for free. It is possible that most of the articles by authors from non-Western countries are actually published in national platinum journals that were classified as gold or hybrid gold. The proportion of such journals in highly developed countries is negligibly small.

The final aim of the current study was to analyze the impact and general outreach of articles in personality psychology, as measured by the number of citations in Scopus and several alternative metrics. Contrary to many previous results, or even some intuitive assumptions, gold OA articles showed the weakest results on practically all measures. They are least cited, least captured, and second least mentioned in social media. If all measures were taken together, green OA articles seem to perform the best. They have significantly higher numbers of citations, captures, and mentions than other OA articles. They were also more often cited on average than non-OA articles. This corresponds with

some earlier studies conducted before the surge of gold OA (Antelman, 2004; Lawrence, 2001).

It may be hard to explain the reasons behind the somewhat unexpectedly poor impact and outreach of gold OA articles, having in mind that both green and gold OA articles are equally accessible online, e.g., through Google Scholar. One possible explanation could be traced to the authors' perception of journal and research quality. It may be that authors generally tend to perceive gold OA journals as dubious or even "predatory" and thus more willingly choose to cite "verified" sources, i.e., freely available versions of articles published in prestigious closed journals. In addition to that, since national platinum journals indexed in Scopus are classified as (hybrid) gold OA, it is possible that instead of comparing gold and green OA articles, we are actually comparing articles published in national journals with those published in highly influential international journals.

The number of citations in Scopus has the strongest correlation with the number of captures, i.e., number of downloads to reference management software. This is somewhat expected since both practices are basically measuring the impact on peer researchers. On the other hand, mentions in social media and, to some extent, the number of citations in policy documents, are referring to other groups of stakeholders, government officials, or even general public. In this context, correlations with the number of citations should not be considered a way to validate alternative metrics. Instead, they should be used to choose appropriate measures that could complement traditional impact indicators. For example, bronze OA articles have generally not performed very well on most of the measures but had the highest number of citations in policy documents. This indicates that articles recognized as relevant by fellow researchers do not have to be perceived in the same way by other knowledge consumers. It may also be used as a validation of editorial boards' decisions to make certain articles freely available, since bronze OA articles have most successfully reached policy stakeholders.

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## Limitations of the study

The two largest limitations of the current study refer to criticism that may be thrown to practically any bibliometric analysis. The first is related to the article selection criteria. There were concerns that using the term “personality” to locate articles in personality psychology may be inappropriate since in many of them this term is not even mentioned (Allik, 2013). However, we believe that other commonly used criteria, such as selecting only articles from a limited set of (the most influential) journals, would have led to even more biased picture, particularly having in mind that our sample included significant number of articles from national, non-Western journals. The second possible criticism is related to the selection of threshold values. It is possible that due to the methodology used in this study, selected subsets of entities do not adequately represent the whole knowledge domain in personality psychology. Nevertheless, the quality, richness, and interpretability of presented maps, as well as the large size of our sample, ensures that the results presented in this paper have provided a sufficiently objective picture of the structure and dynamics of current research in personality psychology with the unique insight into the role of open access.

## Conclusions

The presented study has offered a comprehensive overview of the structure and dynamics of current research in personality psychology. As a takeaway, three key conclusions should be considered. First, the emergence of “hot” topics can easily disrupt the current research practice in a sense of moving the focus towards more popular, but not necessarily more relevant topics in science. This stands particularly for relatively small and specialized fields such as personality psychology. The intention is not to devalue the importance of COVID-19 as a research subject nor as a globally significant phenomena, but to stress the importance of choosing research problems not by their attractiveness or potential academic benefits, but by their importance in answering fundamental questions in a field. Second, the practice of publishing articles in gold OA journals seems to be less effective than it was expected, at least



judging by their scientific and public impact. This is particularly problematic bearing in mind that authors are abandoning the practice of green OA, although the expected impact of those articles seems to be the highest. Finally, our study has shown that most of the highly economically developed countries are actually preferring green over gold OA. It is obvious that, although you may need a significant amount of money to do the research, you don't need it to make your research open and make a broader impact.

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#### *Conflicts of Interest*

The authors declare no conflicts of interest with respect to the authorship or the publication of this article.

#### *Data availability statement*

Primary data used in this study are not available for sharing due to Elsevier's terms and conditions. All figures in high resolution and JSON files for bibliographic maps are deposited to the OSF repository: <https://osf.io/7mnwc/>.

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