

# Researchers' perceptions, patterns, motives, and challenges in self-archiving as a function of the discipline

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## **Abstract**

The green open access (OA) model, which offers the most economical approach to comply with open access policies, can increase researchers' audience and scientific outputs impact by delivering wider and easier access. This study examined researchers' perceptions from STEM (science, technology, engineering, math) and SSH (social sciences, art and humanities) disciplines in order to reveal the types, patterns, motives, and challenges underlying their articles' self-archiving in the green route to open-access (repositories and institutional repositories) and ASNs (academic social networks). Interviews were conducted with 20 Israeli academic researchers. Half were from STEM and half from SSH disciplines. Interviews were mapped using a bottom-up thematic analysis and follow-up quantitative comparisons. According to the findings, STEM researchers self-archived pre/post-print versions of their articles to subject-based repositories as a part of their discipline norm resulting from their funding grant requirements and as a way to receive recognition and claim priority. SSH researchers post a link to the printed-published article at the publisher's website in ASNs, and their goal is greater visibility. In addition, findings indicate a lack of awareness, mostly by SSH researchers, regarding copyright issues and OA repositories. The green OA model provides opportunities for researchers to self-archive their work. However, there are differences between the disciplines regarding where, when, why, and how to self-archive, and what is considered a legitimate mode of green OA. This indicates an urgent need to raise SSH researchers' awareness of the existence of open subject-based repositories and of the terms of self-archiving from publishers.

**Keywords:** Green open-access model, self-archiving articles, repositories, academic social networks (ASNs), SSH, STEM.

## Introduction

The changing landscape that has emerged in the digital age offers academics new ways to work on research and disseminate research outputs (Laakso and Björk, 2022; Scanlon, 2014). Open access (OA) refers to free and unrestricted access to electronic versions of scholarly publications (Björk et al., 2014). There are two main subtypes of OA: *gold OA*, in which articles are published in open access when they are open directly on the journal website (Piwowar et al., 2018; Tennant et al., 2019) and the *green OA* route refers to indirect free access to an article or an earlier version of the manuscript that is available on the web at a repository (Harnad et al 2004; Piwowar et al., 2018; Tennant et al., 2016). Traditional green OA refers to the depositing of an article in subject-based or institutional repositories (Björk, 2017). However, academic social networking sites (ASNs), such as ResearchGate and Academia.edu, both founded in 2008, allow scholars to share their work and provide open access virtually to scholarly articles (Lovett et al., 2017). Although some scholars propose to address ASNs as part of the illegal black route to OA due to the copyright compliance issues (e.g., Björk, 2017), others address these platforms as an additional mode of OA publishing similar to academic repositories (Jordan, 2019).

The terms ‘green OA’ and ‘self-archiving/depositing’ are often used interchangeably. However, the decision to make the article openly available does not always depend only on the author, but rather on various policies among publishers, institutions, research findings, and the authors (Laakso, 2014; Tennant et al., 2016). Green and gold OA levels vary greatly by discipline, with the highest levels being in some STEM (science, technology, engineering, math) fields and low levels overall in SSH (social sciences, arts and humanities) (Bosman and Kramer, 2018). Green repositories are well developed in STEM disciplines compared to their counterparts in humanities and social sciences (Bosman and Kramer, 2018; Momeni et al., 2021). In addition, STEM subscribers’ journals require a shorter embargo period before making the published articles freely available, compared to SSH journals. Academics often raise concerns about publishers’ copyright terms and policies regarding self-archiving, which prevent them from depositing their articles on green OA platforms (Narayan and Luca, 2017; Zhang and Watson, 2017).

OA publishing benefits the public and authors. Piwowar et al. (2018) emphasized that the number of OA articles' citations, can greatly increase while using the green channels. However, other researchers (Zhang and Watson, 2017) asserted that much of the OA citation advantage experienced by green OA articles might be the result of other factors such as disciplinary affiliation with STEM disciplines publications. Hence, it is important and interesting to explore the phenomenon of self-archiving in the green OA route from researchers' perspective. Therefore, the present study aims to explore Israeli researchers' perceptions from STEM and SSH disciplines, in order to reveal the types, patterns, motives, and challenges underlying their self-archiving in the green route to open-access and in ASNs.

## **Literature Review**

### ***The green route to OA: The potential, challenges, and discipline-based context***

OA describes a radical new dissemination model for scientific research publications (Björk et al., 2014). The Budapest Open Archive Initiative (BOAI) (2002) declaration provided the first community-agreed definition of open access and was closely followed by the Berlin declaration and Bethesda definition, both in 2003, and known as the BBB OA Declarations. According to Suber (2015), OA work has the following characteristics: digital, online, free of charge, and free of most copyright and licensing restrictions. The key elements of these definitions and declarations were neutral as to whether this goal should be achieved through Green (repositories) or Gold (journals) open access (Gadd and Troll Covey, 2019). Thus, Piwowar et al.'s (2018) definitions address OA articles as "free to read online, either on the publisher's website or in an OA repository" (p. 4).

Simultaneous with the development and establishment of open-access journals since 2005, institutions and organizations began to establish repositories to address the need for discoverability and preservation of self-archived open access copies of papers (Gadd and Troll Covey, 2019). The green route to open access addresses author self-archiving, in which peer-reviewed articles and/or non-peer-reviewed pre-prints are posted online, usually without charge, after an appropriate embargo period that is agreed upon with commercial publishers (Abdelrahman, 2020; Tennant et al., 2016). The Scopus database allows green articles to be freely read *at repositories only*, and includes two versions: green accepted and green final. That is, the manuscript accepted for publication

(manuscript after peer review, but without publisher formatting) and the final manuscript are available at a repository (McCullough, 2022).

Authors can self-archive their work in *institutional repositories* which are under the direct control of the institution, or in *subject-specific repositories* such as arXiv (<https://arxiv.org/>) for STEM disciplines, BioRxiv (<https://www.biorxiv.org/>), a preprint server in biology, or SSRN (<https://www.ssrn.com/>) for the social sciences. Two databases provide a comprehensive list of institutional and subject OA repositories: ROAR (Registry of Open Access Repositories, <http://roar.eprints.org/>) and OpenDOAR (Directory of Open Access Repositories, <http://www.opendoar.org/>). Additionally, authors can upload a version of their work on their personal website. Although institutional repositories (IRs) have become widespread, they were consistently under-populated and under-utilized (Laakso et al., 2017; Ten Holter, 2020).

Following the BBB OA declarations, major research institutions in Australia, China, France, Germany, Greece, Hungary, Italy, Norway, Portugal, Switzerland, the UK, and the US have committed themselves to provide OA for their research output (Edwards, 2016; Sanjeeva and Powdwal, 2017). More recently, grant stipulations for over 100 funding organizations, including Plan S and Europe PMC Funders' Group, increasingly require peer-reviewed research outputs be freely available. These aims can be achieved by publishing in OA journals (gold OA), or archiving publications in an OA repository (green OA). In some cases, both options are required (<https://v2.sherpa.ac.uk/juliet/about.html>). Further, in March 2021, the European Commission launched an Open Research Europe repository platform for scientific papers funded by Horizon Europe - Horizon 2020 (<https://open-research-europe.ec.europa.eu/>).

### ***Challenges in self-archiving articles***

Researchers, students, libraries, organizations, businesses, physicians and patients, and developing countries all greatly benefit from open research and data (Laakso et al., 2011). OA can increase researchers' audience and impact by delivering wider and easier access. According to Piwowar et al. (2018), OA articles receive 18% more citations than average, an effect driven primarily by Green and Hybrid OA. Yet, there is a large gap between the potential for self-archiving permitted by publisher policies and the practice of self-archiving by scholars (Bosman and Kramer, 2018; Piwowar et al, 2018).

Although the rate of archiving green papers has increased over time, in 2019 it was only 4% of the total articles published (Piwowar et al., 2019). According to Fry et al. (2011), researchers who associated open access with ‘self-archiving’ were in the minority. Self-archiving processes in green OA repositories are complex for some authors due to their technological aspect which can be a tedious and difficult administrative task requiring numerous attempts to complete. Thus, authors refrain from depositing articles to repositories (Ten Holter, 2020). Moreover, many researchers lack awareness regarding the value of open access in general and of the green route in particular (Björk, 2017; Zhu, 2017). Further, there is confusion and misunderstanding about publishers’ copyright policies (Narayan and Luca, 2017). Studies have shown that researchers lack resources and information regarding self-archiving and that they struggle with exhausting and difficult administrative processes that may require to complete (Lovett, 2017; Ten Holter, 2020). Gadd and Troll Covey (2019) assert that publishers have in theory become ‘greener’ over time by allowing some sort of self-archiving, while simultaneously increasing restrictions around the when, where, and how of self-archiving.

### ***Green open access and discipline-based context***

Green open access levels vary by discipline, with the highest levels (over 50%) in STEM (science, technology, engineering, math) fields and low overall levels (under 20%) in Social Sciences and Arts and Humanities (Bosman and Kramer, 2018; Maddi et al., 2021; Momeni et al., 2021; Laakso and Björk, 2022). According to Martín-Martín et al.s' (2018) finding, the disciplines with a larger share of documents in the green OA category were astronomy and astrophysics (56.2%), and mathematics (21.1%), and the lowest were arts (4.1%) and literature (2.9%).

Whitley (1984; 2000) identifies two elements that explain cultural differences between disciplines: *mutual dependence* and *task uncertainty*. *Mutual dependence* addresses the *degree of interdependence* among researchers as they create valid knowledge. Mutual dependence has two aspects: functional mutual dependence (FMD) - that addresses the degree to which researchers are expected to adhere standardized ideas. A high FMD implies that a set of methods must be followed in order to gain recognition and reputation. The second aspect is strategic mutual dependence (SMD) which tends to relate to social considerations such as reputation building. This aspect includes the extent to which

researchers have to convince others of the significance of their work. (Fry & Talja, 2007). Low SMD is typical of a discipline that does not have a dominant set of ideas that presents what is considered as an acceptable and valuable scientific output (Whitley, 1984; 2000).

*Task uncertainty* addresses the *degree of uncertainty* in producing and evaluating the valid knowledge. A high degree of uncertainty is influenced by external factors such as lack of consistency of strategies and goals. Whitley (1984; 2000) divided task uncertainty into two aspects. The first is technical uncertainty (TU) that addresses the inability to understand work techniques or how to produce reliable results. The second aspect is strategic uncertainty (SU) that addresses the inability to perceive a consensus about the importance and/or priority of goals. Whitley (1984; 2000) argues that a combination of possible variations in the degree of mutual dependence and task uncertainty can be used to explain the contrasting organizational structures exhibited by SSH and STEM disciplines.

The present study, follows previous studies (e.g. Bayer et al., 2019; Fry & Talja, 2004), and tries to explain the variation between disciplines. Researchers proposed Whitley's theory as a theoretical framework that illustrates the connection between the cultural identity of a field and the patterns of scientific publication (Fry et al., 2016). While trying to investigate cultural differences between the STEM and SSH disciplines, researchers addressed several aspects. The first is that publication practices and behavior are shaped by a discipline's traditional cultures (Bosman and Kramer, 2018; Maddi et al., 2021). The second is that research outputs' assessment is influenced by the institutional and national contexts where SSH and STEM research is taken place (Bayer et al., 2019).

According to Ochsner et al. (2020), there is difficulty in various SSH disciplines to define and evaluate research outputs compared to STEM disciplines. This may be a result of the lack of a linear process of progress and a much longer time span required to assess the academic impact of SSH publications. In addition, SSH disciplines are traditionally less focused on demonstrating an 'impact' on external and internal stakeholders compared to STEM (Reale et al., 2018). Thus, the different roles of informal and formal interdependence in each discipline shapes its publishing norms and practices (Fry et al., 2016; Momeni et al., 2021).

Parallel with the accelerated development of gold OA in STEM fields, green OA is well-developed in their fields compared to their counterparts in SSH (Bosman and Kramer, 2018; Serrano-Vicente, 2016). Researchers in STEM disciplines are more confident about the green route process. For some of the STEM disciplines, preprints are essential and for others, self-archiving of the published version have a central role (Bayer et al., 2019; Fry et al., 2016). In addition to the discipline's norm, different publishing houses impose different embargo periods before making the published articles freely available, which can explain the observed differences between the disciplines. STEM subscribers' journals require up to a year's embargo, compared to up to 36 months for SSH journals (Martín-Martín et al., 2018). For these reasons, some refer to STEM as 'open access (OA) friendly' disciplines (Fry et al., 2016).

#### *Academic social networking sites*

Over the course of a decade, academic social networking sites (ASNs) have emerged. In ASNs, articles are shared by authors using commercial online social networks. The most popular sites, both founded in 2008, are ResearchGate and Academia.edu and allow scholars to share their work and connect virtually with other researchers worldwide (Matthews, 2016). There is an ongoing debate as to whether the ASNs are an integral and legitimate part of the OA green route (Björk, 2017). Some argue that publications shared on ASNs are not OA at all because, in contrast to the green OA repositories, ASNs do not check for copyright compliance. Thus, a considerable rate of their content is illegally posted and hosted (Jamali, 2017). Due to these issues, some studies exclude ASN-hosted content from their definition of OA (e.g., Piwowar et al., 2018).

Moreover, Scopus and Web of Science, the two titans of bibliographic information in today's academic world, include published, submitted or accepted versions of articles in the green category only if they are hosted on a legitimate source, namely an institutional or subject-based repository (Pranckutė 2021; McCullough, 2022). The source of OA green and gold documents in Scopus is Unpaywall, a non-profit organization that harvests OA content from over 50,000 publishers and repositories. According to Unpaywall, they harvest content from legal sources including repositories run by universities, governments, and scholarly societies, but they "do not harvest from sources of dubious legality like ResearchGate or Sci-Hub" (Unpaywall, para. 3). Nevertheless, despite these concerns, ASNs platforms as far provide an online hosting space for



academics to upload their papers, are used by other scholars, and serve as an additional channel of green OA (Jordan, 2019; Lovett et al., 2017).

### ***The research context, aim, and questions***

Sustainable OA policies and mandates by funders and research institutions have led to a significant shift to OA publication models in academic workflows (Carvalho et al., 2017). According to the registration of open access repository mandates and policies (ROARMAP), Israel has one institutional repository (Weizmann Institute IR) but no institutional academic OA mandates. In addition, according to Moskovkin et al.'s (2021) index of countries involved in the OA movement, Israel ranks 96th out of 168 countries, far below countries that have similar scientific outputs. According to the Scopus database, 47.9% of the total publications of the Israeli researchers was published in OA routes in 2021. Of these, 75.8% were defined as green OA (published version or manuscript accepted for publication, available at repositories); most of these green publications were in STEM fields (85.5%).

The literature discussed so far has presented a general positive trend towards the OA route; however, it also presented large disparities among countries, resulting in the various measures they take concerning OA policy (Maddi et al., 2021; Martín-Martín et al., 2018). In addition, the literature suggests a correlation between the disciplinary profile and green OA publications. Further, there is an ongoing debate as to what is being considered as green OA, and whether ASNs are an integral and legitimate part of the OA green route. Therefore, the aim of the current study is to examine Israeli researchers' perceptions from STEM and SSH disciplines concerning the green route to open-access, in order to investigate the types, patterns, motives, and challenges underlying self-archiving articles in the green route to open-access.

### **Research questions:**

1. What are the characteristics (types, patterns, and motives) of self-archiving articles in the green route of researchers from STEM and SSH disciplines?
2. Who is the initiator and responsible for self-archiving an article in the green route?
3. What are the challenges facing researchers when self-archiving articles using the green route?

## **Method**

### ***Participants***

The participants in this study were 20 researchers from universities and colleges in Israel: half were from STEM fields and half from SSH disciplines. Regarding gender, 50% were female. Most (90%) deposited articles in OA repositories and ASNs. Regarding seniority in research: 6 (30%) researchers had less than 10 years, and the remainder over 10 years.

### ***Procedure and instruments***

An email was sent to researchers from STEM and from SSH disciplines, with a request to participate in the study. Semi-structured interviews with the participants who agreed to be interviewed were conducted via Zoom. During the interviews, researchers were asked: 1) to report about the repositories they used to deposit their work; 2) what article version do they deposit; and 3) what are their motives for depositing. They were also asked to specify who initiates the deposit and to describe their experiences, perceptions, and challenges they face in self-archiving in the OA green route.

This study combines qualitative and quantitative research methods. It uses a qualitative bottom up thematic analysis (section A), followed by quantitative statistical comparisons (section B), as detailed below:

- A. The answers were collected through the Google Form application, analyzed “bottom-up”, and categorized using a Thematic Analysis (TA) technique. This analysis allowed us to conduct in-depth research to reach the main categories, as well as to classify the interviewees’ quotes, in order to identify common expressions and recurring themes, and build trustworthiness and credibility of the data (Braun et al., 2006; Yin, 2015). The unit of analysis in this study was a statement having a content unit. These analyses yielded 334 statements classified into three main categories. Each main category includes several subcategories (see Table 1). The coding was not exclusive so the same statements could be attributed to several categories. To ensure inter-rater reliability of the coding, 25% of the statements were analyzed by a second coder (in addition to the researcher) and the agreement level (Cohen’s Kappa) was .86.
- B. In order to examine and define the significant differences found in subcategories between the two groups, we conducted quantitative comparisons. First, a chi-square

goodness of fit test was conducted. This test examines the difference between the number of statements received (H1) compared to the expected quantity (H0) in each subcategory between the groups. In addition, the standardized residuals index was performed to indicate the ratio (i.e., the degree to which an observed chi-square cell frequency differs from the value expected). The rule of thumb is that standardized cell residuals which exceed an absolute value of two (+/- 2) are considered to contribute to a statistically significant degree in the omnibus chi-square test (Sharpe, 2015).

Table 1 describes the set of final research main categories and sub-categories.

**Table 1.** Array of research categories (no. of statements=334)

<b>Main category</b>	<b>Sub-category</b>	
<b>1. Types of OA repositories, patterns, and motives in self-archiving (182, 54%)</b>	1.1 <i>Types of self-archiving</i>	
	1.1.1 Self-archiving in subject-based repositories.	
	1.1.2 Self-archiving in academic social networks (ASNs).	
	1.1.3 Deposit OA version on author's page.	
	1.2 <i>Patterns and motives in self-archiving articles</i>	
	1.2.1 Self-archiving a pre-print version as an accepted norm in the field in order to claim priority.	
	1.2.2 Self-archiving a pre/post-print version to receive recognition and prestige	
	1.2.3 Posting a link to the publisher's site as a way to increase visibility.	
	<b>2. The initiative to deposit an article in OA repositories (72, 22%)</b>	2.1 The author was responsible for the decision to self-archive.
		2.2 Self-archiving articles due to the terms/requirements of the funding grant.
2.3 Co-authors' decision to deposit the article.		
<b>3. Challenges in self-archiving articles to the green route to OA (80, 24%)</b>	3.1 Unawareness of copyrights and publishers' terms for article self-archiving.	
	3.2 Lack of awareness of appropriate repositories in the researcher's field.	
	3.3 Fear of "scooping."	
	3.4 Lack of time as a reason for not depositing	

### **Rigor**

In order to ensure reliability in the findings, rigor in interviews was based on “trustworthiness of data”, by adhering to four principles (Lincoln and Guba, 1985): 1. Truth-value of data: researchers were informed in advance that their perspectives and reports would be confidential; 2. Applicability of the data: by selecting researchers from geographically dispersed institutions from different types of institutions (universities and colleges), gender, and different seniority; 3. Consistency of the data was assured by verbatim transcripts of the interviews and keeping records of data collection; and 4. Data neutrality was ensured by presenting the researchers’ perspectives on the phenomenon, and recording all steps during the data encoding of the interviews.

## **Results**

### ***Types of OA repositories, patterns and motives in self-archiving***

The first research question examined the types and patterns of s articles’ self-archiving in the green route of researchers, and their motives (n=182, 54% of the total statements). A chi-square for goodness of fit and standardized residuals tests were conducted (Table 2) in order to examine the significance of the differences in the number of statements observed in each group according to researchers from STEM and SSH fields. Statistically significant results are presented in the following tables in bold.

**Table 2.** Types of OA repositories, patterns and motives in self-archiving (182, 54%)

Category	Sub-category	Total Statements N (%)	Standardized residuals	Discipline	
				STEM N (%)	SSH N (%)
A. Types of OA repositories	Self-archiving in subject-based repositories	39 (21%)	+1.57	<b>32</b> (82%)	7 (18%)
	$X^2(1) = 16, p = .000$				
	Self-archiving in academic social networks (ASNs)	30 (16%)	-.06	10 (33%)	<b>20</b> (67%)
$X^2(1) = 3.3, p = .068$					
	Deposit OA version on author’s page	22 (12%)	-1.51	9 (41%)	13 (59%)
$X^2(1) = .7, p = .394$					
$X^2(2) = 2.43, p = .296$					

B. Patterns and motives in self-archiving articles	Self-archiving a pre-print version as an accepted norm in the field in order to claim priority	35 (19%)	+ .85	<b>31</b> (81%)	4 (11%)
					$X^2(1) = 20.8, p = .000$
	Self-archiving a pre/post-print version to receive recognition and prestige	27 (15%)	- .60	<b>23</b> (85%)	4 (15%)
				$X^2(1) = 20.8, p = .000$	
	Posting a link at the ASNs to the publisher's site as a way to increase visibility	29 (16%)	- .24	7 (24%)	<b>22</b> (76%)
				$X^2(1) = 7.8, p = .005$	
$X^2(2) = .57, p = .752$					

Note: N= the number of statements.

As seen in Table 2, there are sub-categories regarding the types, the version patterns, and the motives without any significant difference between the proportion of statements in each sub-category. Significant differences within the sub-categories were found between the two groups (i.e., STEM researchers compared to those in SSH). The sub-categories and representative statements are presented below.

#### A. Types of OA repositories

**Self-archiving in subject-based repositories versus self-archiving in ASNs.** Most researchers who participated in the study (96%), from all fields, referred to self-archiving articles in the OA green route. However, while SSH researchers deposit in social academic networks at a marginally significant rate, STEM researchers significantly deposit more in subject-based repositories, as expressed in the following statements:

*I do not know repositories in my field, so I put a link to the article where I can, especially in ResearchGate and Academia.com databases (SSH.R. 254).*

*Even the articles that are not published in open access, we upload to arxiv.org. So my articles are open in any way, and anyone can read them (STEM.R.183).*

**Deposit OA version on author's page.** This sub-category refers to depositing articles on an author's personal page or university website page regardless of discipline: *I, like most researchers I know, publish their articles on their website or personal page (STEM.R.127).*

### ***B. Patterns and motives in self-archiving articles***

Researchers have referred to articles' deposit patterns as a function of disciplinary norms: ***Depositing pre-/post-print version versus posting a link to the publisher's site.*** STEM researchers reported significantly more statements than SSH researchers regarding self-archiving their articles to subject-based repositories such as arXiv. STEM researchers self-archived their articles in pre- and post-print versions as a norm and an acceptable alternative to publish in open and closed access journals in order to receive recognition, professional prestige, and claim priority for research innovation. This is expressed in the following statements:

*In my field (astrophysics), publishing in an open repository is more important than publishing in a journal. Everyone in the community uploads their work to arXiv while submitting to a journal, so the question of whether the journal is open or not is irrelevant (STEM.R. 82).*

*There is a rapid advance in the computer science field, so I publish an initial version of my work in an open repository to declare that I am researching this subject before others. (STEM.R. 261).*

Compared to STEM researchers, SSH researchers reported significantly more statements regarding **uploading to the ASNs a link to the printed or published version of their article at the publisher website**, where the goal is distribution and greater visibility:

*I do not know exactly what is allowed and what is not, but I want to "open" and distribute the article and increase visibility, so I upload an abstract - mainly to ResearchGate and Academia.com - and put a link to my article on the publisher's site (SSH.R. 36).*

### ***Initiators and those responsible for depositing articles in open repositories***

The second research question examined who is responsible for depositing an article in OA repositories (72, 22% of all statements). A chi-square for goodness of fit and the standardized residuals tests were conducted (see Table 3) in order to examine the significance of the differences in the number of statements observed in each group: STEM and SSH researchers by their occurrence in the study. Table 3 presents the sub-categories and research variables.

**Table 3.** The initiative to deposit an article in the OA repositories (72, 22%)

Sub-category	Total Statements N (%)	Standardized residuals	Discipline	
			STEM N (%)	SSH N (%)
The author was responsible for the decision of articles' self-archiving	34 (47%)	+2.04	16 (47%)	18 (53%)
			$X^2 (1) = .10, p = .715$	
Self-archiving articles due to the terms/requirements of the funding grant	22 (31%)	-.41	<b>20 (91%)</b>	2 (9%)
			$X^2 (1) = 14.7, p = .000$	
The co-authors decided to deposit the article	16 (22%)	-1.63	<b>13 (81%)</b>	3 (19%)
			$X^2 (1) = 6.2, p = .012$	
$X^2 (2) = 7, p = .032$				

Note: N= the number of statements.

As seen in Table 3, researchers had three main reasons for depositing and/or self-archiving articles: personal, research funders, and co-authors. It appears that *Author was responsible to deposit in OA repositories* was the largest sub-category among the three (standardized residuals= +2.04) with no difference between the disciplines. Significant differences within the other two sub-categories were found between STEM researchers compared to SSH. The sub-categories and representative statements are presented below:

***Author responsible for self-archiving in OA repositories.*** The largest sub-category referred to researchers' independent choice to submit their article to a subject-based repository or to social academic networks: *The decision is mine. I choose which article and which database to deposit it as well* (STEM.R.89).

***Grant conditions require OA archiving.*** STEM researchers have reported that the grant conditions of funding organizations require peer-reviewed research outputs to be made freely available: *The articles were written under a research grant we received from "The Seventh Framework Research Program (FP7) foundation, and they demanded open access publishing in journals as well as in open repositories* (STEM.R.131).

***Decision of the co-authors.*** A number of statements, mostly from the STEM researchers, referred to the fact that co-authors are the ones who upload the article to the repository, mostly a subject-based one: *There are articles that my research partners uploaded to arXiv. For example, an article from 2018 - I did not deposit the article there* (STEM.R.17).

### *Challenges in self-archiving articles using the green route to open access*

The third research question examined the challenges in self-archiving articles with the green route to OA (80, 24% of the total statements). A chi-square for goodness of fit and the standardized residuals tests were conducted (Table 4) in order to examine the significance of the differences in the number of statements observed between each group in the study. Table 4 presents the sub-categories and research variables.

**Table 4.** Challenges in self-archiving articles to the green route to OA (80, 24%)

Sub-category	Total Statements N (%)	Standardized residuals	Discipline	
			STEM N (%)	SSH N (%)
Unawareness of copyrights and publishers' terms of articles' self-archiving	37 (46%)	+3.80	12 (32%)	<b>25</b> (68%)
			$X^2(1) = 4.6, p = .033$	
Lack of awareness of appropriate repositories in the researcher's field	19 (24%)	-.22	6 (32%)	13 (68%)
			$X^2(1) = 2.6, p = .108$	
Fear of "scooping"	13 (16%)	-1.57	<b>11</b> (85%)	2 (15%)
			$X^2(1) = 6.2, p = .013$	
Lack of time as a reason for non-deposit	11 (14%)	-2.01	<b>9</b> (82%)	2 (18%)
			$X^2(1) = 4.5, p = .035$	
$X^2(3) = 21, p = .000$				

Note: N= the number of statements.

As seen in Table 4, researchers mentioned four challenges in self-archiving articles in OA repositories. *Unawareness of copyrights and publishers' terms of self-archiving articles* was found to be significant, and the largest sub-category among the four (standardized residuals= +3.80) with significant difference between the disciplines. Significant differences within the other sub-categories were found between STEM researchers and SSH researchers. The sub-categories and representative statements are presented below.

#### *Unawareness of copyrights and publishers' terms of articles' self-archiving.*

Researchers, mostly those in the social sciences and humanities, have focused on copyright issues and lack of awareness of publisher's terms and permitting self-archiving as the main reasons that prevent them from depositing articles to repositories:



*As soon as I uploaded to that repository, they removed the article and also warned me that I would not upload the same article a second time. I was told that the article is still unpublished... since I do not deposit articles in open repositories. I do not have time to check for each article what is allowed and what is not (SSH.R.225).*

***Lack of awareness of appropriate repositories in the researcher's field.*** Some researchers have reported that they are unfamiliar with open repositories in their field: *I just do not know well open repositories in my field, where I can deposit my articles there (SSH.R.29).*

***Fear of "scooping".*** STEM researchers significantly reported feeling fear. As a result of depositing a pre-print article in OA repository, someone else may claim the research idea or the findings:

*One of the reasons to self-archiving in OA repositories is to claim priority. But that does not stop people from copying from you and publish before you do. Most researchers do not want to ruin their good name. But there are other researchers, and they will say that they happen to be researching the same idea in parallel with the one you published in Bioarchive, so I cannot take a risk (STEM.R.91).*

***Lack of time as a reason for non-depositing.*** STEM researchers have reported lack of time as a reason that prevents them from depositing articles to repositories: *I do not upload to repositories, but basically, if I had time I would upload. It is not because of unwillingness, but simply out of lack of time (STEM.R.24).*

## **Discussion**

The green route to open access takes place via self-archiving (depositing) an output into institutional or subject-based repositories, and can greatly benefit authors by increasing scientific output impact, as well as by providing wider and easier access (Bosman and Kramer, 2018; Piwowar et al, 2018). This study incorporated qualitative and quantitative methods for an in-depth understanding and revealed the types, patterns, motives, and challenges underlying researchers' perceptions regarding self-archiving articles in the green route to open-access. Interviews were conducted with 20 Israeli academic researchers, 10 from STEM and 10 from SSH disciplines.

The first research question examined the types of OA green routes, patterns, and motives in self-archiving articles. Researchers in the current study reported the

widespread use of the green OA model. Due to the lack of institutional repositories in Israel, researchers reported depositing in subject-based repositories, in ASNs or in their personal or university websites. However, the types, patterns, and motives of self-archiving vary greatly by discipline. STEM researchers self-archiving articles to subject-based repositories (such as arXiv, BioRxiv and PubMed Central), using pre-/post-print versions, as a part of their discipline norm due to grant conditions, and receive recognition, professional prestige and claim priority. As found in a previous study, self-archiving in the green route is associated with researchers' awareness of OA policy and attitudes towards the importance of OA publishing (Zhu, 2017). Here, as was true of previous studies (e.g., Bosman and Kramer, 2018; De Filippo and Mañana-Rodríguez, 2020), findings reveal a significant difference between the disciplines and suggest different norms in various disciplines. Indeed, as was previously suggested, the researcher's social environment influences and predicts publication in OA ((Laakso and Björk, 2022; Kocaleva et al., 2015).

In addition, as a result of different embargo periods, there are fewer established subject-based repositories in SSH than STEM subject-based repositories (Martín-Martín et al., 2018; Narayan and Luca, 2017), a fact that may explain STEM researchers' preference for these repositories. Hence, it seems that such repositories have become part of the established workflow for researchers in STEM fields. Although STEM participants were concerned about their research being "scooped" by preprints, the overall benefits for those researchers seem to outweigh any perceived risk (Sarabipour et al., 2019).

The current study used Whitley's (2000) theory as a theoretical framework to show the connection between the cultural identity of a field and the patterns of scientific self-archiving. Whitley (2000) argues that the epistemic and social organization of scientific fields can be conceptualized along the axes of "task uncertainty" and "mutual dependence". The study's findings are in accordance with Whitley's (1984; 2000) theory of the differences between the disciplines. Findings reveal that STEM researchers are characterized by a high functional mutual dependence (FMD). They established methods of self-archiving and adhered to disciplinary norms to gain recognition and reputation. Moreover, STEM researchers have consistent goals, they were more confident in sharing their knowledge and exposing it to the scientific community, and are therefore characterized by a low degree of uncertainty.

In contrast to STEM researchers, SSH researchers have less familiarity with open repositories in their fields. However, they upload a link to the printed-published version of their articles to publisher's websites in ASNs. Their goal is to have greater visibility, which may increase the number of citations. Lovett et al. (2017) discovered that academics prefer to distribute the final version, although this is more likely to violate copyright restrictions. Indeed, this study also found that SSH academics prefer to deposit articles in their final version. Yet, some SSH researchers seem to be content with simply uploading links to the published closed article, perhaps because they lack an understanding of copyright policies, as found in other studies (Jamali, 2017; Martín-Martín et al., 2018).

Although most leading scholars and databases do not include ASNs as an integral and legitimate part of the OA green route, due to copyright issues (Jamali, 2017; Piwovar et al., 2018; Scopus database), ASN platforms are referred to by some scholars as an additional channel of green OA (Jordan, 2019; Lovett et al., 2017). However, ASNs do not prevent uploading final manuscripts, even though this action may involve a great risk in terms of copyright violation (Jordan, 2019; Serrano-Vicente, 2016). Our current study suggests that ASNs provide SSH researchers the opportunity to have an online hosting space for their articles, in addition to the traditional closed publishing model. SSH researchers in this study wanted to "open" their articles in order to achieve greater visibility and perhaps they consider ASNs a part of the green route, without getting into the legitimacy issue. In accordance with Whitley's theory (1984; 2000), mutual dependence is influenced by reputational control and control over access to resources. According to the research's findings, SSH researchers, with their limited resources, make efforts to increase their reputation and convince others regarding the significance of their work. Therefore, SSH researchers in the current study are characterized by low degree of strategic mutual dependence (SMD).

The second research question asked who is responsible for the motivation to deposit an article in the OA green route. This question is important as it finds out whether-self-archiving is a consequence of an autonomous choice or an external requirement (such as that of the research funders). Significantly more researchers, regardless of their disciplines, reported that the decision to deposit in repositories or ASNs was a self-made one. These findings are consistent with previous results that self-archiving in repositories

and/or ASNs is associated with the author's personal belief in OA visibility and its citation advantages (Serrano-Vicente, 2016; Zhu, 2017).

STEM researchers also reported that it was the co-authors' decision to deposit the article in the open repository. In addition, they said that the grant conditions of funding organizations require peer-reviewed research outputs to be made freely available. Indeed, STEM researchers have more access to resources and grants compared to their colleagues in SSH disciplines (Natale, 2019; Olejniczak and Wilson, 2020; Zhu, 2017). Our findings reinforce other studies that have found that green open access is the most economical approach to comply with open access policies (Zhang and Watson, 2017), compared to gold OA journals that normally charge a fee, known as an article processing charge (APC) (Abdelrahman, 2020).

Finally, the third research question examined the challenges of self-archiving articles using the green route to OA and ASNs. More SSH researchers reported being unaware of copyright issues and publishers' terms for self-archiving published articles. This is the main factor that prevents them from depositing an article and a significant inhibitor, as was found in other studies (Jamali, 2017; Laakso, 2014; Martín-Martín et al., 2018). Further, researchers (mainly from SSH) have reported that they are unfamiliar with open subject-based repositories in their field. SSH disciplines experience low levels of OA adoption, and subject-based repositories have not yet become part of the established workflow for these researchers (Narayan and Luca, 2017). These findings can be explained by Whitley (1984; 2000) theory. According to this theory, due to the lack of awareness of copyrights, and lack of familiarity with self-archiving repositories, SSH researchers are characterized by a high degree of technical and strategic uncertainty. STEM researchers, for their part, were concerned that by depositing pre-print articles in an open repository, someone else may claim priority to the research idea or their findings. There is no evidence, however, that "scooping" research via preprints exists (Sarabipour et al., 2019). Another challenge reported by STEM researchers in this and past studies is the lack of time that prevents them from depositing articles using the green OA route (Lovett et al., 2017; Ten Holter, 2020).

## **Conclusion and implications**

This study displays a significant difference between STEM and SSH researchers regarding the types, patterns, motives, and challenges in self-archiving articles in the OA green route and in ASNs. This difference may reflect different norms that prevail each discipline. The green OA model provides opportunities for financially disadvantaged disciplines to self-archive in open repositories. However, according to the current findings, there is an urgent need to raise SSH researchers' awareness of open subject-based repositories in their fields.

Further, authors should be aware of the permissions and publisher requirements for self-archiving pre-/post-print articles. These policies can be found on the [SHERPA/RoMEO \(https://v2.sherpa.ac.uk/romeo/\)](https://v2.sherpa.ac.uk/romeo/) database.

Regarding ASNs, although they provide SSH researchers the opportunity to self-archive their works, there were SSH researchers who were satisfied with uploading links to the published closed article. Moreover, SSH researchers in this study wanted to "open" their articles in order to achieve greater visibility, regardless of the copyright violation issue. Those researchers, as some scholars' assumption, consider ASNs as an additional mode of OA publishing, similar to academic repositories (Jordan, 2019). This comparison should be carefully considered, followed by the need to provide researchers with information about the OA green route and its characteristics.

## **Limitations and future work**

The current study has some limitations. It should be considered that this study was based on self-reported methodology. Further studies may expand the sample and crosscheck researchers' perspectives with other quantitative methods, including a large-scale bibliometric and altmetric analyses. In addition, future studies could expand the professions sampled by adding librarians' and policymakers' perspectives.

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