EARLY CAREER RESEARCHERS: THE HARBINGERS OF CHANGE?

FINAL REPORT

CIBER RESEARCH LTD

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Executive summary

Three years ago, the Publishing Research Consortium (PRC) commissioned a highly unusual and ambitious, international study, the like of which had not been seen in the scholarly communications field. More than a hundred science and social science early career researchers (ECRs) from seven countries (China, France, Malaysia, Poland Spain, UK and US) were in-depth interviewed annually for three-years (2016 – 2018) in order to explore their scholarly behaviours and attitudes and establish if and how these were changing. It was felt that this was the only way of answering that often-asked question: are the new wave of researchers set to be change agents and upset the scholarly applecart, or will they simply be yet another generation willing to toe the traditional line? The study, completed in October 2018 and unique in that we could not find any other covering the same territory, goes some way towards providing the answer to this question.

In order to obtain a good understanding of the significance (and limitations) of the study it is first necessary to go-over the characteristics of the ECR sample. The project started out with a convenience sample of 116 ECRs, of which 103 remained by its conclusion. The size and make-up of the panel was largely dictated by the funding available, levels of co-operation that could be expected and the interests of the PRC. It was the wishes of the latter that steered the investigation towards taking a multi-country approach, focusing on the sciences and social sciences, and investigating a greater number of UK and US ECRs (amounting to around 40% of the original sample). We also employed a fit-for-purpose definition of ECRs, which differs from that typically adopted by research institutions, in that we sought to capture data on new, younger, as yet untenured researchers, who might or might not have been doing a PhD at the same time.

Setting out to establish whether ECRs are the harbingers of scholarly communications change, the study sought evidence from three sets of data:

a) A headline quantitative analysis of the qualitative findings in 23 aspects of scholarly behaviour, supplemented by contextual narrative country reports, which provides a broad overview, and, beyond that, seeks to establish patterns and trends.

b) A categorised set of verbatim quotes (ECR voices), with annotations, which fleshes out some of the quantitative findings.

c) A set of statements summarising beliefs conventionally held about ECRs and their scholarly communications behaviour, treated as hypotheses and validated in the project.

The quantitative analysis

At the conclusion of three years of study, just over half of ECRs were still in a precarious employment position, not having obtained a secure research post. A little over a third did manage to land a secure job in academe, one tenth found a secure position in research elsewhere and a similar proportion dropped out or left for a non-research job. Employment status proved to be a major factor in attitudinal and behavioural change, with the tenured or tenured track group growing much more positive towards change in their attitudes and more active in bringing about change in their behaviours.

In every one of the 23 scholarly communication aspects studied some change in attitudes and practices could be discerned and, by the same token, every ECR interviewed testified to some changes in outlook and activities. Although in aggregate over 60% of the assessments shows little or no evidence of change, the level of change is still significant. Most of the change found involved increases in positivity and negativity in both attitude and practice. However, most of it was positive and progressive and the more positive attitude/more practice outcome was the most common.

Only small differences in attitude and behaviour are discernible when the data is broken down by gender, discipline and age of the ECRs, much more, though, when broken down by country. Female social scientists proved to be the most progressive and male scientists and job status least. Age data shows positive attitudes declining by age, perhaps a moving away from a youthful optimism, but the oldest ECRs do seem to be revitalised, perhaps as a result of their finally becoming more established career-wise. With regard to practice, the tendency to innovate less with age is apparent. Country comparisons have to be made with a degree of caution because of differences in the number of ECRs involved and their demographic make-up. Nevertheless, the US and UK ECRs appear to be changing the least and the French the most, a state of affairs

explainable by the levels of maturity among the interviewees, their employment status and cultural factors.

The highlights of the scholarly aspect analysis are:

- Collaboration and (research) impact lead the changes, both in terms of positive attitudes and practices, recording more than a third of an increase over the period.
- Millennial-facing activities, such as participating in social media based online communities and sharing, all showed significant levels of positive change in both attitude and practice.
- By contrast, some scholarly attitudes have not changed nearly as much (defined as less than a 25% increase). Positive changes in attitude to access, discovery and metrics and in practice with regard to libraries, metrics and open science are at the head of this list. At the other end of the scale, libraries again, altmetrics (an unusual bedfellow) and transformations (future changes) were viewed much more negatively or dispassionately and undertaken less.

ECR voices

The quotes, which add flesh to the quantitative analysis, show that:

- ECRs are sympathetic to open access (OA) publishing because they believe it benefits science and enables researchers to take back the control over their research outputs. However, reputational concerns and worries about costs and quality act as a drag anchor on practice. It is a similar story with open data: it is thought to benefit science in the long run, but in the here-and-now the concerns with maximising its value, before release to the community, hampers practice. There is more awareness of the open science agenda in general, but it does not make much of a difference in practice.
- Social media are now embedded in the scholarly enterprise, and for some ECRs have become an everyday, mainstream activity. Indeed, it is social networks and online community platforms, not just ResearchGate, but also the likes of WhatsApp (in Malaysia) and WeChat (in China), that enable and promote sharing. Nobody seems to regard sharing negatively anymore (perhaps with the exception of data sharing), and few ECRs mention the loss of a competitive edge. The digital visibility proffered by social media is seen as a major plus point, joined by their increasingly mentioned capability to expose ECRs to different voices, viewpoints and ways of presenting research. While the

quantitative data shows that ECRs still blow hot and cold about social media, and voices of concern are still heard, there are far fewer of them.

- ECRs cannot decrease their publishing efforts, as they might wish, because this would impact negatively on their career and promotional chances. The sole goal for most appears to be publishing in top ranked journals (irrespective of publisher, open access and audience). Publish more and higher is their clarion call.
- ECRs are not happy about the quality and appropriateness of peer reviewers and are not sure about the merits of open peer review. Some say that while open peer review gives them protection from bullying reviewers, they would still hesitate to do it themselves because it would put them in the firing line.
- It is hard to find ECRs lauding the benefits of altmetrics, although a small number do, mainly pointing to the downstream citation benefits that can accrue. Essentially, after 3 years, altmetrics are yet to catch on with younger researchers.
- Impact and outreach are synonymous for many ECRs, with outreach, above all else, seen as an appealing option to be adopted more intensively. ECRs' interest in outreach is fueled by the drive to widen the audience for their research, but the shortage of time and the lack of a reputational reward in targeting the general public hold back practice.

Hypotheses

Of the 26 hypotheses tested, only three obtained near unanimous acceptance and five were largely rejected, which, according to the data, means that many of the assumptions generally held about ECRs are simply not true.

The 3 widely-accepted hypotheses concerned:

- The friction caused by an unbending reputational system.
- The attraction of double-blind peer review.
- The precarious nature of the work environment.

The 5 largely rejected hypotheses concerned:

- The positive benefits of altmetrics.
- The ease of getting published in OA journals.

- The big ECR dropout rate.
- The low publishing productivity of ECRs.
- The willingness of ECRs to ‘game’ the system in order to publish and progress.

The double-bind

ECRs live in a precarious scholarly environment, which is tough enough, but they also live in a complex and tangled scholarly communications one. Thus, most ECRs started out with beliefs about scholarly communications that are at variance with the system as it was and which did not square with their commitment to openness, sharing and transparency about which they can be very articulate. Over time these attitudes have hardened. But changes in practice are slower to follow because of the requirements to climb the career ladder. This keeps the lid on change, yet at the same time many look for transformation in the future when they are in power. Very few are actually giving up their principles, even though on open access, for instance, the demands of the assessment system may mean they are temporarily going backwards.

Conclusions and implications

Returning to the question posed at the beginning of the study, as to whether ECRs will be the harbingers of change: weighting up all the evidence, the answer has to be yes, albeit a qualified yes. The drivers of change are social media, open science and collaboration and, of course, ECRs’ Millennium-generation beliefs. However, change will take time and not everything will change; plainly, the overarching importance accorded to journal publishing, the peer review system and the traditional ways and means of assessment are bound to reign on. Nevertheless, publishers should not be complacent about these findings because of the challenges that remain, such as those posed by the two disrupting platforms, ResearchGate and Sci-Hub. Beyond and above all, the crucial question is how the needs of the tidal wave of new researchers to be met. After all, they are the foot soldiers of science, the ones who are attempting to fashion scholarly communications more to their liking. There is a sense that publishers are out of step with the way researchers want to work. Listen to ECRs: they know what they are saying, and in doing so, give them a voice, as this study has striven to do.

1.0 Preliminaries

What is presented here is the main findings of the longitudinal project *Early Career Researchers: the harbingers of change?* Throughout its three-years the research team have issued regular reports and published widely in the peer reviewed literature in order to obtain peer review accreditation for the project's methods and findings and, also, disseminated preliminary results and highlights via conference proceedings and research policy newsletters. The list of all these publications can be found in Appendix 1. We shall not duplicate the information already published, but instead, focus on the main theme of the project, which is to establish and calibrate changes in the scholarly communication attitudes and behaviours of ECRs. In order to cover all the ground in a manageable way we will lead with a panoramic view of the data by conducting a 'quantitative' analysis of the qualitative data. More detailed and specific qualitative information, for instance, on open science or mega journals and specific ECR communities, will be released as journal papers over the coming 12 months, and will be announced on the project website.

2.0 Introduction

In a nutshell, what the project set out to do was to determine whether the new wave of researchers - in our specific case early career researchers (ECRs) - with their millennial beliefs, social media interests and access to, possibly, attractive digital disruptors, such as ResearchGate and Sci-Hub, are changing or adapting the scholarly communications system to their Millennial needs and desires. The unique aspects of the study are that: a) it focuses wholly on early career researchers; b) the adoption of an ECR definition that provides a better approximation of the population of the 'new wave' researchers; c) it provides an extremely comprehensive picture of their scholarly communication attitudes and behaviour covering as it does more than 20 scholarly aspects; d) it is a rare qualitative and longitudinal study. Together we believe this provides a unique, unusual and worthy examination of the topic.

2.1 Early career researchers

Early Career Researchers (ECRs) is a term variously defined by universities, funders and government bodies, but most (the UK Research Councils, for instance) tend to define them by the number of years since completing their PhD, typically within 10 years. However, this is a too administrative and rough-and-ready definition for the purposes of this research project, principally, because it does not define accurately the

'new wave' of junior researchers – the possible change agents, which we are wholly focussed on. We mean to cover not just 'relatively' new researchers, as the aforementioned definition does, but also untenured researchers, who are, of course, both the newest and the most insecure of all researchers. Furthermore, the aforementioned 'industry' definition does not consider take in to account the fact that, as we have soon discovered, a good proportion of ECRs are working as untenured researchers on projects *and* undertaking PhD studies. Thus, the definition adopted for this study, which suited all the 7 countries involved, was: "Researchers who are generally not older than 35, who either have received their doctorate and are currently in a research position or have been in research positions but are currently doing a doctorate. In neither case are they researchers in established or tenured positions".

There are plenty of very important reasons for studying ECRs – some mentioned already - and we summarise them all here:

1. As well as being new and mainly young researchers, ECRs typically constitute the largest body of researchers in the higher education sector (Jones, 2014) and in some countries, such as China can be counted in the tens of millions[1].
2. ECRs are widely recognized as being among the most creative and energetic researchers and, as such, constitute a vast pool of global talent that can play a central role in knowledge economies (Friesenhahn & Beaudry, 2014).
3. Bringing with them, as they allegedly do, the Millennials' belief system about openness, sharing and transparency (Anderson & Rainie, 2010; Taylor & Keeter, 2010), ECRs can conceivably be the harbingers of disruptive change in research and innovation systems (Boulton, 2011; LERU, 2010).
4. They provide a powerful lens through which to investigate and take the temperature of scholarly communications today because they are the workhorses: they are authors, reviewers, sit on editorial boards, lead research groups and do all the fundamentals, such as searching, discovery, and referencing. So, if you want to know how every aspect of scholarly communications, what better community to ask as they are the tasters and testers of the system, and, of course, they are the future.

Nevertheless, while the value of studying the scholarly communication attitudes and behaviours of ECRs in today's digitally transformed scholarly

[1] http://www.most.gov.cn/kjtj/201803/P020180305380063904804.pdf

environment is generally understood, somewhat surprisingly, their practices and attitudes – certainly as we have defined them - have merited very little actual attention over the years (maybe, not thought worthy of study given their 'junior' positions?). What little attention there is has been paid mostly by wide-ranging, quantitative studies adopting a rag-bag of ECR definitions. The Ithaka S+R faculty surveys (Wolff et al., 2016a, 2016b) and the CIBER studies on social media use (Nicholas & Rowlands, 2011; Rowlands et al., 2011) and trustworthiness (Nicholas et al., 2014; Nicholas et al., 2015; Watkinson, et al., 2016; Tenopir et al., 2016a) are prime examples. In addition, there have been a few, limited-scope, topic-specific studies (such as Rodriguez, 2014; Tenopir et al., 2016b; Tenopir et al., 2017), which looked at young researchers as part of the research population as a whole to determine how different or similar they are to their seniors.

There has to be a good chance then, that existing research on ECRs and changes in scholarly communication is of limited value because of an over reliance on quantitative surveys, which tend to scratch the surface of the subject and, generally, point to little change, sometimes arguing that ECRs behave even more conservatively that their seniors (Herman, 2018). But could this really be the case because an argument could be put forward that the voices of ECRs have been suppressed by an unforgiving reputational system and misrepresented by an unsuitable methodology. And if you only obtained the trust of ECRs and spent long enough talking to them (over years rather than minutes) things might turn out to be quite different, as we hope to demonstrate.

3.0 Methodology

In order to test the aforementioned assertion a more appropriate and sympathetic methodology was adopted. Thus, over a period of three years (2016 – 2018), ECRs were subject to annual, repeated, in-depth, semi-structured interviews. Such an approach to the topic was employed because it was felt that this offered the best opportunity to obtain deep insights into change and to be able to accurately calibrate it. Partly because 'following' ECRs and then observing what has actually changed has to be more effective than asking them whether things *are changing/will change* (Cohen et al., 2011). Semi-structured interviews were used because questions about technological and social change challenges the ubiquitous questionnaire because, by definition almost, they are asking about things people do not fully understand and are

difficult to articulate. Take questions, for instance, about altmetrics or open science; clearly, they are not easily answered.

Interviews were conducted, remotely (Skype or telephone) or face-to-face, by domestic university researchers in their home country and in their own languages[2]. The only exception was the US, which was also covered by the UK interviewer who was conversant with the US scholarly scene. The interview schedule – sent to interviewees ahead of time - featured 60 largely open-ended questions[3], which allowed for a conversation to build and information exchanged and took between 60 – 120 minutes to complete. Interviews were not recorded because of cultural sensitivities and notes instead taken. Transcripts were then returned to interviewees to confirm, correct and add to.

Transcripts were translated into English for all non-English-speaking countries and then manually coded using a heuristic approach and a standardised thematic framework[4]. Coding was checked for consistency by a third-party not involved in the actual interviews. Selective data were then transferred to spreadsheets for further analysis. Of course, the diamonds in the mine for qualitative studies like this one are the verbatim quotes obtained from the interviewees. These unadulterated comments offer the direct and fresh views of ECRs which are a world away from the shoe-horned responses found in questionnaires.

As far as we are aware, in recent times, only one other study has employed a longitudinal approach to examining and following this crucially important scholarly cohort with the express intent of exploring their extant and possibly changing scholarly communication practices. This study, by Carpenter et al. (2012), however, was a technology-focused study of UK Generation Y doctoral students, which, having taken place between 2009-2011, is by now obviously dated, and, in any case, was restricted to aspiring scholars, not practising ones.

3.1 Panel and sampling

A convenience sample (Bryman, 2016) of 116 ECRs was derived, the size of which dictated by available funding and the fact that the project was demanding in terms of its duration (keeping people onboard would be challenging). The characteristics of the sample, shown in detail in Table 1,

[2] Except in few cases where the ECR was not fluent in the local language. For instance, in France, one member of the ECRs panel was from South America, and the interviews were processed in English.
[3] See http://ciber-research.eu/download/20160916-Harbingers-research_instruments.pdf
[4] http://ciber-research.eu/download/20160916-Harbingers-research_instruments.pdf

was determined by the funders' subject and geographical interests, the availability and co-operation of interviewers on the ground and the belief that these interviewees would stay with us for the full duration of the project. Thus, ECRs were selected from 7 countries - China, France, Malaysia, Poland, Spain, UK and US. Interviewers for these case-study countries were given a recruitment quota of 20-29 ECRs for the UK and US (the larger number reflecting the importance of these countries to our funders) and 10-19 for the other countries. While just 7 countries were covered Scopus data does show that, in fact, they account for 50% of all papers published in 2016. Within these parameters, the aim was to recruit a sample that would be around two-thirds sciences and one-third social sciences (reflecting the larger numbers of ECRs in science and its strategic importance to the publishers), be reasonably balanced in terms of gender, include researchers from a mixture of universities and some research groups outside universities, and feature ECRs in their twenties and thirties. ECRs were approached via publisher and learned society lists and research networks within individual countries. The sample cannot be claimed to be representative of the population as a whole and this was, anyway, only one of our considerations and, even if we wished it, this would have been almost impossible to achieve as the global population is so enormous and ill-defined.

Table 1: Characteristics of the original Early Career Researcher panel (*N* = 116)

Country	No. of ECRs	Social Sci. (%)	Science (%)	Male (%)	Age 20s (%)	Age 30s (%)	Post-doc (%)
China	13	31	69	54	46	54	92
France	14	21	79	64	64	36	100
Malaysia	12	42	58	50	0	100	100
Poland	10	20	80	60	40	60	50
Spain	18	22	78	56	39	61	72
UK	21	38	62	62	24	76	67
US	28	21	79	61	29	71	64

By the end of the project, the original panel of 116 was reduced to 103, largely because of ECRs leaving their jobs as researchers (Table 2). This mostly meant leaving for a non-research job in industry, government etc. People who moved to a tenured position or moved to another research job elsewhere continued to be interviewed. In addition, a few ECRs stopped

co-operating because of job and time issues. These loses were anticipated as the original target was to have 100 ECRs at the project end, which was achieved. Having a deep conversation, as the project did, with a 100 or so researchers in precarious job positions for three years is quite an achievement. Most of the loses occurred in the UK and US and will have changed the characteristics a little, something to bear in mind when assessing change.

Table 2: ECR panel composition as of 2018

ECRs	China	France	Malaysia	Poland	Spain	UK	US
Total panel size (original number in brackets)	13 (14)	13 (14)	12	10	16 (18)	16 (21)	22 (28)
No. obtaining tenure	3	6	6	0	0	7	9
No. still an ECR	8	5	4	10	10	7	9
No. left for another organisation, but still conducting research	1	2	2	0	3	2	4
No. left for a non-research job	0	1	0	0	3	3	1
No. left for other reasons	1	0	0	0	2	3	5

4.0 Results

4.1 Introduction

In order to provide an overarching and accessible examination of the 3 years of research we shall focus on the broad changes and trends that have occurred in respect to 23 broad aspects of scholarly communications and research work (See Table 7 for list). Highlighting how much change has occurred, where and to whom and establish whether ECRs are the harbingers of change and the hypotheses we started with are confirmed or not. More detail will be rolled out in the peer review articles published in the wake of the published final report.

In order to achieve this, we shall present three different sets of evidence:

1. A ‘quantitative’ or overarching analysis of the qualitative data, the purpose of which is to provide the necessary panoramic picture of change and, also, as a way into the qualitative data. The qualitative data is complemented by contextual qualitative data.
2. By way of contrast and triangulation, a presentation of a broad selection of verbatim quotes, translated where necessary into English, and accompanied by editorial comment to show the thrust and significance of the ECR quotes.
3. Continuing with the contrasting theme, an examination and assessment of 26 hypotheses (or statements) the project began with. This section provides an assessment of whether they are supported or not by the data.

An explanation of how change has been categorised and measured is necessary in order to fully understand the quantitative data because of its complexity. Firstly, change can be associated with: a) attitudes or sentiment; and, b) practices or usage. Of course, attitudes and practices do not always go hand-in-hand and hence require separate study. This is especially so in the case of ECRs who are not their own bosses and not in sole control of what they do. Thus, ECRs might be positive about OA publishing, but do not practice it because of traditional working practices and reputational concerns and it is important to discover how widespread this is. The distinction is also an important one because changes in attitude, while, arguably, a softer form of change, might signal big changes in practice down the line, thus, providing advanced intelligence of things to come. Secondly, change, can be positive or negative variable or, indeed, not occur at all.

In consequence, the following descriptors were adopted to calibrate change:

- In regard to changes in attitude (2016 – 2018): more positive (P), more negative (N) and the same (S).
- In regard to changes in practice (2016 – 2018): again, more practice (M), less practice (L), the same (S) and, in addition, variable (V). ‘Same’ here means that practice is on an even keel throughout the three years and ‘variable’ that there is no continuing trend as there is a change mid-term.

These essentially qualitative measures depend for their robustness on the consistent judgement of the multi-national research team and there

should be few worries in this department because interviewers have been drilled for three years and their judgements reviewed by a third party. Nevertheless, as an insurance policy, a narrative briefing of the data was supplied for each country and this provides an overall impression to set against an algorithmic interpretation of the dataset, and provides an opportunity to make observations which fall without our interview schema. In analysing the data, we have been conscious of the dangers of over-analysing small quantitative variations in responses and highlight only the changes that appear significant.

For the sake of brevity, we are not providing analyses at the individual question level (there were more than 60 of them) but at the general scholarly aspect level (23 of them) and, as a result, we are clumping questions together. For instance, there were 5 direct questions on peer review, the responses to which have been averaged out in order to come up with a change assessment for the aspect. Future publications will provide a more specific analysis, assessing, for instance, just open peer review.

4.2 Broad levels and direction of change

With 103 ECRs we ended-up with dataset comprising 2,369 (103 x 23) pairings of attitude and practice, upon which to base the analysis. Over the 3 years, every scholarly aspect and every ECR has recorded some change in scholarly attitude or practice, but in aggregate a little over 60% of assessments show that there has be little or no change (Table 3). How you interpret this finding partly depends on whether you see it as a glass half empty or glass half full, although in reality 40% seems to be a large figure and the real significances of this becomes apparent when we drill down into the detail, a little later on and see even higher increases. Significantly, there was greater forward movement than backward movement, with close to a third of ECRs being more positive in attitude towards aspects of scholarly communication and a quarter practising them more. Given that our interviewees were at (least in theory) at the start of their careers it is, perhaps, not altogether surprising. If we deem variable change (5%) to be a form of change then there is even more change taking place.

Table 3: Broad changes in scholarly communication attitudes and practice (2016 – 2018)

Attitude	*Same*	*More Positive*	*More Negative*	
	62%	30%	8%	
Practice	*Same*	*More*	*Less*	*Variable*
	61%	25%	9%	5%

4.3 Attitudes v practices

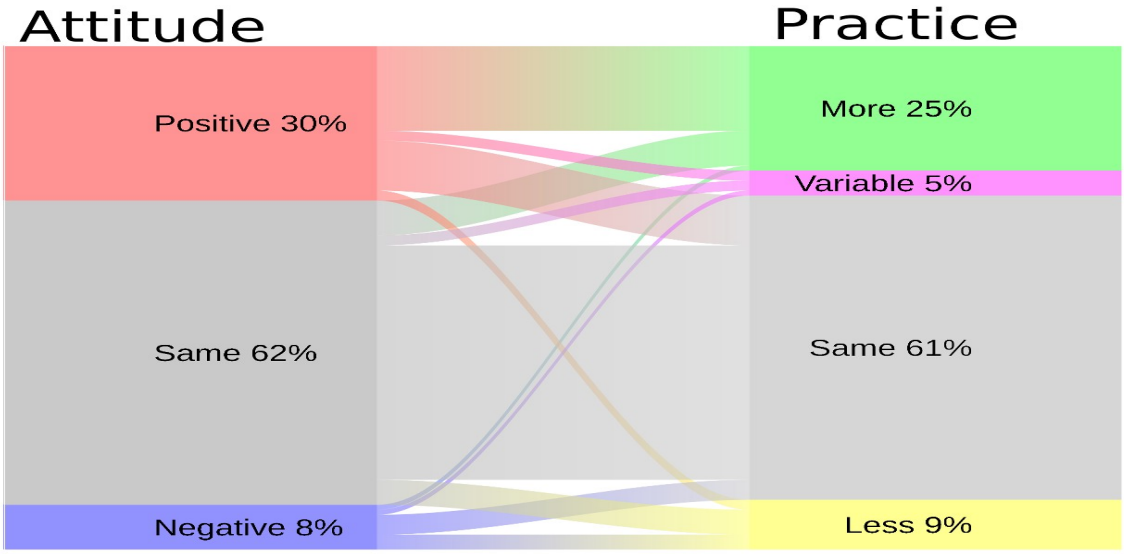
Returning to our earlier question, to what extent do attitudes and practices go hand in hand? According to Table 4 and Figure 1, to a large extent they do. 'Same' in attitude and practice is the most common pairing (just under 50% of all pairings), and there is a strong correlation between 'positive' attitude and doing 'more' (17%). The ECRs who recorded this pairing are clearly a key community of interest and we shall be looking to see what the characteristics of those who populate this community are. There is significant crossover between positive-same (10%) and same-more (7%), so that these pairings balance out. A similar crossover applies to negative attitudes and doing less. Rarely is a positive attitude coupled with doing less, nor a negative attitude with doing more. More generally, we are interested in discovering whether ECRs are frustrated in that, in principle they wanted to adopt new practices, but, in practice they were unable to do this because of prevailing system, for instance, university assessment procedures. While the analysis does not allow us to directly answer this question a key pairing to look at is the more positive attitude/same practice, which shows some support (10% of pairings) for the contention one. The small more negative attitudes and less practice pairing also requires further investigation, because it might point to some issues that need addressing.

Table 4: Scholarly communication attitude and practice pairings

Pairings	No.	%
Same attitude/same practice	1121	47
More positive attitude/more practice	404	17
More positive attitude/same practice	228	10
Same attitudes/more practice	175	7
Same attitudes/less practice	120	5
More negative attitude/same practice	86	4
More negative attitude/less practice	65	3
Same attitudes/variable practice	53	2
More positive attitude/less practice	34	1
More positive attitude/variable	40	2

practice		
More negative attitude/variable practice	30	1
More negative attitude/more practice	13	1

Figure 1: Correlation of scholarly communication attitudes and practices



4.4 Diversity

Surprisingly, perhaps, there are only small differences in attitude and behaviour in regard to gender, discipline and age, but more in the way of country differences, which will be examined in more depth later. Regarding gender (Table 5), women are becoming increasingly positive in attitude. Looking at both discipline and gender, men in the sciences, who constitute nearly half the panel, appear to be the least positive and proactive, with, perhaps, women in social sciences being the most.

Table 5: Changes in scholarly communications attitudes and behaviour: gender differences

Gender and discipline	Attitude			Practice				No of ECRs
	More positive	More negative	Same	More	Less	Variable	Same	
Females	33%	7%	60%	26%	7%	5%	61%	43
Males	28%	9%	63%	24%	11%	5%	60%	60
Female scientist	32%	8%	59%	26%	8%	4%	63%	31

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Male scientists	26%	9%	65%	23%	11%	4%	62%	46
Female social scientists	34%	4%	52%	26%	8%	7%	60%	12
Male social scientists	33%	7%	60%	27%	11%	4%	58%	14

Age (or generation) is a key focus of the study, however, our ECRs ranged considerably in age, from the late twenties to the early forties – covering a period of 15 years. The relatively 'old age' of the cohort can be put down to the fact that: a) ECRs inevitably aged over the duration of the study; b) because of the precarious situation ECRs find themselves in they stay untenured for longer. They are an aging workforce. As a consequence, it was felt necessary to analyse in age bands in order to determine whether there is any evidence to suggest that younger ECRs differed from older ones (Table 6).

A pattern, in fact, can be inferred from a breakdown of ECRs by age in 3-year increments, with positive attitudes declining from a youthful optimism, but the oldest of our cohort seem to be revitalised (36% positive attitudes), perhaps the result of finally approaching an established career. With regard to practice the tendency to innovate less with age is apparent.

Table 6: Changes in scholarly communications attitudes and behaviour: age differences

Age	**Attitude**			**Practice**				**No of ECRs**
	More positive	More negative	Same	More	Less	Variable	Same	
27-29	32%	8%	59%	28%	4%	4%	64%	13
30-32	30%	11%	59%	24%	6%	7%	63%	26
33-35	29%	8%	63%	25%	10%	5%	59%	38
36-38	25%	5%	70%	24%	10%	5%	62%	16
39-42	36%	8%	56%	25%	20%	1%	54%	10

4.5 Aspects of scholarly communication

So far, we have been generalising about 23 quite different aspects of scholarly communication and it comes as no surprise to discover that

there are differences in the change indicators for all of them. Table 7 shows this and is effectively a change dashboard for all aspects of scholarly communication and activity. There are some very big differences here, even at the relatively broad scholarly levels we are utilising and the colours in the table highlight the most important of them: green most positive or used; red most negative or least used; orange the same; grey the most variable. What is clear is that aspects, such as social media, experience both positive and negative change, sometimes cancelling each other out. To get a better approximation as in what direction the scholarly tide is flowing, we need to look at net change, which shows the size of the majority view by taking negative attitudes away from positive ones and less practice away from more practice. See the second and third columns from the right in Table 7. Bearing in mind the clear correlation of positive with more and negative with less, for the convenience of having a single scalar to compare and represent change we have also used a combined value, which is the mean of the net values for attitude and practice (final column in the Table).

Table 7: Changes in scholarly communications attitudes and behaviour: individual scholarly communication aspects

Scholarly aspects in alpha order*	**Attitude**			**Practice**				**Net change**		
Change description	*More positive*	*More negative*	*Same*	*More*	*Less*	*Variable*	*Same*	*Attitude*	*Practice*	*Comb.*
Access (obtaining documents)	16%	1%	83%	18%	8%	7%	67%	15%	11%	13%
Altmetrics	20%	16%	64%	17%	9%	4%	70%	5%	9%	7%
Authorship	31%	1%	68%	26%	12%	2%	60%	30%	15%	22%
Career (aims, ambitions and motivations)	34%	18%	48%	36%	15%	7%	43%	16%	21%	18%
Collaboration	46%	5%	50%	46%	8%	2%	45%	41%	38%	39%
Data	24%	14%	62%	28%	14%	3%	55%	11%	15%	13%
Discovery (finding documents**)**	17%	0%	83%	20%	3%	9%	68%	17%	17%	17%
Ethics	24%	7%	69%	22%	2%	7%	69%	17%	20%	19%
Impact (research)	44%	3%	53%	31%	5%	10%	54%	42%	30%	36%
Jobs (projects/role/ status)	38%	16%	47%	36%	12%	2%	50%	22%	24%	23%

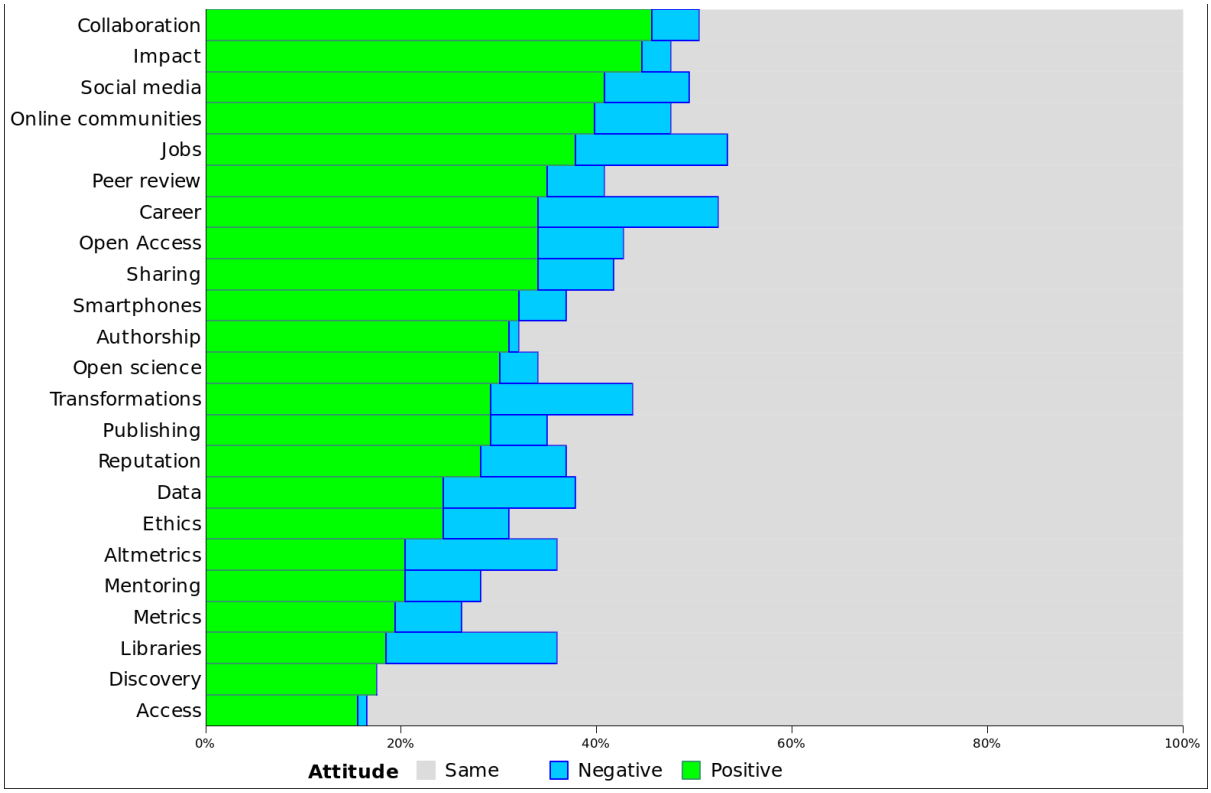
Libraries	18%	17%	64%	9%	10%	3%	79%	1%	-1%	0%
Mentoring	20%	8%	72%	17 %	16%	5%	63%	13%	1%	7%
Metrics (citation based)	19%	7%	74%	12 %	6%	5%	78%	13%	6%	9%
Online communities	40%	8%	52%	34 %	12%	5%	50%	32%	22%	27%
Open access	34%	9%	57%	24 %	12%	5%	59%	25%	13%	19%
Open science	30%	4%	66%	14 %	10%	0%	77%	26%	4%	15%
Peer review	35%	6%	59%	31 %	8%	10%	51%	29%	23%	26%
Publishing (strategies)	29%	6%	65%	21 %	10%	3%	66%	23%	12%	17%
Reputation	28%	9%	63%	25 %	7%	1%	67%	19%	18%	19%
Sharing	34%	8%	58%	30 %	11%	3%	56%	26%	19%	23%
Smartphones	32%	5%	63%	29 %	3%	5%	63%	27%	26%	27%
Social media (Facebook, twitter)	41%	9%	50%	36 %	15%	16%	34%	32%	21%	27%
Transformations	29%	15%	56%	10 %	12%	9%	70%	15%	-2%	6%
All	30%	8%	62%	25 %	9%	5%	61% %	22%	16%	19%

*Note: there is a little overlap between characteristics

4.5.1 Attitudes

The real stand-outs in respect to attitudinal change are collaboration and (research) impact, which show, respectively, a 46% and 44% increase in positivity. Figure 2 shows this graphically, with the biggest changes at the top. Following on comes social media (41%) and online communities (40%). The impact figure might be an unexpected result, but then again ECRs are pragmatic and also interested in a wider definition of impact and reputation, which includes the general public. On the other hand, careers (18%), libraries (17%), data and altmetrics (both 16%) registered the greatest negativity. Careers we understand, because, by definition, ECRs work in a precarious environment, but with libraries it appears they are being seen increasingly as ‘old hat’, and altmetrics is simply not an important topic.

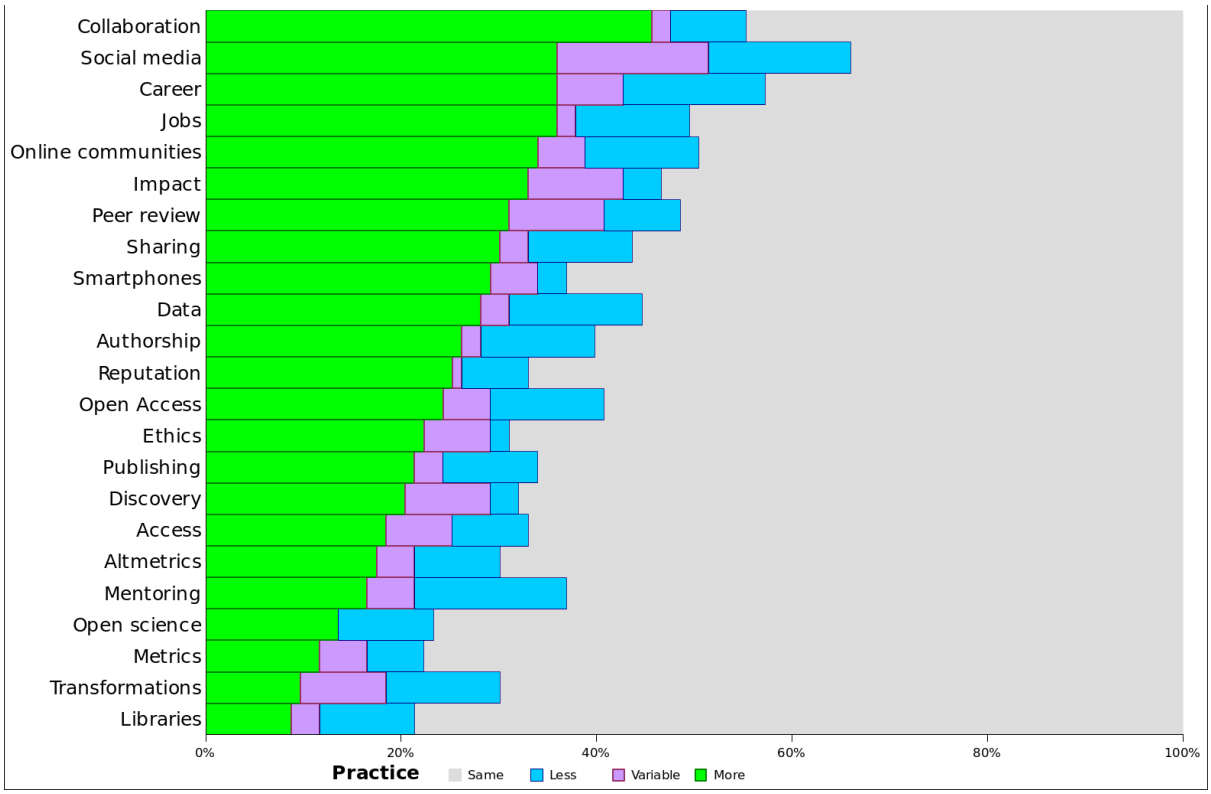
Figure 2: Attitudinal change in scholarly communication



4.5.2 Practices

Figure 3 highlights changes in practice or usage. Increases in practice broadly mirror changes in attitude, but although the rankings are roughly the same the percentages are down, suggesting practice lags behind sentiment. Collaboration is confirmed to be increasingly the main scholarly game in town, but there are some notable rises and falls. Thus, impact drops from 2 to 6, partly as a result of a relatively high variable practice score of 10% and data rises from 17 to 10. Libraries come bottom of the list in growth terms and this could partly be because of existing high levels of penetration. Data and mentoring are the aspects which shrank the most, although the figures are relatively low compared to the growth ones.

Figure 3: Practical changes in scholarly communications



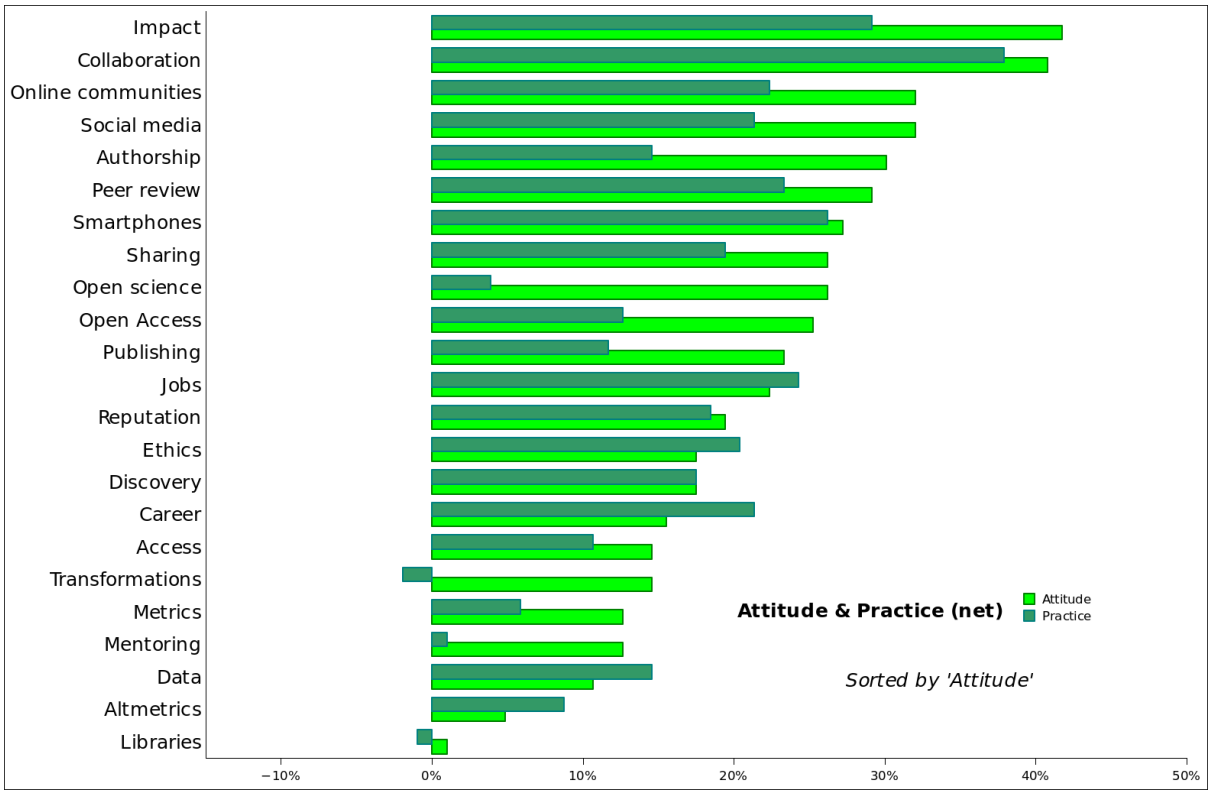
4.5.3 Net change

In Figure 4, plus territory equals more positivity and practice and minus territory equals greater negativity and less practice Interestingly, impact shows the greatest net change in attitude (42%). Maybe, this shows a dawning on the part of ECRs that it could matter in terms of jobs, but also an increased desire to look for impacts among the general public. Practice is yet to catch up with interest it seems, with, possibly, assessment systems slowing things down. Collaboration comes a near second, although, again, practice lags a little behind sentiment. Smartphone use is notably up experiencing a 26% net growth. Down at the bottom end of the Figure can be seen those aspects in deficit and that is clearly the case with libraries, which show a -1% decline in usage and a tiny (1%) percentage growth in positive attitudes. It does sound like they are storing up problems for the future. Interestingly open science attitudes are more positive but practice is very lack lustre.

Altmetrics appear to be treading water with, for instance, a net increase in practice of 9% after 3 years when so many other areas have shown healthy double-digit growth. And it cannot be because the data is not

there, because availability has grown massively in recent years. Practices that might lead to transformations, in fact, recorded the most decline (-2%), but attitudes are still in positive territory. In other words, for instance, they might still believe in open peer review, but do not send their papers to journals that practice it. There is more on transformation in the special analyses section (4.7.3). Finally, there is a massive attitude/practice differential in the case of open science, with more favourable attitudes prevailing (26%), but very little (4%) more going on in practice.

Figure 4: Net growth in scholarly communication attitudes and



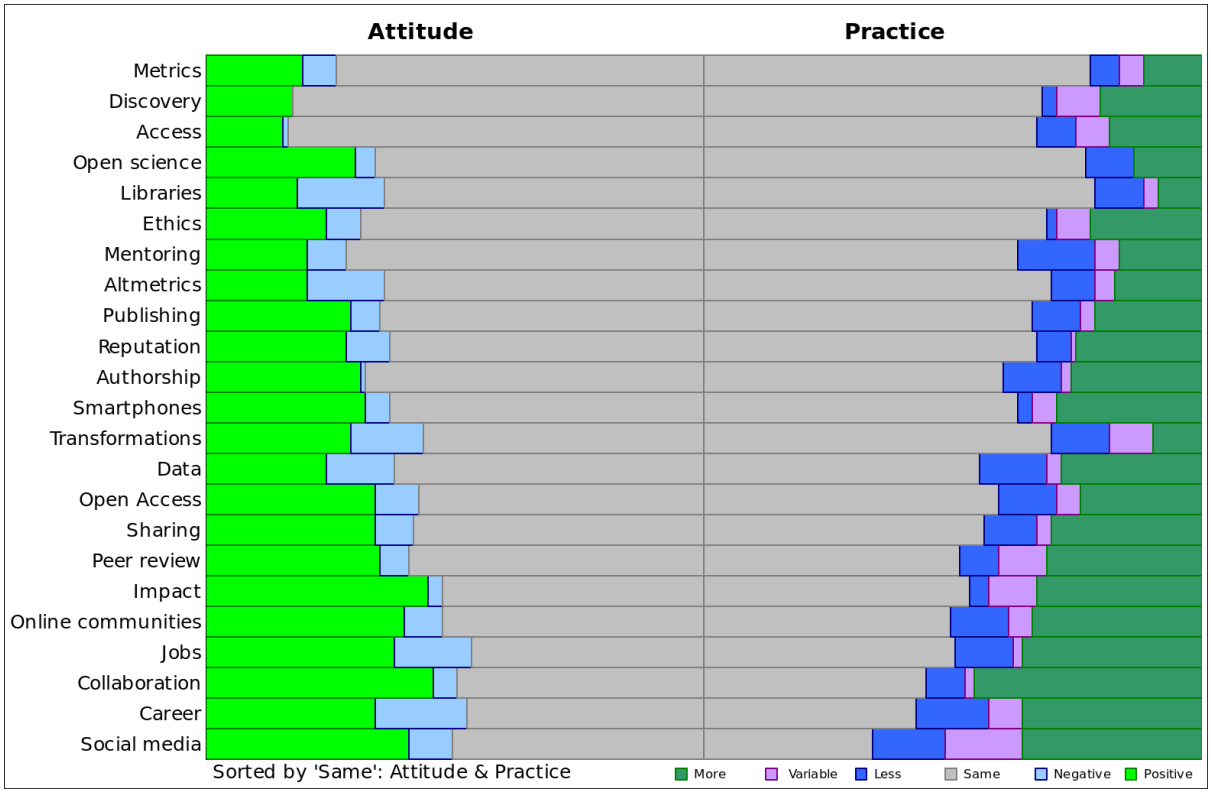
practices

4.5.4 Stability

No (or very little) change is certainly worth looking at as it, probably, points to the solid pillars that prop up the scholarly enterprise and might well do so well into the future. Figure 5 shows what they are - conventional metrics, discovery, open science, access and libraries (and this has to be good news for libraries). These are the time-honoured and essential props of the scholarly communications business. Interestingly, open science and altmetrics - relative novices to the field - are also high

up in the stability rankings, but, probably, the explanation here is that they have yet to take-off.

Figure 5: Unchanging scholarly attitudes and practices



4.6 Country differences

When investigating differences between countries care needs to be taken because of the differences between the number of ECRs involved (see column 2 of Table 8) and their demographic make-up (Table 1). The key differences to bear in mind are:

a) half the Polish ECRS are also PhD students;

b) around four-fifths of Poles, Spanish and French ECRs are scientists;

c) all Malaysian ECRs were in their thirties, making it quite a mature group;

d) two-thirds of Malaysian ECRs have obtained a secure post. and no Poles and very few Spanish;

e) two-fifths of ECRs come from the UK and US.

One other thing to bear in mind is that both the UK (5) and US (6) lost a number ECRs over the duration of the project which of course could lead to change, however, it is felt that the basic profile remained of each cohort remains much the same and it should not have made much difference.

Overall, Table 8 shows quite big differences between countries, but – outwardly anyway - not so much between the UK and US, with both countries ECRs registering the highest no change scores in attitude (80%) and practice (72%). Meaning that they are the two most stable countries in terms of scholarly communications. The best explanation for this is that the US/UK: a) are well established in the world academic system, which they originated and still dominate and did much of their changing some time ago; b) scholarly conditions/resources are generally generous. Utilising the combined net score, France exhibits the greatest change (38%), although the attitudinal net change score shows that it is attitudes that are changing a little more (42%).

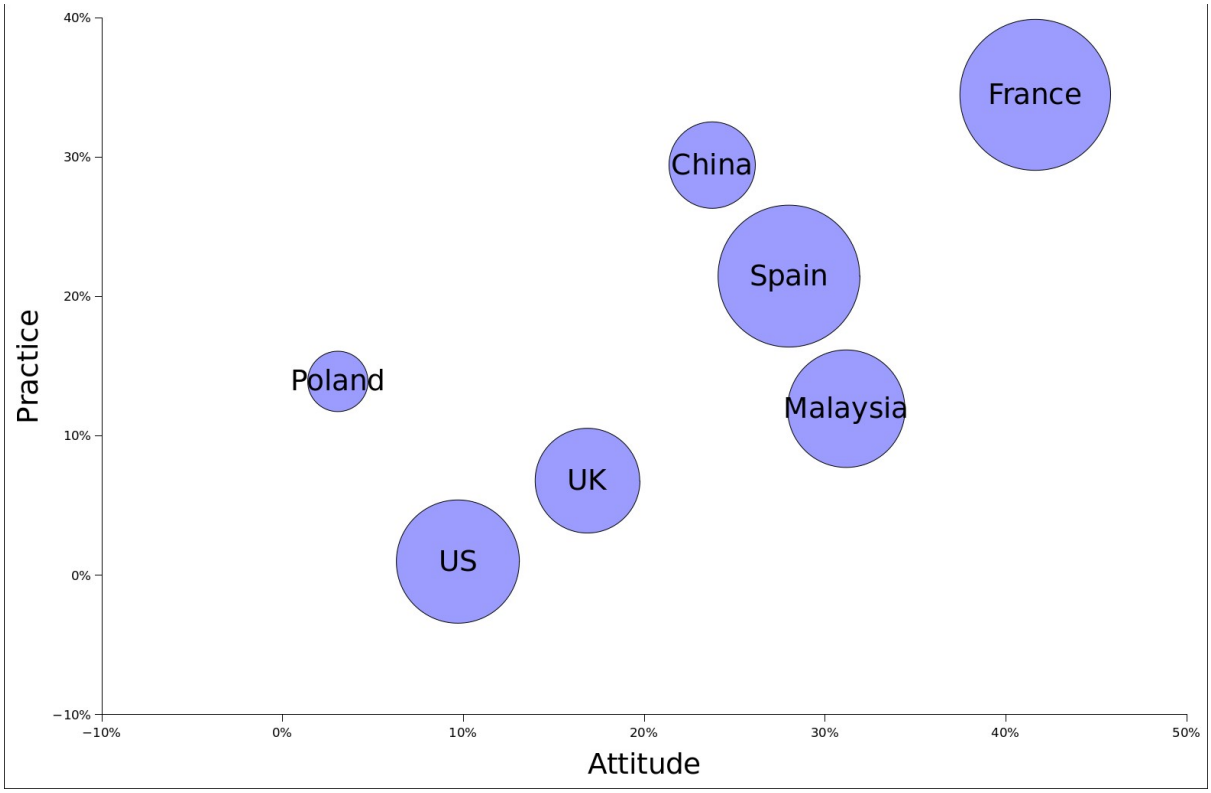
Figure 6, in an attempt to show graphically which countries are closest to each other in their change profiles. The smaller the balloon the smaller the change. France is clearly floating away from the other countries and while it might look like its liberating fast in terms of scholarly communication, in fact, the position of the balloon is partly explained by changed that have resulted from ECRs obtaining a tenured position and the resultant change is attitudes and practices. However, while half of French ECRs obtained tenure, so did 67% of Malaysians and 46% of Chinese so we have to credit a deal of change to progressive shifts in attitudes and practices. The Figure also makes the point that it is the US that is the most unchanging. In addition to the UK/US cluster there is a cluster formed by Spain, China and Malaysia. Poland is clearly an outlier, something Poles would readily admit to.

Table 8: Changes in scholarly communication attitudes and practices: broad country comparisons

		All 23 Aspects							**Net**		
		Attitude			Practice				Attitude	Practice	Comb
		More positive	More negative	Same	More	Less	Same	Variable			
ALL	103	30%	8%	62%	25%	10%	61%	4%	22%	15%	18%
China	13	37%	13%	50%	35%	5%	44%	16%	24%	29%	27%
France	14	53%	11%	36%	36%	2%	57%	5%	42%	34%	38%
Malays	12	36%	4%	60%	32%	20%	47%	0%	31%	12%	22%

ia											
Poland	10	16%	13%	72%	19%	5%	71%	6%	3%	14%	8%
Spain	16	40%	13%	47%	31%	9%	54%	6%	28%	21%	25%
UK	16	18%	1%	80%	16%	9%	72%	3%	17%	7%	12%
USA	22	15%	5%	80%	13%	12%	72%	2%	10%	1%	5%

Figure 6: Graphic representation of country similarities



4.6.1 China

The standouts in the Chinese data (Table 9) are:

- **Collaboration**. The biggest net changes in attitude (77%) and practice (69%) occurred in respect to collaboration. Compared with 2016, ECRs are far more positive in collaborating and sharing information with colleagues and peers. All of the ECRs collaborate with other research teams and more than half now collaborate with foreign experts. Co-authoring papers is becoming the main collaboration form for Chinese

ECRs. Collaboration brings more sharing, so they are now more open to sharing scholarly information.

- **Career and jobs.** Big changes here, too, in attitude and practice (both a 62% increase). In the past three years nearly all ECRs progressed in their careers becoming associate professors and receiving (relatively) long term contracts from their universities. Some have even become leaders of their research team. So, they are a successful and satisfied cohort. Nevertheless, they are facing big challenges ahead because promotion means less free time, more working pressures and the publishing of more papers. And this is just beginning to tell on behaviour.
- **Online communities and social media.** Here growth manifests itself in increased net use, respectively, 54% and 62%. ECRs just spend more time on these platforms than they did three years ago. Social media platforms, such as WeChat, a Chinese multi-purpose messaging, social media and mobile payment app, now dominates ECRs daily communications, in both the scholarly and social environment. It was only just on the radar 3 years ago, some change. Scholarly online networks, such as ResearchGate and ScholarMate, a similar platform that connects people to research and innovate and obtain reputational scores. There is also a small minority of ECRs rowing the other way, who believe that using social media too much is not good for their original research and wastes their time.
- **Open access publishing**. More ECRs have the experience of publishing papers with OA journals or deposited their publications in institutional repositories. In 2016, there was a misunderstanding of what OA was, confusing it with predatory journal publishing. By 2018, all of them understood the OA model and have increasingly warm sentiments towards it, although, in practice, not all ECRs choose this model because of reputational worries. In general, the data shows a community split over OA and its benefits.
- **Swings in sentiment and practice**. A characteristic of the Chinese data is the number of aspects that have been classified as variable, that is there are swings from year-to-year. Mentoring, online communities, social media, transformations and peer review are all in this category. Current news and events, government policies, personal experiences and the precarious environment they inhabit are the reasons for the swings.
- **Some things do not change much**. The attitudes and practice in respect to libraries, open science, reputation, and authorship have changed little. The main reason is that the academic research system

and evaluation policy is largely unchanged over the period. Libraries it should be noted exhibit negative growth.

Table 9: Changes in scholarly communication attitudes and practices: China

Country	**China**						13	**Net**		
	Attitude			Practice				Attitude	Practice	Comb.
Activity	P	N	S	M	L	S	V			
Access	46%	0%	54%	31%	0%	69%	0%	46%	31%	38%
Altmetrics	23%	8%	69%	31%	0%	62%	8%	15%	31%	23%
Authorship	8%	0%	92%	15%	15%	62%	8%	8%	0%	4%
Career	69%	8%	23%	69%	8%	8%	15%	62%	62%	62%
Collaboration	77%	0%	23%	69%	0%	23%	8%	77%	69%	73%
Data	46%	15%	38%	31%	15%	38%	15%	31%	15%	23%
Discovery	46%	0%	54%	38%	0%	54%	8%	46%	38%	42%
Ethics	31%	15%	54%	23%	8%	38%	31%	15%	15%	15%
Impact	38%	8%	54%	38%	0%	54%	8%	31%	38%	35%
Jobs	69%	8%	23%	69%	8%	23%	0%	62%	62%	62%
Libraries	0%	15%	85%	0%	8%	92%	0%	-15%	-8%	-12%
Mentoring	15%	38%	46%	8%	15%	38%	38%	-23%	-8%	-15%
Metrics	23%	8%	69%	15%	0%	62%	23%	15%	15%	15%
Online communities	54%	38%	8%	54%	0%	15%	31%	15%	54%	35%
Open Access	46%	31%	23%	38%	15%	23%	23%	15%	23%	19%
Open science	8%	15%	77%	23%	8%	69%	0%	-8%	15%	4%
Peer review	31%	8%	62%	15%	8%	31%	46%	23%	8%	15%
Publishing	15%	0%	85%	31%	0%	69%	0%	15%	31%	23%
Reputation	15%	8%	77%	31%	0%	62%	8%	8%	31%	19%
Sharing	31%	8%	62%	46%	0%	46%	8%	23%	46%	35%
Smartphones	54%	23%	23%	31%	8%	46%	15%	31%	23%	27%
Social media	62%	38%	0%	62%	0%	0%	38%	23%	62%	42%
Transformations	38%	8%	54%	31%	8%	23%	38%	31%	23%	27%

ALL	37 %	13%	50%	35%	5%	44%	16%	24%	29%	27%

4.6.2 France

The standouts in the data (Table 10) are:

The French ECRs have changed the most. However, the biggest big changes have occurred in a cluster of related topics; in order of rate of change: collaboration (86% net attitude and 64% net practice), reputation (71% and 79%) and online communities (71% and 54%). Of course, all this is ResearchGate territory and French ECRs use it a lot. What is also striking is the negativity in attitudes towards a transformed scholarly communications world. This can probably be ascribed to ECRs obtaining a secure job and therefore not caring about a changed scholarly environment anymore (see below).

Job changes explain changes in attitude and behaviour. Much of the sizeable change you witness can be attributed to obtaining a secure position. This reinforces the point that change is a two-way street, change can move forwards or backwards. Thus, half the panel, obtained a secure position, and 3 others are close to obtaining such a position and this results in a change of mindset. They now see themselves as peers and not as ECRs anymore. A wedge has been driven. As a result, they row back on some of the things they were doing as untenured ECRs.

Competitive and strategic behaviour drives change. Those who obtained secure positions “leave” some practices (e.g. social media), but at same time, develop other ones (e.g. sharing) and pay attention to areas previously neglected (data sharing). Typically, they used social media, smartphones, and other “tools” in order to better compete, and left them (or toned down) in 2018 when obtaining their positions. Those ECRs still inhabiting a precarious environment exhibit fewer changes in their practices. However, they show increasingly negative attitudes towards topics they regard as regulatory and possible hinderances to obtaining security - ethics, research impact and metrics.

Various types of changes are at work. Some changes are better described as evolutions, a consolidation of what was observed before, while others represent new, abrupt changes. Examples:

- Smartphones show evolutionary change. ECRs who did not use them in 2016, started using them in 2017, but only personally, and now they use them professionally. A natural progression.

- Some changes, however, represent a clean break with past practice. Thus, an ECR who started using social media in 2016, moved to daily use in 2017 and is now saying in 2018 it is not useful anymore because they are tenured, getting older and lack the time. Echoes here of what we have heard in China.

Somethings change less. For many topics, attitudes and behaviours the change was much less dramatic: in this camp are access, libraries (which seemed to have stalled with ECRs), open access, open science and mentoring. What is common about these topics is that they are largely taken as a given, imposed etc. ECRs have more room for manoeuvre in respect to topics, such as smartphones and online communities.

Table 10: Changes in scholarly communication attitudes and practices: France

Country	**France**						14	**Net**		
	Attitude			Practice				Attitude	Practice	Comb.
Activity	P	N	S	M	L	S	V			
Access	43%	0%	57%	36%	7%	57%	0%	43%	29%	36%
Altmetrics	36%	29%	36%	14%	0%	86%	0%	7%	14%	11%
Authorship	57%	0%	43%	50%	0%	50%	0%	57%	50%	54%
Career	71%	14%	14%	57%	0%	36%	7%	57%	57%	57%
Collaboration	86%	0%	14%	71%	7%	21%	0%	86%	64%	75%
Data	57%	7%	36%	36%	0%	64%	0%	50%	36%	43%
Discovery	50%	0%	50%	29%	0%	71%	0%	50%	29%	39%
Ethics	43%	36%	21%	50%	0%	50%	0%	7%	50%	29%
Impact	79%	14%	7%	64%	0%	29%	7%	64%	64%	64%
Jobs	64%	7%	29%	50%	0%	43%	7%	57%	50%	54%
Libraries	7%	0%	93%	0%	7%	93%	0%	7%	-7%	0%
Mentoring	21%	7%	71%	0%	0%	100%	0%	14%	0%	7%
Metrics	64%	21%	14%	36%	0%	57%	7%	43%	36%	39%
Online communities	79%	7%	14%	57%	0%	43%	0%	71%	57%	64%
Open Access	50%	0%	50%	29%	0%	57%	14%	50%	29%	39%
Open science	43%	0%	57%	21%	0%	79%	0%	43%	21%	32%
Peer review	71%	14%	14%	36%	0%	57%	7%	57%	36%	46%
Publishing	43%	29%	29%	29%	0%	57%	14%	14%	29%	21%
Reputation	86%	14%	0%	79%	0%	21%	0%	71%	79%	75%
Sharing	57%	7%	36%	36%	7%	57%	0%	50%	29%	39%
Smartphones	43%	7%	50%	14%	0%	71%	14%	36%	14%	25%
Social media	50%	0%	50%	29%	0%	29%	43%	50%	29%	39%

Transformations	14%	43%	43%	14%	14%	71%	0%	-29%	0%	-14%
ALL	53%	11%	36%	36%	2%	57%	5%	42%	34%	38%

4.6.3 Malaysia

The stand-outs (Table 11) are:

- **No variable practices have been identified**. This is thought to be because scholarly behaviour is very cut and dried. ECRs are on a steady path, everything works according to a plan or procedure. A well-regulated environment.
- **Sizeable negative swings in practice** concerning altmetrics, mentoring, open science and social media. Explanations for this are provided in the following bullets. There is not much negativity in respect to attitudes, aside from altmetrics and open data.
- **Altmetrics** are just not capturing interest but thought of very negatively, they are seen to have no real value.
- **Open science** negativity is largely explained by the fact that there are few incentives to practice it and other things, such as publishing in high-ranked journals, are incentivised.
- **Sentiment seems strongly against open data**. ECRs share data because it is required by journal publishers (i.e. publishing data as supplementary material). However, there is a general reluctance to change and they would rather share data on a personal and private basis.
- The **Mentoring** decline is down to fewer people being mentored because they have obtained secure positions.
- **Social media and online community** use are on a decline in some sections as a result of the rise in the use of WhatsApp and Telegram, which leads to a reduction in the use of Facebook, LinkedIn and Twitter. A case of scholarly communication fashions at work it seems. ResearchGate is appreciated, but in general the social media are not thought to promote scholarly reputation-building activities.
- **Impact registered the biggest positive change** with large net rises in attitude (75%) and practice (42%). Malaysian ECRs are very target-oriented. Peers are still regarded to be the most important audience for ECRs in regard to research impact and this is largely seen as being achieved by publishing in high impact factor journals.

- **Discovery** is interesting as so much more practice appears to be going on. This is put down to ECRs researching and publishing more, which means there is a lot of web browsing and online searching activities going on and the fact that smartphones are used much more for discovering and reading articles.
- **Smartphone usage is strongly up** with an impressive net rise of 58%. All ECRs now admit to having and using smartphones for scholarly purposes (searching and viewing), but few use them regularly for reading scholarly articles. WhatsApp and Telegram are driving-up widespread and constant use of smartphones.
- **Ethics bigger here than elsewhere.** ECRs are much more aware of unethical behaviours believing them to be quite widespread and provide plenty of stories to prove it. The combined change score is 54%.

Table 11: Changes in scholarly communication attitudes and practices: Malaysia

Country	**Malaysia**						12	**Net**		
	Attitude			Practice				Attitude	Practice	Comb.
Activity	P	N	S	M	L	S	V			
Access	8%	0%	92%	25%	0%	75%	0%	8%	25%	17%
Altmetrics	17%	50%	33%	0%	67%	33%	0%	-33%	-67%	-50%
Authorship	42%	0%	58%	50%	0%	50%	0%	42%	50%	46%
Career	42%	0%	58%	25%	0%	75%	0%	42%	25%	33%
Collaboration	58%	0%	42%	42%	0%	58%	0%	58%	42%	50%
Data	17%	33%	50%	42%	33%	25%	0%	-17%	8%	-4%
Discovery	0%	0%	100%	67%	0%	33%	0%	0%	67%	33%
Ethics	50%	0%	50%	58%	0%	42%	0%	50%	58%	54%
Impact	75%	0%	25%	42%	0%	58%	0%	75%	42%	58%
Jobs	50%	0%	50%	33%	0%	67%	0%	50%	33%	42%
Libraries	33%	0%	67%	33%	33%	33%	0%	33%	0%	17%
Mentoring	25%	8%	67%	17%	58%	25%	0%	17%	-42%	-13%
Metrics	25%	8%	67%	17%	17%	67%	0%	17%	0%	8%
Online	33	0%	67%	25%	42%	33	0%	33%	-17%	8%

communities	%					%				
Open Access	42 %	0%	58%	50%	8%	42 %	0%	42%	42%	42%
Open science	33 %	0%	67%	0%	67%	33 %	0%	33%	-67%	-17%
Peer review	50 %	0%	50%	58%	17%	25 %	0%	50%	42%	46%
Publishing	42 %	0%	58%	42%	25%	33 %	0%	42%	17%	29%
Reputation	42 %	0%	58%	42%	0%	58 %	0%	42%	42%	42%
Sharing	33 %	0%	67%	17%	33%	50 %	0%	33%	-17%	8%
Smartphones	33 %	0%	67%	58%	0%	42 %	0%	33%	58%	46%
Social media	25 %	0%	75%	0%	67%	33 %	0%	25%	-67%	-21%
Transformations	42 %	0%	58%	0%	0%	100 %	0%	42%	0%	21%
ALL	36 %	4%	60%	32%	20%	47 %	0%	31%	12%	22%

4.6.4 Poland

The standouts in the data (Table 12) are:

- **Careers create widespread negativity.** There is increasing dissatisfaction with academic careers because conditions and prospects are not good. This is partly because half of the Polish ECRs are studying for a PhD and conditions are especially poor for them. They have a second job because payments are so low, studentships are hard to get and, of course, contracts are temporary. So, they have to do research, write a thesis and do another job. Inevitably then this is not a very experienced group and have allegiances elsewhere. This largely explains why there is so much negativity about careers (a minus 50% net change in attitude and minus 40% in practice). Even those with a PhD want jobs outside academe or in universities abroad. A brain-drain, perhaps.
- **Transformations.** Career negativity spills over into a pessimism about the future of scholarly communications and ECRs' role in this (there is a minus 30% net change in attitude). Also, young researchers do not believe that older researchers will give them power and the opportunity to decide.
- **Libraries** came close to careers in negativity (a minus 80% net change in attitude and 0% in practice). By the final year no one anymore believes that libraries will have central role in the future, yet they all

use the access to databases provided by the university library, which is clearly regarded as a utility.

- **Open access publishing** commands little sympathy or practice, and less than in other countries (a minus 20 % net change in attitude and 0% in practice). This can largely put down to the fact that it is not obligatory in Poland and unless it is nothing will change.
- **Smartphones** lead the changes with a 40% attitude and practice net change. Use is growing fast because of their convenience, popularity and 24/h internet connections.
- **Sharing, collaboration and online communities.** There are more positive attitudes and more practice in respect sharing (both 30% net change), collaboration (both 30% net change) and the online community platforms they use for this (30% and 40%). ResearchGate in a key platform in enabling all this. Fewer ECRs believe that there is a risk of losing a competitive edge through sharing and collaborating with people outside their research group.

Table 12: Changes in scholarly communication attitudes and practices: Poland

Country	**Poland**						10	**Net**		
	Attitude			Practice				Attitude	Practice	Comb.
Aspect	P	N	S	M	L	S	V			
Access	0%	0%	100%	40%	0%	40%	20%	0%	40%	20%
Altmetrics	10%	10%	80%	0%	0%	100%	0%	0%	0%	0%
Authorship	0%	0%	100%	0%	0%	100%	0%	0%	0%	0%
Career	0%	50%	50%	0%	40%	60%	0%	-50%	-40%	-45%
Collaboration	40%	10%	50%	40%	10%	50%	0%	30%	30%	30%
Data	10%	10%	80%	30%	10%	60%	0%	0%	20%	10%
Discovery	0%	0%	100%	20%	0%	60%	20%	0%	20%	10%
Ethics	0%	0%	100%	0%	0%	80%	20%	0%	0%	0%
Impact	0%	0%	100%	0%	0%	30%	70%	0%	0%	0%
Jobs	40%	40%	20%	50%	40%	10%	0%	0%	10%	5%
Libraries	0%	80%	20%	0%	0%	100%	0%	-80%	0%	-40%
Mentoring	10%	0%	90%	10%	0%	90%	0%	10%	10%	10%
Metrics	0%	0%	100%	0%	0%	100%	0%	0%	0%	0%
Online communities	30%	0%	70%	40%	0%	60%	0%	30%	40%	35%
Open Access	10%	30%	60%	0%	0%	100	0%	-20%	0%	-10%

						%				
Open science	20%	10%	70%	0%	0%	100 %	0%	10%	0%	5%
Peer review	20%	10%	70%	50%	0%	50%	0%	10%	50%	30%
Publishing	40%	0%	60%	20%	0%	80%	0%	40%	20%	30%
Reputation	30%	10%	60%	30%	10%	60%	0%	20%	20%	20%
Sharing	30%	0%	70%	30%	0%	70%	0%	30%	30%	30%
Smartphones	40%	0%	60%	40%	0%	60%	0%	40%	40%	40%
Social media	30%	0%	70%	30%	0%	70%	0%	30%	30%	30%
Transformations	0%	30%	70%	0%	0%	100 %	0%	-30%	0%	-15%
ALL	16%	13%	72%	19%	5%	71%	6%	3%	14%	8%

4.6.5 Spain

The standouts in the data (Table 13) are:

- **Impact is everything.** Every activity of the ECRs has a goal and that is to increase their competitive edge in order to obtain that secure position. This is why there is so much interest in obtaining impact. Table 13 shows a 63% net change in positive attitudes. It is a becoming more and more important for ECR because so many have not obtained tenure. They want to have an impact on peers, policy makers and industry. They feel they can do this best by wider dissemination of their research. However, they do not practice as much as they would like because their assessment procedures do not reward the effort they would have to put into the task: maintaining of blogs etc.
- **Social media** is the area of greatest change, with a 63% net change in both attitudes and practice. Sentiment still outstrips practice, so there is probably more use in the pipeline. They use social media mainly for showcasing purposes in order to influence all possible parties that can help them obtain a secure position. A broader variety of platforms are used and Twitter increasingly so. There is more institutional encouragement to use social media.
- Attitudes towards **online scholarly communities** are increasingly positive, too (63% net change) although practice lags a little, but still sizeable with a 38% net change. They use these platforms for searching purposes and for discovery through alerts or following researchers, but much less so for showcasing their papers. ResearchGate is the main platform used.
- **Transformations.** Spanish ECRs are much more positive (50% net change) in attitude in respect to their role in changing the scholarly

communications. This is yet to be translated into practice as ECRs do not know how to proceed.

- The generally positive attitudes and practices associated with **open access** are largely in respect to gold and not green OA. The alleged advantages of OA in terms of outreach and citations is driving greater usage.
- **Collaborating.** Just moderate changes here, but there is a dawning that collaboration can improve research methods and techniques, so that it can help them to write better papers which have a bigger impact. They are more conscious about the benefits of collaboration than before because they have had time to build a network.
- **Access and discovery.** There is a growing preference for accessing open access resources, however, the change is more visible in practice than in attitude. Google and Google Scholar, PubMed and Scopus are increasingly the main discovery platforms.
- **Smartphones** are on the march, with significant changes in net attitudes (44%) and practice (38%). Today they use the smart phones as a discovery platform, for checking colleagues, journals, etc.

Table 13: Changes in scholarly communication attitudes and practices: Spain

Country	**Spain**						16	**Net**		
	Attitude			Practice				Attitude	Practice	Comb.
Aspect	P	N	S	M	L	S	V			
Access	19%	0%	81%	13%	19%	38%	31%	19%	-6%	6%
Altmetrics	25%	25%	50%	31%	0%	69%	0%	0%	31%	16%
Authorship	44%	0%	56%	25%	19%	56%	0%	44%	6%	25%
Career	25%	50%	25%	25%	25%	44%	6%	-25%	0%	-13%
Collaboration	44%	13%	44%	38%	13%	44%	6%	31%	25%	28%
Data	38%	19%	44%	56%	13%	31%	0%	19%	44%	31%
Discovery	19%	0%	81%	6%	13%	56%	25%	19%	-6%	6%
Ethics	50%	0%	50%	19%	6%	75%	0%	50%	13%	31%
Impact	63%	0%	38%	44%	6%	44%	6%	63%	38%	50%
Jobs	38%	44%	19%	25%	25%	44%	6%	-6%	0%	-3%
Libraries	31%	38%	31%	13%	6%	69%	13%	-6%	6%	0%
Mentoring	50%	0%	50%	56%	0%	44%	0%	50%	56%	53%
Metrics	6%	6%	88%	6%	0%	94%	0%	0%	6%	3%
Online communities	63%	0%	38%	44%	6%	50%	0%	63%	38%	50%
Open Access	25%	6%	69%	38%	6%	56%	0%	19%	31%	25%

Open science	38%	6%	56%	25%	0%	75%	0%	31%	25%	28%
Peer review	38%	6%	56%	38%	0%	56%	6%	31%	38%	34%
Publishing	56%	6%	38%	19%	13%	63%	6%	50%	6%	28%
Reputation	31%	19 %	50%	13%	13%	75%	0%	13%	0%	6%
Sharing	38%	13 %	50%	50%	6%	44%	0%	25%	44%	34%
Smartphones	44%	0%	56%	44%	6%	50%	0%	44%	38%	41%
Social media	81%	19 %	0%	69%	6%	13%	13%	63%	63%	63%
Transformations	69%	19 %	13%	13%	13%	56%	19%	50%	0%	25%
ALL	40%	13 %	47%	31%	9%	54%	6%	28%	21%	25%

4.6.6 UK

The standouts in the data (Table 14) are:

- **The environment is relatively unchanging.** Low increases, especially in practice, can be put down to a stable and mature cohort (traditional scholarly culture works for them), with few leaving academe.

- **Research impact sees the biggest change**, with much more positive attitudes towards it (44% net change) and greater practice (19%) being shown. However, this change manifests itself in an increased interest in influencing their peers, and not the wider public. This is because they do not see how they can influence public/policy makers more without all the extra work of putting their research into languages comprehensible to a wider audience because they do not have the capacity to do it. There is also a belief that this type of work is the responsibility of the principal investigators because they obtain the benefits in the Research Evaluation Framework (REF), where impact is promoted and rewarded.

- **Open Science including open access** has always been welcomed, but it is increasingly so. ECRs are keen in principle, but recognise that in practice for purposes of grants, promotion and tenure OA does not deliver (hence a decline in practice). The same goes for open data – they need the data for themselves to get out attractive papers, but in 2018 as compared with 2016 they are less worried about sharing. It is not clear why they are less worried. They are also less worried also about doing open peer review. Only one

ECR was really suspicious about OA on the grounds that the people who can use their work will read the journals they write for, lay people, on the other hand, will get the wrong end of the stick and really need material written specially for them, and they disapprove about having to pay.

- **Mentoring**. Almost all seem to still be happy with the mentoring they receive, but the great majority of them are getting less mentoring as they move up the ladder.

- **Publishing Strategies**. Most ECRs seem to be able to produce a strategy even when they were part of a group. On the whole there was a movement towards longer more substantial papers. Most wanted to have their cake and eat it in the sense that they wanted to papers to be both OA and in a journal with a high impact factor and as well as one which reached their preferred audience, but the middle value (IF) wins out.

- There were some minor changes in **discovery** techniques with on the whole Google Scholar coming top of the list more times and the library less so. Where the content is **accessed** produced much more complex answers with the library the main source, but what they do if library does not have the journal needs further investigation. A few more ECRs said they would use Sci-Hub if they did not find the article elsewhere, but only one (in industry) used Sci-Hub preferentially.

- Unlike the US, **online community** use is strongly up, by a quarter. Use of ResearchGate seems to have slowed though. Attitudes generally to **social media** are increasingly positive.

Table 14: Changes in scholarly communication attitudes and practices: UK

Country	**UK**									16
	Attitude			Practice				**Net**		
Activity	P	N	S	M	L	S	V	Attitude	Practice	Comb.
Access	0%	0%	100%	0%	13%	88%	0%	0%	-13%	-6%
Altmetrics	13%	0%	88%	13%	0%	81%	6%	13%	13%	13%
Authorship	38%	0%	63%	31%	25%	38%	6%	38%	6%	22%
Career	13%	0%	88%	44%	13%	38%	6%	13%	31%	22%
Collaboration	25%	6%	69%	38%	19	44%	0%	19%	19%	19%

					%					
Data	13%	6%	81%	13%	13 %	69%	6%	6%	0%	3%
Discovery	6%	0%	94%	0%	6%	88%	6%	6%	-6%	0%
Ethics	0%	0%	100 %	6%	0%	88%	6%	0%	6%	3%
Impact	44%	0%	56%	19%	0%	81%	0%	44%	19%	31%
Jobs	19%	0%	81%	25%	6%	69%	0%	19%	19%	19%
Libraries	19%	0%	81%	13%	6%	81%	0%	19%	6%	13%
Mentoring	13%	0%	88%	0%	25 %	75%	0%	13%	-25%	-6%
Metrics	13%	0%	88%	13%	6%	75%	6%	13%	6%	9%
Online communities	19%	0%	81%	31%	6%	63%	0%	19%	25%	22%
Open Access	38%	0%	63%	13%	19 %	69%	0%	38%	-6%	16%
Open science	31%	0%	69%	13%	0%	88%	0%	31%	13%	22%
Peer review	25%	6%	69%	25%	13 %	63%	0%	19%	13%	16%
Publishing	6%	0%	94%	13%	19 %	69%	0%	6%	-6%	0%
Reputation	6%	6%	88%	6%	6%	88%	0%	0%	0%	0%
Sharing	25%	6%	69%	13%	6%	75%	6%	19%	6%	13%
Smartphones	19%	0%	81%	13%	0%	81%	6%	19%	13%	16%
Social media	31%	0%	69%	19%	6%	63%	13 %	31%	13%	22%
Transformations	6%	0%	94%	6%	0%	88%	6%	6%	6%	6%
ALL	18%	1%	80%	16%	9%	72%	3%	17%	7%	12%

4.6.7 US

Given that the US has the largest number of ECRs on the panel there is more data to play with and so we shall look at it in greater detail.

The standouts in the data (Table 15) are:

- **Stability in scholarly communications.** Scholarly communication attitudes and behaviour have changed less here than anywhere else, with just a 10% net positive change in attitudes and a small (1%) net change in practice. Virtually standing still.
- **Where there has been change though much of it is negative, especially in regard to practice.** There are 5 areas showing a double-digit drop in net practice – metrics, online communities, open access, reputation and transformations. Not areas where you might have expected to see negative growth, but this might be explained by job changes and some of the bullets below.

- **There are changes in respect to the open agenda.** In net terms the biggest attitudinal changes have occured in respect to open science (up 32% net) and open access publishing (23%). However, there is a yawning gap between attitudes and practices and for open science the net change in practice is miniscule (5%) and for open access actually negative (-14%). The reason for the former appears to be that while more ECRs than ever before recognize the concept of open science and have bought into its mission, albeit mostly in respect to open data, there are fewer examples of practice than there had been in previous years. The main explanation for the differences in attitude and practice in the open access publishing figures is that while ECRs are hard wired for the open agenda, which went back to their doctoral work and even to their masters, a large minority of them published less in them because of an increased emphasis on publishing in top ranked journals, usually not OA (sometimes hybrid). There are other reasons, too. Thus, while more funding was available for author charges, ECRs rejected the idea that they had to pay and in one case a principle investigator rejected the change of going OA even though the money was available because the money could be better spent elsewhere. A problem also is that in many fields there are no “serious” OA journals. For most of the US (and UK) ECRs actual publishing in OA was undertaken before 2016.

- **Transformations shows the biggest net increase in practice.** There has been a large net drop in practice of 27% and this can be explained by the fact that while many ECRs would like change, very few have decided what sort of scholarly communication ecosystem they want and very few are going to do anything to help with the transformation. In 2017 it did seem that some ECRs might, compared with 2016, begun to think a little more, but it has not been sustained, and, indeed, ECRs have rowed back on it.

- **Social media and online communities.** There are mixed and confusing messages coming out here in repect to use. Social media net use is rising steadily (14%) but online community net usage is down (18%) and appears to fluctuate. Much of the drop can be attributed to ECRs obtaining work outside academia where there is just not the need for platforms, such as ResearchGate.

- **Altmetrics** shows a gentle (18%) rise in interest and practice and larger than we have seen elsewhere. This can be put down to greater knowledge and awareness and a few ECRs have started looking at

altmetrics from time to time, but none see them as metrics in the same sense as citations.

- **Collaboration.** Greater understanding is being shown here. The groups which are practically more involved in collaboration on the whole are enlarging the subject areas or nationality of their collaborators. There was evidence of a more reasoned and thoughtful answer to the question about whether collaboration involved the loss of a competitive edge. The majority thought that collaboration was a good thing overall, but a large number were more worried. Mostly they were worried, but they collaborated. One used the word “protective”. More caution comes with greater responsibility.

- **Data**. Negative changes (- 9% net) in attitude to the exposure of data reflect an increase in responsibility for holding on to data to enable sole use for a while and this was reflected in the practice of these groups (-9%). The concept of Open Data was understood but so were the practical reasons not to follow the principles for most. Again, it would seem that ECRs with more control over their destiny than had been the case had to think through options none of which were ideal. A majority made some data available as part of the supplementary material now made possible by relatively recent journal policies but none used data journals.

- **Impact**. The question asking for a definition of “impact” was answered in one of two ways – either it was seen as relating to impact factors or it was related to outreach through policy makers. On the whole, where there were changes in the attitudes and practices the emphasis was more concentrated than it had been on influencing one’s peers with the remaining answers divided to outreach to the public and policy changes particular in health through reaching policy makers.

- **Jobs.** Changes in attitudes and practices reflected closely changes in jobs, mostly a step up the academic ladder to tenure track. US practices relating to tenure track seem to be very much the same across the university sector: once ECRs get on to the ladder with tenure track they immediately become much more secure even though of course there is no certainty that they will get through the hoops (getting grants for example) which will present themselves over the next seven years.

- **Libraries.** The significant positive change to a more positive view of the usefulness of libraries from 2016 to 2017 was sustained in 2018

although levels of practice show a marginal fall. Medical researchers have more contact with librarians and they not surprisingly were appreciative.

- **Mentoring.** The very positive attitude to the quality of mentoring received from 2016 was sustained but the rise up the ladder by a number of ECRs means that there is less mentoring going on. The general agreement in the quality of mentoring in current and previous jobs is very striking and, bearing in mind the insecurity of the post-doctoral role, surprising.

- **Peer Review.** Past concerns about bias in peer review seem to have been overcome and where there was change it was all positive, but not all were doing or experiencing more peer review while some were doing/experiencing less. Frequent complaints were still that peer review took too long, that the editors chose the wrong reviewers and that they (the ECRs) received no training where training would have been helpful. No-one had a clear picture of how the system should be improved. On the whole double blind was welcomed but there was a large minority with a negative view – it was just too easy to recognise the handprints of the author in a small field.

- **Sharing.** There was an increasingly positive attitude towards sharing in principle, but not in practice which fits with the practice of what we have learned regarding the exposure of data. It was a rare area where ECRs distinguished their attitude and practices from their mentors who it was said were more cautious. Sharing as an attitude was also picked out by ECRs as a mark of their millennial birthright.

Table 15: Changes in scholarly communication attitudes and practices: US

Country	**US**									22
	Attitude			Practice				**Net**		
Activity	P	N	S	M	L	S	V	Attitude	Practice	Comb.
Access	0%	5%	95%	5%	9%	86%	0%	-5%	-5%	-5%
Altmetrics	18%	0%	82%	23%	5%	64%	9%	18%	18%	18%
Authorship	23%	5%	73%	14%	14%	73%	0%	18%	0%	9%
Career	23%	14%	64%	27%	18%	45%	9%	9%	9%	9%
Collaboration	14%	5%	82%	32%	5%	64%	0%	9%	27%	18%
Data	0%	9%	91	5%	14	82	0	-9%	-9%	-9%

			%		%	%	%			
Discovery	5%	0%	95 %	5%	0%	91 %	5 %	5%	5%	5%
Ethics	5%	0%	95 %	9%	0%	91 %	0 %	5%	9%	7%
Impact	18%	0%	82 %	18 %	18 %	64 %	0 %	18%	0%	9%
Jobs	9%	14%	77 %	18 %	9%	73 %	0 %	-5%	9%	2%
Libraries	27%	9%	64 %	5%	9%	82 %	5 %	18%	-5%	7%
Mentoring	9%	5%	86 %	18 %	14 %	68 %	0 %	5%	5%	5%
Metrics	9%	5%	86 %	0%	14 %	86 %	0 %	5%	-14%	-5%
Online communities	14%	9%	77 %	5%	23 %	68 %	5 %	5%	-18%	-7%
Open Access	27%	5%	68 %	9%	23 %	68 %	0 %	23%	-14%	5%
Open science	32%	0%	68 %	9%	5%	86 %	0 %	32%	5%	18%
Peer review	18%	0%	82 %	14 %	14 %	64 %	9 %	18%	0%	9%
Publishing	14%	5%	82 %	9%	9%	82 %	0 %	9%	0%	5%
Reputation	5%	5%	91 %	0%	14 %	86 %	0 %	0%	-14%	-7%
Sharing	27%	14%	59 %	23 %	18 %	55 %	5 %	14%	5%	9%
Smartphones	9%	5%	86 %	18 %	5%	77 %	0 %	5%	14%	9%
Social media	14%	5%	82 %	36 %	23 %	36 %	5 %	9%	14%	11%
Transformations	27%	9%	64 %	5%	32 %	64 %	0 %	18%	-27%	-5%
ALL	15%	5%	80 %	13 %	12 %	72 %	2 %	10%	1%	5%

4.7 Special analyses

A number of topics require further analysis because of big strategic messages they send to publishers and they are Millennium-friendly scholarly aspects, libraries, transformations and job changes.

4.7.1 Millennium-friendly scholarly aspects

While we have looked at change comprehensively so far, it is worth focussing on just those scholarly aspects that might be thought to be more in tune with beliefs of ECRs. That is, the aspects where change might be expected to be most dramatic, because they ECRs are pushing against an open door. Six aspects were selected on the basis of their

Millennium-facing characteristics (see Table 16 for a list) and the data was run against a range of demographics to see what transpired.

- These aspects, indeed, show significantly bigger changes for the three net scores: 30% attitude, 20% practice and 25% combined as compared to, respectively 19%, 14% and 16%.
- The younger the researcher the bigger the changes registered, so they are behaving as type.
- French researchers are out front in terms of the changes, as they are generally are.
- Social scientists show bigger changes in attitude and practice.
- But here is the big surprise, it is the tenured and not the non-tenured researchers who lead the field and externals seem to bail out from these activities.

Table 16: Changes in scholarly communications attitudes and practices: Millennium-facing aspects

		Millennial Spectrum									
		Attitude			Practice				Net		
		P	N	S	M	L	S	V	Attitude	Practice	Combi
Collaboration	103	46%	5%	50%	46%	8%	45%	2%	41%	38%	39%
Online communities	103	40%	8%	52%	34%	12%	50%	5%	32%	22%	27%
Open Access	103	34%	9%	57%	24%	12%	59%	5%	25%	13%	19%
Open science	103	30%	4%	66%	14%	10%	77%	0%	26%	4%	15%
Sharing	103	34%	8%	58%	30%	11%	56%	3%	26%	19%	23%
Social media	103	41%	9%	50%	36%	15%	34%	16%	32%	21%	27%
AVERAGE	103	**37%**	**7%**	**56%**	**31%**	**11%**	**53%**	**5%**	**30%**	**20%**	**25%**
China	135	46%	22%	32%	49%	4%	29%	18%	24%	45%	35%
France	145	61%	2%	37%	40%	2%	48%	10%	58%	38%	48%
Malaysia	125	38%	0%	63%	22%	36%	42%	0%	38%	-14%	12%
Poland	104	27%	8%	65%	23%	2%	75%	0%	18%	22%	20%
Spain	164	48%	9%	43%	44%	6%	47%	3%	39%	38%	38%
UK	164	28%	2%	70%	21%	9%	67%	3%	26%	11%	19%
USA	224	21%	6%	73%	19%	16%	63%	2%	15%	3%	9%

		%		%	%	%	%				
Age: 27-29	13	45 %	4%	51 %	33 %	3%	60 %	4%	41%	31%	36%
Age: 30-32	26	37 %	8%	55 %	29 %	6%	57 %	7%	29%	23%	26%
Age: 33-35	38	37 %	9%	54 %	28 %	14 %	53 %	5%	28%	14%	21%
Age: 36-38	16	32 %	2%	66 %	33 %	9%	51 %	6%	30%	24%	27%
Age: 39-42	10	38 %	8%	53 %	35 %	23 %	42 %	0%	30%	12%	21%
Female	43	40 %	5%	55 %	32 %	9%	55 %	4%	34%	22%	28%
Male	60	36 %	8%	56 %	30 %	12 %	52 %	6%	28%	18%	23%
Sci	77	36 %	8%	56 %	29 %	11 %	55 %	5%	28%	18%	23%
Soc	26	42 %	4%	54 %	35 %	11 %	49 %	5%	37%	24%	31%
External Research	11	27 %	20 %	53 %	18 %	27 %	50 %	5%	8%	-9%	-1%
Insecure	56	35 %	7%	58 %	28 %	8%	60 %	4%	28%	20%	24%
Tenure	36	44 %	3%	52 %	39 %	11 %	44 %	6%	41%	28%	35%

4.7.2 Libraries

There were no general questions about publishers, just two specific ones about their role in peer review and sharing mechanisms, but there were ones about libraries who are very important customers for publishers (partners, maybe). As we have learned already, possibly, disturbingly for publishers, libraries appear to be the outliers (the odd one out) in that they lag behind other scholarly aspects in terms of positive sentiment and increased usage. Indeed, they tend to stumble along at the bottom of many of our tables and figures. They are either stagnating (the negative outlook) or simply plateauing having being around for so long (the positive one). Libraries are anecdotally talked about as being traditional, old fashioned and unchanging and this is the picture that emerges from our data.

Table 17 looks more closely at the library data. The headline figures are a rise of 18% in sentiment a 9% increase in usage, a negative figure for net change in practice (-1%) and a combined net change figure of zero. Libraries are treading water in other words. The situation is, however, not

uniform, and in some countries, libraries are viewed more positively (e.g. Malaysia, US and Spain) and in one country (Malaysia) actually used more. Although, Malaysia's figure is slightly inflated by the presence of a (slightly biased) ECR studying library and information science and this is the case, too, with Spain where there were 2 ECRs studying librarianship. Libraries perform much worse in Poland and China. There is an age factor, too, with sentiment and use declining with age, which could be worrying down the line. And a discipline one, as well, with social scientists exhibiting a much more positive towards them.

If we look at the core scholarly communication aspects that might be thought to be associated with libraries, such as access and discovery, the data shows that access and discovery attitudes and practices have changed moderately over the years (Table 17). How then do we reconcile this with the library performance, which seems to be moving in the opposite direction? The most plausible reason is that ECRs are using more and more platforms for discovery and access and libraries, still used for this, are just becoming just a smaller part of the ecosystem, in which Google does much of the heavy lifting. The case of Spanish ECRs is illustrative. For information discovery, the library catalogue or discovery service is not central to them anymore. Google is the king. However, although Spanish ECRs do not go physically to the library, they obtain information through library subscriptions and they are aware of this. For them providing access to scientific information is the only role of the library but as there are more and more papers OA, the role of the library is seen less and less important. A sober message for libraries here.

Table 17: The worrying case of libraries

		Attitude			Practice				**Net**		
		P	N	S	M	L	S	V	Attitude	Practice	Combi
Libraries	103	18%	17%	64%	9%	10%	79%	3%	1%	−1%	0%
China	13	0%	15%	85%	0%	8%	92%	0%	−15%	−8%	−12%
France	14	7%	0%	93%	0%	7%	93%	0%	7%	−7%	0%
Malaysia	12	33%	0%	67%	33%	33%	33%	0%	33%	0%	17%

Poland	10	0%	80%	20%	0%	0%	100%	0%	−80%	0%	−40%
Spain	16	31%	38%	31%	13%	6%	69%	13%	−6%	6%	0%
UK	16	19%	0%	81%	13%	6%	81%	0%	19%	6%	13%
USA	22	27%	9%	64%	5%	9%	82%	5%	18%	−5%	7%
Age: 27-29	13	8%	23%	69%	0%	15%	77%	8%	−15%	−15%	−15%
Age: 30-32	26	15%	27%	58%	0%	4%	88%	8%	−12%	−4%	−8%
Age: 33-35	38	16%	16%	68%	8%	18%	74%	0%	0%	−11%	−5%
Age: 36-38	16	19%	13%	69%	25%	0%	75%	0%	6%	25%	16%

4.7.3 Transformations

ECRs were asked whether they felt the scholarly communications system would be transformed, whether they felt they had a responsibility to change it and what changes they would like to see occur. The answers to these questions might alert us to change down the road and/or their keenness or otherwise for change. The stand-out findings from Table 18 are:

- They are increasingly, albeit moderately, positive that a transformation will occur, but their actions suggest they are not changing sufficiently to contribute significantly towards this. Or so they think, because ECRs are reticent about their role in transformational change.
- Going by the attitude and practice net scores, Chinese ECRs are the most positive about transforming the scholarly communications system.
- The French are, yet again, interesting because although they appear to be changing a lot they are somewhat negative in regard towards transformational change.

- Practice tends to lags behind the wishes/desires for change, especially in the case of Malaysia, which makes you wonder whether it is a case of ‘hot air’?
- Female attitudes towards changing the future are more positive although their actions do not support this; the same is true of social scientists.

Table 18: The interesting case of scholarly transformations

		Attitude			Practice				Net		
		P	N	S	M	L	S	V	Attitude	Practice	Combi
Transformations	103	29 %	15 %	56 %	10 %	12 %	70%	9%	15%	−2%	6%
China	13	38 %	8%	54 %	31 %	8%	23%	38%	31%	23%	27%
France	14	14 %	43 %	43 %	14 %	14 %	71%	0%	−29%	0%	−14%
Malaysia	12	42 %	0%	58 %	0%	0%	100 %	0%	42%	0%	21%
Poland	10	0%	30 %	70 %	0%	0%	100 %	0%	−30%	0%	−15%
Spain	16	69 %	19 %	13 %	13 %	13 %	56%	19%	50%	0%	25%
UK	16	6%	0%	94 %	6%	0%	88%	6%	6%	6%	6%
USA	22	27 %	9%	64 %	5%	32 %	64%	0%	18%	−27%	−5%
Age: 27-29	13	38 %	15 %	46 %	23 %	15 %	62%	0%	23%	8%	15%
Age: 30-32	26	19 %	23 %	58 %	4%	8%	73%	15%	−4%	−4%	−4%
Age: 33-35	38	29 %	13 %	58 %	13 %	11 %	63%	13%	16%	3%	9%
Age: 36-38	16	13 %	13 %	75 %	0%	19 %	81%	0%	0%	−19%	−9%

Age: 39-42	10	70 %	0%	30 %	10 %	10 %	80%	0%	70%	0%	35%
Female	43	35 %	16 %	49 %	5%	16 %	72%	7%	19%	−12%	3%
Male	60	25 %	13 %	62 %	13 %	8%	68%	10%	12%	5%	8%
Sci	77	26 %	18 %	56 %	9%	12 %	71%	8%	8%	−3%	3%
Soc	26	38 %	4%	58 %	12 %	12 %	65%	12%	35%	0%	17%
External Research	11	36 %	27 %	36 %	9%	9%	73%	9%	9%	0%	5%
Insecure	56	30 %	14 %	55 %	9%	13 %	70%	9%	16%	−4%	6%
Tenure	36	25 %	11 %	64 %	11 %	11 %	69%	8%	14%	0%	7%

4.7.4 Job change

Thirty-seven per cent of the 103 ECRs who got past the project's finishing line (11% did not) obtained the prize of a tenured or secure job (Table 19). A further 9% obtained research jobs in industry or government. This means that a majority of ECRs have remained an ECR for three-years. And in the cases of Poland and Spain that is virtually everybody.

Because of the early evidence coming through - largely coming from France at the time, but since reinforced by US data - that those people reaching (or approaching) an established position change attitude and behaviour, a number of analyses were conducted to determine whether there was widespread evidence that this was happening and also whether there are differences between those in and out of academe? Clearly there are significant differences as Table 20 (and 16) demonstrates. Regarding the tenured group first, they have grown much more positive in their attitudes than the insecure group (36% v 28%) and more active in their behaviours (32% v 22%); their net change scores reflect this, too. ECRs

obtaining an outside research job show even greater differences, which might have been expected given the big environmental changes and demands. They appear to be a very different cohort now – more negative in attitudes and practising much less, with a combined net change score in the negative range (-4%). They have turned their backs.

Table 19: What happened to the ECR class of 2016?

	No. of ECRs in 2018	No. without tenure or secure position	No. with tenure or secure position in academe.	No. left academe but still researchers	No. no longer researchers or dropped out
China	13	6	6 (46%)	1	1
France	14	5	7 (50%)	2	-
Malaysia	12	4	8 (67%)	0	-
Poland	10	10	0 (0%)	0	-
Spain	16	13	2 (13%)	1	2
UK	16	7	7 (44%)	2	5
USA	22	11	8 (36%)	3	5
Total	103	56 (54%)	38 (37%)	9 (9%)	13 (11%)

Table 20: Job changes and scholarly communications

Job status	Attitude			Practice				Net		
	More positive	More negative	Same	More	Less	Var.	Same	Attitude	Practice	Combined
Insecure	28%	9%	64%	22%	8%	65%	5%	19%	14%	17%
External Research	21%	18%	61%	13%	23%	61%	2%	2%	-9%	-4%
Tenure	36%	5%	60%	32%	8%	56%	4%	31%	24%	28%

5.0 ECR voices

Of course, the real diamonds in the mine for a project like this is the rich cache of qualitative data gathered - the comments, conversations, quotes and insights freely proffered from ECRs from around the world and rendered in English for an international evaluation. This means the data is fresh and, in many cases, unlikely to have been seen before. As mentioned earlier, much of this data will be disseminated and discussed in the dissemination programme that follows the publication of the project report and which will be advertised on the project website. Here we provide a representative picture of the data and in order to show its unique quality for 13 key scholarly aspects. We have selected quotes on the basis that they represent what the majority of ECRs are thinking and on that they help to put flesh on the quantitative data.

On job changes and changing behaviour:

- *My attitudes changed but rather because I switched from being a student to being PhD to being a postdoc, which are very different jobs with different expectations towards scholarly communication.* UK ECR
- *Now I'm tenured, I do not feel anymore the need to rush to publish articles like a chicken producing eggs. I have more freedom and comfort to choose the research questions, to do the collaborations I want*. *The focus is more on writing proposals to obtain funds.* French ECR.

On discovery

Only pure players, such as Google and ResearchGate, are used for discovery and as is so often the case Google is king.

- *My triplex is GS, Sci-Hub and RG, efficient, fast and fitting with my lack of time, I do not need anything else. The DOI is my key, everything is linked to the DOI.* French ECR

On OA publishing and repositories:

ECRs are very sympathetic to OA publishing because they believe it leads to scientific improvements and it enables researchers to take back control over their research outputs, but reputational concerns, worries about costs and quality act as a drag anchor on practice. But pre-print repositories seem to be catching genuine interest, where they exist, of course.

- *I have increased OA use and advocacy during the interview period. Technology is now there, subscriptions are expensive and there is absolutely no excuse for not making scientists work available particularly to other scientists! This is the whole point of writing papers!* UK ECR
- *I am more aware of open practices in my new university. It is more common among ECRs, but it comes from the seniors. I see taking back control for academics as important in dissemination.* US ECR
- *Yes, to open access publishing, but this is not a requirement of the department, university or funders. So, I do not take OA into account when submitting a paper, just that it is a SCI or SSCI journal*. Chinese ECR
- *Journals, even some with excellent reputations, seem to be increasingly charging publication fees. This makes publication out of reach for scholars in smaller institutions/subjects and/or developing countries, which is a shame. I worry that in an effort to be open access, we may actual limit the number of voices that are heard.* US ECR
- *I am warier about OA and still critical about review practices. I have noticed that there are more poor papers and shorter ones*. UK ECR
- *Perhaps, I am more open to/aware of preprint servers, but other than that I think my attitude is the same. Still positive towards open access. A gradual increase in the use of preprint servers probably caused my change in attitude. In my field more and more papers are being published on preprint servers, so it has become more important to check there to keep up with the current work.* UK ECR
- *OA is central to my community (Mathematics). Knowledge produced by academics needs to be shared and arXiv is (for us) the place where we can all share our papers, wherever we are.* French ECR
- *OA is fine as long as the journal is ISI rated, reputable and the university will pay the article processing fees but you need to make sure that it is not listed in Beall's list. Not predatory. But the university will not pay if you want to make the article free in an OA (hybrid) journal.* Malaysian ECR

On open data:

Open data is thought to benefit science in the long run, but in the here-and-now concerns about the need to maximise its value to the researcher and, less so, losing competitive advantage, slows practice.

- *Data is the most important intellectual asset in our field. Why share it? However, when I have fully exploited it and published my papers, I will give it to others, but it is really useless for others to use it.* Chinese ECR
- *Sharing data is good for verification and reproducibility, but we should wait before we do this until they have been completely exploited to avoid competition.* Spanish ECR
- *Sharing data is good for verification and reproducibility, but we should wait before we do this until they have been completely exploited to avoid losing our competitive edge.* Spanish ECR
- *I like the concept of open science, but in our current society it is difficult because money moves everything. However, Europe is moving to a circular economy and sustainability and in this context, I believe that open science will be more possible and this will be great to make a great progress in science.* UK ECR
- *Since last year's interview, my university has launched a policy regarding open data and open science and encouraged academics to follow seminars, trainings etc. I attended many of them and I learned a lot. I'm very interested now and I believe that will help us to be more visible to society and citizens.* French ECR
- *The current reward system does not provide much incentive for Open Science (open data sharing and green open access), and to change the current culture is hard.* Malaysian ECR.

On sharing:

It is the social networks and online community platforms, not just ResearchGate, but also the likes of WhatsApp and WeChat, that enable, promote and stoke sharing. Sharing is also held to result in the advancement of science. And it is not just the sharing of journal articles that is being talked about. Nobody anymore believes, perhaps, with the exception of data (where we have seen there are reservations) that sharing is a bad thing and few mention the loss of a competitive edge. Sharing without bounds is what they all want.

- *Now, I find that ResearchGate works very well and I find the articles I want on it. There are a lot of brilliant people on it, so long as you post your letter or leave a message, people are always willing to share the article to you and it's very useful.* Chinese ECR

- *I think transparency and sharing data is important and helpful to advance science.* UK ECR

- *Hard to come up with a perfect system but I believe the focus should be on sharing and not just sharing only in the top journals.* US ECR

- *Now, I predominantly use WhatsApp to. share links and even full papers.* Malaysian ECR

- *I am aware of the need to disseminate my research work. I realise that if I want to cooperate with other scientists I have to share my work and information about me in the social media.* Polish ECR

- *The main barrier for sharing is the publishers' copyright restrictions for uploading full texts in social media.* Spanish ECR

On ethics:

Ethical concerns are not usually freely voiced by ECRs (a taboo, perhaps), except in the case of Asia where ethical concerns seem very much alive given the numerous retractions coming out from that part of the world. When ECRs do engage they mention that unethical behaviour abounds and a publish or perish mentality is to blame.

- *Overload is everywhere, papers, journals, researchers, unethical behaviour is prospering.* French ECR

- *Misconduct exists, I believe everywhere when people strive hard to publish. I am aware of this, it happens here even among very senior professors.* Malaysian ECR

On social media and online scholarly communities:

Clearly the social media is now embedded in the scholarly enterprise, and for some ECRs an everyday, mainstream activity. While ECRs still do blow hot and cold (the quantitative data shows this) about social media and voices of concern are still heard there are far fewer of them. The digital visibility proffered is a major plus point, but something new is emerging and that is the number of researchers who are stressing the importance of the social media in exposing them to different voices, viewpoints and ways of presenting their research, and also, as a place for taking the pulse of their field of study.

- *More and more people (colleagues) are on RG. It is now in my toolkit, to download papers and to showcase my own. I realised that it plays as a kind of a personal web site*. French ECR

- *I will not cite social media. My university has held academic training and mentioned that the use of social media content is not encouraged, and that social media content is not original or primary information.* Chinese ECR

- *Through social media, I can spot research trends and communicate instantly. By using the social media, I can get different sounds.* Chinese ECR

- *I use WeChat for scholarly communication almost every day.* Chinese ECR

- *YouTube provides a new way to see how science can be displayed without the normalized frame of the scientific article. As researchers, we all have watched TV programmes for children and this captured our imagination and made us want to be a scientist. We should continue to use it in this way* (French ECR)

- *WhatsApp, I rate it top. You know I even communicate about research with international collaborators using WhatsApp. Information from WhatsApp is accepted as proof of research activities by my university* Malaysian ECR. *Social media for scholarly communication, yes, WhatsApp and Telegram are now considered official for research reporting and disseminating.* Malaysian ECR

- *Social media provides visibility but exposure can also bring reputation as you can get citations, invitations, new connections, etc.* Spanish ECR

- *We are abusing our use of social media. It seems more important to communicate than to invest time in doing serious research*. Spanish ECR
- *ResearchGate provide a unique opportunity to find scientists in each scientific field and allows you to communicate with them*. Polish ECR

On metrics:

It's hard to find any researchers lauding the benefits of altmetrics, most seeing them as inconsequential, but there are a few and mainly point to the downstream citation benefits that might accrue. After 3 years,

altmetrics, despite all the promotion, are still yet to catch-on with younger researchers, although, maybe, there is a sense of a stirring in attitude in places, but no stronger than that.

- *I don't think alternative metrics such as recommendations and tweets reflect the impact of research. High alternative metrics might just mean that the general public is interested in your research*. Chinese ECR.
- *It is very easy to game altmetrics, I do not trust them, it is easy to observe how these "toys" are playing influence game*. French ECR
- *Actually, the views and numbers of downloads does not influence me in my decision to download. I tend to choose the latest research, the relevant article, leading researchers in my field, that I know.* Malaysian ECR
- *Impact is all about citations and/or utility for society, altmetrics on the other hand just tell us about curiosity*. Spanish ECR
- *Easily gamed as you can have fake followers on Twitter or likes on RG.* Malaysian ECR
- *Citations are* the *important research measure, but obtaining good altmetrics might mean that you will get citations in the future.* Spanish ECR
- *In my experience recommendations work very well. (…) I know that somebody recommends to me an article that may suit my interests. Also, downloads are a good way of measuring the impact of research. Of course, citations as well. I am not sure about "likes". What does it mean to give somebody a "thumb up" in the social media? It does not say anything about your work. It is different when you comment on something or recommend somebody's studies as interesting.* Polish ECR

- *I think tweets, etc. can highlight the potential reach of an article but ultimately, I'm not sure these really capture true impact (e.g. a download doesn't mean the article has been read or used in anyway – unfortunately!)* UK ECR

On peer review:

Peer review – and many of them do it – is generally felt to be in a reasonable state of affairs, but there are concerns about the quality and appropriateness of reviewers. And it has to be said that ECRs are definitely not sure about the merits of open peer review with some

believing that, while it gives them protection from bullying reviewers, they would hesitate to undertake it themselves because that would put in an unwelcome spotlight and they might obtain unwanted attention. They much prefer double-blind peer review.

- *The open peer review system can prevent reviewers being too hard (and dismissive) when reviewing a paper and so help improve the article more*. Spanish ECR
- *Open peer review - I am all for it. I believe this practice would force reviewers to give a more accurate verification of the publications reviewed. In addition, by identifying reviewers to the authors may potentially have a positive impact upon, the quality of reviews, the recommendation regarding publication, the tone of the review and the time spent on reviewing. On the other hand, I think that it would extend the review process and would certainly reduce the number of scientists willing to reviewing publications*. Polish ECR
- *Open peer review is tricky because you engage your own reputation as a reviewer, write a well-meaning, positive-eye review that requires time, which we do not have. I do not believe in this modality.* French ECR
- *I think double-blind peer review is fair, but there needs to be some assessment of the quality of the reviewer*. Chinese ECR
- *Double-blind makes it more difficult to compare current papers with previous ones from the same authors*. Spanish ECR

On outreach and impact:

Impact and outreach are synonymous for many ECRs and it is, above all else, is something they would like to do much more of. What fuels interest and action in the topic is the drive to widen the audience. The general public is clearly the main target, but a shortage of time and a lack of a reputational reward holds back practice. Citations are still a key measure of impact for many, but the numbers saying so appear to be declining. The thought that collaboration improves impact is an interesting one.

- *I am more conscious of the importance of the dissemination of our research to a general public in order to wake up the interest of the generations about science. So, with the new technologies is very easy to make this so.* US ECR
- *To build bridges with society is a must.* Spanish ECR
- *If I do not succeed in finding a position or a decent contract, I will switch to outreach. It is something we can do differently from the*

past thanks to technologies. What I learned from Open Science programs make me think that it could be a valuable "way out" for me if I fail in having a position. French ECR

- *My behaviour has changed during my career because the technologies changed and I am now keen on reaching out to general public. So, with the new technologies is very easy to make this so I try to make this practise as much as he can, but sometimes I do not have enough time.* UK ECR

- *Maybe, my research has impact. Impact based on citations. Impact means people contact you and refer to your work. But not necessarily in publication. Industry that do R&D contact me, the researchers there refer to my work.* Malaysian ECR
- *Collaboration improves impact as it facilitates the use of better techniques, improves learning and publishing in the best outlets.* Spanish ECR

On journals and publishing strategies:

Of course, all roads lead to journal publishing, but there are worries about what this is leading to a diminution in quality and impacts negatively on the progress of science. ECRs do not feel able to reduce their publishing efforts as some wish because of institutional assessment policies. The sole goal appears to be publishing in top ranked journals (irrespective of publisher, open access and audience). More and higher was what one ECR said and this would have been echoed by most of the others. A comforting thought for publishers, though.

- *Yes, I believe that there is a real problem with the quality of scientific articles. Now I have found more papers where the results and discussions are so speculative that I can obtain any relevant information, or the data is wrong, or the conclusions are invented from no clear experimental results*. UK ECR
- There isn't another suitable vehicle for research quality control and evaluation. Spanish ECR
- *If I were to 'go it alone' and implement such a strategy (give my results and ideas away unrecognized in data bases and only publish a few, longer papers) that would be tricky to get into top flight journals) I would not expect to get promoted and it would be difficult to get funding.* US ECR

I regret not paying attention to ranked journals particularly with my earliest publications, about half of my total publications are not from ISI journals. I would have had a better impact if I had done so. Malaysian ECR

I don't actually go for publisher, I want ISI accreditation. I know Elsevier and Springer have fast review and publication processes, but this is not the requirement of my university. Malaysian ECR

My strategy is to publish parts of the research without waiting for complete data in order to get a presence in the field as early as possible. Spanish ECR

I believe, in fact, that it is more efficient to publish less papers and better papers, and target the most relevant journals, even their IFs are not the highest. It makes you more visible to your community (thanks to the quality of the paper) and your paper is published more quickly if you spent enough time to consolidate and improve. It is the strategy I applied, and I believe that it worked because I obtained a position. French ECR

To publish a lot and as high as possible as senior (last or corresponding) author. Spanish ECR

6.0 Hypotheses and statements tested

To provide direction and to ensure focus in what was a very wide-ranging study of scholarly communications the project was provided with 26 hypotheses (or statements) to test. They came from statements made in the literature and at conferences (cited in this report) and raised at two focus groups held with publishers and ECRs at the beginning of the study. The national interviewers were asked on the basis of their deep knowledge of their interviewees (literally having talked to them for hours and hours) to review their data and determine whether these hypotheses were confirmed, partly confirmed or rejected (not confirmed). Their judgments are shown in Table 21. We trialled this analysis in year 1 (see http://ciber-research.eu/download/20160901-Harbingers-hypotheses.pdf) and where they are differences with 2018 they are noted in the Table (see writing in white letters). A traffic light colour system is used in order to help show consensus among the 7 countries, with red signifying not confirmed, orange as partly confirmed and green as confirmed. A quick visual scan shows that red is a common colour suggesting that quite a few hypotheses statements are not supported by the evidence. This is especially the case for:

- ECRs are interested more in social media and usage metrics because citations take so long to count.
- They publish in OA journals because they are easier to get into.

where there is no support for them at all. The first statement fits with the low esteem and usage shown in the quantitative data in the preceding analyses. The low support for the second statement might have more to do with the relatively small number of ECRs publishing in OA journals and, possibly, their unwillingness to tell us this.

Three other statements are rejected by nearly all countries, 6 out of 7 countries of them:

- There is a big drop-out rate among ECRs
- ECRs are not very productive (publications).
- ECRs are willing to ‘game’ the system to progress and publish.

No particular shocks here: a) we know they live in a very precarious environment (but less so in France it seems); b) we have confirmed in a previously published paper that they in fact publish quite a lot (Nicholas et al, 2017), they are not the novices as they are sometimes portrayed; c) we might have expected them not to admit gaming the system, except in China where they are very open to new ways of working, but they are certainly strategic.

In contrast only one statement obtained full support, taken together with the above suggests that much of what we think about ECRs is not true. This exception was:

- New behaviours not taking hold, because academics typically recruited, promoted and obtain funding on basis of their publication record and citation scores.

The quantitative data we have seen reinforces that this is an obstacle to change, but, nevertheless, change is still occurring but perhaps not at the rate it might otherwise have done so if assessment obstacles were removed.

One statement obtained near unanimous support (but not by China) and that was:

- The environment in which they work is precarious

This is clearly true with just 37% obtaining academic tenure and a further 9% obtaining a research job outside academia.

What of the changes between 2016 and 2018 because this provides another view on change? There were 43 changes out of a possible 182, so change is quite widespread and matching what we have seen elsewhere in the report. In fact, the most widespread change occurred in respect to:

- The system is unchanging and unbending, but there is little desire for change among ECRs. There were 4 changes giving this statement a unanimous partially met score. Maybe, the one step into the future description of ECRs has much truth in it.
- ECRs would like to use social media more, but traditional norms that dominate scholarly behaviour prevent them from doing so. Similarly, there were 4 changes here, 3 of them from partially confirmed to not confirmed, which would seem to indicate a lightening of regulations.

Spain saw the highest number of changes, which was 14 and this was attributed to the growing maturity of the panel.

Table 21: Hypothesis statements and their verification

1. Background	CH	FR	ML	PO	SP	UK	US
Hypotheses to test:							
ECRs do many jobs for short periods of time	Confirmed	Confirmed	Not confirmed	Confirmed	Partly confirmed *Ch from*	Not confirmed	Partly confirmed

					Confirmed		
They do many things on a project (multi-taskers)	Confirmed	Confirmed	Not confirmed	Confirmed	Partly confirmed *Ch from Confirmed*	Not confirmed	Not confirmed
Environment in which they work is precarious	Not confirmed *Ch from confirmed*	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed
There is a big drop-out rate among ECRs	Not confirmed *Ch from confirmed*	Confirmed	Not confirmed	Not confirmed	Partly confirmed *Ch from Not confirmed*	Not confirmed	Not confirmed
2. Career							
Getting a tenured job is the major motivation, not changing world or science.	Not confirmed	Not confirmed *Ch from confirmed*	Confirmed	Partly confirmed *Ch from confirmed*	Partly confirmed	Not confirmed	Not confirmed *Ch from partly confirmed*
ECRs are not very happy with their lot as research 'apprentices' or 'slaves'.	Confirmed	Not confirmed *Ch from confirmed*	Partly confirmed *Ch from Not confirmed*	Confirmed	Partly confirmed *Ch from confirmed*	Partly confirmed	Not confirmed
ECRs have little personal freedom and security.	Partly confirmed	Not confirmed *Ch from partly confirmed*	Partly confirmed	Partly confirmed *Ch from not confirmed*	Confirmed	Partly confirmed	Partly confirmed
3. General (scholarly) communication behaviour							
ECRs adopt the practices of their mentors & heads of groups to which they belong.	Not confirmed	Partly confirmed	Partly confirmed Ch from not confirmed	Confirmed	Partly confirmed	Partly confirmed	Confirmed
New behaviours not taking hold, because academics typically recruited, promoted and obtain funding on their publication record and citation scores.	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed *Ch from partly confirmed*	Confirmed *Ch from partly confirmed*
4. Influence of social media and online communities							
ECRs would like to use social media more, but traditional norms that dominate scholarly behaviour prevent them from doing so.	Not confirmed *Ch from partly confirmed*	Not confirmed	Confirmed	Partly confirmed	Partly confirmed *Ch from Confirmed*	Not confirmed	Not confirmed *Ch from partly confirmed*
ECRs do not see social media as being scholarly 'noise', but useful for research purposes.	Partly confirmed *Ch from confirmed*	Not confirmed	Confirmed	Partly confirmed *Ch from not confirmed*	Confirmed	Partly confirmed	Not confirmed
Social scientists are more favourable towards scholarly use of social media.	Not confirmed	N/A	Not confirmed	Not confirmed	Not confirmed *Ch from Partly confirmed*	Not confirmed	Not confirmed
ECRs are detached from institutions and more closely networked with their peers.	Partly confirmed	Confirmed	Partly confirmed	Partly confirmed	Not confirmed *Ch from Partly confirmed*	Not confirmed	Not confirmed

5. Authorship, publishing and open access							
ECRs toe-the line (do what they are told).	Not confirmed *Ch from partly confirmed*	Confirmed	Confirmed *Ch from partly confirmed*	Confirmed	Partly confirmed *Ch from Confirmed*	Partly confirmed	Confirmed
ECRs are not very productive (publications).	Not confirmed	Not confirmed	Not confirmed *Ch from partly confirmed*	Not confirmed	Not confirmed	Partly confirmed *Ch from not confirmed*	Partly confirmed *Ch from not confirmed*
They publish in OA journals because easier to get into	Not confirmed	Not confirmed	Partly confirmed *Ch from not confirmed*	Not confirmed	Not confirmed	Not confirmed	Not confirmed
6. Peer review							
ECRs feel locked out by the existing peer review system, which they think of as a 'gentleman's' club.	Not confirmed	Not confirmed	Not confirmed	Not confirmed	Not confirmed *Ch from Partly confirmed*	Partly confirmed	Partly confirmed
ECRs prefer double blind peer review because it provides fairer appraisal.	Confirmed	Confirmed	Confirmed	Confirmed	Confirmed	Partly confirmed *Ch from confirmed*	Partly confirmed *Ch from confirmed*
ECRs are worried by too much transparency in peer review because it will make it difficult to criticise submissions of their seniors.	Not confirmed *Ch from partly confirmed*	Confirmed	Not confirmed	Not confirmed	Partly confirmed *Ch from Not confirmed*	Confirmed	Confirmed
7. Reputation							
They are 'slaves' to a metric-based & journal focussed system, which have to adhere to climb academic ladder.	Partly confirmed *Ch from confirmed*	Confirmed	Confirmed *Ch from partly confirmed*	Confirmed	Confirmed	Partly confirmed	Confirmed
8. Sharing and collaborating							
ECRs share and collaborate extensively even at the risk of losing their competitive edge.	Partly confirmed	Confirmed	Not confirmed	Partly confirmed *Ch from not confirmed*	Partly confirmed *Ch from Not confirmed*	Partly confirmed	Partly confirmed
ECRs use social networking sites to build own networks, separate from networks already established by research groups they work for.	Not confirmed	Not confirmed	Confirmed	Not confirmed	Partly confirmed *Ch from Not confirmed*	Not confirmed	Not confirmed
9. Metrics							
ECRs are interested more in social media and usage metrics because citations take so long to count.	Not confirmed	Not confirmed	Not confirmed	Not confirmed	Not confirmed	Not confirmed	Not confirmed
10. Unethical behaviours							
ECRs are willing to 'game' the system to progress and publish.	Confirmed	Not confirmed	Not confirmed	Not confirmed	Not confirmed	Not confirmed	Not confirmed
11. Impact and transformations							
ECRs see connecting to	Not	Partly	Confirmed	Partly	Confirmed	Partly	Partly

a wider audience as an important impact of their work.	confirmed	confirmed		confirmed	*Ch from Partly confirmed*	confirmed	confirmed
The system is unchanging and unbending, but there is little desire for change among ECRs	Partly confirmed *Ch from confirmed*	Partly confirmed	Partly confirmed	Partly confirmed	Partly confirmed *Ch from Confirmed*	Partly confirmed *Ch from not confirmed*	Partly confirmed *Ch from not confirmed*

7.0 Conclusions

Good people to ask

Having had deep, long and extended interviews/conversations with more than a hundred early career researchers over a period of three years, in the course of which we watched them developing as researchers, we believe we are in a unique and privileged position when it comes to commenting about their scholarly communication attitudes and behaviours and how these are changing in the present-day digital times. What they think and do really matters, not simply because they are the future, which is important enough, of course, but, also, because they are in the engine room of scientific research and on the front line of scholarly communication. Not only that, but they are also thoughtful, knowledgeable and experienced. There is nobody better to ask about scholarly communications, so that to see them as just novice researchers is a big mistake: after all, they have to be savvy to exist and prosper in the hothouse environment in which they find themselves. Indeed, they are the perfect test-bed for all thing's scholarly communication.

Important changes

Change is the only constant these days and it comes as no surprise that we have found change occurring nearly everywhere in ECRs' attitudes and practices. In some areas, such as collaboration and research impact, and in some countries, best exemplified by France, ECRs certainly act as the advanced guard of scholarly communication, bringing about change very fast indeed. In other areas, such as conventional metrics, reputation and publishing strategies and in some countries, like the US, change seems to be occurring much more slowly. There is a momentum everywhere, but it is not evenly spread out and is much stronger in the Millennial-facing scholarly communication aspects. This is probably down to the fact that some things, such as the assessment system, are set in stone and therefore not so easily budged by ECRs; other things are much more easily changed, such as the use of smartphones for scholarly purposes and participation in online communities, where ECRs are in the driving seat even.

We too often make the mistake of regarding change as a one-way street, taking it to be invariably progressive, positive and revolutionary; however, some things have to give in a busy world and head the other way. Libraries seem to be a case in point, moving in change terms into negative territory: they are used relatively less and appreciated less,

though not by everybody. Plainly, the days when researchers acknowledged the library in their publications are now long gone. As publishers' close partners in the scholarly communication business are the libraries, indeed, publishers are locked into a library business model, there are big implications for them here. Interestingly, it is not just the traditional activities that are suffering. Altmetrics, for example, seem to be on a bumpy road and not making much headway with researchers, contrary to early predictions that saw them jumping at what was propounded as a fast-track reputational metric.

There are, of course, scholarly activities and areas where the jury is still out or things are still at the tipping point, where sentiment is positive, but practice is yet to take off. Open science and its constituent parts (e.g. open data, open access publishing, open peer review) is very much in this camp. What holds back practice in these areas are typically assessment and reputational concerns, but in the case of open peer review also an unwillingness to attract unwelcome attention. ECRs like digital visibility, but they are justifiably wary of digital notoriety.

Causes and drivers of change

Another mistake is to believe that changes arise solely as a consequence of the introduction of new technologies or platforms, such as ResearchGate, which support ECRs' Millennial beliefs in respect to openness and sharing. In fact, some of the biggest changes occur as a result of job change, typically the landing of a secure position (within or without academe), which requires a change in mind-set, typically to a more conservative one. Furthermore, among untenured researchers another driver of change is the pressing need to increase their competitiveness by making themselves more visible and important. ECRs, well-aware of the huge importance accorded in the scholarly world to obtaining digital visibility, as a crucial precursor of reputation, happily join the ranks of online community platform members. It is of course right up their alley and, for once, here tradition does not block their way to success.

Much of the churn that we have found – and Table 10 provides a wonderful visualization of this – is that ECRs will drop or pick-up an activity on a strategic basis. Indicated by the amount of flipping evidenced in our data, ECRs, being relatively young and ambitious, are clearly more likely to be early adopters, happily trying out new options, indeed, looking for shortcuts more enthusiastically than established researchers. Their risk-reward orientation seems to favour such experimentation.

Finally, we have also witnessed manifestations of evolutionary change, where there seems to be no turning back, just a constant move forward. This is perhaps best exemplified by the use of smartphones: hardly used at all in the first year, as not thought scholarly acceptable, and only cautiously tried out in the second year, smartphones suddenly became wholly acceptable in the third year, possibly spurred on by the march of the social media scholarly community platforms.

Testing the widely-held assertions

To provide direction for a project, whose territory was as broad as could possibly be with its remit being the whole of scholarly communications, 26 widely held assertions about ECRs were tested, mostly accrued from focus groups and the literature. Only three of the hypotheses obtained near unanimous acceptance and five were widely rejected, which means that according to our data many of the assumptions made about ECRs do not pass muster. The three accepted hypotheses unsurprisingly cited the well-known and much discussed woes of having to live by the inflexible rules of the scholarly reputational system and in a precarious work environment. However, the five largely rejected hypotheses are perhaps a little more unexpected: ECRs denying any positive benefits that altmetrics might have or the possibility of easier publishing opportunities on offer in OA journals certainly came as a surprise. Two of the remaining hypotheses among those voted down by ECRs were even borne out by the evidence emerging from the study: the big dropout rate purportedly characterising ECRs turned out to be 10% in our case and, by the same token, contrary to ECRs' allegedly low publishing record, in our study they in fact published quite prolifically. Finally, and in this case perhaps inevitably, our ECRs did not admit to a willingness to 'game' the system to progress and publish.

Testing the data against the published literature

Trying to place our findings in the context of the (largely quantitative) research in the field is not made easy by the fact that no one else has attempted to find out whether ECRs will be the harbingers of change in the scholarly world. Nevertheless, there have been a plethora of quantitative and one-off studies that have examined aspects of scholarly communications change, both of early career and tenured researchers, and the data in this report do challenge their findings.

It is quite clear from the literature that the broad consensus is that ECRs have to play by the traditional rules (Sinclair, Barnacle, Cuthbert, 2014) in

order to obtain a secure research job and, therefore, will blinker themselves to publishing papers in prestigious journals in order to obtain reputation and pass muster with assessment systems (Carpenter, 2012; Harley, Acord, Earl-Novell et al., 2010; Ivancheva, 2015; Müller, 2014a, 2014b; Nicholas, Herman, Jamali et al., 2015; Nicholas, Jamali, Watkinson et al., 2015; Nicholas, Watkinson, Jamali et al., 2015). Suppressing their millennial beliefs about openness, sharing and transparency (Anderson and Rainie, 2010; Taylor and Keeter, 2010), they thus put in cold storage their more encompassing views on reputation (Jamali, Nicholas and Herman, 2016). Indeed, there may be plenty of papers exhorting ECRs to embrace open practices (Enago Academy, 2015; Eschert, 2015; Gould, 2015; McKiernan et al., 2016; PhD on Track, 2017), but no research showing robustly that ECRs are in fact rushing in hordes to do so.

Of course, most of the studies mentioned pre-date the start date of the Harbingers study, so, maybe, things have changed in the interim, which might explain why the present study, indicating that the walls have been breached and ECRs have, at the very least, planted one foot in the future, is at odds with the research of others.

The scale and significance of change

We sought, above all, to determine the scale of change in scholarly communications. What you make of the of the project results depends in part on whether you are a ‘glass half full’ or ‘glass half empty’ person. We have seen in this study a 40% change in scholarly communication attitudes and activities over three years, which, of course, means that 60% have remained the same. So, is this a half full or half empty result, lots of change or not much change? Well, there is good reasons to believe that it is a half full result. True, around 60 percent hold on to their beliefs and practices, but that is always the easier or default option in a field so assessed and crawled over. Change is threatening and not easy to accomplish, so the fact that so many have changed does seem impressive. After all, if your salary rose by 40% in 3 years, or if you improved your running times by that percentage, it would seem an achievement. Most importantly, if our ECRs are typical, even if not necessarily wholly representative, roll out the change across the tens of millions around the globe and you have something not to be sniffed at.

There is enough evidence, then, to believe that ECRs, propelled by their Millennium beliefs of openness, sharing and transparency and steeped in the social media, are going to be instrumental in a root and branch overhaul of the scholarly communications system. Indeed, they may even

change the nature of research itself, already increasingly shaped as it is by scholarly communications. They are quite capable of changing it within and influencing their seniors. ECRs might be apprentices to the system, but they are certainly not slaves to it, and, of course, the general direction in which society is moving is in their favour.

Returning to the question posed right at the beginning of the study: are ECRs the harbingers of change? Weighting up all the evidence be answer has to be yes, albeit a qualified yes. The drivers of change are social media, open science and collaboration and of course ECRs' Millennium-generation beliefs. However, change will take time and not everything will change; plainly, the overarching importance accorded to journal publishing, the peer review system and the traditional ways and means of assessment is bound to reign on.

Limitations

The strengths of the study lie in the depth and duration of the conversations held with ECRs and the trust built up as a consequence, and its weakness is rooted in our sample, which is relatively small and not necessarily representative of the population as a whole. Even so, nobody has undertaken such a study in this field before and what we have learnt from over 100 ECRs in over 350 hours of interviews must constitute a big contribution to our understanding of this key group of researchers.

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Appendix 1: Harbinger project publications

List of internal reports

(all available on project website http://ciber-research.eu/harbingers.html)

Year one:

- Early Career Researchers: the harbingers of Change? Year one report.
- Harbingers — early career researchers: a review of the literature and definitions
- Harbingers — hypotheses testing
- Harbingers — comparative national findings (2016)
- Harbingers — research instruments (2016)

Year two:

- interim report (May 2017)
- Harbingers — second year results summary (Sep 2017)
- Harbingers — presentation at APE 2018
- Harbingers - Year Two, Final Report November 2017

Year three:

- Year three interim report Early thoughts.

List of journal articles and conference proceedings

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