Can Mendeley Bookmarks Reflect Readership? A Survey of User Motivations[1]

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Although Mendeley bookmarking counts appear to correlate moderately with conventional citation metrics, it is not known whether academic publications are bookmarked in Mendeley in order to be read or not. Without this information, it is not possible to give a confident interpretation of altmetrics derived from Mendeley. In response, a survey of 860 Mendeley users shows that it is reasonable to use Mendeley bookmarking counts as an indication of readership because most (55%) users with a Mendeley library had read or intended to read at least half of their bookmarked publications. This was true across all broad areas of scholarship except for the arts and humanities (42%). About 85% of the respondents also declared that they bookmarked articles in Mendeley to cite them in their publications, but some also bookmark articles for use in professional (50%), teaching (25%) and educational activities (13%). Of course, it is likely that most readers do not record articles in Mendeley and so this data does not represent all readers. In conclusion, Mendeley bookmark counts seem to be indicators of readership leading to a combination of scholarly impact and wider professional impact.

Introduction

Researchers, science funders and evaluators can benefit from knowing who uses research outputs and which outputs are most used, and from understanding the contexts in which research is applied. For instance, the Higher Education Funding Council for England (HEFCE), in the Research Excellence Framework (REF), wants to consider all types of research impact inside and outside of academia (HEFCE, 2011). In addition, the EU-funded ACUMEN project has proposed new indicators to assist research evaluators to assess many types of impact to avoid relying upon just formal citations and expert judgements (see http://research-acumen.eu). This is part of a new research trend, known as altmetrics, that is developing indicators for research impact using social web data, such as from online reference managers, Twitter, blogs, Wikipedia, and academic social networks (Priem, Taraborelli, Groth, & Neylon, 2011).

Early altmetric investigations have focused on measuring the correlations between citation and altmetrics to partially validate the new metrics. These studies have typically found weak or moderate correlations between altmetrics and citations for specific sets of articles (Thelwall, Haustein, Larivière, & Sugimoto, 2013; Priem, Piwowar, & Hemminger, 2012; Costas, Zahedi, & Wouters, 2014). In particular, some studies focused on Mendeley readership counts from different perspectives. For example, medium correlations between Mendeley readership counts for a sample of papers published in Nature and Science, JASIST and Information System Journal (Li, Thelwall, & Giustini 2012; Bar-Ilan 2012; Schlögl et. al. 2013). Mohammadi and Thelwall (2014) found low and medium correlations between Mendeley readership counts and citations for several social sciences and humanities disciplines (Mohammadi & Thelwall, 2014). Following these correlational studies, qualitative

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investigations based on surveys and interviews are important to validate altmetrics by finding out why articles are cited, bookmarked or linked to in various contexts and by whom (Sud & Thelwall, 2014).

One indicator of the academic use or value of an academic publication could be the extent of its readership within the scientific community, which gives evidence of interest in using it in research or other scholarly activities (e.g., teaching and discussions). Although data about the readership of academic publications can be difficult to get (Wouters & Costas, 2012), several studies have used download counts for electronic articles to indicate readership (Kurtz et al., 2005; Haque & Ginsparg, 2009). Nevertheless, it is not clear whether downloads tend to reflect intellectual impact or some other type of impact. Although the type of user can be used to partly differentiate the contexts that articles are used for (Thelwall, 2012), the identities of downloaders of papers are typically unknown due to confidentiality and privacy issues, which makes inferences from the information that can be collected (from server logs) difficult and not straightforward (Duin, King, & Van den Besselaar, 2012). In contrast, the social reference sharing site Mendeley provides data for scientific publications about those that have saved information about each article to their Mendeley library (called 'bookmarking' here to distinguish it from reading, although this is not a strictly accurate term) *and* identifies their roles (e.g., professors, PhD students, masters students, and users outside academia). As an altmetric, Mendeley bookmarking counts have been interpreted as an indicator of 'readership' (Bar-Ilan, 2012; Li, Thelwall, & Giustini, 2012; Thelwall, Haustein, Larivière, & Sugimoto, 2013; Mohammadi & Thelwall, 2014) but it is not known whether Mendeley bookmarks reflect readership or whether users tend to use their libraries for other purposes. In response, this paper investigates the motivations for bookmarking papers in Mendeley with a large-scale survey of Mendeley users.

Literature review

Changes in scholarly reading habits in the digital era

Since 1990, librarians, publishers and scholars have increasingly attempted to publish scientific literature in digital formats (Kling & McKim, 2000) and electronic resources have been an integral part of scholarly communication as a result. For example, the high cost of providing print journals and the increasing success of electronic journals motivated many academic institutions to shift towards electronic resources (Vaughan, 2003). Flexibility of use is one of the key attributes of electronic articles, making it easier for scholars to access and share their work (Niu & Hemminger, 2010). Nevertheless, researchers in the early years of digital resources printed electronic papers rather than reading them on the screen (McKnight, 1997; Belefant-Miller & King, 2000). This progressed towards faculty members using the electronic versions of papers but printing them for a final reading (Tenopir, King, Edwards, & Wu, 2009). By 2014 there were 46,827 active academic electronic journals in different languages across all disciplines (Ulrich, 2014), indicating their widespread acceptance by scholars (see also: Tenopir, 2003; Rowlands, 2007; Tenopir, Wilson, Vakkari, Talja, & King, 2010). Electronic books are a recent innovation in comparison to journal articles but may be valued for their convenience (Shelburne, 2009). Around two-thirds of faculty members and students in Britain that responded to a survey claimed to read eBooks in their scholarly activities (CIBER, 2009; see also: Chrzastowski, 2011) and so it is no longer an unusual activity.

The amount of reading done by academics has increased alongside the growth of online publishing, at least in the USA, and scholars continue to prefer journal articles despite the range of other information sources available (Tenopir & King, 2002). There have been

changes in the types of reading done, however, with readers apparently spending more time on activities like browsing, keyword searching, and selective reading than on detailed reading (Liu, 2005).

Disciplinary differences in reading habits

The subject background of readers is influential in their reading behaviours (Talja & Maula, 2003; Tenopir, King, Spencer, & Wu, 2009a; Tenopir et al., 2010) and some fields even use electronic sources in unique ways (Tenopir, King, Boyce, Grayson, & Paulson, 2005). Electronic journal usage differs between physics, geography, and linguistics and even within these disciplines (Fry, 2003). Disciplinary differences seem to be more substantial than organisational differences, except perhaps internationally (Niu & Hemminger, 2010; Nicholas, Rowlands, Huntington, Jamali, & Salazar, 2010). Kling and McKim (2000) believed that "communicative heterogeneity" and "communicative plurality" in scholarly communication could result in disciplinary differences in the uptake and use of electronic resources. More generally, social scientists tend to search for information whereas scientists keep up to date by browsing journals (Pullinger & Baldwin, 2002). Nevertheless, social scientists seem to read abstracts and new articles more than do scientists in other disciplines (Nicholas, Huntington, & Jamali, 2008).

In terms of types of information sources, journal articles are the most common in sciences and medical sciences disciplines but humanities scholars tend to use monographs and book chapters instead (Tenopir, Volentine, & King, 2012b). Hence, academics in the humanities read fewer electronic articles than do scholars in other subjects (Tenopir et al., 2010). The time spent reading individual papers can also vary from one discipline to another. For example, medical scientists spent less time reading an article compared with scholars in other disciplines (Tenopir, King, Edwards, et al., 2009; Tenopir & King, 2001; Tenopir, Volentine, & King, 2012a).

Academic status differences in reading habits

Surveys of Australia, Finland, and the United States indicate that the academic position of scholars can affect their reading behaviour (Tenopir et al., 2010). For example, doctoral students and assistant professors may use online resources more than do associate or full professors (Smith, 2003; Ge, 2010). In contrast, academics with more publications read more articles than do faculty members with fewer publications (King, Tenopir, Choemprayong, & Wu, 2009; Tenopir et al., 2012b). Undergraduates may share some reading habits with faculty members because of references suggested by faculty members (Korobili, Malliari, & Zapounidou, 2011; Brennan, Hurd, Blecic, & Weller, 2002), but presumably focus on more basic texts and tend to read a higher proportion of books in comparison to journal articles in most disciplines.

Outside of academia, some professionals use scholarly publications and their reading habits may be affected by their work (Leckie, Pettigrew, & Sylvain, 1996). Medical science professionals are an important group of readers, often using the findings of research articles in practice (McAlister, Graham, Karr, & Laupacis, 1999; Schilling, Steiner, Lundahl, & Anderson, 2005). Nevertheless, medical practitioners use academic publications less than do faculty members (Tenopir, King, Clarke, Na, & Zhou, 2007). Engineers also use scientific papers in their professional activities (Kwasitsu, 2003; Freund, Toms, & Waterhouse, 2006) but their colleagues and technical reports are more likely to fulfil their information needs (Hertzum & Pejtersen, 2000). Overall, whilst some people outside of academic settings use scientific publications, they are likely to read less than users inside academia (Tenopir & King, 2002), and access to primary research may be less important in their professions.

Reasons for reading academic publications

Academic publications may be read for different purposes, including long life leaning, research, writing and teaching (Belefant-Miller & King, 2000; King & Tenopir, 1999; King et al., 2009). For example, a survey of scientists and engineers at the Oak Ridge National Laboratory in Tennessee found that doing research, being updated and continuing education were the main reasons for reading academic papers (Tenopir & King, 2002) and astronomers in the United States read articles to help their research and to keep current (Tenopir et al., 2005). Surveys of academics in several countries have found that doing research was the main reason for reading papers while teaching and updating knowledge were secondary reasons (Tenopir et al., 2010). Analyses of online syllabi confirmed that academic publications are routinely used for teaching activities (Kousha & Thelwall, 2008). Practitioners probably have different motivations, however. For example, pediatricians in the American Academy of Pediatrics mainly read academic papers for current awareness (Tenopir, King, Clarke, Na, & Zhou, 2007).

Academic uses of the social web

With the emergence of the social web, some academics have taken advantage of its affordances, although one UK survey of faculty members and PhD students found a modest level of adoption (Procter et al., 2010). Respondents in another survey very positive about using social web platforms and sizable minorities, and used wikis (42%), blogs (39%), social networks (35%), social bookmarking (26%) and micro-blogging (18%) tools (Ponte & Simon, 2011). In contrast, faculty members and PhD students at a university in Finland were familiar with social web tools but few used them for scholarly communication (Gu & Widén-Wulff, 2011). Hence, the uptake of social web services may vary between countries. Similarly, few highly cited researchers in European organisations had profiles in academic social websites, such as Academia.edu (4%), Mendeley (6%), and SlideShare (5%). Hence, more senior researchers may use the social web less than do others (Mas-Bleda, Thelwall, Kousha, & Aguillo, 2014).

Social web tools can help from the beginning a research study to the dissemination of the findings at the end but are mainly used for collaborative writing, conferencing and meeting management (Rowlands, Nicholas, Russell, Canty, & Watkinson, 2011). A survey of scholars from an Indian university found that social scientists used Facebook and ResearchGate for scholarly communication but scientists used them for amusement (Chakraborty, 2012). An analysis of one academic social web site, Academia.edu, found that faculty members were more visible, contributed more and interacted more than did other users (Menendez, Angeli, & Menestrina, 2012). Another study of Academia.edu also found seniority differences but also found some evidence of gender differences in the popularity of users (Thelwall & Kousha, 2014). Although a general purpose social web tool, Twitter is also used by scholars for networking with peers and sharing information with them as well as for spreading information with a wider audience (e.g., Letierce, Passant, Breslin, & Decker, 2010).

Research Questions

The objective of this study is to find out why articles are bookmarked in Mendeley so that Mendeley bookmark counts in altmetrics can be appropriately interpreted in future. The following research questions drive this investigation.

1. Why do people use Mendeley (e.g., as a reference manager, to publicise publications, for social networking)?
2. Why do users bookmark individual publications in Mendeley?

3. To what extent do Mendeley bookmarking counts reflect article readership?

Methods

An online survey was conducted to answer the research questions. This seems to be the first large scale survey to investigate the reasons for using Mendeley to help interpret bookmarking counts.

An unbiased sample of Mendeley users was needed for the survey. A comprehensive list of Mendeley users was therefore needed as a starting point for the sampling. Although Mendeley claims to have more than 2.5 million users (Mendeley, 2013), a full list of its users is not available for researchers. Nevertheless, Mendeley publishes a directory[2] that contained approximately 188,100 users from different disciplines at the time of data collection (October 2013). We used this directory as the largest available list of Mendeley users, although it is presumably biased in some way. We initially selected 5,000 random Mendeley users across all disciplines from the directory and tried to contact the chosen sample by sending direct messages via Mendeley messaging, with permission from Mendeley. This was not successful because, as an undocumented anti-spam feature of Mendeley, only a limited number of messages can be sent each day.

Instead, we emailed Mendeley members using the contact information in their public home pages, if any. For this, a list of all users in the Mendeley directory was automatically extracted, including their research discipline and Mendeley profile URL (see Appendix 1). Next, using web searches in Webometric Analyst (lexiurl.wlv.ac.uk) with the query below, users who had personal web page URLs in their Mendeley profiles were identified automatically from the Bing API (Applications Programming Interface).

"Webpage:" "[two last keywords of the Mendeley Profile URL]" site:
http://www.mendeley.com/profiles

For example, the query `"Webpage:" "kayvan kousha" site: http://www.mendeley.com/profiles/` captured the webpage www.koosha.tripod.com from the user's Mendeley profile. This process identified 19,959 users who had a URL “contact information” section in their Mendeley profile. Email addresses were manually collected from these webpages, when present, giving 6,122 for all disciplines. As shown in Appendix 1, the backgrounds of 8%, 23%, 10%, 26% and 26% of those in the Mendeley directory were arts and humanities, basic science, engineering, medicine and biology and social sciences, respectively. Similarly, 10%, 31%, 12%, 24% and 23% of the extracted emails belonged to users (who shared their emails in their Mendeley profiles) in arts and humanities, basic science, engineering, medicine and biology and social sciences, respectively. This means that the proportion of extracted email addresses for each subject area is only very approximately representative of the population of each discipline in the Mendeley directory (see Appendix 1). This sample clearly biases the results to Mendeley users declaring a website in their profile. These users may tend to be more senior and may be more likely to be based in a richer country, for example.

The survey questions were designed to answer the above research questions and were evaluated and refined through a series of pilot tests with Mendeley users and altmetrics researchers. The survey received ethical approval from the University of Wolverhampton Research Institute for Information and Language Processing. The final version of the questionnaire is at: http://goo.gl/xlbrSl.

In the middle of January 2014, using Survey Monkey, email questionnaire invitations were sent to 5,927 Mendeley users (excluding invitations that bounced) across all disciplines (see Table 1). A reminder was sent to non-responding persons in late January. Participants

[2] http://www.mendeley.com/directory

were offered the chance to win one out of ten $100 Amazon vouchers to increase the response rate. As shown in Table 1, 14.6% (864) people responded to the survey, ranging from 13% in medicine and biology to 17% in the social sciences (Appendix 2). Altogether, 73% of the participants replied to the survey in the first call and 27% responded after the reminder.

Table 1. Email invitations sent to Mendeley users and response rates across disciplines.

Broad disciplines based on users' Mendeley profiles	Number (%) of users in the Mendeley directory	Number (%) of recruited users (excluding bounced emails)	Response rate (No.)
Arts and Humanities	14,380 (7.6%)	582 (9.8%)	13.1% (76)
Basic Science	43,727 (23.2%)	1,843 (31.1%)	13.7% (253)
Engineering	19,229 (10.2%)	7,11 (12%)	17.2% (122)
Medicine and Biology	48,881 (26.0%)	1,440 (24.3%)	12.9% (186)
Social Sciences	49,823 (26.5%)	1,351 (22.8%)	16.8% (227)
Total	188,100 (100%)	5,927 (100%)	14.6% (864)

Results

The survey respondents were representative of the initial survey sample in terms of academic disciplines and to some extent of all Mendeley users (Mendeley, 2012). However, the method of categorising academic disciplines in Mendeley and in this survey may not be identical and so this is a tentative conclusion.

Occupation and Discipline of Respondents

Over half of the survey respondents were PhD students (27%) or postdoctoral researchers (26%) and the rest were mainly assistant (14%), associate (13%), and full (11%) professors. Only 6% of the survey respondents were *other professionals,* and so Mendeley is clearly dominated by academia. There were very few masters (3%) and undergraduate (1%) students, although the email survey method may be biased against students if they tend not have a traditional website, or do not feel the need to publicise it.

Table 2. The occupations declared by the survey respondents (n=864).

Occupation	Participants
PhD student	233 (27%)
Postdoctoral researcher	226 (26%)
Assistant professor/lecturer	121 (14%)
Associate professor/reader / senior lecturer	112 (13%)
Professor	94 (11%)
Other professionals	48 (6%)
Masters student	23 (3%)
Undergraduate student	8 (1%)

Comparing Table 3 and Appendix 2, the respondents are approximately representative of the chosen sample subject areas in terms of numbers. The distribution of the participants also agrees with all Mendeley users at the level of broad disciplines to some extent (Mendeley, 2012).

Table 3. The broad subject areas declared by the survey respondents (n=864).

Broad discipline	Participants
Basic science	232 (27%)
Social sciences	230 (27%)
Engineering	227 (26%)
Medical sciences	120 (14%)
Arts and humanities	55 (6%)

Motivations for Using Mendeley

About 78% of the respondents had a personal library in Mendeley. Most importantly, the majority of respondents (87%) reported that they used Mendeley as a reference manager, whereas only 30%, 25% and 15% used it as a database for searching academic publications, as a tool for publicising their publications, or as a social networking site (Figure 1).

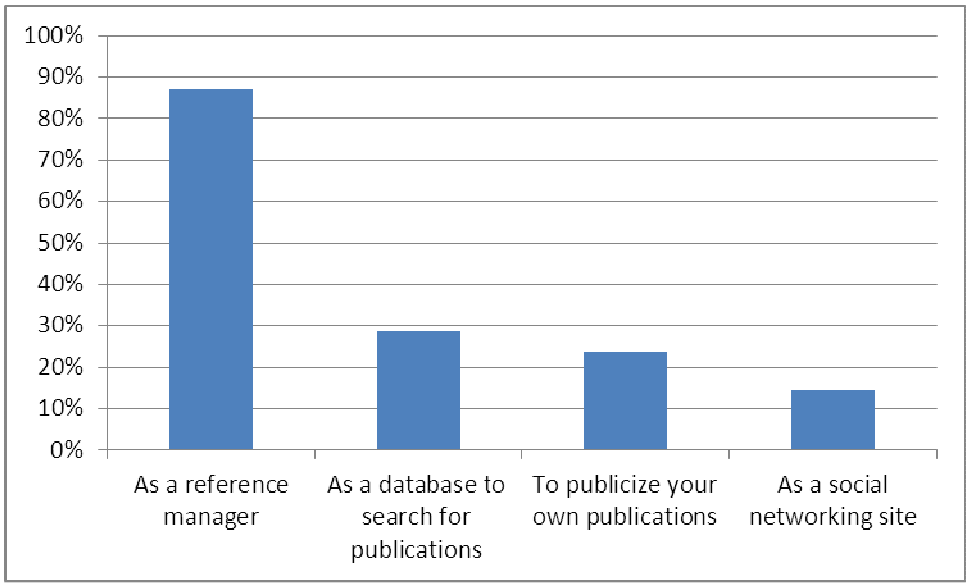

Figure 1. Purposes for using Mendeley, as reported by survey respondents (n=864).

A chi-square test found no significant disciplinary differences in purposes for using Mendeley (p=0.691). Nevertheless, were statistically significant differences between occupations in purposes for using Mendeley (p=0.025; see Appendix 3). Academic staff used Mendeley to publicise their publications more than did the other professions and undergraduate students; masters students used Mendeley as a platform for searching academic publications more than did the other groups.

Motivations for Bookmarking Papers in Personal Libraries

Disciplinary differences About 85% of the respondents across all disciplines bookmarked papers in Mendeley to cite them in their publications. There is strong evidence (p=0.001, see Appendix 5) that *overall* motivations for bookmarking papers differ between disciplines.

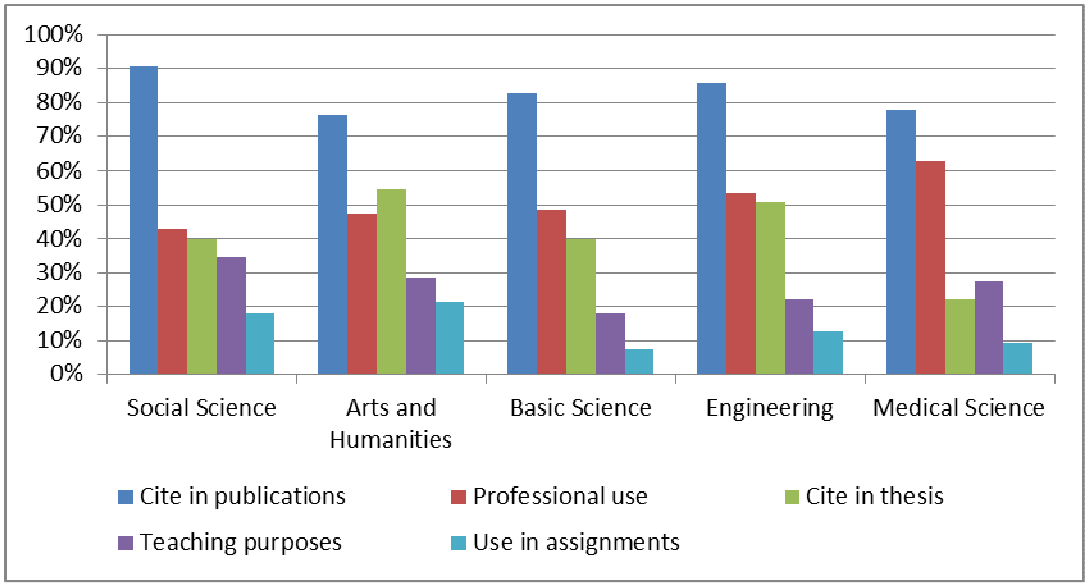

Figure 2. Mendeley users' motivations for bookmarking papers in their personal library by discipline (n=679).

Although bookmarking with the aim of *future citation* was the most common reason across all disciplines, the percentage varied from 91% for social science users to 76% for arts and humanities users, and these differences are statistically significant (p=0.023, see Appendix 5). The second most common purpose for adding scholarly publications to Mendeley was for *professional use* (i.e. to keep track of research relevant to a job) in all subject areas (50%), and there were also disciplinary differences in this p=0.021, see Appendix 6). Most Mendeley users in medical science (63%) and engineering (54%) bookmarked academic records for professional use but most users with basic science (49%), art and humanities (48%) and social science (43%) backgrounds did not. This seems likely to reflect disciplinary differences in the nature of research rather than in the way in which Mendeley is used.

Approximately 40% of the participants added records to their Mendeley libraries to *cite in their thesis or dissertation* but 55% in arts and humanities and 51% in engineering. Approximately 25% of Mendeley users bookmarked publications for teaching and only 13% for use in assignments.

Occupation differences The most common reason for bookmarking scientific publications for professors (83%), associate professors (88%), assistant professors (94%), and PhD students (88%) was to cite in their publications (Figure 3). Unsurprisingly, there were statistically significant differences in motivations for bookmarking documents in Mendeley between different user occupations (p=0.000, Appendix 7). Around 85% of both PhD students and masters students added documents to their Mendeley personal libraries to cite in their theses. Similarly, 38% of masters and 20% of PhD students bookmarked documents for course assignments. Unsurprisingly, scientific documents were bookmarked in Mendeley for teaching mostly by professors (45%), associate professors (36%) and assistant professors (33%).

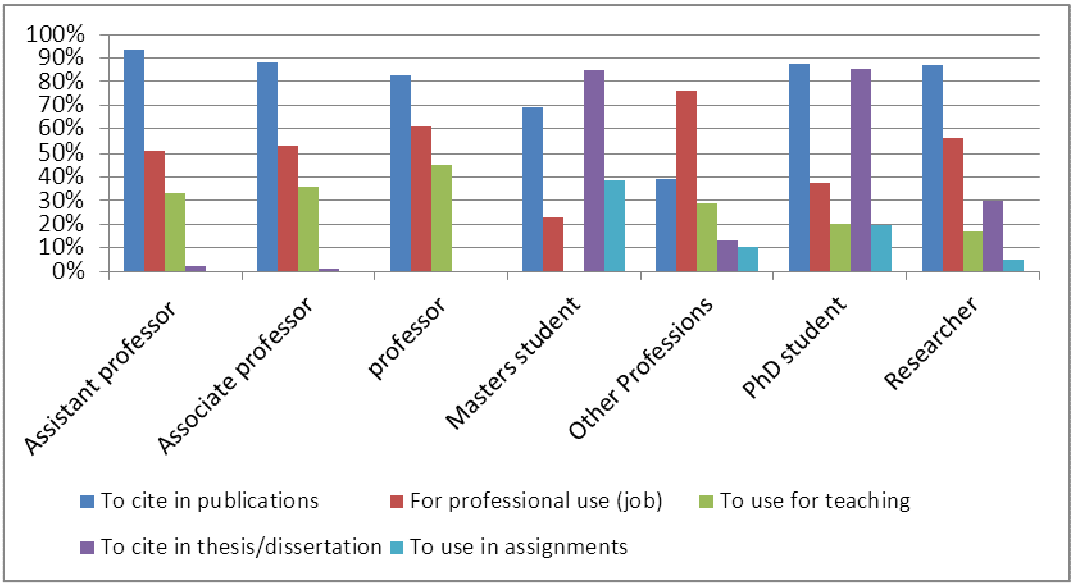

Figure 3. Mendeley users' motivations for bookmarking papers in their personal libraries based on occupation (n=679).

Other professional users mainly bookmarked publications to use in their professional activities (76%), although 39% bookmarked documents to cite in their publications and so were active in research to some extent (Figure 3).

Reading Bookmarked Publications

A total of 679 out of 864 respondents had a personal library in Mendeley. Moreover, 27% of users with a personal library in Mendeley had read or intended to read all of their bookmarked records, 55% had read or intended to read at least half and 18% had read or intended to read less than half of the bookmarked items. Almost none (0.4%) of the users had not read any of their bookmarked records and did not intend to read them. Thus, 82% of the Mendeley users had read or intended to read at least half of the bookmarked publications in their personal libraries. A chi square test (p=0.282, see Appendix 8) found no significant disciplinary differences in the proportions of items from personal libraries that the survey respondents had read. Hence, it seems that in most cases articles bookmarked in Mendeley have been read or are intended to be read by the user.

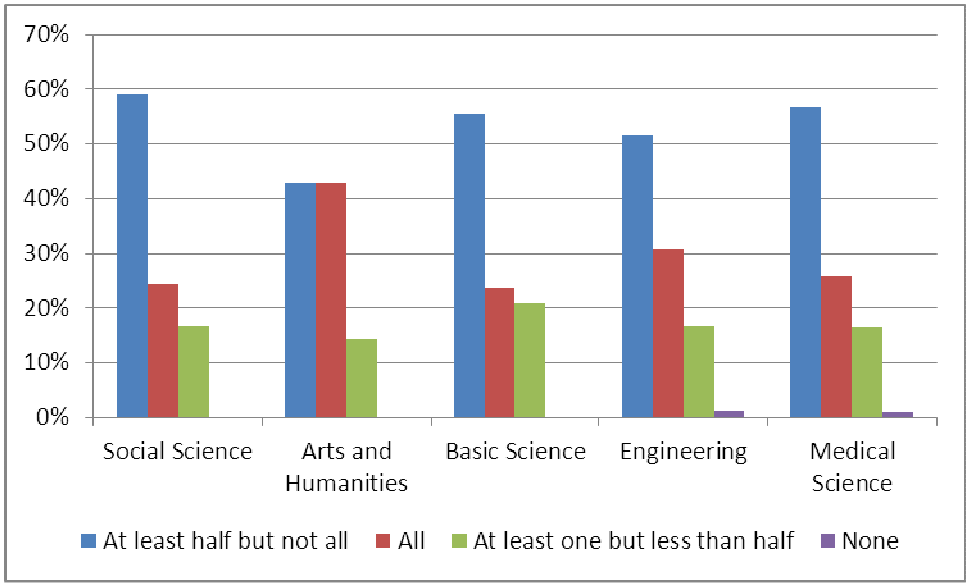

Figure 4. The proportion of the items from Mendeley personal libraries that survey respondents had read by discipline (n=679).

Discussion

Most survey participants were PhD students and postdoctoral researchers, which agrees with previous analyses of Mendeley profiles (Mohammadi et al., in press; Schloegl, Gorraiz, Gumpendorfer, Jack, & Kraker, 2013; Zahedi, Costas, 2013). Perhaps because Mendeley is a social web platform it attracts younger researchers, but senior scholars are unlikely to use social web platforms (Mas-Bleda, Thelwall, Kousha, & Aguillo, 2014). However, the number of masters students was low in this survey in comparison with a previous study, which reported that masters students were among most common readers of Mendeley papers (Mohammadi et al., in press). A possible reason for this is the lower visibility of contact information for masters students in Mendeley in comparison with other categories (e.g., if fewer listed a personal webpage).

In answer to the **first** research question, Mendeley was mainly used to manage references (87%), but was also used for academic literature searching (30%). These reflect Mendeley's nature as a social reference sharing site. Nevertheless, a quarter used Mendeley to publicise research but it was rarely used as a social network site. Mendeley was perhaps not popular as a social network site because some of its social features are not free. For instance, free plan Mendeley users can only create one private group with up to three members.

In response to the **second** research question, the most common reason for bookmarking publications in Mendeley was to cite them in future publications. Mendeley users who were authors of scholarly publications (e.g., professors, assistant professors) were the most likely to bookmark papers for future citation but others can also cite papers in non-journal publications (e.g., dissertations). Therefore, Mendeley bookmarking counts can partly represent future citations and this is consistent with the medium correlations between citations and Mendeley bookmarking counts in previous studies (Bar-Ilan, 2012; Li, Thelwall, & Giustini, 2012; Thelwall, Haustein, Larivière, & Sugimoto, 2013; Mohammadi & Thelwall, 2014).

Surprisingly, around half of the Mendeley users bookmarked publications for professional use, and this amount was higher for those with backgrounds in applied disciplines, such as medical science and engineering. Similarly, the main motivation for *other professionals* (e.g., engineers, surgeons and lawyers) for bookmarking papers in Mendeley

seemed to be related to their professional activities because they work outside academia and may use research for other aims, such as updating their knowledge (Tenopir, King, Clarke, Na, & Zhou, 2007). This is evidence that Mendeley could be used to track the use of academic publications in practical contexts.

The majority of masters and PhD students with a personal library in Mendeley bookmarked academic publications for citing them in their thesis. Thus, Mendeley readership counts may be able to capture citation-like activities in broader contexts than those covered by conventional citation indexes. Moreover, a substantial minority of masters (38%) and PhD (20%) students bookmarked records for completing their assignments, reflecting the educational value of the bookmarked publications. A high proportion of professors (45%), associate professors (36%) and assistant professors (36%) added records to their Mendeley library for use in their teaching activities. In summary, the current study suggests that Mendeley bookmarking counts reflect multiple types of scholarly activities, including future citation in publications and theses, use in practical contexts, and application in teaching and education. These findings are broadly consistent with previous findings about why papers are read (Tenopir et al., 2010) and so Mendeley bookmarking seems to broadly reflect academic reading.

In response to the **third** research question, most Mendeley users had read or intended to read most of the bookmarked publications in their personal libraries. This provides direct evidence that Mendeley bookmark counts can reflect readership, but not that Mendeley bookmarking counts are proportional to the number of readers of a publication, due to the sampling representativeness issues discussed above.

Limitations

The findings are subject to a number of limitations. First, the relatively low response rate to the survey may influence the results, presumably by under-representing less enthusiastic Mendeley users and busy scientists. Second, the Mendeley directory was the source of the sampled Mendeley users but it covers only 188,100 out of the 2.5 million Mendeley users and there is no information about the criteria for listing users in this directory. Thus, the representativeness of the initial sample is unknown, although it broadly matches some known properties of Mendeley users. Third, the sample recruited in this survey is limited to Mendeley users mentioning their personal websites in their Mendeley profiles, and this is likely to bias the findings towards Mendeley users with a greater web presence, disadvantaging masters and undergraduate students. Additionally, the Bing API used to capture the personal webpages in Mendeley user profiles has unknown coverage of this site. Finally, all the data analysed is self-reported and hence maybe misleading to some extent. For example, users may be optimistic in their claims that they will read bookmarked articles in the future. Hence, the findings should be only cautiously generalised to all Mendeley users.

Conclusions

The results suggest that Mendeley bookmarking counts are an indicator of readership because most records bookmarked by most survey respondents had been read or were planned to be read. Moreover, almost all of the findings were broadly consistent with what is known about why academics read articles, giving further evidence for the value of Mendeley bookmark counts. The possibility of connecting bookmarking records to attributes of the readers (i.e., profession, discipline) means that Mendeley can help to reveal information about the readers of individual academic papers, in contrast to typical download data (Moed, 2005). Nevertheless, Mendeley bookmarking cannot reflect the full spectrum of types of reader of academic articles if some types of readers rarely use Mendeley.

The results also show that an important difference between Mendeley bookmarking counts and citation counts for publications is that Mendeley bookmarks can reflect educational and professional uses of articles in addition to citing in (future) research. Even though few professionals seem to use Mendeley, a substantial minority of academics claimed to use it in their professional activities, especially in applied fields such as medical science and engineering. Hence, Mendeley bookmarking counts can perhaps capture some evidence of the wider use of academic publications, which is a key goal of altmetrics research (Priem, Taraborelli, Groth, & Neylon, 2011). The reasons for the previously discovered significant moderate correlations between Mendeley readership and citations (Li, Thelwall, & Giustini, 2011; Bar-Ilan, 2012; Zahedi, Costas, & Wouters, 2013) may be due to the main motivations for bookmarking documents in Mendeley, and the correlations are perhaps not strong because of the variety of purposes for bookmarking papers in Mendeley. For example, some of the highly bookmarked papers may be useful in education rather than research.

In summary, this study confirms that Mendeley readership counts are useful for capturing aspects of the readership of scholarly publications and probably reflect mainly scholarly impact but also educational and professional impact to some extent.

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Appendix 1: Descriptive statistics for Mendeley users who published personal webpage in their Mendeley profiles.

Field	Discipline	Number and % of users in Mendeley directory	Number of users who have contact information in Mendeley profile*	Extracted emails
Art and Humanities	Arts and Literature	4279 (2.3%)	554	169 (2.8%)
	Humanities	4575 (2.4%)	397	94 (1.5%)
	Law	1662 (0.9%)	198	91 (1.5%)
	Linguistics	2174 (1.2%)	299	87(1.4%)
	Design	2480 (1.3%)	427	92 (1.5%)
	Philosophy	1690 (0.9%)	175	65(1.1%)
	All	*14380 (7.6%)*	*2050*	*598 (9.8%)*
Basic science	Environmental sciences	6152 (3.3%)	704	238(3.9%)
	Chemistry	6030 (3.2%)	402	163(2.7%)
	Computer and information science	27491 (14.6%)	3500	842 (13.8%)
	Earth science	4445 (2.4)	587	176 (2.9%)
	Materials science	2631 (1.4%)	277	67 (1.1%)
	Mathematics	2442 (1.3%)	334	117(1.9%)
	Physics and Astronomy	8090 (4.3%)	907	307(5.0%)
	All	*43727 (23.2%)*	*6711*	*1910 (31.2%)*
Engineering	Electrical and electronic engineering	5842 (3.1%)	674	206 (3.4%)
	Engineering	13387 (7.1%)	1273	523 (8.5%)
	All	*19229 (10.2%)*	*1947*	*729 (11.9%)*
Medicine and biology	Biological Sciences	31216 (16.6%)	3323	966 (15.8%)
	Medicine	17665 (9.4%)	1117	525(8.6%)
	All	*48881 (26.0%)*	*4440*	1491(24.4%)
Social Sciences	Business Administration	8552 (4.5%)	583	224 (3.7%)
	Economics	4101 (2.2%)	491	154 (2.5%)
	Education	10047 (5.3%)	280	74 (1.2%)
	Management Science	3428 (1.8%)	386	89 (1.5%)
	Psychology	8981 (4.8%)	1243	366 (6.0%)
	social-sciences	13398 (7.1%)	1765	470 (7.7%)
	Sports and Recreation	1316 (0.7%)	63	17(0.3%)
	All	*49823 (26.5%)*	*4811*	1394 (22.8%)
Total	*Total*	*188100*	*19959*	*6122*

Appendix 2: Respondents to the survey based at the level of sub-disciplines.

Field	Discipline	Number and % of users in Mendeley directory	Number of recruited users (bounced are excluded)	% of recruited users in the sample	Number of respondents	Response rate
Arts and Humanities	Arts and Literature	4,279 (2.3%)	162	2.7%	17	10.5%
	Humanities	4,575 (2.4%)	92	1.6%	7	7.6%
	Law	1,662 (0.9%)	90	1.5%	22	24.4%
	Linguistics	2,174 (1.2%)	84	1.4%	15	17.9%
	Design	2,480 (1.3%)	90	1.5%	6	6.7%
	Philosophy	1,690 (0.9%)	64	1.1%	9	14.1%
	All	14,380 (7.6%)	582	9.8%	76	13.1%
Basic Science	Environmental Sciences	6,152 (3.3%)	228	3.8%	23	10.1%
	Chemistry	6,030 (3.2%)	159	2.7%	29	18.2%
	Computer and Information Science	27,491 (14.6%)	814	13.7%	97	11.9%
	Earth Science	4445 (2.4)	172	2.9%	32	18.6%
	Materials Science	2631 (1.4%)	66	1.1%	14	21.2%
	Mathematics	2,442 (1.3%)	113	1.9%	20	17.7%
	Physics and Astronomy	8,090 (4.3%)	291	4.9%	38	13.1%
	All	43,727 (23.2%)	1,843	31.1%	253	13.7%
Engineering	Electrical and Electronic Engineering	5,842 (3.1%)	199	3.4%	33	16.6%
	Engineering	13,387 (7.1%)	512	8.6%	89	17.4%
	All	19,229 (10.2%)	711	12.0%	122	17.2%
Medicine and Biology	Biological Sciences	31,216 (16.6%)	938	15.8%	118	12.6%
	Medicine	17,665 (9.4%)	502	8.5%	68	13.5%
	All	48,881 (26.0%)	1,440	24.3%	186	12.9%
Social Sciences	Business Administration	8,552 (4.5%)	218	3.7%	38	17.4%
	Economics	4,101 (2.2%)	148	2.5%	23	15.5%
	Education	10047 (5.3%)	72	1.2%	19	26.4%
	Management Science	3,428 (1.8%)	84	1.4%	14	16.7%
	Psychology	8,981 (4.8%)	356	6.0%	67	18.8%
	Social-Sciences	13,398 (7.1%)	457	7.7%	63	13.8%
	Sports and Recreation	1,316 (0.7%)	16	0.3%	3	18.8%
	All	49,823 (26.5%)	1,351	22.8%	227	16.8%
Total		*188,100*	*5,927*	*100.0%*	*864*	*14.6%*

Appendix 3: A chi-Square test of motivations for using Mendeley by user occupation.

Reason of using Mendeley/ Occupation	Assistant professor	Associate professor	professor	Other Professions	PhD student	Researcher	Undergraduate and masters students	P-Value
As a reference manager	102 (57%)	92 (50%)	76 (48%)	43 (51%)	217 (64%)	195 (59%)	27 (49%)	
To publicize your own publications	31 (17%)	37 (20%)	28 (18%)	12 (14%)	37 (11%)	57 (17%)	5 (9%)	
As a social networking site	16 (9%)	20 (11%)	18 (11%)	12 (14%)	32 (9%)	22 (7%)	7 (13%)	0.025
As a database to search for publications	31 (17%)	34 (19%)	36 (23%)	18 (21%)	54 (16%)	58 (17%)	16 (29%)	
Total	180	183	158	85	340	332	55	

Appendix 4: A chi-Square test of all motivations for bookmarking documents in Mendeley across different disciplines.

Motivations of bookmarking / discipline	Arts and Humanities	Basic Science	Engineering	Medical Science	Social Science	p value
To cite them in my publications (e.g., papers, books)	32 (33%)	153 (42%)	150 (38%)	74 (39%)	165 (40%)	
To cite in my thesis / dissertation	23 (24%)	74 (20%)	89 (23%)	21 (11%)	73 (18%)	
To use them for teaching purposes	12 (13%)	33 (9%)	39 (10%)	26 (14%)	63 (15%)	0.001
To use them in my assignments for a course that I am taking	9 (9%)	14 (4%)	22 (6%)	9 (5%)	33 (8%)	
For professional use (job)	20 (21%)	90 (25%)	94 (24%)	60 (32%)	78 (19%)	
Total	96	364	394	190	412	

Appendix 5: A chi-square test for citing bookmarked documents in future publications (e.g., papers, books) across different disciplines.

Disciplines	Yes	No	p value
Arts and Humanities	32	10	
Basic Science	153	32	
Engineering	150	25	0.023
Medical Science	74	21	
Social Science	165	17	

Appendix 6: A chi-square test for using bookmarked documents in professional (job) activities across different disciplines.

Discipline	Yes	No	p value
Arts and Humanities	20	22	0.021
Basic Science	90	95	
Engineering	94	81	
Medical Science	60	35	
Social Science	78	104	

Appendix 7: A chi-Square test of all motivations for bookmarking documents in Mendeley for different user occupations.

Motivations of bookmarking / Occupation	Assistant professor	Associate professor	professor	Other Professions	PhD student	Researcher	Undergraduate and masters students	p value
Future citation (publications and thesis)	90 (51%)	74 (48%)	57 (40%)	20 (31%)	353 (69%)	203 (6%)	26 (65%)	0
Educational and teaching activities (assignment and teaching)	38 (22%)	37 (24%)	44 (31%)	15 (23%)	81 (16%)	38 (11%)	9 (23%)	
For professional use (job)	48 (27%)	44 (28%)	42 (29%)	29 (45%)	77 (15%)	98 (29%)	5 (13%)	
Total	176	155	143	64	511	339	40	

Appendix 8: A chi-Square test for the proportion of the items from their Mendeley personal library that the users had read or will read across different disciplines.

Proportion of the items read or will read from Mendeley personal library	%Social Science	%Arts and Humanities	%Basic Science	%Engineering	%Medical Science	P value
All	24%	43%	24%	31%	26%	0.282
At least half but not all	59%	43%	55%	51%	57%	
At least one but less than half.	17%	14%	21%	17%	16%	
None	0%	0%	0%	1%	1%	
Total	185	42	182	173	97	