Disciplinary differences in the use of academic social networking sites

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Abstract

Purpose: The main objective of this article is to detect and describe disciplinary differences in the users and use of several social networking sites by scientists.

Design/methodology/approach: *Consejo Superior de Investigaciones Científicas* (CSIC) (Spanish National Research Council) researchers registered in the most currently relevant academic social network sites (Google Scholar Citations, Academia.edu, ResearchGate and Mendeley) were analysed. 6,132 profiles were classified according the eight research areas of the CSIC.

Findings: Results show that Academia.edu is massively populated by humanists and social scientists, while ResearchGate is popular among biologists. Disciplinary differences are observed across every platform. Thus, scientists from the humanities and social sciences and natural resources show a significant activity contacting other members. On the contrary, biologists are more passive using social tools .

Originality/value: This is the first study that analyses the disciplinary performance of a same sample of researchers on a varied number of academic social sites, comparing their numbers across websites.

Keywords:

Webometrics; Academic social sites; Altmetrics; Spanish National Research Council

Introduction

Social networking sites have become increasingly important in the scholarly community. Many researchers have built personal profiles that allow them to interact with colleagues and share interests, questions and papers (Nentwich and König, 2014). These public profiles also provide the opportunity to boost one's achievements and compete with other researchers for social recognition and future research rewards (Bik and Goldstein, 2013). This transparent attitude is also favouring the possibility of auditing the research performance of these scientists and making comparisons across disciplines, institutions, and countries. Hence, scientometricians are facing a new

challenge to measure and evaluate the online activity of these users in the context of the research evaluation (Priem and Hemminger, 2010). For example, the number of views, downloads and followers are statistics produced by these sites that provide a new perspective on the social nature of science. These metrics might be considered in research evaluation as signs of scholarly impact and popular attention. However, before incorporating these metrics in assessment exercises, it is necessary to understand their meaning, limitations and connections with traditional impact measures (Bollen *et al.*, 2009; Priem *et al.*, 2012; Thelwall *et al.*, 2013). Even more, it is necessary to study the characteristics of the users of these platforms and how their functionalities are used to understand the nature and origin of these alternative indicators. These tools need to be analysed in order to validate whether they are representative of the entire scholarly community or if only specific types of disciplines are using them. This study aims for detecting disciplinary differences in the population and use of some of the most popular academic social network sites: Google Scholar Citations, Academia.edu, ResearchGate and Mendeley.

Related research

The fast growth of academic social network sites sets up the need of knowing how these sites are populated. Several studies showed the low uptake of these technologies by the research community. Bik and Goldstein (2013) mentioned that in 2011 only 2.5% of UK and US academics had created a Twitter account. Haustein *et al*. (2014), tracking the presence of 57 scientometricians on the Web, found that 23% were present on Google Scholar Citations and 16% had a Twitter account, whereas Mas-Bleda *et al.* (2014) followed 1,517 highly cited authors in several social sites, uncovering a low adoption rate and the limited overlap of academic social sites. Ortega (2015) specified that from a sample of CSIC's researchers 72% had a profile in only on academic social site. Besides this low use of social media platforms by scientists, several studies demonstrated that these sites have an unbalanced population: for example, on Academia.edu, humanists represented the majority of the population (Thelwall and Kousha, 2014) and the most active user group (Almousa, 2011); whereas computer and information scientists were dominant on Google Scholar Citations (Ortega and Aguillo, 2012). To a lesser extent, ResearchGate showed a slight predominance of biology researchers (ResearchGate, 2014).

Along these lines, many papers have described the advantages of social networks for research performance since a theoretical approach (Bullinger *et al*., 2010; Veletsianos and Kimmons, 2012; Kelly, 2013). Others have employed surveys to assess the opinion of researchers about the use of these tools (Chakraborti, 2012; Jahan and Ahmed, 2012). The most relevant and recent was the questionnaire by the journal *Nature* (Van Noorden, 2014). This study showed that researchers use social sites differently. For example, ResearchGate and Academia.edu were mainly utilised for contacting new collaborators, while Mendeley was used for uncovering new papers. Haustein *et al*. (2014) also report that Google Scholar Citation was used to check citations, while Academia.edu and ResearchGate were used to upload papers.

In this context, where each social site is used for different purposes, several studies have analysed if differences occur across research disciplines as well. It is interesting that most of these studies were made using Mendeley. Oh and Jeng (2011) studied user groups on Mendeley and found that core humanist disciplines (arts and literature, law) had the smallest proportion of users forming groups, while computer science was the discipline with most users in discussion groups. Jiang *et al*. (2013) presented that humanities' scholars had more followers as a proportion of the number of users. On the other hand, Jeng *et al*. (in press) found no statistical differences by disciplines in the motivations to use Mendeley. Mohammadi and Thelwall (2014) observed that correlations between readership counts and citations for the social sciences were higher than for the humanities.

However, studies analysing disciplinary differences on scholarly social networking sites except Mendeley are rare. Kadriu (2013) extracted several collaborative networks in ResearchGate by group of interest. Thelwall and Kousha (2014) analysed metrics from Academia.edu in four disciplines, but they did not find significant differences. Jordan(2014), by means of a questionnaire, detected that humanists and social scientists follow people who they do not know personally.

The present study analyses the use of different academic social network sites by a large number of researcher (+6,000) to explore disciplinary differences within and across the most popular platforms Google Scholar Citations, Academia.edu, ResearchGate and Mendeley.

Objectives

The main objective of this article is to detect and describe disciplinary differences in the population and use of several social platforms for scientists. The following research questions are analysed:

- Are there research fields more prone to use academic social sites than other ones?
- Are there research disciplines that prefer to use one academic site instead of other?
- Is there any behavioural difference in the use of social sites across disciplinary research areas?
- Are these disciplinary differences transversal across different sites or they contrarily depend on each social platform?

Methods

Object of study: CSIC

Consejo Superior de Investigaciones Científicas (CSIC) is the largest research organization in Spain, which comprises around 11,000 staff members (95% of them

devoted to research activities) and more than 120 research institutes and centres (CSIC, 2013). The reasons to choose CSIC for this study are:

- Size: Being one of the largest research institutions (Scimago Lab, 2015) in the world ensures the obtaining of a wide and statistically representative sample.
- Controlled population: A sample from a specific institution simplifies the retrieval of profiles, the unambiguous identification of users and disambiguating researchers with similar names.
- Multidisciplinary centre: CSIC is divided in eight research areas from Humanities and Social Sciences (Area 1) to Chemical Science and Technologies (Area 8). This allows for the comparison of the behaviour of a same group of authors in several platforms using a same subject matter classification.

Data sources and extraction

Four academic social sites were selected: Google Scholar Citations, ResearchGate, Academia.edu and Mendeley. Google Scholar Citation cannot exactly be named a social network, because it does not allow the interaction among users. However, setting up a profile is voluntary, which makes it possible to analyse the extent to which researchers are interested in maintaining such a profile. In addition, it provides a list of publications such as Academia.edu and ResearchGate. The reasons to select these platforms are that they are the sites with most profiles and they currently are the most popular in the scholarly community (Nentwich & König, 2014). Therefore the obtained samples are highly representative. Another reason is that they present measures on usage and performance which makes it possible to compare metrics across services.

Google Scholar Citations (GSC) presents for each researcher their list of publications as indexed in Google Scholar and provides some basic bibliometric indicators based on citations within the platform. These profiles are created and edited by the users themselves so that biographic information on each researcher is optional and written in natural language. This provokes the principal disadvantage of GSC, that is, the hard and tedious task of normalization and identification of affiliations. Three queries were therefore launched to retrieve the largest number of CSIC's researchers: CSIC, "Consejo Superior de Investigaciones Cientificas" and "Spanish National Research Council". In consequence, profiles without this institutional information were not retrieved. Next, this list was revised to eliminate false positives (i.e. "formely in CSIC")

ResearchGate (RG) is a social networking site that allows uploading papers, taking part in discussions, and following other researchers. RG is the site that provides the largest number of indicators at the author level, going from social measurements (followers, following) and usage metrics (page view, document downloads) to bibliometric indicators (impact points, papers and citations). RG Score is a compound index based on these indicators. Impact Points is the addition of the Journal Impact Factor (JIF) of the sources where each paper was published. However, this indicator takes their values from the last JIF updating independently from the publication date, so

articles from different years have the same JIF. Authors are optionally able to link with their academic institutions; therefore the Institutions section does not ensure that all researchers from CSIC are actually attached to their organization. For example, 4% of CSIC's researchers are not linked to "Spanish National Research Council". The three queries used for GS were then applied to retrieve all the CSIC's.

Academia.edu is a web platform centred in hosting academic papers that can be shared among their users. Academia.edu allows users to build a profile along with the list of documents uploaded to Academia.edu. This profile is completed with statistics on usage (views) and social interactions (followers/following). As in RG, each author profile is assigned to an institution, but in this case the action is mandatory. All profiles linked to "CSIC (Consejo Superior de Investigaciones Científicas-Spanish National Research Council)" were extracted.

Mendeley, a reference manager, is focused on sharing bibliographic references and discussing in thematic groups. Unlike the rest of the social network sites, Mendeley is more focused on publications than on authors. In fact, in the context of altmetrics the number of readers is being used as an impact measure of articles, while author profiles are much less explored. Due to this, Mendeley is the academic social site that displays less usage information on profiles, including only number of followers/following as social indicators. Compared to the other platforms, it is more difficult to retrieve authors belonging to a certain institution, because the search function is limited to retrieving author names only. A list of names from the previous sites (GSC, RG and Academia.edu) was used to retrieve Mendeley profiles from CSIC's researchers.

A specific SQL script was written for each service to automatically extract profiles and their indicators between April and May 2014. Only for RG this task was done offline because of some limits in its HTML code.The query results were saved and then extracted. In total, 6,132 profiles were retrieved and used in this study.

CSIC's Annual Report 2013 was used to identify research staff by research areas (CSIC, 2013). These data were used to compute the penetration index of these academic social sites in the academic community. In CSIC, each research institute belongs to one research area. The classification of profiles was then done through the affiliations included in their profiles.

Disambiguation and data cleaning

The first step to tie each author with their profiles was to split their names in three parts: name, surname1, and surname2 (in Spanish it is usual to use two surnames). After a manual revision, abbreviations and misspellings were corrected to unify these names and detect duplicate profiles. In the case of authors with several profiles, those with less content were removed. Mendeley's list could have some limits because it was generated from the profiles of the other services. Therefore, only profiles from authors previously registered in GSC, RG and Academia.edu were retrieved.

The next step was to compare each list of profiles through queries that match the presence of a same author in different web services. In cases of authors which fit in with several profiles, different heuristics were employed to individuate each profile:

- A picture of each profile was downloaded to help to identify the same person in other services.
- Affiliations, interests, labels, and thematic classifications were compared to confirm different profiles from the same author.
- Co-authors and followings/followers lists were explored to identify similar connections, because profiles with the same name and similar contributors are assumed that belong to the same person.
- Finally, publication lists were also examined to identify affiliations and research interests.

Statistics

Kruskall-Wallis H test detects if *n* data groups belong or not to the same population. This statistic is a non-parametric test, suitable to non-normal distributions. This type of distributions is frequent in large web and social network data. In this case, this test allows to find statistical differences between several non-parametric samples.

Results

Presence and market penetration

This section shows the proportion of researchers from the eight research areas who are present on the various academic social network platforms.

Research Areas	*Research Staff*	*Authors in social sites*	*Profiles*	*Mendeley*	*Google*	*Academia*	*ResearchGate*	*Market penetration*
Central Services	635	39	46	6	2	29	9	**6.14**
Biology and Biomedicine	2,377	746	887	99	145	24	619	**31.38**
Materials S&T	1,263	445	585	75	127	53	330	**35.23**
Agricultural Sci.	1,535	592	754	60	131	45	518	**38.57**
Chemical S&T	1,207	493	614	62	92	35	425	**40.85**
Food S&T	587	242	285	19	21	16	229	**41.23**
Physical S&T	1,346	573	838	128	257	52	401	**42.57**
Natural Resources	1,772	940	1482	283	433	117	649	**53.05**
Humanities and Social Sci.	749	424	641	55	107	288	191	**56.61**
TOTAL STAFF	**11,471**	**4,494**	**6,132**	**787**	**1,315**	**659**	**3,371**	**39.18**

Table 1. Distribution of profiles, authors in social sites and total staff by research areas.

Table 1 contains the CSIC research staff by scientific areas as well as the number of researchers with a profile in any academic social site and the total profiles in each service. In addition, the penetration index shows the ratio of total CSIC scientific workers by number of CSIC profiles in academic social sites. This indicator lets us to know in a normalized way the degree of interest of the academic social sites for a

disciplinary group. In general, 39.2% of the CSIC staff has a profile in an academic social site. According to research areas, Humanities and Social Sciences (56.6%) and Natural Resources (53%) are the academic sections with the largest proportion of researchers with a profile identified on a social site. The research areas with a lowest presence on academic social networking sites are Biology and Biomedicine (31.4%) and Materials S&T (35.2%).

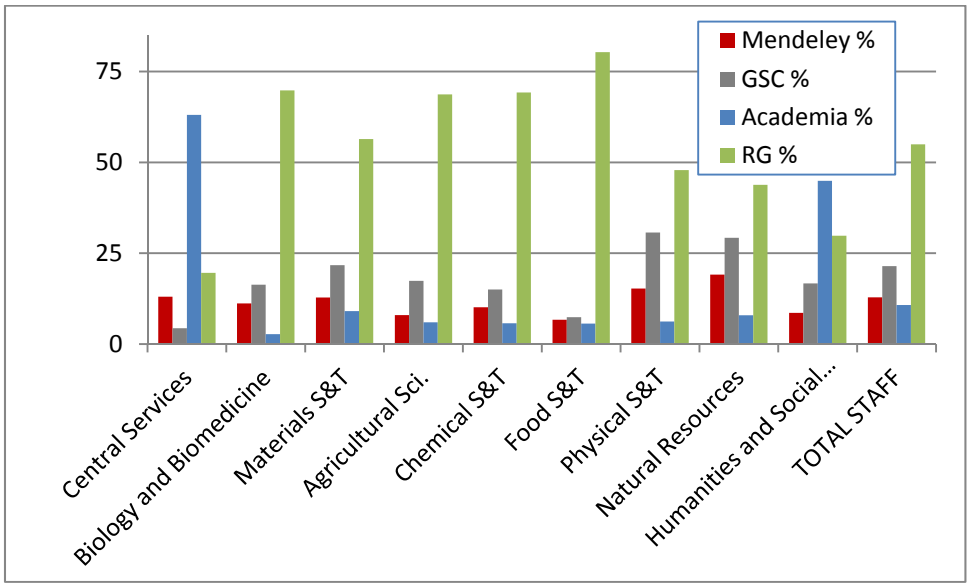

Figure 1. Percentage of profiles in each academic social site by research areas

Figure 1 describes the distribution of CSIC staff across the four social network sites. The social sites most used are RG (54.9%), followed by GSC (21.4%), Mendeley (12.8%) and Academia.edu (10.7%). Some research areas describe particular preferences when they come to use certain social services. Thus, Academia.edu is mainly used by researchers from Humanities and Social Sciences (45%) and Central Services employees (63%), most of these last are librarians that work in centralized units. RG is the favourite source for researchers from Food S&T (80.3%) and Biology and Biomedicine (69.8%). Meanwhile GSC and Mendeley are most used by Physical S&T (GSC=30.6%; Mendeley=15.3%) and Natural Resources' researchers (GSC=29.2%; Mendeley=19.1%). It is important to remind the limitation of Mendeley's sample, which was obtained from the profiles of the other sites. It is possible that the percentage of Mendeley profiles would be higher.

Publications

In the cases of Academia.edu and RG, the number of publications of users can be considered as an indicator of the type of usage made done by the members, as these papers are voluntary uploaded. In GSC, these documents are automatically added to the profile from the main database Google Scholar. This fact would be a good reference to compare the content contribution in the other sites, because they are included by different reasons.

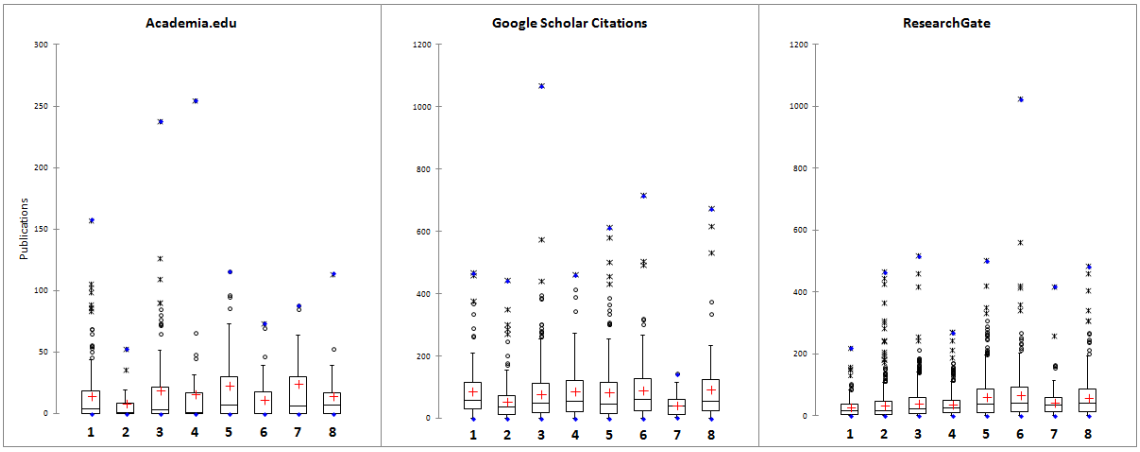

Figure 2. Box plots of papers by research areas in the three academic social sites

	Research Areas	*Academica.edu*	*GSC*	*RG*
1	Humanities and Social Sci.	13.84	88.78	28.80
2	Biology and Biomedicine	7.75	56.99	36.57
3	Natural Resources	18.65	79.61	42.35
4	Agricultural Sci.	15.65	89.85	37.98
5	Physical S&T	22.51	85.32	**63.04**
6	Materials S&T	10.96	92.15	**68.77**
7	Food S&T	24.15	44.57	**43.79**
8	Chemical S&T	14.00	95.51	**60.68**
	Total	14.8	81.7	47.4

Table 2. Average of papers by research areas in the three academic social sites (in bold significant differences p<.0001)

Table 2 shows the average number of papers of researchers of the various research areas in Academia.edu, RG and GSC. Figure 2 demonstrates the distributions in box plots. GSC (81.7) is by far the service that most papers include, almost doubling RG (47.4). The low average of papers in Academia.edu (14.8) could be caused by the platform including uploaded documents and not just bibliographic information.

The results show that, on Academia.edu, the research areas with the highest number of documents per researcher uploaded are Food S&T (24.1), Physical S&T (22.5) and Natural Resources (18.6), while Biology and Biomedicine (7.7) and Materials S&T (10.9) are the disciplines that employ this functionality the less. However, the Kruskal-Wallis test does not confirm those differences to be statistically significant (K=6.6, p-value=.47). To the opposite, it finds differences on GSC (K=23.6, p-value=.001), on which Food S&T (44.6) and Biology and Biomedicine (57) are much less active than Chemical S&T (95.5) and Materials S&T (92.1). Finally, RG presents a high publication rate for Materials S&T (68.7) and Physical S&T (63) and a low average of uploaded papers for Humanities and Social Sciences (28.8) and Biology and Biomedicine (36.6). In general, from these results it is deduced that Biology and Biomedicine and Food S&T are the disciplines that upload fewer papers on average. On the contrary, the most active users in this facet are Chemical S&T and Materials S&T

profiles, although the uptake of the latter in terms of the penetration index is lower in Academia.edu.

Research Impact

Only two services, GSC and RG include information on the research impact of author profiles. The RG Score was not considered because this measure is calculated as a composite index from other RG indicators, such as publications, followers/followings, downloads and views. RG Impact points is the addition of each journal's impact factor where each paper is published. Thus, if a profile has two papers, one published in journal A (IF=1.24) and another in journal B (IF=4.53), the RG Impact point of that profiles is 5.77.

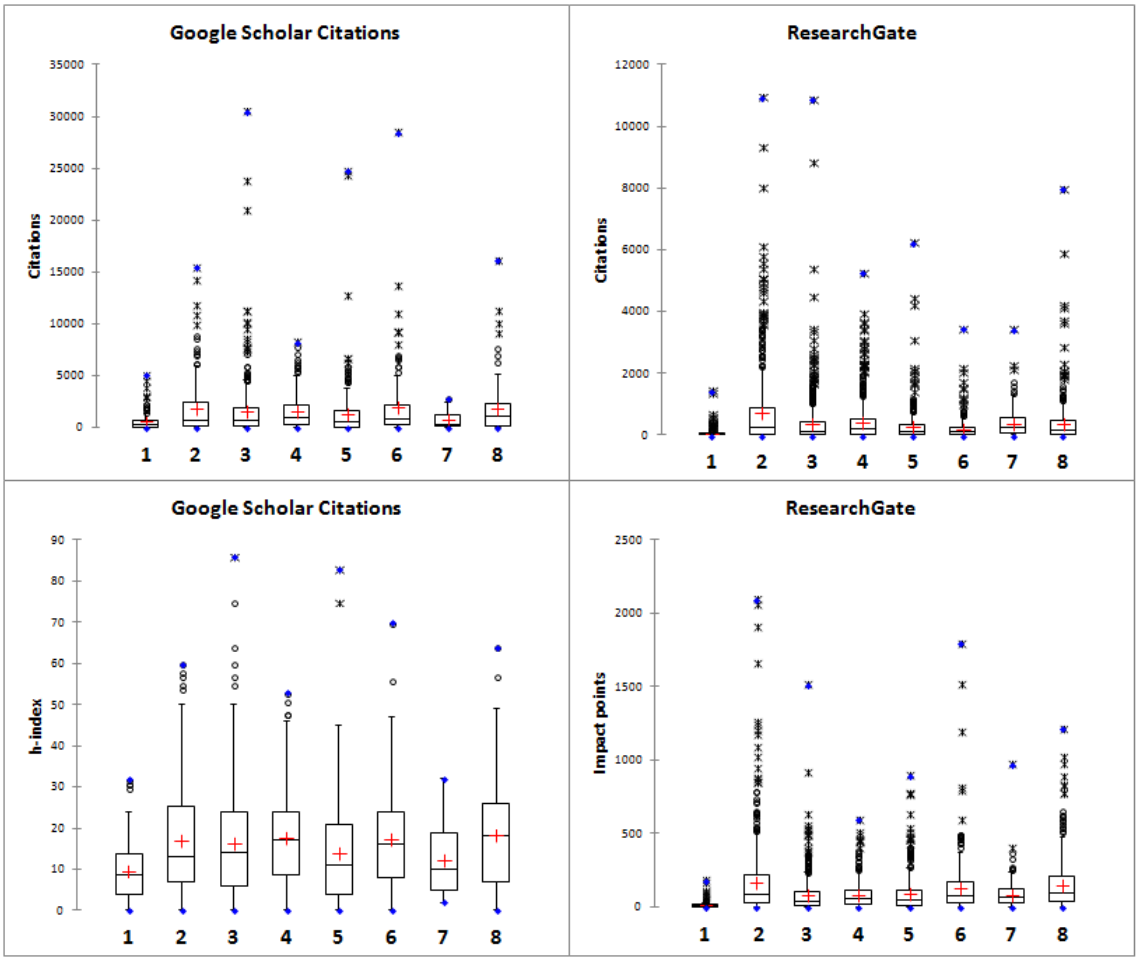

Figure 3. Box plots of impact measurements by research areas in two academic social sites

		GSC		*ResearchGate*	
	Research_Area	Citations	h-index	Impact points	Citations
1	Humanities and Social Sci.	**621.25**	**9.91**	**16.89**	**75.04**
2	Biology and Biomedicine	1910.31	17.25	169.35	754.33
3	Natural Resources	1549.91	16.45	**80.34**	**379.38**
4	Agricultural Sci.	1609.62	17.82	**80.97**	441.86
5	Physical S&T	1322.92	14.18	**95.94**	**286.15**

6	Materials S&T	2014.88	17.76	132.50	**203.22**
7	Food S&T	766.05	12.67	**88.07**	384.68
8	Chemical S&T	1899.48	18.65	149.20	391.65
	Total	1532.90	15.92	111.46	414.37

Table 3. Average of impact measurements by research areas in two academic social sites (in bold significant differences p<.0001)

Figure 3 and Table 3 display the distribution of several impact measurements from GSC and RG. Only citation counts are comparable between both platforms. GSC is basically 4 times larger than RG, which shows that depth of GSC's indexing, as well as the limits of RG to compute or extract citations. These differences are also due to the aforementioned fact that GSC extracts directly their papers from Google Scholar database, while RG hosts documents voluntarily uploaded by the users.

The discipline where researchers have the highest mean citation scores in GSC is Materials S&T (2014), followed by Biology and Biomedicine (1910) and Chemical S&T (1899). In the case of RG, Biology and Biomedicine (754) is the discipline where researchers have the highest number of citations in average, followed by Agricultural Sciences (441) and Chemical S&T (391). According to the h-index of GSC, the largest values are for Chemical S&T (18.6) and Agricultural Sciences (17.8). On the other hand, Impact points of RG signs that Biology and Biomedicine (169) and Chemical S&T (149) accumulate greater impact than the other research areas. Summing up, Humanities and Social Sciences is the research area that has the worst lowest research impact, with statistical differences regarding other disciplines. Meanwhile, Biology and Biomedicine and Chemical S&T are the subjects that achieve the most highest impact according to the indicators provided on the platforms.

Social connections

This section explores disciplinary differences in the number of followers and following accounts from Academia.edu, Mendeley and RG. GSC followers data were omitted because they are barely representative. These indicators describe the social connectivity between profiles.

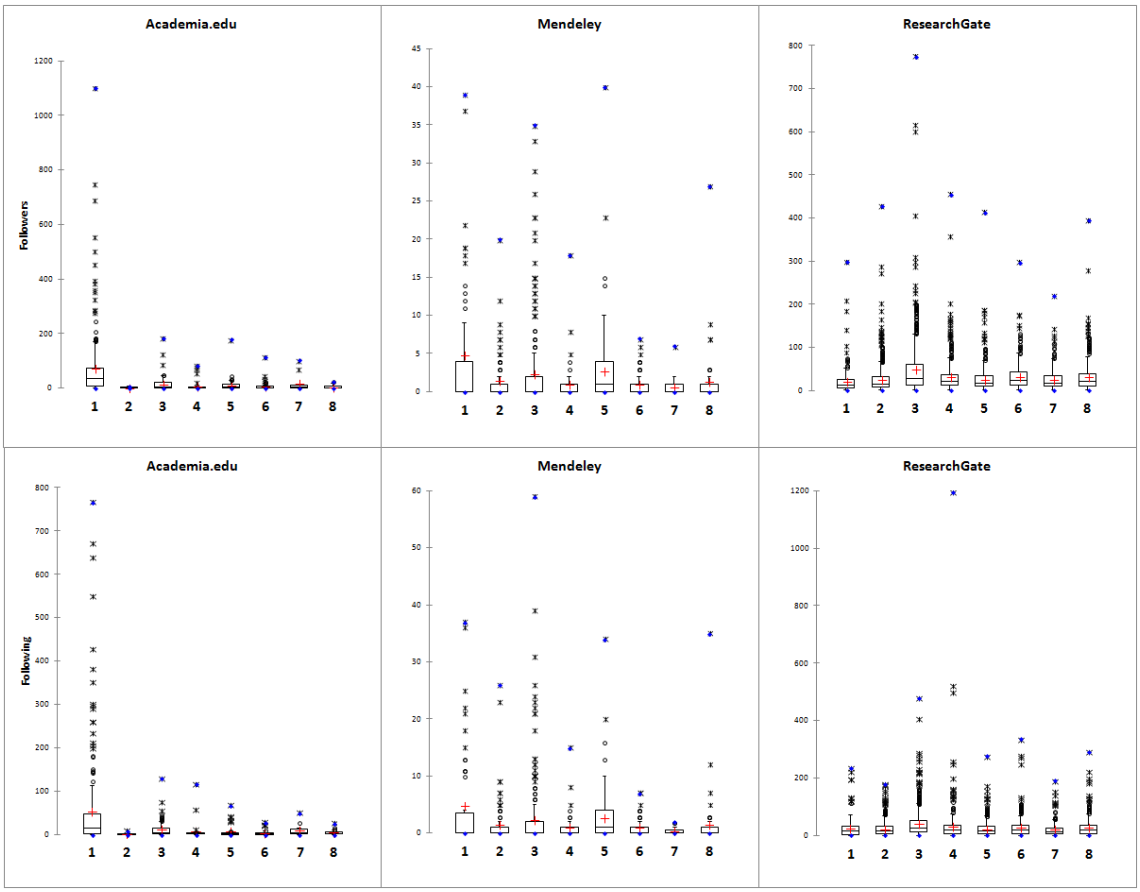

Figure 4. Box plots of followers/followings by research areas in the three academic social sites

	Research_Area	*Academia.edu*		*Mendeley*		*ResearchGate*	
		Followers	Followings	Followers	Followings	Followers	Followings
1	Humanities and Social Sci.	**73.49**	**52.95**	4.82	4.84	22.61	26.09
2	Biology and Biomedicine	2.20	1.00	1.41	1.56	25.59	22.69
3	Natural Resources	14.12	**11.05**	2.37	2.39	**50.10**	**41.90**
4	Agricultural Sci.	9.18	6.33	0.97	0.97	**31.75**	30.84
5	Physical S&T	12.62	6.91	2.70	2.64	26.99	23.45
6	Materials S&T	8.48	3.29	1.00	1.00	**32.29**	28.70
7	Food S&T	17.23	9.46	0.63	0.37	27.00	22.38
8	Chemical S&T	5.26	4.48	1.35	1.47	**32.48**	28.20
	Total	37.73	26.83	2.11	2.13	32.91	29.24

Table 4. Average of followers/followings by research areas in the three academic social sites (in bold significant differences p<.0001)

Table 4 and Figure 4 provide the distribution of the number of followers and following by each research area. On average, it is observed that CSIC members have more accounts that follow them (followers) than they follow themselves (following). The exceptions — Humanities and Social Sciences in RG, and small differences in some cases of Mendeley — might be due to websites' disciplinary orientation which we have seen in Figure 1. Results show that there is a very different use of these elements in

each website. RG is the site in which the followers and followings are more uniformly distributed, whereas Academia.edu presents an important bias to Humanities and Social Sciences. Mendeley shows very low numbers, because it recently incorporated this functionally (Bonasio, 2014).

In the case of Academia.edu, our results confirm that the network is massively used by humanities and social scientists as they have, on average, 73.5 followers and 52.9 followings, which is far above Food S&T (followers=17.2; followings=9.5) and Natural Resources (followers=14.1; followings=11). In Mendeley, this pattern persists but with smaller differences across disciplines. Humanities and Social Sciences is the most active area (followers=4.8; followings=4.8), followed by Physical S&T (followers=2.7; followings=2.6) and Natural Resources (followers=2.4; followings=2.4). To the opposite, Natural Resources (followers=50.1; followings=41.9) emerges as the most socially-active research area in RG, followed by Chemical S&T (followers=32.5; followings=28.2) and Materials S&T (followers=32.3; followings=28.7). In general, it is shown that scholars in the Humanities and Social Sciences and Natural Resources are the most active on the social media platforms studied, while Biology and Biomedicine is the section that uses these social functionalities least.

Usage metrics

Finally, usage measures were analysed to understand how the scientific profiles are used by users in terms of document and profile views. In this case, only Academia.edu and RG contain indicators of this type.

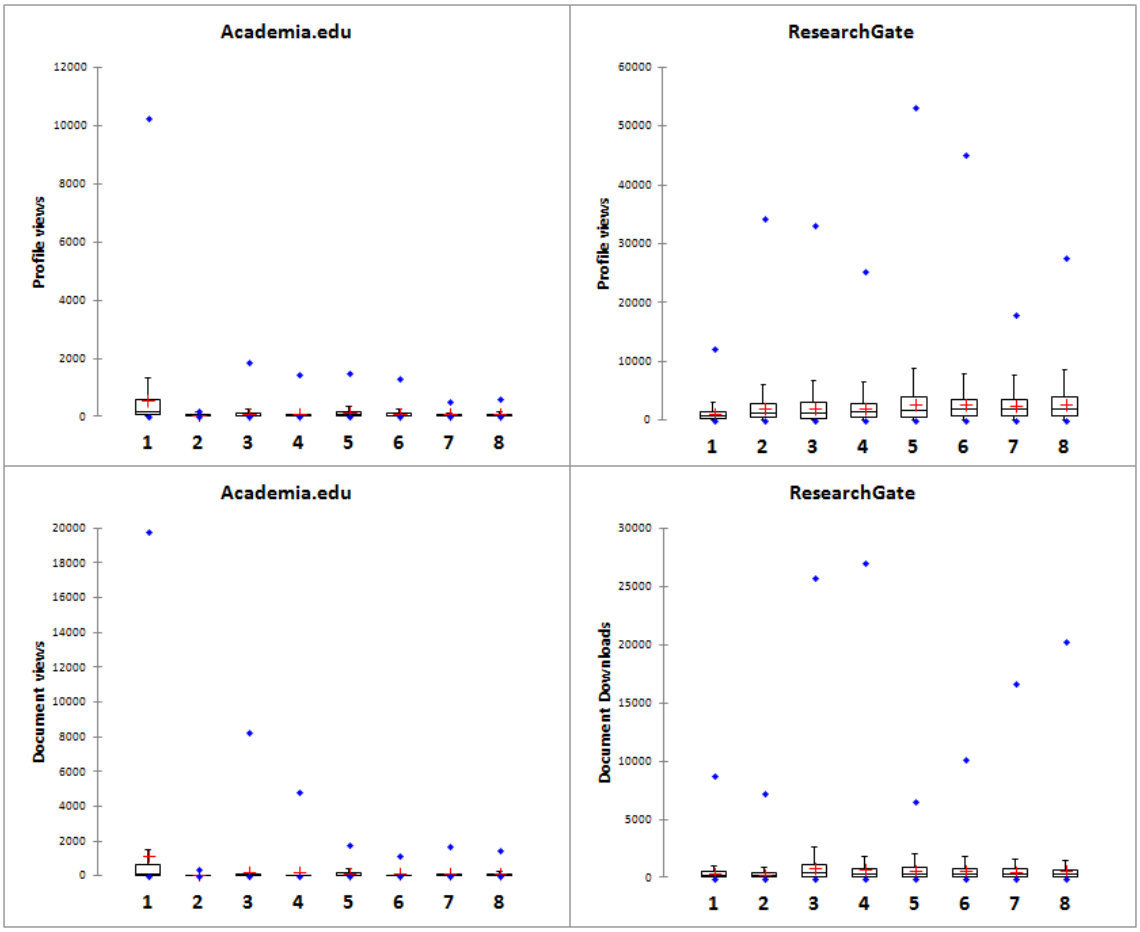

Figure 5. Box plots of document and profile views by research areas in two academic social sites

		Academia.edu		*ResearchGate*	
	Research Area	Document views	Profile views	Profile views	Downloads
1	Humanities and Social Sci.	**1171.4**	**569.1**	1165.3	437.9
2	Biology and Biomedicine	53.1	49.7	2125.5	371.4
3	Natural Resources	228.7	124.3	2114.4	**926.3**
4	Agricultural Sci.	228.0	96.0	2140.2	**820.1**
5	Physical S&T	191.7	167.7	**2776.2**	**649.3**
6	Materials S&T	125.0	115.0	**2722.9**	**645.6**
7	Food S&T	188.6	87.7	**2559.5**	630.5
8	Chemical S&T	127.5	88.8	**2823.6**	696.1
	Total	607.52	310.38	2332.11	671.63

Table 5. Average of document and profile views by research areas in two academic social sites (in bold significant differences p<.0001)

Figure 5 and Table 5 present the distribution of usage metrics by research areas. Figure 5 shows that these variables are extremely skewed. In these distributions, most of the profiles are rarely visited, while only a few of them attract most of the views. In general, RG's members have 7 times more views than Academia.edu. However, both services present similar document views/downloads on average. This is caused by the very high proportion of views of Humanities and Social Science profiles (1,171) in

Academica.edu, 5 times more than Natural Resources (229) and Agricultural Sciences (228). A similar pattern is observed regarding profiles views. However, in RG's case, the distribution is more homogeneous, highlighting users from the Chemical S&T (2,823) and Physical S&T (2,776) as the most viewed profiles. According to document downloads, the most unloaded papers are from Natural Resources (926) and Agricultural Sciences (820). In summary, Academia.edu is almost an exclusive network for humanist and social scientists, with a disproportionate use of these profiles. On the other hand, Biology and Biomedicine is once again the area that uses fewer social tools, with the lowest values of profiles views and document downloads.

Discussion

This study analysed the online presence and visibility of a group of users, researchers from CSIC, on the most important academic social networking sites, with an emphasis on disciplinary differences on the use of the various platforms. This approach permits to determine if they have any particular preference in joining a social site and analyse whether their behaviour changes across sites. According to the first question, results highlight disciplinary differences in the use of the various platforms and have evidenced that the populations in some academic social sites are thematically not homogeneous. For instance, researchers from Humanities and Social Sciences area are much more active on Academia.edu, while RG attracts the attention of researchers from Food S&T and Biology and Biomedicine areas. It is also found that GSC has an important presence of researchers from Physics S&T area. These results corroborate findings obtained by previous studies that showed that Academia.edu is massively populated by humanists and social scientists (Almousa, 2011; Thelwall and Kousha, 2014), RG is preferred by bio-scientists (Biology, Medicine, Food, etc.) (ResearchGate, 2014) and GSC is used by computer scientists (Ortega and Aguillo, 2012).

However, the fact that a disciplinary community is more present on a site does not automatically imply that it is more active. Results of this study have noted that scientists from Biology and Biomedicine area do not actively engage on these sites, even in RG where they represent the majority of users. This inactivity on the part of biomedical researchers was already seen in the practice of self-archiving (Björk *et al*., 2010; Spezi *et al*., 2013) and using Twitter (Holmberg and Thelwall, 2014). On the contrary, other research areas show high level of activity in certain indicators. For example, Natural Sciences stands out in social contacts and browsing papers, a fact also noted by Rowlands *et al*. (2011) in the use of other generalist social tools. Researchers from Chemical S&T and Biology and Biomedicine obtain high scores in citations, a common result in these core and intensive research areas (Schubert and Braun, 1996; Iglesias and Pecharroman, 2007); and Materials S&T researchers are very active uploading their research papers on several platforms.

From these results, one can conclude that the behaviour of each thematic group is independent of the platform and it could be due to intrinsic characteristics of each field (Jordan, 2014). Thus, the fact that humanists and social scientists are the most active

users in Academia.edu (Almousa, 2011; Van Noorden, 2014) is not because they have massively colonized this media, but because this group is generally quite active on social platforms, such as was seen in RG and Mendeley. Perhaps, this is motivated by the nature of each research field. Thus, non-experimental disciplines, such as humanities, favour the discussion in forums and seminars to a greater extent than experimental disciplines. This activity could be reflected in the virtual space through discussion groups and followers networks.

From a research evaluation view and considering the coverage and completeness, GSC is the most appropriate service, almost doubling RG in number of documents. On the other hand, Academia.edu does not include an extensive publications list and the existing one is biased to humanities and social sciences, which suggest that this social site is not a proper source for measuring the scientific production of authors — neither a complete database for exploring bibliographic references — except in the humanities and social sciences. In terms of citations, differences are larger and the average of citations in Google Scholar is 4 times larger than RG. In this sense, GSC could be considered the best platform to measure the research performance of an author. However, an uptake of self-archiving on RG, Academia.edu and Mendeley would rapidly increase their document coverage and become serious competitors of other research evaluation platforms, such as the Web of Science and Scopus. They would also complement these bibliometric indicators with usage and social metrics, which could introduce new perspectives.

On the other hand, these results might be limited by the CSIC's research areas and the way in which these researchers are classified. Thus, Physical S&T area includes distant disciplines in publishing terms such as Mathematics, Computer Sciences and Theoretical Physics. Along these lines, Materials S&T and Food S&T are small and specialized areas that share publishing patterns with Biology and Biomedicine, in the case of Food S&T, and Chemical S&T, in the case of Materials S&T. Hence, other analyses with different disciplinary classifications are welcome to confirm these results.

Conclusions

Results on the settling population of researchers on social sites bring that the scientific areas where the penetration of these technologies is largest are Humanities and Social Sciences and Natural Resources. On the other hand, RG is the site with most profiles from CSIC's researchers.

These results allow to conclude that there are significant differences in the way in which the populations are distributed among the academic social sites, evidencing the predominance of humanists and social scientists in Academia.edu and biomedical researchers in RG. This suggests the possibility that some social sites are been populated by researchers from specific disciplines.

Researchers also show disciplinary differences in the use of these services. Thus, results have described that biomedical researchers are not active users of these sites because

they have low rates of social connections and usage; contrarily, humanists and naturalists present better values for social and usage indicators than the other research areas.

These results also indicate that these behavioural differences are across social sites. For example, biomedical researchers show inactivity in RG, Academia.edu and Mendeley both in social contacts and usage. Humanists describe high social activity in Academia.edu and Mendeley, whereas naturalists stand out in viewing profiles and downloading papers.

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