

Users' Distribution and Behavior in Academic Social Networking Sites

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ABSTRACT

Academic social networking sites (SNSs) are growing rapidly. Worldwide, academicians use academic SNSs for many reasons regardless of their nation, gender, position, and discipline. In this paper, the authors extend their previous work in exploring the distribution and behavior of a particular academic SNS (academia.edu) on a large scale. The authors classify users into different groups based on their position, discipline, and continent. This study gives a better understanding of usage patterns in academic SNS, especially in the lack of large-scale studies about different classes of users on academic SNSs.

KEYWORDS

Academia.edu, Academic Social Network, Collaborative Software, Human-Computer Interaction, Social Network Analysis, User Behavior Pattern

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1. INTRODUCTION

Academic social networking sites (SNSs) are growing rapidly. This growth is driven mainly by the continuous demand from academic people to exploit different aspects of the Internet. Similar to general-purpose SNSs, Academic SNSs offer several functionalities such as the management of profiles, posts, connections, and private messaging. However, in academic SNSs these features have more emphasis on academic metaphors. Several reasons motivate people to join academic SNSs, especially communicating peers and thus collaborating with them. Academic SNSs users vary on different levels, such as their academic position, discipline, country, experience, and motivation. This wide diversity is reflected on their behavior and usage patterns. It is obvious that studying users' distribution and behavior is essential in providing a better understanding their needs and thus improving academic SNSs.

This paper aims to find whether different groups of academic users have behavioral patterns on academic SNSs (specifically on academia.edu). The significance of this study originates from the need for large scale studies about academic SNS; especially with different user classes/categories. Moreover, understanding academic users' behavior and distribution is vital not only in improving existing systems for them, but also for designing new services and systems for their ease. To achieve this, we directly collected data of more than 30 thousand user profile from academia.edu website. We looked after users from four different academic disciplines, namely: Anthropology, Chemistry, Computer science, and Philosophy. We categorized our data set into four groups on basis of the academic position of each user: faculty members, graduate students, independent researchers, and post-doctoral researchers. After that, we analyzed our data set on basis of seven variables that we defined according to different elements of a user profile on academia.edu. Our analysis indicates that each of the four groups of users generally has a regular behavior regardless of the science discipline it originates from. However, there we found obvious behavior division in some aspects; especially in the behavior of independent researchers. Although these irregularities, independent researchers have distinct behavior pattern most of the time.

The rest of the paper is structured as follows: In Section 2, we give a discussion of related research in order to put this study in its context. Section 3 gives an overview of the academic social network site that we target in our study, namely: academia.edu. In Section 4, we present our research methodology in order to show processes, data, sampling, and variable definitions. Section 5 shows our main results followed by a discussion for our findings. Finally, we conclude with a set of findings and future work in Section 7.

2. RELATED RESEARCH

In this section, we try to navigate through some related literature. We start with general concepts about social networks, then we narrow our review to academic SNS. In general, a social network (SN) is found when a computer network connects people or

organizations as in Schleyer et al. (2008). According to Cooke (2006), it is defined as a group of people and connections among them. Since the World Wide Web (WWW) is shifting to Web 2.0, the Internet become more of a social network serving people with information resources, creating ties among them, and allowing them to create their own content easily, cf. DiMicco et al. (2008). The use of collaborative technologies such SNSs invoked people to create on-line communities to facilitate their communication and collaboration effortlessly, Fu et al. (2008). An SNS is defined in Kumar et al. (2013) as a web-based service that allows users to construct a profile, articulate a list of other users, and traverse their list of connections and those made by others within a bounded system. The nature of these connections may vary from site to site. In light of Boyd and Ellison (2007); Boyd (2006) and the previous definition, an SNS can be defined is website that offers the ability for people of common interest to manage profiles, posts, comments, relations, feelings, and messaging. By management we mean the ability to create, edit, delete, and constraint a specific feature or artifact, e.g., SNSs users can create their own profiles, edit them, delete posts, block a friend (constraint a relation), etc. Again, the nature of constructed relations within an SNS along with the common interest articulate the type of SNSs creating specialized SNSs, e.g., professional, academic, etc. Before specialized SNSs, people of common interest started using general-purpose SNS to achieve the aforementioned goals of communicating and collaboration. However, it was obvious that general-purpose SNS cannot cope with certain needs of such groups. The emergence of specialized SNSs, according to Vascellaro (2007), is targeted toward specific user groups of specific common interest and provide added value to several kinds of users in different ways in comparison to general purpose SNS, Li (2011). Specialized users can gather and meet new or previously known people remotely, and thus achieve shared goals with them, McCarthy (2007). Therefore, professionals use SNSs in order to extend their professional networks, learn about colleagues and their colleagues, locate experts, solve problems, and find potential collaborators as to Joinson (2008). According to McCarthy (2007) SNSs can play a critical role in specifying ways to solve problems, run organizations, and increase the success level of goal achievement for individuals. Thus, SNSs are increasingly attracting the attention of professionals motivated by its availability and reach. cf. Lampe et al. (2008). One of those specific user groups targeted by SNSs is the scientific or the academic body; providing academic people with a computer-supported cooperative work (CSCW) tools. Moreover, SNSs help scientists find appropriate collaborators more quickly and efficiently than other methods especially as science has become more collaborative in over past several decades, Joinson (2008).

Academic and scientific SNS offer several social networking services that are on-line services that help in constructing scholarly SNs by focusing in providing on-line research-oriented activities, Oh and Jeng (2011). Academic SNS such as academia.edu¹, LinkedIn², ResearchGate³, and some others are becoming increasingly popular recently. According to Alexa⁴, their global ranking was 7982, 16, and 16324 respectively (as in June, 18th 2011). Note that this work extends our previous work (Almousa (2011))

by asking/answering a third question about users' behavior in accordance to their geographical location worldwide (the study questions are a paragraph away from here). Since that, several related work was produced such as in Thelwall and Kousha (2014) in which authors investigated profile views on academia.edu for faculty and students in philosophy, computer science, law and history. Unlike our work, they classified users according to their gender, and introduced a method to handle time delays in joining academia.edu. In Elsayed (2016), the researcher designed an on-line questionnaire and invited more than 3000 Arab researchers in order to find out their motives in joining academic SNSs. She received 315 answered questionnaires, and her analysis found that the majority of Arab researchers tend to prefer ResearchGate and their main motive was to share their publications. The authors of Jordan and Weller (2018) used an on-line survey to find a disciplinary divide on the selection of an academic SNS, they also find a position divide on the purposes of usage of academic SNSs. With a reasonably large data set, Manca and Ranieri (2017) investigated over 6,000 Italian scholars in quest for their motivations and use frequencies. The authors tried to find correlations in light of different factors such as gender, academic title, and years of experience. However, the novelty of this research is still persistent being amongst the first ones to address the particularity of academic SNSs on a large scale (+30,000 profiles). In fact, several of the previous works cited the conference version of this paper Almousa (2011) that we extend here on basis of study questions, discipline coverage, and continent distribution. Although academic SNSs are gaining more popularity among academic people, and they are extremely important in determining how scientific collaborations are formed, SNSs have not yet been studied comprehensively, although usage patterns in SNSs were studied as in Stutzman (2011) and Lampe et al. (2008). Yet, a little is known about academic SNSs and how academic people use academic SNSs, so there is a lack of knowledge on users' groups and usage behaviors. This study aims to explore users' groups and behavior in academia.edu by different groups of academic users. To that end, we try to answer the following three questions:

1. Do people from different disciplines use academic SNSs differently?
2. Do people with different academic positions use academic SNSs differently?
3. Do people from different places use academic SNSs differently?

To answer this question, we classified users according to their continents. More specifically, the classification is made on basis of the continent of their affiliated university not their citizenship continent; since academia.edu does not offer citizenship information of users. The next section gives an overview of academia.edu SNS.

3. ACADEMIA.EDU

Now we give an overview about academia.edu SNS. In October 2008, academia.edu was first introduced, and within 30 months it reached more than 300,000 profiles with one million hits daily. We selected academia.edu in this research because of its academic

nature of profiles including university, department, primary research interest and many others. Additionally, academia.edu has a wide users' diversity on basis of their academic position, i.e., department members, students (graduate and undergraduate), post doctoral, independent researchers, etc.. Moreover, we consider Alexa ranking for similar SNSs, as other SNSs with better ranking are not as academic oriented as academia.edu, for instance LinkedIn can be considered as more professional-oriented than academic-oriented SNSs. Like most of SNSs, a user profile in academia.edu acts as a personal image of the user by which she can express her academic personality. It is a crucial component for establishing connections (Tufekci, 2008), and according to Boyd and Ellison (2007) user profiles are the "backbone" of any SNS. In academia.edu a user profile contains personal information, contact information, position information, and academic related information such as research interests. The complete list of information found in a user profile on academia.edu is as follows:

1. Personal information that includes: Name, Picture, Status, Position, Position title, Department, University, About.
2. Contact details that includes: Email, Homepage, Address, Phone, Skype, and Recent updates.
3. Research Interests that includes: Primary Research interests and Secondary Research interests.
4. Uploaded Materials that includes: Papers, Books, Talks, Teaching Documents, Blogs, CV, Websites, and Others.
5. Relationships that includes: Colleagues, Follows, and Followed by.
6. Questions that includes: Asked Questions, and Answered Questions.
7. Following that includes: Following Papers, Following Questions, and Following (updates).

Academia.edu motivates its users to build connections by following researchers and research; this is reflected in many ways. For example, it enables users to follow other users, papers, questions, and updates. Moreover, it has a logo that says: "Follow Research". Users are informed about others following them or their work. "Recent updates" feature dynamically report activities a user may perform. This feature reports not only the type of a recent activity, but also it reports the users involved in that activity, as well as the date or the time elapse of that activity.

4. METHODOLOGY

After reviewing some of related literature and introducing academia.edu, we now describe our research methodology. We start with our research questions, then we discuss the data collection process followed by presenting users' distributions.

4.1. Research Questions

In this research, we try to answer the following questions:

1. Do people from different academic disciplines use SNSs differently?. In other words, we wonder if a user behavior is affected by the user academic discipline. In order to answer this question, we consider four different academic disciplines trying to cover different specificities from different natures. The four academic disciplines are as follows:
 - (a) Anthropology from humanities disciplines.
 - (b) Philosophy from arts disciplines.
 - (c) Chemistry from natural sciences disciplines.
 - (d) Computer science from technical sciences.
2. Do people with different academic positions use SNSs differently?. By this question we try to know if the academic position of a user affects the behavior of that user. In order to answer this question, we consider four different academic positions, namely:
 - (a) Faculty members.
 - (b) Graduate students.
 - (c) Independent researchers.
 - (d) Post-doctoral.

We selected these positions since we noticed during primary navigation of academia.edu that they cover a majority of users. Moreover, the four academic positions cover most of people working in academia.

3. Do people from different places use SNSs differently?. By this question we aim to know if a user place affects her behavior on academia.edu. To answer this, we divided users into their continents. More specifically, the continent of the university they belong to, not their citizenship continent; since academia.edu do not offer citizenship information as we discuss later.

As we pointed out previously, our different classification is mainly motivated by its wide coverage of the population. This coverage has two levels: data set coverage and academic discipline coverage, i.e., we believe that the four academic disciplines are a good representative for academic disciplines in general. Moreover, they formed a majority in our primary exploration. Among each of the four disciplines, we found that the dominant academic position categories were faculty members, graduate students, independent researchers, and post-doctoral researchers.

4.2. Data Collection

In this section, we describe the process of our data set construction. We collected our data directly from academia.edu website using C# code in the period from March 15th 2011 to June 1st 2011. (We performed recent attempts to update our data set, but we failed mainly because of countermeasures taken by websites against data harvesting, e.g., CAPTCHA). The total number of harvested profiles exceeded 30,000 records in our data set. After that, we performed a data cleaning step to filter out problematic

records that contain for example spelling mistakes, or spurious records. We also made a data unification step to gather records that are supposed to belong to the same set. For example, a user with post-doc position should belong to the same set of another user with post-doctoral position. Another example, a user from USA should belong to the same set of another user with United States of America in country field. After that, we performed a step to classify our data set in three different ways:

1. Academic discipline: Anthropology and Philosophy from art disciplines, Chemistry from natural sciences, and Computer science as technical science discipline.
2. Academic position: Faculty members, Graduate students, Independent research, and Post-doctoral researchers.
3. University country.

The reason behind the selection of these specific four classes or groups is due to the fact that they have the widest coverage of total users with nearly 70% from the total data set as illustrated by Figure 1. Finally, we codified our data set and specified its variables as a preparation for further analysis. Codification and variables are shown in Table 1.

After the process of data gathering, codification, and variable definitions is done, the results are shown in Table 1.

4.3. User Distribution

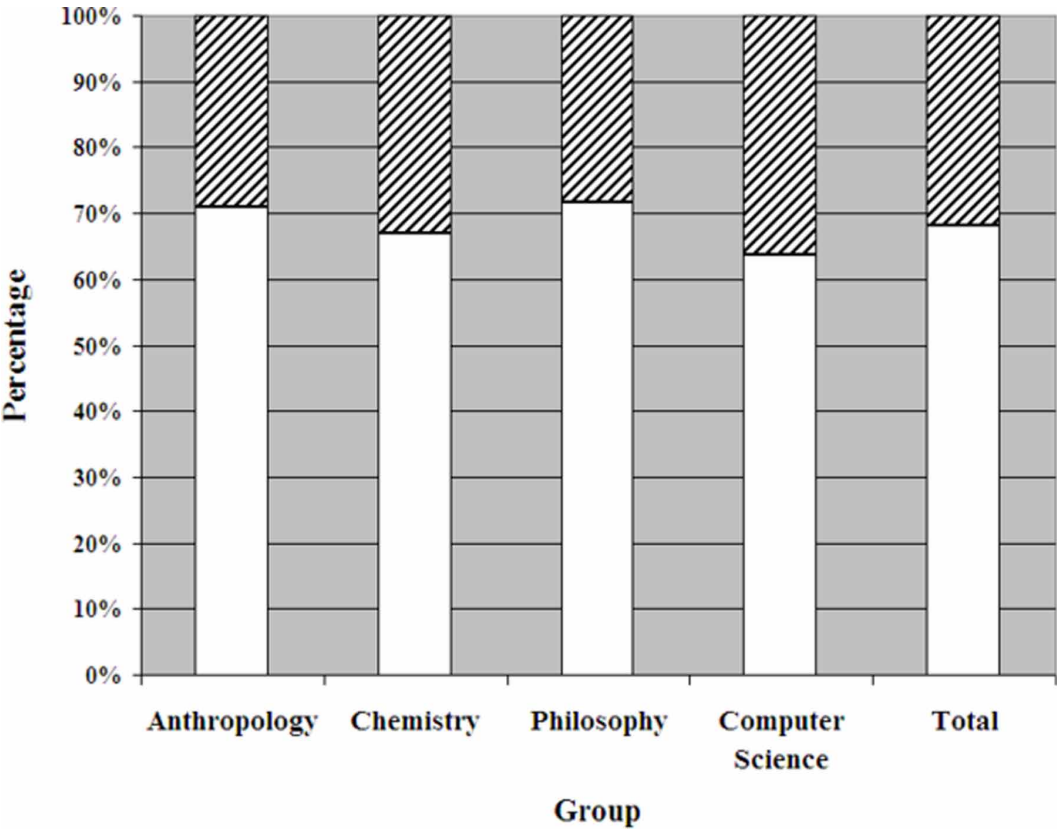
Concerning continents, continent-groups are: Africa, Asia, Australia, Europe, North America, and South America. The distribution of users in our data set over continents is given in Figure 2. Figure 2 shows that users from North America and Europe have the largest share amongst others with a percentage of 71%. This is clearly due to many reasons. First, the number of universities in the two continents is larger than in the rest of continents. Second, English language is the interface language of academia.edu, and users from the two continents have English language as either a native language or widely used and practiced. Lastly, academia.edu is an American website, and thus it is widely diffused there. For the rest of continents, users from Asia present 19% with the third share. South America, Australia, and Africa are all behind with less than 10%.

5. RESULTS AND FINDINGS

In this section, we first present our results then we reflect on them trying to answer the three questions of this study. Table 2 shows results for Anthropology users along with the number of people in each group. Similarly, we show the results for Chemistry users in Table 3.

Table 4 presents the results for Computer science users, and finally the results of Philosophy are shown in Table 5. Finally, Table 6 shows results of users grouped by continents. One can notice that the total users distributed over continents is larger than the total of users in all disciplines; this is mainly due to the fact that Independent

Figure 1. Academic disciplines coverage



researchers have no institutions, and thus we cannot associate any of them to a country. Moreover, for some of the institutions, we cannot associate them to a country; since a user on academia.edu can make up any name for his institution and associate it to any country!.

Now we present the first two questions jointly, then we finish with the third question. We first address each variable separately for a better presentation.

5.1. First Two Questions

- **Profile Completeness:** Both of faculty members and post-doctoral researchers have close values for this factor that exceeds other two groups; this can be attributed to the demanding career of them. Graduate students have recorded more incomplete profiles, but independent researchers are the least. The latter case is somehow not much typical for the case as they are looking for “marketing” themselves through such SNSs.
- **Research Interest:** One can easily notice that independent researchers group has the highest values compared to other groups; we attribute this to the willingness to find as many collaborators as they can. Another reason can be their openness to

Table 1. Variables and codification

Variable name and description	Computation method	Items	
		Item name	Data type and codification method
Profile completeness: expresses personal information and contact details provided by the user, and it is shown in his profile.	Computed by finding the mean of the following (right) data items (after being codified) as we explain, and then finding the average for all users in each group (class).	Picture	Binary: 1: picture uploaded, 0: otherwise
		Status	Binary: 1: status mentioned, 0: otherwise
		Position title	Binary: 1: Position title mentioned, 0: otherwise
		About	Binary: 1: About mentioned, 0: otherwise
		Email	Binary: 1: Email mentioned, 0: otherwise
		Homepage	Binary: 1: Homepage mentioned, 0: otherwise
		Address	Binary: 1: Address mentioned, 0: otherwise
		Phone	Binary: 1: Phone mentioned, 0: otherwise
		Skype	Binary: 1: Skype mentioned, 0: otherwise
Uploaded Material: Expresses the uploaded materials of a uses.	Same as above	Papers	Discrete: number of papers
		Books	Discrete: number of books
		Talks	Discrete: number of talks
		Teaching Documents	Discrete: number of teaching documents
		Blogs	Discrete: number of blogs
		CV	Binary: 1: CV uploaded, 0: otherwise
		Websites	Discrete: number of websites
		Others	Discrete: number of other materials
Research Interest: Expresses the research interests a user adds into his profile.	Same as above	Primary Research interests	Discrete: number of primary research interests
		Secondary Research interests	Discrete: number of secondary research interests
Relationships: Expresses number of users that a user is connected to in somehow.	Same as above	Colleagues	Discrete: number of department colleagues
		Follows	Discrete: number of other users that the user follows.
		Followed by	Discrete: number of other users following the user.
Questions: Expresses the questions a user asked or answered.	Same as above	Asked Questions	Discrete: number of asked questions by the user.
		Answered Questions	Discrete: number of answered questions by the user.
Following: Expresses the activities that a user follows.	Same as above	Following Papers	Discrete: number of papers followed questions by the user.
		Following Questions	Discrete: number of questions followed by the user.
		Following (updates)	Discrete: number of updates followed by the user.
Activity Frequency: Expresses the frequency of activity for a user.	Derived by dividing #Updates by Delta Days	Delta Days	Discrete: derived from "Recent updates" by finding the difference in days between first update and last update
		#Updates	Discrete: derived directly from "Recent updates" by counting number of updates

Figure 2. Continent distribution

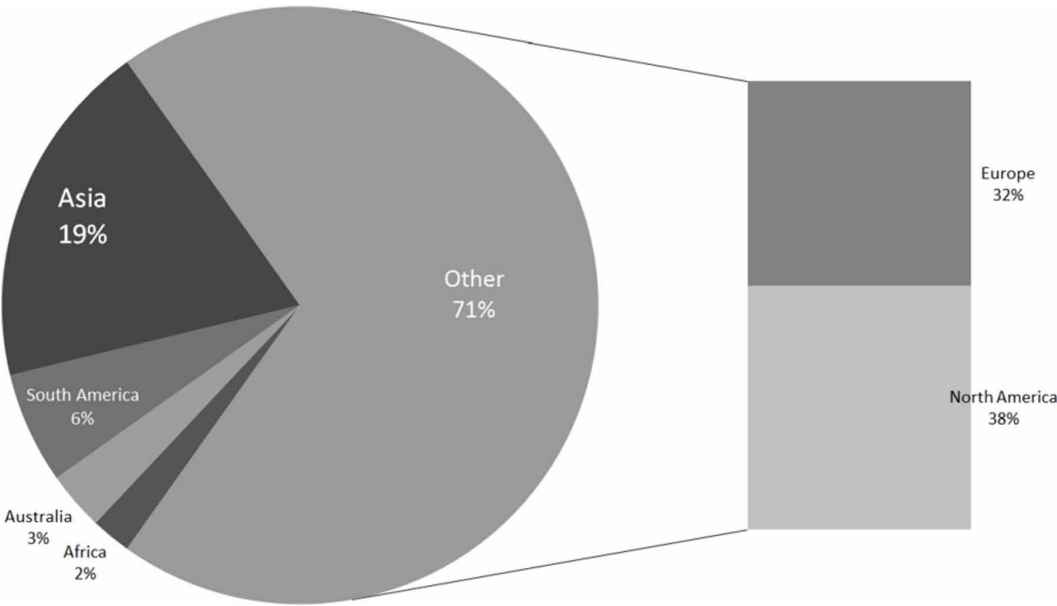


Table 2. Anthropology results

	Faculty Members	Graduate students	Independent Researchers	Post Doctoral
Number	2481	3539	804	391
Profile Completeness	0.303	0.236	0.185	0.306
Research Interest	6.958	6.924	10.989	6.703
Relationships	16.128	16.777	6.208	18.046
Following	1.426	1.367	0.970	1.769
Activity Frequency	0.033	0.036	0.057	0.039
Questions	0.036	0.028	0.015	0.049
Uploaded Material	1.004	0.428	0.424	1.009

target new research areas, especially as they are not restricted to research groups within institutions.

- **Relationships:** Independent researchers have the very least score in relationships (a third of the next 4.412 to 12.047 for graduate students); this may probably account for the lack of institutional body that supports their connections with others. Other groups have very close results; since they exist within academic

Table 3. Chemistry results

	Faculty Members	Graduate students	Independent Researchers	Post Doctoral
Number	1113	1658	221	458
Profile Completeness	0.245	0.178	0.154	0.208
Research Interest	2.837	2.794	5.217	2.571
Relationships	6.633	6.000	2.863	7.218
Following	0.328	0.406	0.860	0.414
Activity Frequency	0.028	0.026	0.068	0.025
Questions	0.007	0.003	0.059	0.001
Uploaded Material	0.755	0.272	0.307	0.686

Table 4. Computer science results

	Faculty Members	Graduate students	Independent Researchers	Post Doctoral
Number	3177	5026	757	619
Profile Completeness	0.262	0.202	0.148	0.268
Research Interest	4.293	3.483	7.077	3.645
Relationships	10.079	10.794	3.592	10.812
Following	0.595	0.514	0.569	0.647
Activity Frequency	0.023	0.027	0.068	0.023
Questions	0.006	0.004	0.011	0.008
Uploaded Material	0.852	0.323	0.296	0.768

institutions. Among them, post-doctoral group has the highest score; possibly since their early academic career that may need stronger ties with others.

- **Following:** Post-doctoral researchers have the largest result for this variable/ Other groups have close values. This applies to Anthropology, Computer science and Philosophy. In Chemistry However, independent researchers have the highest score. They even two-folded the next greatest (0.860 to 0.414). This indicates that Chemistry independent researchers are interested in following updates, papers and questions much more than their colleagues in other disciplines.

- **Activity Frequency:** The group of independent researches score the highest value. We think that it is due to their willingness to stay “connected” to peers. Another reason for that can be the fact that they have fewer duties than other.
- **Questions:** Unlike previous result of variable, here we have an evident difference amongst disciplines. This is the case especially for independent researchers. More specifically, independent researchers in Anthropology have the least value, while independent researchers of computer science and chemistry have the highest value. This result indicates their high activity in asking and answering questions. On the other hand, post-doctoral researcher of Philosophy and Anthropology are the most active in questioning and answering. This can be because for their time freedom that they have in comparison to faculty members. Faculty members and graduate students share a moderate level in all disciplines.
- **Uploaded Material:** faculty members and post-doctoral researchers are the first in uploading materials in comparison to other groups. Obviously this is because both groups have teaching responsibilities and therefore upload teaching materials on academia.edu. Another reason is that they are generally more research productive than students and independent researchers, and they tend to upload their research materials.

5.2. Third Question

- **Profile Completeness:** As shown in Table 6, users can be divided into three groups, the highest from Europe and Australia, followed by users from America (North and South), and the lowest were from Asia and Africa. However, there is no evident difference in profile completeness among users from different continents.

Table 5. Philosophy results

	Faculty Members	Graduate students	Independent Researchers	Post Doctoral
Number	3718	3673	1043	455
Profile Completeness	0.309	0.240	0.168	0.314
Research Interest	6.337	6.676	8.364	6.512
Relationships	15.554	14.617	4.986	17.771
Following	1.195	1.238	0.810	1.668
Activity Frequency	0.032	0.035	0.063	0.035
Questions	0.031	0.035	0.011	0.053
Uploaded Material	0.975	0.448	0.392	0.963

- **Research Interest:** Users from Europe have the highest values amongst others, whereas Asians have the lowest score in this.
- **Relationships:** Differences among continent groups are obvious in relationships. Users from South America and Africa are the least in relations, while Europeans are the highest. After the European come North Americans, then Australians and Asians.
- **Following:** The same as the results of the previous one.
- **Activity Frequency:** No evident difference holds in this criterion.
- **Questions:** The least active users are the ones from Africa, Asia and South America. On the other hand, Australians, North Americans and Europeans score the highest.
- **Uploaded Material:** The same order of groups remains as in the previous variable, but with Europeans group having the highest score instead of Australians.

6. DISCUSSION

Now we present our reflections on the results and findings of the previous section. In concern to the first question, users from arts and humanities are more active than users from the other two disciplines. We attribute this to the type of research activities they carry out that needs an involvement of bigger groups. Additionally, the “humanity” nature of these disciplines encourages higher communication skills, and therefore stronger relationships with peers. In the least active part, users of computer science are more active than chemistry, we think that the more “technical” a discipline is, the less its people have connections or seeking for.

Moving to the second question, one can notice that Post-docs are the most active disregarding the originating discipline. We think that this is due to their efforts are focused mainly on research, i.e., they have less administration and teaching duties. Faculty members have similar levels of activity with Post-doctoral researchers. However, they have lower levels of activity in relationships. This is so since they have extra non-research duties, and also because they are more likely to have more

Table 6. Continents results

	Africa	Asia	Australia	Europe	North America	South America
Number						
Profile Completeness	0.198	0.205	0.278	0.282	0.250	0.229
Research Interest	4.691	3.780	5.425	6.021	5.328	5.743
Relationships	6.064	10.378	11.592	16.460	14.285	8.772
Following	0.544	0.572	0.898	1.223	0.981	0.843
Activity Frequency	0.030	0.032	0.030	0.031	0.030	0.033
Questions	0.004	0.003	0.049	0.027	0.028	0.006
Uploaded Material	0.380	0.393	0.774	0.778	0.647	0.544

experience and thus wider relationship circles. Moreover, the set of prospective collaborators for Faculty members is mostly known to them because of their career maturity. The behavior of Graduate students is not far from the two previous groups. This behavioral similarity is caused by the existence of an institutional frame for the three groups. Nevertheless, graduates are less active because they have less research experience, and premature career.

Independent researchers are the least active in comparison to others. However, but they show some behavioral irregularities that we think that they are worth mentioning; e.g., they have a wide set of research interests. Moreover, they have more frequent updates. This probably reflects their willingness to increase their prospective collaborators. On the other hand, independent researcher are the least in having relationships, following updates, and providing materials, but with the exception of Chemistry independent researchers who are the most active “followers”!. Another irregularity is revealed in asking and answering Questions; i.e., they have the highest activity in Anthropology and Philosophy, but the lowest in Chemistry and Computer science. We think that the openness of discussions in arts and humanities disciplines cause longer conversations, i.e., more questions and answers.

Finally, in reference to the third question, we noticed slight differences among different groups from different continents. European researchers tend to be the most active in almost all aspects. On the other hand, researchers from Africa and South America tend to be the least active. Users from Australia and North America have shown a high level of activity in most of the criteria studied. Note that we have a brief discussion on the results of the third question because we think that this needs to delve into cultural differences among users. In fact, we have some primary results in our previous work: Almousa (2012).

7. CONCLUSION AND FUTURE WORK

This study aims to find distinct users’ behaviors and groups in academia.edu being an representative example of academic SNSs. To that end, we directly collected a data set of 30 thousands user profiles distributed over four academic disciplines, four job positions, and all continents. The academic disciplines are: Anthropology, Chemistry, Computer science, and Philosophy. We also classify our data set based on their job position: Graduate students, Faculty members, Post-doctoral researchers, and Independent researchers. A third classification we perform is based on the continent of users depending on the country of their university of affiliation. The study tries to answer three questions that concern the existence of behavior difference among users grouped by discipline, position, and continent respectively to the questions. We analyze our data set in reference to a number of variables that we define according to academia.edu profile elements.

Our analysis indicates that each of the academic position groups has generally a distinct behavior despite of the discipline the group belongs to, with some irregularities that we pointed out in the Discussion (Section 6). We find that independent researchers

have most of the time a divergent behavior. We also noticed that Faculty members and post-doctoral researchers almost share a unique behavior. Moreover, graduate students behave in a similar way to the previous two groups, but they are less active in general.

As expected, this investigation was subject to several limitations. First one is its limitation to a single academic SNS, we believe that considering several SNSs will give better understanding and finer results. Another limitation is considering four disciplines of science only. Although we think that they are a good representative for other disciplines, but having more disciplines can surely support our results and enhance our findings. Finally, the continent based grouping is not very accurate. This is because we consider the citizenship of universities instead of the citizenship of users. In fact, the citizenship of users is not available on academia.edu. These limitations can be addressed in future works that target more academic SNSs, more science disciplines, finer country associations, and the effect of cultural factor in the behavior of users.

This study may be improved in many directions. Thanks for to constructive feedback from the reviewers. For example, this research can be improved by rerunning the study with recent data, and compare how behavior patterns changed since then. Another way to improve the findings is performing more sophisticated statistical tests such as t-test or ANOVA. It will be also very interesting to look at the data from different perspectives, e.g., examine the items within the variables in Table 1 as individual variables. Investigating the relationship between the research quality/quantity produced by a user and her behavior on academic SNSs is also another very interesting future work.

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ENDNOTES

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