Outcompeting Traditional Peers?
Scholarly Social Networks and Academic Output

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Abstract

In this paper we evaluate the interplay between scholarly social networking and academic output. To this end, we tested the hypotheses that the activity of users on scholarly social networks is associated with academic output, and that the intra- or interdisciplinary background of scholars affects academic output and online activity. The quantitative data used for this study was collected from the publicly-accessible scholarly social network HASTAC and complemented with a qualitative survey collected from 123 students and recent alumni of the HASTAC Scholars Program. After processing the different sources of data, we rejected the hypotheses that academic output and activity on scholarly social networks are affected by scholar's intra- or interdisciplinary backgrounds, but our results partially support the hypothesis that activity in scholarly networks is associated with academic output. Finally, we discuss the generalizability of our findings and argue that online activity and academic output are both likely driven by networked Scholars committed to academic research.

1. Introduction

The production of scholarly work is determined by a network of academic peers that influence scholarly practice and define the limits and scope of disciplinary research. These peers are colleagues with whom scholars share ideas, collaborate on projects, review papers, discuss ideas, and receive feedback. Prior to the emergence of online social networks that facilitate the collaboration between scholars, this network was limited to those with whom scholars interacted regularly, either by exchanging correspondence, working together in the same space, or meeting up in academic conferences [1]. Online social networks eliminated the physical constraints and allowed scholars to build up a network of peers and to collaborate on projects that otherwise would require physical proximity.

This epochal transformation has been discussed in the academic literature [2], and research on the effects of digital media to scholarly communication is recent but profuse [3], with works covering the impact of digital communication to scholarly work [4], the impact of the internet to social sciences research [5], and the consequences of social media for science and research [6, 7]. More recently, particularly in the last four years, online social networking sites assumed a central role in digital communication [8, 9]. The availability of such websites and online networking platforms brought an impact to scholarly work and allowed for unprecedented possibilities to engage with interdisciplinary and cross-institutional scholarly collaborations.

During this period, a range of tools were made available for the dissemination of scholarly work. Complementing formal academic publication, scholars started to communicate their findings in blogs, wikis, social networking sites, and numerous online platforms [10-12]. Such services carry both opportunities and risks for early-career researchers. They differ substantially from traditional forms of scholarly communication and are used for a wide variety of purposes and objectives [13, 14], mostly non-academic. Moreover, informal genres of scholarly communication frequently lack peer review and rely on new measures of impact that are yet to be accepted within academia [15]. While researchers are now able to disseminate their findings more quickly and reach out to broader audiences than was previously possible, they also risk that their work will not be acknowledged in more traditional and hierarchical professional structures.

As a result, researchers have been very careful in their acceptance of digital formats that compete with established forms of expert knowledge dissemination, largely choosing instead to focus on established formats [16]. This is especially true in the humanities [17], where departments have remained structurally organized in disciplinary silos, conservatism towards new publishing formats is particularly strong, and where the collaboration patterns are considerably different to those observed in the social sciences, natural sciences, and engineering [18, 19]. Humanities scholarship is split into multiple domains with discernable boundaries, and research in the humanities that relies on digital methods is referred to as "digital humanities."

The challenges associated with interdisciplinary research and the use of social networks for scholarly work stem from disciplinary silos unintentionally structured around academic disciplines with dedicated journals and established professional associations. Despite funding agencies' support for cross-disciplinary research teams and the growing demands for interdisciplinary skills [20], researchers have to consider the institutional backdrop in which interdisciplinary endeavors are often discouraged by discipline-centered academic reward systems. In fact, previous studies have found evidence of near-term income risk associated with completing an interdisciplinary dissertation [21]. For tenure-seeking young scholars, there is little evidence that interdisciplinary risk-taking helps professional advancement or increases the potential for academic collaboration.

The implications of this scenario can be summarized in two main trends. Firstly, and mostly due to the challenging aspects of digital scholarship, studies investigating the relationship between the affordances of social networking sites and academic output have largely lagged behind on scientometrics. Secondly, and particularly in the context of collaborative research in the humanities, the impact of online networking sites on scholarship that transcends the constraints of disciplinary boundaries remains largely underexplored.

In this paper we address these issues by examining the impact of online social networking activity on the academic output of scholars with intra- and interdisciplinary backgrounds. To our knowledge, this is the first attempt to investigate the interplay between scholarly social networks and academic output, and we expect the results reported in this study to inform future research focusing on the effects of interdisciplinarity and scholarly networks to the academic output of young scholars. In the next sections of this paper we review the relevant literature, describe the networks investigated in this study, detail the data and the methods used in the analyses, and report the results. In the last section of the paper we discuss the empirical findings and attendant theoretical claims that motivated this study.

2. Previous Work

As scholars increasingly integrate social media tools into their workflow, the production of scholarly work and the factors that determine the quality of scholarship and peer knowledge production are quickly changing to accommodate online scholarly networking. Complementing traditional citation metrics, the emerging field of "altmetrics" attempts to explore the properties of these social media-based metrics [22]. Perhaps not surprisingly, recent studies have found that altmetrics is not a simple complement to established citation metrics. Priem et al. [15, 23] reported that alternative metrics vary greatly in comparison to traditional metrics and that they measure types of impact that are interrelated but different, with neither describing the complete picture of scholarly use alone. Although tweets were found to predict highly cited articles, social media activity is mostly associated with social impact rather than citation metrics [24].

Not only the impact, but also the nature of collaboration was affected by the introduction of online social networks to academic research. Scientific collaboration creates a social network of researchers that can be sustained and extended outwards with social media [25]. The network of scientific collaborations varies greatly across different disciplinary fields [26], with patterns of collaboration between fields also showing unique features [27]. Moody [28] argued that scientific collaboration networks have a direct effect on scientific practice and described how sociology became more socially integrated from 1963 to 1999 due to a direct linkage between social interaction patterns and the structure of ideas.

Cognate researches have investigated the relationship between social networking sites and students' engagement in higher education, with mixed and often conflicting results. Heiberger & Harper [29] reported that social networking sites are positively correlated to student engagement, while Junco [30] found a negative correlation between student time on Facebook and students' engagement. Another study [31] conducted with first year undergraduates reported that Facebook played an important role at helping students settle into university life. The study concluded that students thought Facebook was important for social networking, but not for formal learning purposes.

Within our field of inquiry, Abbasi & Altmann [32] measured the correlation between the collaboration (co-authorship) network and the research output of scholars. The authors compared social network metrics of collaboration with academic output and found that the output of scholars was positively correlated with two metrics derived from social network analysis (i.e., weighted degree centrality and efficiency). In particular, the results showed that scholars with strong ties (i.e., repeated co-authorships) fared better than those with many weak ties (i.e., single co-authorships with many different scholars). The study indicated that scholars who maintain a strong co-authorship relationship to only one co-author of a group of linked co-authors tend to perform better than those scholars with many relationships with the same group of co-authors.

This body of literature has directly informed the study reported in this paper, but there are important differences between the abovementioned studies and this investigation that need to be taken into account. One important point of departure is that we focus on online scholarly networks instead of general-purpose social networking sites such as Facebook or Twitter. Another important point of departure is that we examine the impact of scholarly social networks to academic output rather than students' engagement. Lastly, in this investigation we consider scholarship that is often overlooked or simply not acknowledged by the academia. These involve informal genres of scholarly communication often lacking peer review that constitutes the cornerstone of activity in the HASTAC community.

3. HASTAC Scholars Program

The HASTAC Scholars Program is a collective of graduate and undergraduate students interested in humanities, technology, and education. The program is an initiative of the Humanities, Arts, Science, and Technology Alliance and Collaboratory (HASTAC), an online community and social networking site that connects researchers, young scholars, and the general public interested in humanities-related topics. Founded in 2002 by Davidson & Goldberg [17], HASTAC and the affiliated HASTAC Scholars Program includes educators, scientists, and researchers and is maintained by a small staff. HASTAC network is largely decentralized with content generated by a network of thousands members [33], including university faculty, students, and general public.

Student-run since 2009, the HASTAC Scholars program constitutes a subnet of HASTAC and comprises students nominated by faculty members in North America and internationally. Each HASTAC Scholar nominated by a faculty mentor is supported with a small annual scholarship provided by the home institution. Since 2009, this group of graduate and undergraduate students has created 27 topical research forums led by an interdisciplinary, inter-institutional team of doctoral students and established scholars invited to participate in the forum. The group hosts several collaborative projects such as collective book reviews and various events [34]. For the purposes of this investigation, we invited the 868 students and recent alumni (80% graduate, 20% undergraduate) in 63 disciplines from 120 institutions registered to the HASTAC Scholars Program to participate in this study.

4. Objectives

In this paper we evaluate the interplay between digital scholarly communication and academic peer-produced scholarship. To this end we mined the data of nearly 14,000 users registered to HASTAC.org and compared the activity levels with real-word, offline academic output. HASTAC differs from similar online scholarly initiatives by providing a networking platform to the academic community with a focus on interdisciplinary research. After retrieving the data from HASTAC SQL server, we mined the database to extract the activity patterns of users affiliated with the HASTAC Scholars Program.

The first objective of this study is to determine whether the highly-networked individuals in the HASTAC Scholars Program do or do not "outcompete," as Castells [35, 36] contends, those young professionals whose work remains fixed in more traditional, hierarchical, and linear disciplinary professional structures. The second objective of this study is to assess the effects of interdisciplinary work in the humanities to online and offline academic output. To this end we formulate the following working hypotheses:

H1. The activity level of HASTAC Scholars in the scholarly social network is associated with their academic output.

H2. HASTAC Scholars with interdisciplinary backgrounds present higher academic output.

H3. HASTAC Scholars with interdisciplinary backgrounds present higher activity level in the scholarly social network.

5. Data

Data for this study were collected from two sources. Firstly, we mined the Drupal-powered MySQL database of HASTAC website to explore the network activity of users that joined this study. The data reveal connections across thousands of individuals, institutions, professional associations, conferences, publications, blog posts, blog comments, forums, research projects, and grants that allow for calculating metrics of users' activity in the HASTAC network. Secondly, we developed and implemented a survey study using the Qualtrics platform to measure the correlation between online and offline (onsite) collaboration. The survey questionnaire collected data on 123 students and recent alumni of the HASTAC Scholars Program from a population of 868 individuals (14% response rate).

The information collected with the survey was used for determining the academic output of HASTAC Scholars and for measuring the relationship between online collaboration and academic output. To address the research questions of this study, we asked Scholars to list the number of academic publications produced in the period. We also asked the respondents to indicate if they were the sole author or co-author of the publication. In the latter case, we asked Scholars to list the HASTAC.org users with whom they have collaborated in the period. Given that HASTAC Scholars are remarkably engaged with collaborative online scholarship [34], we provided a comprehensive list of multiple types of scholarly work. This list included journal articles, conference posters and papers, books, book chapters, digital projects, blog articles, and participation in HASTAC forums.

We processed the data from the survey together with the website database and filtered the sources of scholarly work as follows: comments to blog posts between two users and participation in HASTAC forums between two or more users were used as a metric to compute the activity levels and online collaborations between HASTAC Scholars. Journal articles, conference posters and papers, books and book chapters, and digital projects were used to calculate the academic output and offline collaboration between HASTAC Scholars. When the publication resulted from collaborative work, we identified the users indicated as co-authors and calculated the number of collaborations. Publications with single authors were coded as a self-loop.

The resulting data were represented as sparse matrices related to multiple instances of scholarly collaboration. Each cell *ij* of the matrix indicates how often Scholar *i* collaborated with Scholar *j* during the period considered in this study. HASTAC Scholars data were anonymized before analysis and we consulted with the university IRB representatives to ensure compliance with IRB rules related to unpublished and private information. One limitation of the data is that no information related to the academic output of Scholars prior to joining the HASTAC network is included, and therefore no baseline data for comparison over a period of time is available.

6. Methods

For the purposes of this study, we used quantitative and qualitative methods to 1. identify relationships between qualitative survey information and quantitative metrics based on social network analysis [37-39]; 2. test the hypotheses laid out in the fourth section of this paper. Qualitative methods were required because the survey questionnaire provided comprehensive answers to open-ended questions that needed to be addressed on an *ad-hoc* basis. Answers to open-ended questions were analyzed thematically and whenever possible string values were subsequently recoded as a numeric value.

Quantitative methods included social network analysis, summary statistics, linear regression, and content and text analysis. As HASTAC is a network with a strong focus on interdisciplinary research and peer-mentorship, we relied on these methods to evaluate the validity of the hypotheses and the accuracy of the assumption that participation in an active online social network helps transform researchers from a primarily group-centric disciplinary identity into broader network-centric identification.

The analyses reported in the next section rely on two networks associated with different instances of scholarly collaboration. The first network was created using data from HASTAC.org and is based on the interactions between HASTAC users in the past seven years. We mined 12,067 blog posts and 8,905 comments posted by 2,605 unique users and generated a directed network based on user interactions in the website. The second network was derived from the data collected during the survey with HASTAC Scholars. Collaboration between users that resulted in published scholarship was used to drawn undirected edges in this second network.

The resulting network graphs show strong characteristics of a small-world network, with clearly defined groups and subgroups of users that connect to almost any two nodes within the subnet. As the two networks are drawn from users within the same target population (HASTAC.org users), it is possible to compare the networks and assess the structural properties of offline collaboration relative to the much broader online network. Given the purposes of this study, we did not consider the link strength (edge weight) between users and focused on the structure of the networks.

The limitations of our methodology are related to data representativeness associated with using HASTAC.org as a proxy for online collaboration and selection bias resulting from voluntary survey participation. To address the issue with data representativeness, we asked HASTAC Scholars about their enrollment in other social networks in an open-ended question. These responses were later coded as a numeric value indicating the number of social networks for which HASTAC Scholars have registered. This variable provides a control for other online networks Scholars might use to communicate and collaborate online. The other limitation refers to the surveyed population sample. As we have surveyed only 14% of HASTAC Scholars, we cannot claim representativeness of HASTAC Scholars community.

7. Results

In order to test hypothesis H1, we relied on a multi-regression model to test the variables that explain the variance in academic output of HASTAC Scholars. We regressed the variable academic output measured by the survey on the following predictive variables: 1. activity on the HASTAC website; 2. number of social networks Scholars participate; 3. number of iterations of the HASTAC program in which users have participated; 4. number of years since registering on the HASTAC website; 5. level of education; and 6. number of collaborations with HASTAC users. We repeated the same process to regress the variable online activity and added academic output as a predictive variable.

The results of the regression test confirm hypothesis H1 and show that Scholar's activity levels on the HASTAC website is the best predictor for academic output ($\bar{R}^2$ = .20, $F(1, 215) = 9.08$, $p < .001$). Also, and most remarkably, the model shows that academic output is the best predictor for Scholar's activity levels on the HASTAC website ($\bar{R}^2$ = .39, $F(1, 215) = 21.37$, $p < .001$). Therefore, almost 40% of the variation in the activity levels of HASTAC Scholars is explained by the model. Figure 1 shows the linear relationship (with outliers) between the academic output of HASTAC Scholars and blog posts on the HASTAC website, thus supporting H1 and showing that HASTAC Scholar's activity in the network is associated with academic output.

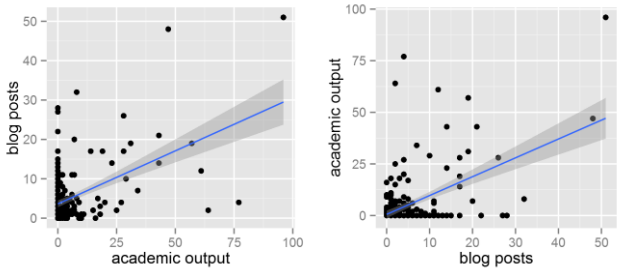

Figure 1: Linear regression of HASTAC Scholars academic output and posts published on HASTAC

Contrary to our expectations, the model shows that scholars with greater time in the HASTAC network were not more likely to present a higher academic output. In short, participation in the network is linearly associated with scholarly output, but greater exposure to the network does not seem to affect this relationship. In fact, academic output varied negatively in response to network exposure, but the magnitude of this effect is not statistically significant. Also remarkably, online activity was not affected by network exposure either, as activity on the HASTAC website was not significantly affected by increased time in the network.

In order to measure the overlap between online and offline collaboration networks, we drawn on previous research with decomposability techniques to identify the overlap between network components [40, 41]. We resorted to adjacency matrices to calculate the number of collaborations offline whose users also collaborated online. Even though the online network is very sparse, with only 2% of users in the population sample having commented or collaborated with other users on the HASTAC website, more than a quarter of all real-world, offline collaborations (27%) fall within these 2% active connections. This result testifies to the existence of a small-world phenomenon and a network effect across the online and onsite collaboration networks within HASTAC.

This also shows a remarkable concentration of activity within a few users that frequently collaborate online and offline. Despite the potential for some self-selection bias, as hard-core HASTAC Scholars were more likely to join the study in comparison to less avid Scholars, these results indicate considerable overlapping between online and offline networks, particularly in view of the sparsity of the matrices. Figure 2 shows the online and offline collaboration networks, with links code-colored orange showing collaborations between users that took place both online and offline (overlapping edges across the two edges between the two networks).

The survey also requested Scholars to provide the user ID of Scholars with whom they contributed regularly on academic projects. Although less than a quarter (23%) of Scholars that responded to the questionnaire provided this information, we found that for this subset of the population the HASTAC network was extraordinarily important, with the majority of Scholars (77%) who collaborated in real-world projects also actively collaborating on blog posts and website forums and commenting each other's posts across the HASTAC website. Figure 4 depicts the network graph of collaborations between HASTAC Scholars, with collaborations within the website colored blue and collaborations that resulted in published scholarship colored red. The network graph is illustrative of the considerable overlapping between the two networks of collaboration.

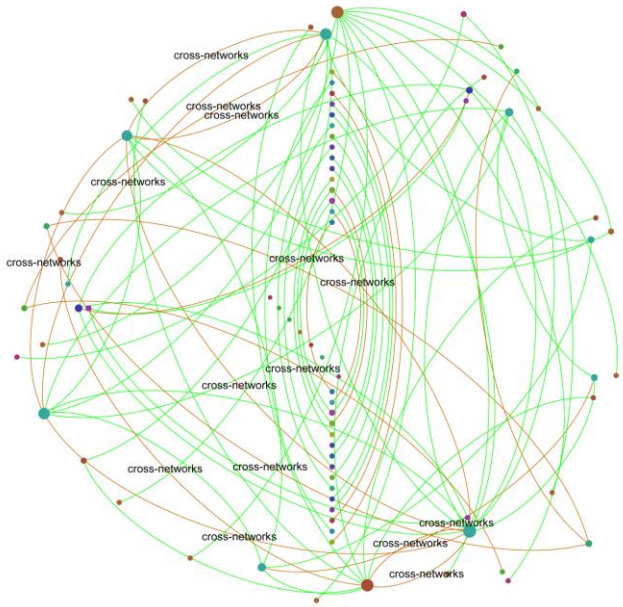

Figure 2: Online and offline collaborations. Networks with shared edges colored orange

We found that HASTAC Scholars that published scholarly work offline play an important role in the information flow of the HASTAC network. We calculated the network metrics and found that the removal of HASTAC Scholars that collaborated offline considerably impacts the network structure. The clustering coefficient goes down to .08 from .11; the average path length requires an extra hop from 3.8 to 4.7; and the network presents a much shorter average degree at 2.5 (as opposed to 4.1). Although the number of connected components remain stable at 86, the removal of these users pushes up the number of unconnected nodes to 132 (as opposed to 89). This is indicative that HASTAC Scholars bridge structural holes in the HASTAC network. Figure 3 shows the network graph before and after the removal of the HASTAC Scholars that reported having collaborated offline.

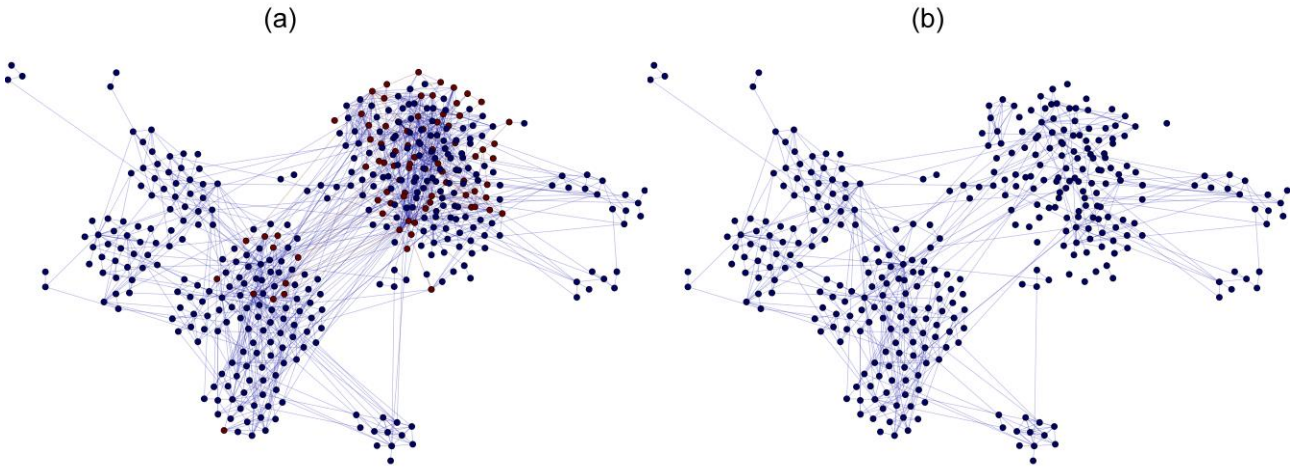

Figure 3: (a) Complete graph of HASTAC network and (b) HASTAC network without Scholars that collaborated offline

Although the data collected cannot support a causal relationship between the activity level on the HASTAC website and collaborations on real-world projects, the overlap between online and offline collaboration networks indicates considerable cross-pollination between the two activities. It also suggests that scholarly networks play a critical role for Scholars collaborating in projects, as most collaborations offline reported by users (77%) took place with a subnet of users that are very active online. Furthermore, most of the remaining collaborations took place with users that registered to the website but did not post any content or comment (17%), and only 4% of the collaborations reported in the period happened with Scholars that did not register to the network. Figure 4 shows a partition of the network with Scholars who collaborated both online (colored blue) and offline (colored red).

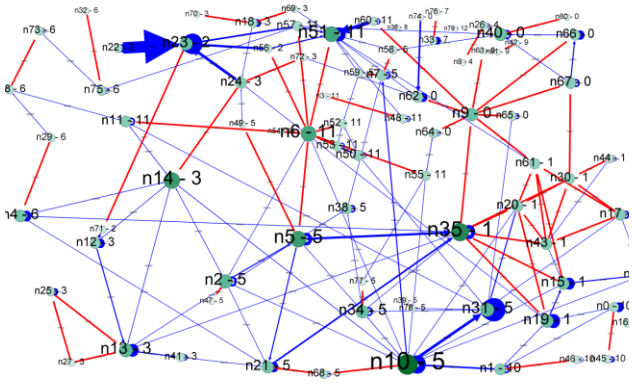

Figure 4: Scholars who collaborated online and offline. Online collaborations colored blue and offline collaborations colored red

In order to test hypothesis H2, we asked Scholars to indicate whether their academic background is focused on a single discipline and compared the results with their academic output and online activity. Answers to the survey question were provided in a 5-point Likert scale including the options "not interdisciplinary at all," "interdisciplinary to a slight extent," "interdisciplinary to some extent," "not interdisciplinary," and "not at all interdisciplinary." In order to allow for regressing the variable, we coded the responses in a numeric value from 1 for the least interdisciplinary to 9 for the most inter-disciplinary. The results rejected hypothesis H2 and indicated no relationship between the level of interdisciplinarity and academic output. The results of the multi-regression model provide very poor fitness and show that the only variable marginally associated with interdisciplinarity as response variable is the activity level in the website ($\bar{R}^2$ = .01, $F(1, 221) = 5.312$, $p < .05$).

Both Scholars with academic background focused on a single discipline and Scholars with inter-disciplinary backgrounds reported an average of four items as academic output. The only significant difference between academic output of Scholars dedicated to interdisciplinary studies and Scholars focused on a single area of study is related to the academic output as single author or in co-authorship. Compared to Scholars with academic backgrounds on a single discipline, Scholars with interdisciplinary backgrounds have a lower average of output as single authors ($\bar{x}$=2.3 and $\bar{x}$=2.0, respectively) and a higher output as co-authors ($\bar{x}$=1.8 and $\bar{x}$=2.3). Figure 5 shows the academic output of Scholars grouped by the level of interdisciplinarity in their academic

backgrounds. We removed outliers from the boxplot to show that sole authorship is higher for Scholars with backgrounds on a single discipline, and that co-authorship is on average higher for Scholars with interdisciplinary backgrounds.

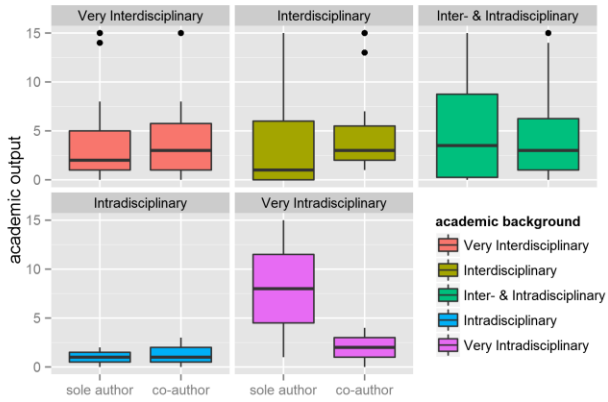

Figure 5: Academic output of HASTAC Scholars with intra- and interdisciplinary academic backgrounds as co-author or sole author

Lastly we tested the hypothesis that Scholars engaged with interdisciplinary work present higher levels of online activity (H3). We relied on the same 5-point Likert scale with options "not interdisciplinary at all," "interdisciplinary to a slight extent," "interdisciplinary to some extent," "not interdisciplinary," and "not at all interdisciplinary" to compare the level of interdisciplinarity reported by Scholars with their activity on the HASTAC website (calculated by the total number of posts and comments to blog posts). The results rejected hypothesis H3, as no significant linear association or statistically significant correlation were found between the level of interdisciplinarity in Scholars' backgrounds and their activity level on HASTAC.

In fact, the results show that Scholars with academic background focused on a single discipline presented on average a higher number of posts on the HASTAC website ($\bar{x}$=14 and $\bar{x}$=10, respectively) and a higher average number of comments ($\bar{x}$=9 and $\bar{x}$=6, respectively) compared to Scholars with inter-disciplinary backgrounds. Although we rejected hypothesis H3 and found no relationship between the level of interdisciplinarity and activity levels on the HASTAC website, we found that Scholars dedicated to interdisciplinary studies present a highly skewed distribution of comments. Figure 6 shows that one-fifth of Scholars with interdisciplinary backgrounds authored ten or more comments to blog posts of other Scholars.

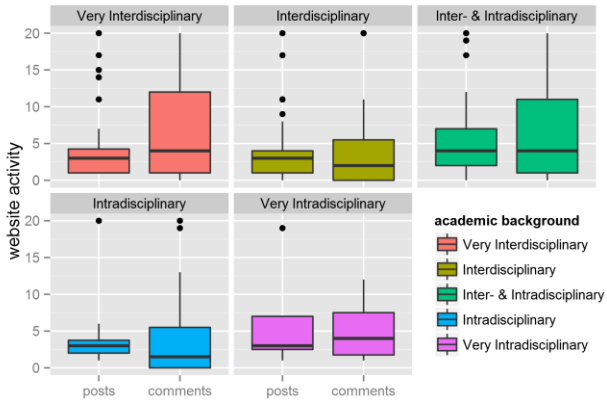

Figure 6: Online activity of HASTAC Scholars with intra- and interdisciplinary academic backgrounds

8. Discussion

In this paper we addressed the relationship between online social networking activity and offline academic scholarship and found considerable cross-pollination between the two activities. Although the regression model used in this study explained at best only 40% of the variation in activity levels on the HASTAC website, the results show that most scholarship published by HASTAC Scholars in the period took place in partnership with other scholars that are also very active in the online network (77%). The remaining collaborations (23%) took place mostly between users registered to the website (17%) and only a minority (4%) of the co-authored scholarship published in the period happened with Scholars not registered to the network. These differences are substantial and we expect the results to inform future research focusing on the effects of online scholarly networks to the academic output of scholars.

Although the HASTAC Scholars Survey data are too limited to validate or refute the hypotheses that the intra- or interdisciplinary backgrounds of Scholars are associated with academic output and/or activity levels in online scholarly networks, the highly skewed distribution of the data suggests that the intra- or interdisciplinary backgrounds of scholars might be associated with the academic output and online activity of scholars. More data are needed to test these hypotheses thoroughly and further research is necessary to identify which type of academic background is hypothetically associated with higher or lower levels of online activity in scholarly networks and academic output.

The results reported in the paper partially support the hypothesis that the activity levels in online scholarly networks are associated with academic output. The data indicate that academic scholarship increased together with activity in the website, thus suggesting a relationship between the two variables. However, the results of the linear regression show that Scholars' activity on the HASTAC website is a poor predictor for academic output, as it explains only 20% of the variation in the academic output of Scholars. On the other hand, academic output is a fairly good predictor for user activity in the social network, as it explains almost 40% of the variation between low and high activity levels of Scholars on the HASTAC website.

The results derived from the two regression analyses indicate that academic output is a stronger predictor than online activity and speak against one of the underlying assumption of this study, as the activity levels on scholarly social networks are not a particularly good predictor for academic output. Nonetheless, the two variables vary together and are likely affected by a third confounding variable that drives both online activity and academic output. We hypothesize that this third underlying variable is related to Scholars' personal commitment to scholarship, either online or onsite.

In the last instance, these results suggest that both academic output and activity levels in the HASTAC network are likely driven by Scholars that are committed to academic research and that rely on scholarly social networks to further strengthen their academic curriculum. In short, we understand that Scholars do not achieve a high academic output as a result of joining scholarly social networks. Rather, we believe Scholars join academic social networks because they are committed to research and are already involved with learning activities supported by digital networks.

There are important caveats to this study that need to be considered. Firstly, the results reported in this paper rely on (co-)authorship as a benchmark for collaboration and academic output. Secondly, this study utilizes Scholar's blog posts and comments as a metric for online activity. These factors limit the scope of this investigation because: 1. authorship is only one form of scholarly collaboration, and one that necessarily takes place at advanced stages of interaction between scholars; 2. online activity also comprises blog posts that did not receive any comment and yet resulted in interaction with the network. Although it is difficult to probe such forms of interaction, further research should take into account other forms of online activity and academic output not considered in this study.

In summary, this study has revealed important relationships in the data by exploring the interplay between online and offline collaboration networks. The analysis reported in this paper shows that the level of engagement in scholarly networks is associated with academic output. This relationship suggests that networked young scholars could potentially "outcompete" more traditional peers that refrain from engaging in online scholarly networks, as most scholarship published by HASTAC Scholars in the period was accomplished together with users of the network (77%). However, we would ultimately caution against overemphasizing the impact of social networks on academic output, and would rather emphasize the role played by macro-level interactions between university groups and micro-level variables associated with Scholars' personal commitment to academic research.

The results also rejected the general hypothesis that Scholars engaged with interdisciplinary work present a higher output measured by academic or website activity, even though Scholars dedicated to interdisciplinary work presented a higher level of co-authorship on academic works compared to peers with an intradisciplinary background. Further research focused on the relationship between intra- and interdisciplinary backgrounds and scholarly social networks is required to decisively advance our understanding of social network growth, community formation, and learning development.

Lastly, and despite the limited generalizability of our study, we believe the results reported in this paper shed light on the nature of collaborative research on online scholarly networks like HASTAC. HASTAC and other networks of its kind are designed to create alternative online social spaces where scholars can find other scholars with similar interests. These platforms emphasize peer-mentorship, group collaboration, and prepublication stages that deviates from academic writing based on rigid procedures spaced over time and systematically organized around revisions and turn-taking. Instead, online scholarly networks allow for web-native scholarly writing where scholars can add and edit content without observing rigid structures of peer-review and other academic practices.

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