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Academic influence and invisible colleges through editorial board interlocking in communication sciences: a social network analysis of leading journals

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Abstract
Editorial boards (EBs) play a crucial role in setting journals' scientific output, generally determining what legitimate science is and thus establishing a benchmark on what should be published. EB members are generally prominent scholars in a given discipline and, as such, are habitually connected to several journals' EB, a phenomenon known as editorial board interlocking. This exploratory study analyses the EB interlocking in a sample of communication journals. Specifically, we apply social network analysis to investigate how 41 JCR (Journal Citation Report) communication journals are connected through EB interlocking. Using graph theory and social network analysis, we identified the scholarly journal network, the high influential journals and scholars, and the cohesive subgroups (i.e. invisible colleges) within the communication field. Our findings shed some important light on the network structure of EBs in communication sciences, arguing that the exploration of editorial interlocks is a complemental approach to understand academic journals' influence within academic fields.

Keywords Editorial boards interlocking · Communication sciences · Journals · Social network analysis · JCR · Diversity

Editorial boards are crucial agents in the governance and development of academic disciplines (Willett 2013). As gatekeepers of knowledge (Metz et al. 2016), play a key role in shaping what is published and thus what informs theory development, research, and practice (Mauleón et al. 2013; Burgess and Shaw 2010). Extant research on bibliometric and scientometric studies (Feldman 2008; Mauleón et al. 2013; Teixeira and Oliveira 2018) suggest that potential candidates to scientifically join the editorial board of a top-tier journal should meet certain criteria, such as a strong record of publications, a great expertise and prestige in the field, and considerable amount of peer citations. Editorial policies are typically deployed by scholars who are members of the board (Burgess and Shaw 2010).

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The crossed presence of academics in different boards is a phenomenon called interlocking editorship and is considered a proxy of the similarity of editorial policies (Teixeira and Oliveira 2018). This article explores how communication journals and editorial board members are connected through editorial board interlocking.

Through a social network analysis of 41 JCR (Journal Citation Report) journals indexed between quartile one (Q1) and quartile two (Q2) in the category of "communication," we try to elucidate how editorial board interlocking establishes and creates a social structure within communication journals. Therefore, our aim is to examine how the memberships of editorial boards of major journals are linked and identify influential scholars, nationalities, and academic affiliations (i.e., universities). In short, the aim of this paper is to: 1) map the editorial board interlocking of the communication field, 2) identify the most influential scholars, journals, academic affiliations and nationalities that shape communication editorial boards and 3) identify the cohesive subgroups of scholars' and journals' networks (i.e. invisible colleges). This study contributes to a growing body of scholarship on the relational networks of editorial boards and its implications for the development of the form and contents of top-tier communication journals.

Editorial boards interlocking

One of the most important factors for academic success represented in tenure and hiring decisions is based on publication in prestigious, indexed, peer-reviewed journals (Zdeněk 2018). The quality of such research is often validated under the form of journals impact rankings (Dahdouh-Guebas et al. 2003) in such a way that publication in higher impact journals is equated with quality of scholarships, reputation, and status (Kurmis 2003). In today's' academy, there is little doubt that scientific journals provide the principal means of science dissemination (Goyanes 2017; Demeter 2018), and publishing in top-ranked journals has now become an essential academic activity (Burgess and Shaw 2010; Mauleón et al. 2013). However, publication in leading journals is not a simple task, and therefore, the production process requires a chain of agents to ensure certain quality standards. One of such agents is the journal editorial or advisory board.

According to extant research editorial boards (EBs) assist the journal's editor(s) in three major ways (Willett 2013): (1) promote the journal, (2) serve as referees when articles are submitted for review and (3) provide strategic and tactical advice to the journal future development. Their role in shaping journals' output and strategy is reflected by the "gatekeepers of knowledge", a metaphor that recognizes their key function in the peer-review process and thus in the establishment of the norms and values that shape legitimate science (Rosenstreich and Wooliscroft 2006; Metz et al. 2016). As EB members, they contribute to ensuring the quality of scientific journals (Willett 2013), are usually selected according to their experience and prestige in their field (Feldman 2008), and occupy a strategic position in the scholarly debate (Barzilai-Nahon 2009). Being invited to join the board of a top-tier journal is a highly prestigious appointment and an important form of academic recognition (Mauleón et al. 2013) favorably regarded in academic promotion processes (Bedeian et al. 2009).

As an institutional body in the governance of academic communities (Dhanani and Jones 2017), EBs play a decisive role by delineating who and what deserves to be published and thus legitimizing certain research topics and scholars. As a result, EBs have a significant influence on academic careers and progression, signalling the issues, priorities, and approaches that are worth to be studied, problematized, or even discussed further. In

doing so, they provide status and visibility to certain scholars, by conferring authority and recommending their work to be published (Willett 2013), providing also the technical and tactical strategies to improve or set the future development of journals (Burgess and Shaw 2010; Petersen et al. 2017).

EB members are appointed by invitation (Dhanani and Jones 2017), generally by those at the top of the EB hierarchy, i.e., editors-in-chief or journal editors. Both instances are the most influential agents in the recruitment process, holding extensive discretion over their selection (Metz et al. 2016). According to Mauleón et al. (2013), the existence of a previous female editor-in-chief predicts the presence of women in EBs, explained by the gender homogeneity in academic networks (Burgess and Shaw 2010). As appointment to membership is usually by invitation (Lee 1997), many EB members are recommended by former editors and academic friends (Feldman 2008). In short, the selection of EB members is usually based on the trajectory and excellence of scholars, which generally means publishing in top journals (Burgess and Shaw 2010). However, recent scholarship cast doubt on this rational view. For instance, Bedeian et al. (2009) show that there is no significant correlation between board memberships and publications, suggesting that the meritocratic argument is not supported by empirical data and thus, academic patronage might be the best explanation (Burgess and Shaw 2010).

The names and positions of scholars in the EB hierarchy are usually displayed in journals' print versions and on the official home page of journals' websites (Burgess and Shaw 2010). Therefore, EB members are often visible, although the recruitment process by which individuals become members is not so transparent (Ozbilgin 2004). Although EB selection has become more formalized over time (Cascio 2008), it is generally assumed that high academic performance (mainly in terms of one's publication record) is a criterion in the selection of EBs (Dhanani and Jones 2017). Therefore, the scientific reputation of a journal is the product of the reputations of its EB (Willett 2013), signaling the "status of the journal to potential subscribers, authors and researchers" (Burgess and Shaw 2010: 630).

As previously outlined, EB members are usually prominent scholars with a strong record of publications (Teixeira and Oliveira 2018) and highly appreciated by scientific peers (Andrikopoulos and Economou 2015). As in the business realm, an EB member may occupy a seat in more than one directory board, a phenomenon known as editorial board interlocking (Baccini and Barabesi 2010). Several disciplines have analysed journals' governance more than others, but there is a general consensus that EB interlocking creates a network structure of elite scholars, influencing the employment of particular research methods, topics, and theories (Teixeira and Oliveira 2018).

The potential consequences of EB interlocking also relate to the creation of a subgroup of scholars linked to some core journals, thus directly exerting influence on the vision and main paradigms of such journals. Since EBs' opinions, suggestions, visions, expectations, and reviews are reflected in many different journals, they can establish clear patterns of knowledge production/dissemination. As a result, editorial interlocks could create 'invisible colleges' which may develop their own norms, values and standards, monitoring also the progress of the field (Zuccala 2006). Previous studies have examined interlocking editorship within Economics (Baccini and Barabesi 2010), Information and Library Sciences (Baccini and Barabesi 2011), Finance (Andrikopoulos and Economou 2015), or Knowledge Management (Teixeira and Oliveira 2018). However, none work had considered EB interlocking in Communication Sciences, despite the crucial implications for knowledge production that this phenomenon might entail. This study seeks to palliate this gap by

identifying the most influential journals and scholars and mapping how they are structurally connected in a social network.

Method

Data collection

Data for this study came from the public web pages of the selected journals. We decide to take the Journal Citation Report (JCR) to examine our research questions because it is the most influential ranking in sciences, usually taken as reference in academic promotions, scholars' evaluations, and research founding (Alvesson et al. 2017). Similarly, we select 2016 for the analysis because we started our data collection in 2017, and therefore 2017 was the most recent data available. Journals indexed by the JCR ranking are divided into four different quartiles, according to their impact factor: Q1, Q2, Q3 and Q4. Those journals with a higher impact factor are thought to be more influential than those with lower ones, and hence Q1 and Q2 journals are arguably the most influential in a given field. In communication during 2016, there were 79 JCR journals in total, of which 41 were indexed in Q1 and Q2. "Appendix 1" presents the journals included in this study. For this study, we analyse the gender composition, the organizational affiliation, and the country of affiliation of each EB.

The country of affiliation was coded according to the geography in which EB members have their current academic affiliation (1 = USA, 2 = Asia-Pacific, 3 = Africa and Middle East, 4 = Europe, 5 = Israel, 6 = UK, 7 = Canada, 8 = Latin America). We follow previous studies for the coding (Goyanes 2019). We combine continent level, country level, and geographical level to present the data in a coherent and concise manner. For example, we consider the U.S., Israel, UK, and Canada as independent values at country level because they are some of the most important countries in terms of total EB members. By contrast, we consider Africa and Middle East and Latin America as a conglomerate of nationalities at a continent-regional level because their contribution to the total number of EB members is limited.

Social network analysis

Connections between scholars and journals in EBs can be analysed by Social Network Analysis (SNA) methods (Andrikopoulos and Economou 2015; Baccini and Barabesi 2010, 2011; Liwei and Chunlin 2015). SNA studies the connections in social structures through the use of graph theory. Actors of the network are called nodes. The relationships or connections between actors are represented as edges between nodes. The social network of journals and members of EBs can be represented as a bipartite graph. Bipartite networks have two sets of nodes that usually receive different names: actors and events. The edges of the bipartite network only connect nodes from opposite sets. In the social network of EBs, actors represent members of EBs (scholars), events represent journals, and edges represent a membership relation between a scholar and the EB of a journal. Bipartite networks are also called affiliation networks or two-mode networks.

A bipartite (two-mode) network can be projected into a unipartite (one-mode) network that contains only nodes of one set. Nodes in the one-mode projected network are connected if they have an edge to a common node in the original network. For instance, in a

one-mode projected network of members of EBs, two scholars are connected if they serve in the EB of at least one common journal. In a one-mode projected network of journals, two journals are connected if one or more scholars are part of the EB both journals. In a one-mode weighted projected graph, each edge of the resulting network contains an integer value that represents the number of common neighbors (weight) between the nodes in the original network. For instance, if two journals share ten members of their EBs, the weighted projected graph of journals has an edge between them with a value of ten. Although one-mode projections reduce the dimensionality of bipartite graphs by compressing information, it is a common analytic approach in SNA because it facilitates the visualization of large networks. Besides, several analytical methods can only be used in one-mode networks.

In this study, SNA was used to analyze the bipartite network formed by journals and scholars in which connections represent a relation of membership to the EBs. Python's NetworkX package[1] was used to create the graphs. NetworkX was also used to compute the metrics of nodes, and create weighted projections of the bipartite network. Graph figures were produced with the Gephi network visualization software (Bastian et al. 2009) using the ForceAtlas2 layout algorithm. The visualization of social networks conveys the results of the analysis showing patterns of connections and of properties for the actors.

Metrics

SNA provides a variety of metrics to quantify different properties of the network, nodes, and edges. Following previous works (Andrikopoulos and Economou 2015; Baccini and Barabesi 2010, 2011; Liwei and Chunlin 2015; Teixeira and Oliveira 2018), the social network of EBs membership formed by scholars and journals was analysed using SNA metrics. Density quantifies the number of connections of the network in relation to the maximum possible number, and it is useful to compare different networks. Centrality measures quantify the importance or influence of a particular node in the network. In this study, we analyze the following centrality metrics of journals and members of their EBs: degree centrality, closeness centrality, and betweenness centrality.

Degree centrality measures the number of connections of a node. In this study, degree centrality of a given node is computed as the fraction of nodes connected to it. It is normalized by dividing by the maximum possible number of connections, which is different for each set of a bipartite graph. Closeness centrality represents the distance to the centre of the network and can be regarded as a measure of how long it will take to spread information from a given node. It measures the average shortest distance to all other nodes of the network. In this study, closeness centrality is normalized by the minimum possible distance (Borgatti and Halgin 2014). Higher values represent more centrality. The maximum possible closeness centrality is one. A value of one means that the node is connected to all other nodes by the minimum possible distance, which is one for all nodes in the other set (e.g., a scholar is member of the EB of all journals) and two for the nodes in the same set (e.g., a journal shares at least one common member of its EB with all other journals). Betweenness centrality measures the number of times that a given node is part of the shortest path between two other nodes. Betweenness centrality reflects the amount of influence a node has over the flow of information or resources in the network. It can be used to find nodes that act as a bridge between different parts of the

[1] NetworkX package documentation https://networkx.github.io/.

network. In this study, betweenness centrality of a given node is computed as the sum of the fraction of all pairs of shortest paths that pass through it. The value is normalized by the maximum possible value, i.e., the maximum number of shortest paths of the complete graph, which for a bipartite graph is limited by the relative size of the two sets of nodes (Borgatti and Halgin 2014).

Cohesive groups

In one-mode social networks, cohesive groups are subsets of actors among whom there are strong or intense ties (Wasserman and Faust 1994). In this work, we analyzed the cohesive subgroups of the two different one-mode weighted projections: the projection of members of EBs (actors) and the projection of journals (events). Cohesive groups of actors are subsets of scholars that interlock in multiple EBs. Cohesive groups of journals are subsets of events that interlock multiple members. In one-mode weighted networks, cohesive subgroups will be determined by subsets of actors or events with numerous connections or with connections that show high weight values.

Cohesive groups were assessed by using two different strategies in the one-mode weighted projections: *k*-cores and the weight of connections (*m*-slices). A *k*-core is a subgraph in which each node is adjacent to at least *k* others. A *k*-core of actors will include only members of EBs that are connected with at least *k* other members by serving in common EBs. A *k*-core of events will include the journals that are connected with at least *k* other journals by having common members in their EB. We can consider different threshold values of *k* to form cohesive subgroups. Subsets of actors or events that have more connections will be part of cohesive groups at higher threshold levels, whereas actors or events that have fewer connections will only appear in cohesive groups at less strict threshold levels. An *m*-slice is a subgraph that has the edges with weight equal to or larger than *m*, as well as the nodes that are adjacent to these nodes. An *m*-slice of actors will include the actors among whose connections the weight is equal to or larger than *m*, i.e., the members that serve in at least *m* common EBs. Similarly, an *m*-slice of events will include the journals that share at least *m* members. We can also consider different threshold values of *m* to form the cohesive subgroups. Subsets of actors or events among whose ties have large values can be part of cohesive groups at higher threshold levels, whereas actors or events among whose connections have small values would only appear in cohesive groups at less strict threshold levels. Although analyzing the derived networks at increasing values of *k* and *m* results in a hierarchical series of cohesive subgroups, previous studies suggest that both thresholds can be chosen ad-hoc by the researcher (Teixeira and Oliveira 2018).

The two strategies show different aspects of subgrouping. While the *k*-core approach shows if the network has a highly connected core, the weight of connections (*m*-slices) may show the presence of cohesive subgroups in which connections are more intense, but such groups may not necessarily be connected among them.

Results

Social network

The network of journals and members of EBs has 2097 nodes (2056 scholars and 41 journals) and 2719 edges. Figure 1 shows the central connected component of the social network

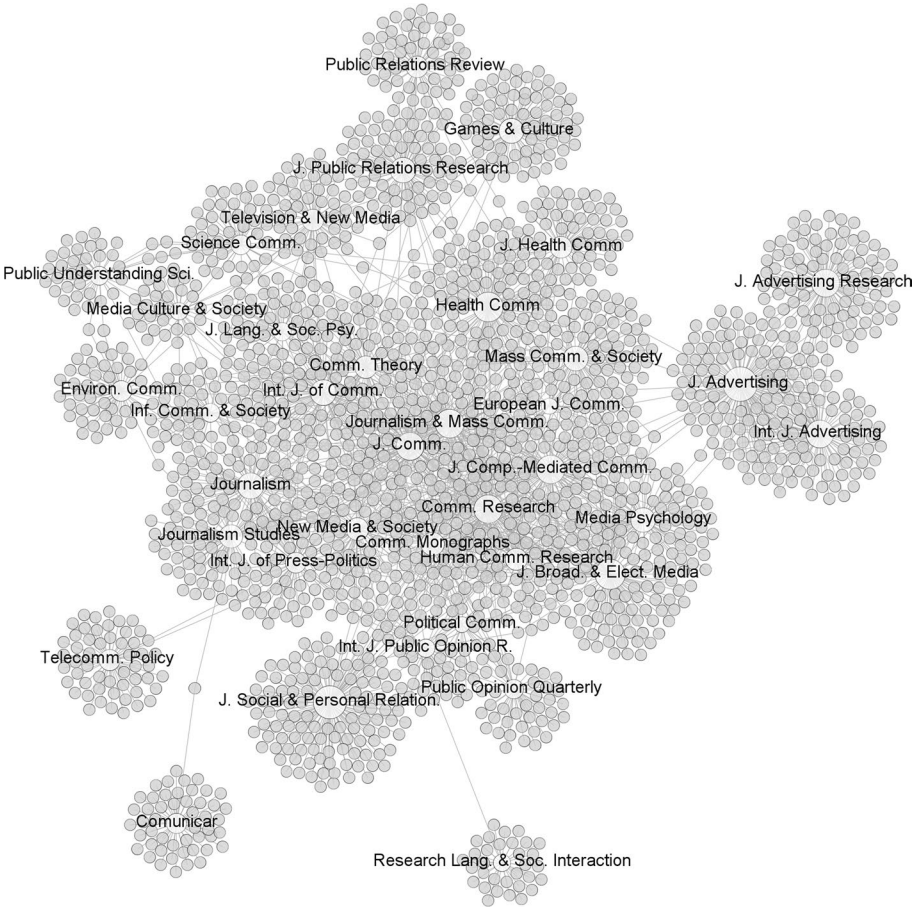

Fig. 1 Social network of members of the editorial boards of communication journals. White nodes represent journals. Size is proportional to the number of members. Grey nodes represent members. (Color figure online)

of members and journals represented as a graph. At a visual interpretation, we observe a fracture between the upper left part of the network and the central part, which included most journals and scholars. Journals that are in the central part form close ties by sharing members of their EBs. We also observe a smaller fracture, which included the three journals that are close together in the right: *J. of Advertising*, *Int. J. of Advertising* and *J. of Advertising Research*. These journals share many members of their EBs between them but only a small number with the central part. There are also several journals in the periphery which share only one or two members with other journals of the central part of the network. These journals are *Research on Language and Social Interaction* (bottommost journal in Fig. 1), *Telecommunications Policy,* and *Comunicar* (both in the bottom left in Fig. 1). The network of journals and members of EBs is classified as a disconnected network since three journals, *Written Communication, IEEE Transaction on Professional Communication,* and *Technical Communication,* do not share any member of their EB members with any other journal. Each of them forms a separate component (not included in Fig. 1).

Table 1 Distribution of degree for scholars in the bipartite network of journals and members of EBs

Degree	Frequency
1	1638
2	277
3	87
4	27
5	11
6	10
7	5
8	1

The density of the bipartite network is low (0.03). The density of the projected one-mode network of scholars is 0.05, which is also low. The density of the projected one-mode network of journals is 0.32 which is significant and higher than the values reported in other fields: 0.22 in Knowledge Management and Intellectual Capital (Teixeira and Oliveira 2018), 0.09 in Library Science (Baccini and Barabesi 2011), 0.02 in Economics (Baccini and Barabesi 2010) and 0 in Finances (Andrikopoulos and Economou 2015). The density of the network represents the occurrence of interlocking between EBs. Since interlocking is interpreted as alignments between journals, a higher-density may suggest that journals are aligned in their policies and preferences; thus existing a state of agreement or cooperation among EBs towards common causes and viewpoints. This may result in a lack of balance in the preferred topics, theories, and methods suggesting the existence of an elite group of researchers and journals in the field of communication. However, previous works analysed larger sets of journals so we have to be careful when comparing density since it may also be that the use of high-ranked journals in our study is the main source of higher density.

Central actors

The average degree of editors in the two-mode network is 1.31 (normalized degree average is 0.032, SD = 0.020). The number of memberships ranges from 1 to 8 (normalized degree centrality range is 0.024–0.195). The distribution presented in Table 1 shows that a substantial number of scholars (1638) are only connected with one journal. Table 2 presents scholars with the highest degree centrality. Journals have an average of 65.43 members in their EBs (normalized degree centrality of journals $M = 0.032$, SD = 0.013).

Average closeness centrality of scholars ($M = 0.392$, SD = 0.050) and journals ($M = 0.245$, SD = 0.032) shows that the distance among members of EBs and journals is small. Closeness centrality is normalized, and the maximum value is 1, which represents the minimum possible distance. Scholars with the highest closeness centrality are presented in Table 3. Values are particularly high, suggesting that these scholars are close to all other nodes of the network.

Betweenness centrality of scholars ($M = 0.001$, SD = 0.004) suggests that, on average, around 0.1% of all the shortest paths go through a given scholar. Top 10 highest ranked scholars are presented in Table 4. The highest value is 0.058. Since the value is normalized to the maximum number of shortest paths and the number of nodes is high (there are also many possible paths), even low values represent a significant amount of betweenness

Table 2 Scholars with highest degree centrality

Pos.	Name	Affiliation	G.	Geographic area	Degree	Normalized degree
1	Michael Delli Carpini	Univ. of Pennsylvania	M	1	8	0.195
2	S. Shyam Sundar	The Pennsylvania State Univ	M	1	7	0.171
2	Zizi Papacharissi	Univ. of Illinois at Chicago	F	1	7	0.171
2	Claes de Vreese	Univ. of Amsterdam	M	4	7	0.171
2	Patricia Moy	University of Washington	F	1	7	0.171
2	David Tewksbury	Univ. of Illinois, Urbana-Champaign	M	1	7	0.171
3	Homero Gil de Zúñiga	Univ. of Vienna	M	4	6	0.146
3	Natalie Jomini Stroud	Univ. of Texas at Austin	F	1	6	0.146
3	Ronald Rice	Univ. of California, Santa Barbara	M	1	6	0.146
3	Michael Slater	Ohio Northern Univ	M	1	6	0.146
3	W. Lance Bennett	Univ. of Washington	M	1	6	0.146
3	Daniel Hallin	Univ. of California San Diego	M	1	6	0.146
3	Sharon Dunwoody	Univ. of Wisconsin-Madison	F	1	6	0.146
3	Jesper Stromback	Univ. of Gothenburg	M	4	6	0.146
3	Jörg Matthes	Univ. of Vienna	M	4	6	0.146
3	R. Lance Holbert	Temple Univ	M	1	6	0.146

Table 3 Scholars with highest closeness centrality

Pos.	Name	Affiliation	G.	Geographic area	Closeness cent.
1	Zizi Papacharissi	Univ. of Illinois at Chicago	F	1	0.569
2	S. Shyam Sundar	The Pennsylvania State Univ	M	1	0.557
3	Homero Gil de Zúñiga	Univ. of Vienna	M	4	0.548
4	Carolyn Lin	Univ. of Connecticut	F	1	0.545
5	David Tewksbury	Univ. of Illinois, Urbana-Champaign	M	1	0.544
6	Natalie Jomini Stroud	Univ. of Texas at Austin	F	1	0.544
7	Michael Delli Carpini	Univ. of Pennsylvania	M	1	0.536
8	Silvia Knobloch-Westerwick	The Ohio State Univ	F	1	0.533
9	Travis Dixon	Univ. of Illinois, Urbana-Champaign	M	1	0.526
10	Ronald Rice	Univ. of California Santa Barbara	M	1	0.525
10	Louis Leung	Hong Kong Shue Yan University	M	2	0.525

centrality. Journals average betweenness centrality is 0.055 (SD = 0.036), meaning that, on average, 6.1% of the shortest paths go through a journal. The top-ranked journal in terms of betweenness centrality is the *Journal of Communication,* with a value of 0.166. Since journals are connected with many scholars (higher degree centrality), more shortest paths also go through them.

Table 4 Scholars with highest betweenness centrality

Pos.	Name	Affiliation	Gender	Geographic area	Between. cent.
1	Shintaro Okazaki	King's College London	M	6	0.058
2	Kathleen Tyner	Univ. of Texas at Austin	F	1	0.045
3	Sharon Dunwoody	Univ. of Wisconsin-Madison	F	1	0.041
4	S. Shyam Sundar	Pennsylvania State Univ	M	1	0.041
5	Zizi Papacharissi	Univ. of Illinois at Chicago	F	1	0.038
6	Rich Ling	Nanyang Technological Univ	M	2	0.036
7	Karen Tracy	Univ. of Colorado	F	1	0.034
8	Jörg Matthes	University of Vienna	M	4	0.033
9	Nick Yee	Standford Univ	M	1	0.029
10	Carolyn Lin	Quantic Foundry	F	1	0.027

Gender and geographic representation

In the dataset of members of EBs, 766 are females (37.26%), and 1247 (60.65%) are males. There are also 43 members (2.09%) whose gender could not be determined. Figure 2 presents a graphical representation of the gender distribution of the central connected component of the network. Although we can observe journals with more female members and journals with more male members, there is no clear pattern. Scholars with highest degree centrality (Table 2) are two females and four males. If we look at scholars with a degree of three or more (top 141), we find 45 females (31.91%) and 96 males (68.09%). So, regarding the number of memberships, females are underrepresented in the top positions. Top 10 scholars with the highest closeness centrality are four females and six males (Table 3) suggesting a distribution closer to the distribution of the complete dataset. However, it is not mirrored in the top 100, which includes 30 females and 70 males. So male members also occupy more central positions in the network. Top 10 scholars with the highest betweenness centrality are five females and five males (Table 4), while the top 100 are 42 females and 58 males. Although females are also underrepresented, the distribution of top scholars regarding betweenness centrality is similar to the distribution of the dataset.

Network metrics for members of EBs do not follow a normal distribution. Non-parametric methods that compare the medians of groups were then used to analyze the interrelationships among scholars. Medians of the three network metrics return the same value when grouped by gender. For instance, if we consider degree centrality, most scholars are members of only one EB. For this reason, we decided to perform the analysis with a subset of the dataset that included only scholars that are part of two or more EBs ($N=418$). Although the median of degree centrality is still the same for male and female members, small differences can be found regarding closeness centrality and betweenness centrality. However, they are not statistically significant ($H=1.83$, $p=0.176$, and $H=0.16$, $p=0.689$ respectively in Kruskal–Wallis tests). We also repeated the analysis with the subset of scholars that are members of three or more EBs ($N=141$) finding the same results ($H=0.00$, $p=0.981$, and $H=0.32$, $p=0.570$ respectively in Kruskal–Wallis tests). This suggests that although female members are less in overall numbers, they occupy

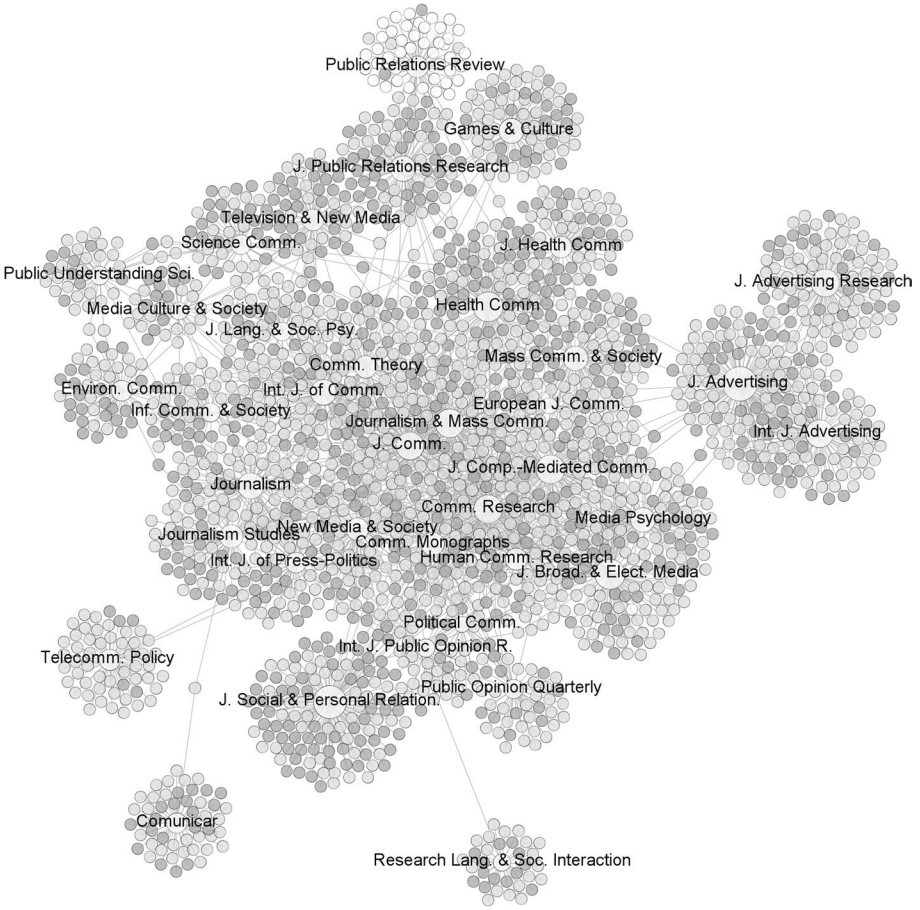

Fig. 2 Gender distribution of the social network of members of the editorial boards of communication journals. Light grey nodes represent male members. Dark grey nodes represent female members. White nodes represent journals, and members whose gender could not be determined

similar positions in terms of the number of connections, positioning, and distance to other members.

Descriptive statistics of network metrics are similar for the different geographic areas (Table 5). Figure 3 presents the geographic distribution of the affiliation of members of EBs (as reported by journals). One individual affiliated to the World Economics Journal was not included. We observe that members affiliated to USA institutions dominate the central part of the network. The left part shows the most diversity in terms of geographical representation, including an important number of members from European and UK institutions. Table 6 presents the geographic distribution of top-ranked scholars for each of the network metrics considered in this study. Members affiliated to institutions of the USA are overrepresented in the sample (61.86%) and top positions. Assuming that top-ranked individuals are the central actors of the network, the representation of institutions from the USA is even higher in top positions regarding the number of connections (70.2%), distance to other actors (82%), and communications paths that go through them (73%). Members of

Table 5 Statistics of network metrics by geographic area

Geographic area	*N*	Mean degree	SD degree	Mean closeness cent.	SD closeness cent.	Mean between. cent	SD between. cent
USA	1272	0.035	0.022	0.401	0.048	0.001	0.004
Asia–Pacific	184	0.032	0.016	0.383	0.049	0.001	0.004
Middle east-Africa	23	0.031	0.014	0.384	0.049	*	*
Europe	309	0.032	0.020	0.373	0.053	*	*
Israel	22	0.036	0.019	0.404	0.042	*	*
UK	173	0.031	0.016	0.375	0.040	0.001	0.001
Canada	47	0.031	0.015	0.384	0.042	0.001	0.003
Latin America	26	0.029	0.012	0.350	0.060	*	*

* < 0.001

European institutions are particularly underrepresented in the top positions of all metrics: 10.6% for degree centrality, 7% for closeness centrality, and 8% for betweenness centrality, while they represent 15.03% of all members of the dataset.

Medians of degree centrality and betweenness centrality return the same value when members are grouped by geographic area. Medians of closeness centrality are significantly different when grouped by geographic area ($H = 123.09$, $p < 0.001$ in a Kruskal–Wallis test). Scholars of institutions from the USA (Mdn = 0.402), Israel (Mdn = 0.409), and Middle East-Africa (Mdn = 0.393) occupy central positions in the network. Scholars from Asian (Mdn = 0.378), European (Mdn = 0.367), UK (Mdn = 0.373) and Canadian (Mdn = 0.373) institutions follow. Scholars from Latin American institutions tend to be in peripheral positions (Mdn = 0.348).

Cohesive subgroups

Cohesive groups were used to evaluate the existence of segmentation in communication journals and scholars. The 5-core of journals is the network in which each journal is connected (shares a common member of its EB) with at least the other 5 journals through EB interlocking. We selected a *k* value of 5 to compare with previous studies. The 5-core of journals (Fig. 4) includes 32 journals and has a density of 0.50, which is higher than the density of the network of journals (0.32). The discipline of Communication has more journals (32 of 41) in its core when compared with other disciplines like Knowledge Management and Intellectual Capital, which reported a core of 13 out of 27 journals (Teixeira and Oliveira Teixeira and Oliveira 2018). However, the density is lower (0.50 vs. 0.66), suggesting the presence of less interlocking in the core.

Cohesive groups of journals were also identified by the number of members which interlock two journals. Following previous studies (e.g., Teixeira and Oliveira 2018), a threshold of five or more editors (5-slice) was defined as parameter for network sectioning, which resulted in four cohesive groups (Fig. 5). The first subgroup is formed by two journals, Journal of Public Relations Research and Public Relations Review. The second subgroup is formed by three journals, Journal of Advertising, Journal of Advertising Research, and International Journal of Advertising. The third subgroup is formed by two journals,

Fig. 3 Geographic distribution of the social network of members of the editorial boards of communication journals. White nodes represent journals. Colored nodes represent the affiliation of members: USA – Turquoise, Asia–Pacific – Red, Middle East-Africa – Grey, Europe – Green, Israel – Black, UK – Yellow, Canada – Blue, Latin America – Orange. (Color figure online)

Table 6 Geographic distribution of top-ranked scholars for each network metric

Geographic area	Degree cent. degree > = 3 (top 149)	% Degree cent. degree > = 3	Closeness cent. top 100	Betweenness cent. top 100	Total	% Total
USA	99	70.2	82	73	1240	61.6
Asia-Pacific	11	7.8	7	9	180	8.9
Middle east-Africa	1	0.7	0	0	22	1.1
Europe	15	10.6	7	8	300	14.9
Israel	3	2.1	1	0	33	1.6
UK	8	5.7	2	7	169	8.4
Canada	3	2.1	0	3	44	2.2
Latin America	1	0.7	1	0	24	1.2

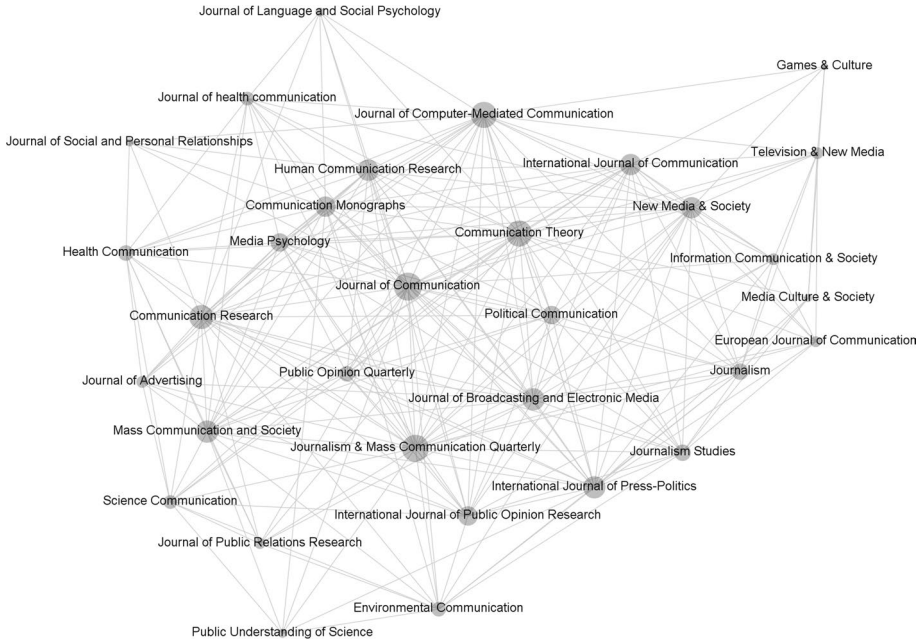

Fig. 4 The 5-core of journals. Size of nodes is proportional to degree

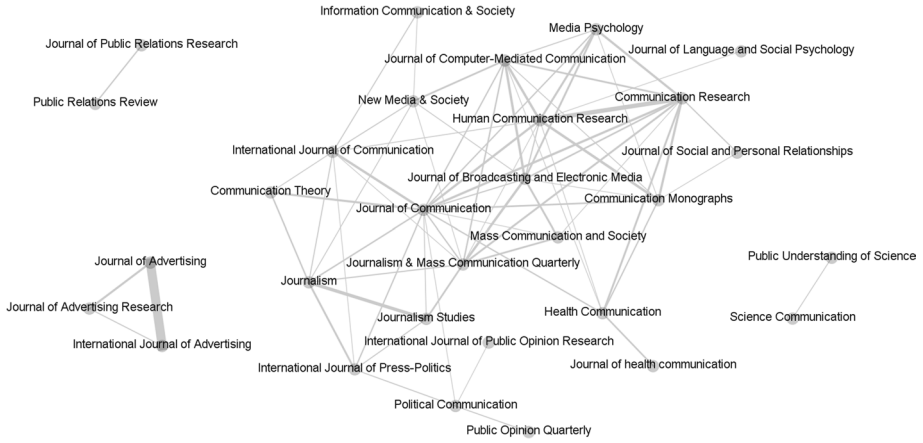

Fig. 5 Cohesive groups of journals which share five or more members (5-slice) of their EBs. The thickness of the edges is proportional to the weight of the connection

Science Communication and Public Understanding of Science. The final subgroup is the main group, and it is formed by 23 journals that cover different subject areas of the field, including journalism, communication, and political communication. Eleven journals did not form part of any group. Subgroups inform about the main areas and topics in the field of communication. Three independent themes were found: public relations, advertising, and science communication. The size and density of the main subgroup suggest that most

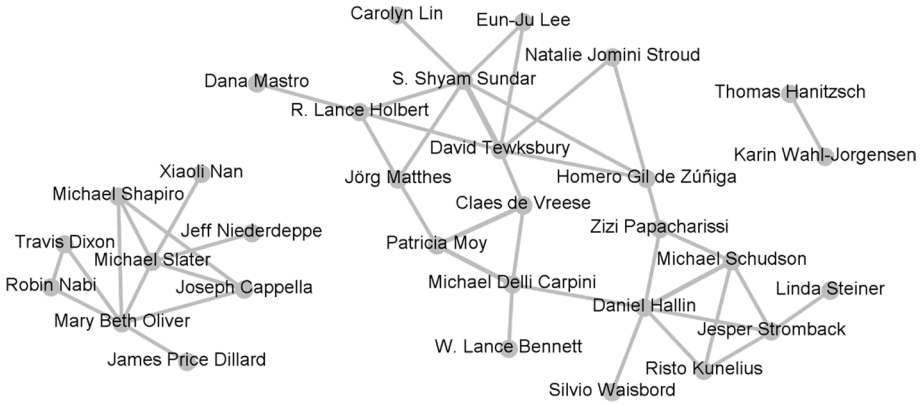

Fig. 6 Cohesive groups of scholars who are part of four or more EBs (4-slice)

journals have connections based on their EBs, and information may flow at a faster pace within the subgroup. This group of journals well connected together suggests the existence of an elite of journals which includes most of the Q1/Q2 ranked journals, although it also has to be pointed out that several journals occupy more prominent positions than others. *Journal of Communication* and *Communication Research* are in the central position (highest degree centrality) because they share a substantial amount of members of their EBs with many other journals. However, the strongest connection is between the *Journal of Advertising* and the *International Journal of Advertising* with 61 interlockings.

k-cores were used to find the centre of the network of scholars. Since journals have a substantial amount of seats in their EB, the degree of the one-mode network of scholars is particularly high ($M = 96.32$, $SD = 61.15$); and k has to be set to high values to cut off the network significantly. The 100-core of scholars has 459 nodes and a density of 0.27. The 130-core has 132 scholars who sit in 16 different journals. The density of the 130-core is 1. Therefore, the centre of the network of scholars is formed by a substantial group of scientists completely connected through EB interlocking.

Cohesive groups of scholars were identified using the number of common journals in which they serve as editors. A threshold of 4 common EBs (4-slice) was defined as parameter for network sectioning, which resulted in three cohesive groups (Fig. 6). The threshold was adjusted ad-hoc. The first cohesive group (left in the figure) includes 9 scholars, who mostly focus on the topic of health communication. The second cohesive group includes 20 scholars who are connected by several common themes, including communication, political communication, and journalism. The third cohesive group (right part in the figure) includes 2 scholars who focus on journalism studies. The size and density of the larger cohesive subgroup suggest that these scholars form an 'invisible college,' a connected elite that may develop its own norms, values, and standards, monitoring the progress in the field (Zuccala 2006).

Interrelationships among institutions

The relationships between scholars, journals, and institutions can be represented as a multipartite graph in which journals are connected with scholars, and scholars are connected to institutions. This multipartite graph can then be projected into a bipartite graph that

Table 7 Network metrics of top institutions

Institution	Degree	Normalized degree	Closeness cent.	Betweenness cent.	# Scholars
Univ. of Texas at Austin	25	0.609	0.806	0.066	37
Univ. of Illinois at Urbana-Champaign	24	0.585	0.753	0.025	29
Michigan State Univ	23	0.560	0.775	0.042	34
Univ. of Wisconsin-Madison	23	0.560	0.726	0.026	32
Univ. of Southern California	20	0.487	0.742	0.047	27
Pennsylvania State Univ	20	0.487	0.738	0.026	33

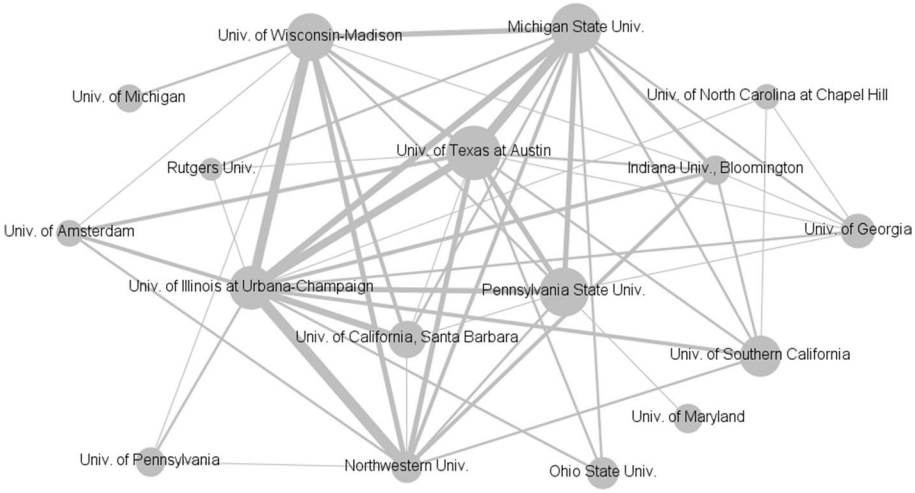

Fig. 7 Weighted projection of institutions that share members of EBs in more than 12 journals (13-slice). The thickness of the edges is proportional to the journals with shared members. The size of each node is proportional to the number of scholars of the institution in the dataset

connects journals and institutions. A journal is connected to an institution if at least one member of the EB is affiliated with the institution. The bipartite graph of journals and institutions has 718 nodes (687 institutions and 41 journals) and 2013 edges. Degree centrality ($M = 0.075$, SD = 0.093) shows that each institution is connected to 2.93 journals on average. Average closeness centrality is high ($M = 0.537$, SD = 0.047), suggesting that institutions are close together when connected through members of EBs. Average betweenness centrality is low ($M = 0.001$, SD = 0.05), suggesting that the flow of information is evenly distributed since only a small proportion of all communication paths go through each institution. Network metrics of top institutions are presented in Table 7. The number of scholars of each institution in the dataset is also included. Institutions of the USA are overrepresented in top positions. Top institutions from other geographical areas as ranked by degree centrality are the University of Amsterdam (ranked 9), the Chinese University of Hong Kong (ranked 22), Cardiff University (ranked 29), the University of Vienna (ranked 30), and the University of Haifa (ranked 33). The number of common journals, in which

scholars serve as editors, was used to try to identify cohesive groups of institutions. A threshold of more than 12 journals in which institutions share at least one member of the EB was defined as parameter for network sectioning. Only one cohesive group was found (Fig. 7) with 17 institutions and 54 edges. The reduced number of institutions that are part of this cohesive group and the density (0.40) suggests that there is also an elite of institutions that shape the field.

The number of scholars that each institution has in the complete dataset is highly correlated with degree centrality ($r=0.942$, $p<0.001$), closeness centrality ($r=0.891$, $p<0.001$) and betweenness centrality ($r=0.873$, $p<0.001$). Simple linear regression models show that the number of scholars also predicts all network metrics and that the linear models fit the data reasonably well: degree centrality ($F=5343$, $p<0.001$, $R^2=0.89$), closeness centrality ($F=2601$, $p<0.001$, $R^2=0.79$) and betweenness centrality ($F=2177$, $p<0.001$, $R^2=0.76$). This suggests that institutions with more members in different EBs have more connections to other institutions, are closer to them occupying central positions in the social network, and are part of more communication paths among members of EBs. This result may seem expected because the connections between journals and institutions of the projected graph are made through the scholars that sit together in EBs. However, the number of scholars is not necessarily an indicator of the connections between institutions. For instance, a given institution can have many members that are only part of a small number of journals, thus limiting the possible connections that the institution can make with other institutions through EBs. Also, EBs can have little diversity accumulating numerous members affiliated only to a few institutions.

Conclusions

Editorial boards, as gatekeepers of knowledge, are key agents in the development of scientific fields (Metz et al. 2016). Their crucial role in ensuring the quality of scientific journals (Willett 2013) and in the promotion and review process of manuscripts, make them a fundamental body in shaping the form and content of scientific outlets (Rosenstreich and Wooliscroft 2006). This exploratory paper contributes to the limited, but fundamental research in this area by examining the EB interlocking in communication sciences. Using graph theory and SNA, we analyse editorial board interlocking and identify the central journals, institutions, and scholars describing their gender and geographic representation. Our results offer relevant descriptive insights to understand why and how these influent agents are structured, linked, and associated in what can be conceptualized as an "elite" academic network.

In relation to the specific composition of the social network of EBs and journals, our results show that the network is tightly connected with a centre that includes most journals and individuals. Average closeness centrality is particularly high, suggesting that the distance between nodes is low. i.e., scholars could reach all other scholars through a small number of connections. All this suggests that the field of communication is a compact discipline and that the scholarly practices related to the social network of EBs are collaboratively performed with a certain degree of internal cohesion. Furthermore, scholars have the possibility to exert their influence in academic decisions effectively since they can reach other actors promptly.

Results also indicate central scholars (individuals) in the network, and therefore the most important ones in shaping the form and reach of the social network structure of EBs: M.

Delli Carpini (rank#1 in degree centrality: member of more EBs than any other scholar), Z. Papacharissi (rank#1 in closeness centrality: closest average distance to all other scholars) and S. Okazaki (rank#1 in betweenness centrality: number of shortest communication paths that go through him). This points to leaders in the discipline but also shows how they can influence scholarly activities: through direct participation in the EBs of journals (degree) (Willett 2013), by having closer network connections with other scholars (closeness), or by acting as gatekeepers of new and crucial information (betweenness). Cohesive group analysis furthers points in this direction, suggesting the existence of an invisible college of individuals that may shape the research agenda of the field. However, such influence is more evenly distributed among journals, with an "elite" of publication venues, which includes most journals ranked in the Q1/Q2 of the JCR. Thematic groups found include a core with journals and scholars focused on journalism, communication, and political communication. Results also suggest the existence of additional thematic groups on health communication, science communication, public relations, and advertising.

With regard to the gender representation of EBs, female members are underrepresented in the dataset (40%). They are even more underrepresented in top positions when it comes to the number of memberships (degree) and distance to other members of the network (closeness centrality). However, the statistical differences for all network metrics when analysing the complete dataset were not found significant, suggesting that the number and quality of connections are similar for female and male members. Similarly, the geographic representation of EBs indicates that institutions of the USA are overrepresented in the dataset (61.82%). They also occupy most of the top positions in the network metrics related to the number of connections (70.2%), distance to other members of the network (82%), and the number of communication paths that go through them (73%). This suggests that the epistemic culture and norms and values of scientific production from North-America are paradigmatic in this field of research.

Despite our results providing empirical support for the existence of a geographical imbalance in the governance of EBs, such findings should be framed according to the real domination of US scholars and institutions in science production/dissemination in communication research. Previous studies suggest that US communication scholars occupy a leading position in communication research production in top-tier journals, and therefore, it is reasonable that they also occupy a leading position as EB members.

In relation to the associations among academic institutions, results indicate that The University of Texas at Austin is ranked in the first position of all metrics. It has more members in EBs than any other institution, their scholars can reach all other actors rapidly, and they are also part of more communication paths. Assuming that these metrics are relevant to determine the promotion and review of research, the University of Texas at Austin is the central institution in shaping the form and content of communication journals. The number of scholars of each institution predicts the number of connections with other institutions and also its capacity to access and spread information, thus reflecting its centrality in the network. The number of scholars that an institution has in the different EBs of Q1/Q2 communication journals is, therefore, a good indicator of the relevance of that institution in the social network as a gatekeeper of knowledge. From a methodological perspective, these findings imply that the overall number of scholars in EBs can be used to measure the centrality of that institution, facilitating future estimations. From a practical perspective, these findings suggest that institutions seeking to improve their relevance in the research field of communication should try to get more members into the EBs of Q1/Q2 journals.

Finally, at a methodological level, this study uses SNA to investigate the connections between scholars, journals, and institutions in the field of communication research by

conducting an analysis of members of EBs of JCR communication journals. To the best of our knowledge, this is the first study that explains the structure of EBs using SNA in communication research. This approach can complement others such as scientometrics, which stresses interlocking between journals, providing valuable insights about how scholars of EBs interrelate. The correspondence of our findings with previous studies on gender and geographic diversity in research argues for the methodological validity as a tool for studying the relationships between scholars, journals, and institutions through the composition of EBs.

Limitations and future research

Six main limitations, which need to be addressed in future research, are noteworthy. First, the ranking and quartiles selected to form the sample are biased towards English-speaking countries. JCR journals generally employ English as lingua franca, which can explain the geographical domination of the United States, United Kingdom, or Canada. Therefore, future studies may also consider the full sample of JCR journals or take other more inclusive rankings (such as Scopus SJR). Second, to gather data related to editorial members' nationality, we take the country of their academic affiliation as reference. However, in the communication field, there are many scholars with a very international background, meaning that their country of origin might not be aligned with their country of residence. Third, many EBs' affiliations were incorrectly reported or outdated in journals' websites. When we detected these mistakes, we directly corrected them in our dataset. However, during data gathering, we did not double-check whether or not the affiliations publically available were correctly or incorrectly reported by journals. Fourth, other geographical categorizations of EBs nationality might be considered. Fifth, our results map some imbalances in the governance of EBs, showing the potential invisible colleges that might exist in the field. However, our findings do not empirically demonstrate if those inequalities cause real effects (or what effects were really produced). In short, results demonstrated an unbalance between institutions/geography, but the extent this unbalance materializes in real prejudice cannot be shown. Future studies may examine the existence of biases in research published when EBs and authors of papers share similar characteristics like gender, nationality, affiliation, or co-authoring. A more challenging endeavour would be investigating how papers published by the invisible college impact the communication field. Since the invisible college may result in a convergence of research streams, future research could investigate whether and how topics, theories and methods are clustering or dispersing in published research. Further work could also examine the similarities and differences in the editorial policies of communication journals to further determine the influence of the invisible college.

Sixth, this study analyses the structure of the social network of connections of EBs in the field of communication research without considering its possible connections with other fields. From this perspective, results show that the field presents a compact and cohesive discipline in its internal structure of the connections, which reflect scholarly practices of EBs. However, this could also mean that there is an excessive level of homogeneity in those practices that result from the lack of interdisciplinary work that can bring new theories and interpretations. As future work, we suggest studying other fields of research to analyse and compare their form, and also to analyse the relations between communication research and other fields to determine interdisciplinary patterns in the composition of

EBs. Further, this study analyses the connections between journals and scholars but not the content of these connections. Future research could investigate how communication journals and members are connected by papers published using co-citation networks and co-author networks to determine their structure and to what extent the imbalances or elites are also present there. Please note that our study shows the connections between journals and scholars indirectly through EBs. Despite these limitations, this article presents original and robust findings to calibrate the power "behind the scenes" in the communication field, addressing the main actors and institutions that shape the form and governance of elite journals.

Appendix 1: Journals included in the study

New Media & Society, Journal of Computer-Mediated Communication, Journal of Communication, Media Psychology, Communication Research, Journal of Advertising, Communication Theory, Information, Communication & Society, Public Understanding of Science, Political Communication, International Journal of Advertising, Comunicar, Journal of Advertising Research, Journalism Studies, Research on Language and Social Interaction, Science Communication, Communication Monographs, Journal of Public Relations Research, Journal of Health Communication, Human Communication Research, Telecommunications Policy, International Journal of Press-Politics, International Journal of Communication, Health Communication, Journalism, Journal of Social and Personal Relationships, Environmental Communication, European Journal of Communication, Public Opinion Quarterly, Television & New Media, Journal of Broadcasting & Electronic Media, Public Relations Review, Mass Communication and Society, Journalism & Mass Communication Quarterly, Journal of Language and Social Psychology, International Journal of Public Opinion Research, Written Communication, Media Culture & Society, Games and Culture, IEEE Transactions on Professional Communication, Technical Communication.

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