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Assessment of Gender Divide in Scientific Communities
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Assessment of Gender Divide in Scientific Communities

Supplementary Information

Antonio De Nicola · Gregorio D'Agostino

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1 Statistical Analysis

This document presents the results of the statistical analysis for the different indicators concerning the authors belonging to the selected four communities: ITAIS, SEBD, ICIS, and VLDB. In some cases the statistical significance provides evidence for a gender divide, while in other cases the set of females appears close similar to a random selected one. The statistical analysis may be regarded as testing the hypothesis of genuine gender divide against the "null hypothesis" that no gender divide is found.

Several indicators were selected to provide evidence of a possible gender divide. Due to their operative definition, a set of indicators are limited to the "semantically treatable" authors [2], i.e. those who wrote at least two papers in two different years. The list follows:

- number of papers of semantically treatable authors,
- degree of semantically treatable authors,
- neighbour susceptibility,
- trend susceptibility,
- authority.

On the other side, another set of indicators applies to all the authors regardless to their semantic treatability. They are:

- semantic centrality,
- betweenness,
- degree centrality,
- closeness,

Antonio De Nicola · Gregorio D'Agostino
Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA),
Casaccia Research Centre, Via Anguillarese 301, 00123, Rome, Italy
E-mail: antonio.denicola@enea.it, gregorio.dagostino@enea.it

- eigenvector centrality,
- clan segregation,
- novelty,
- combinational creativity,
- number of papers of all the authors,
- degree of all the authors.

Authors are classified according to the capability to infer their gender from the first name. If the inferred gender is female, the author belongs to the "female group": $\mathcal{F}$. If the inferred gender is male, the author belongs to the "male group": $\mathcal{M}$. If no gender can be inferred from the first name, the author belongs to the "undetermined group": $\mathcal{U}$. For most of the indicators a figure showing the distributions of the average value of random samples of the same dimension of the female group is presented[1]. All samples were generated by randomly selecting authors from the populations of each available community. These distributions allow to estimate the *degree of belief* (the level of confidence) of the average observed indices characterizing females and males. The vertical pink line, marked by an F, represents the average value of the indicator for females ($\bar{ind}_F$); the blue line, marked by an M, represents the average value for males ($\bar{ind}_M$); the grey line, marked by U, represents the average value for authors (in the ICIS and VLDB communities only) with undetermined gender ($\bar{ind}_U$); finally the black line marked by R represents the average value for the above mentioned random samples ($\bar{ind}_R$). The former average values for the different groups are also reported in tables for all the considered communities. To improve readability, dashed black lines at multiples of the standard deviation (σ) of the distributions are also shown in figures and reported in the tables. Then for each indicator the Z-scores (z_F) [1] [3] of the female groups in the different communities are reported. These are the normalized deviations with respect to the distribution of the random samples. The *p-value* (i.e. the complementary cumulative distribution function) represents the likelihood of having either a higher average indicator value, if $\bar{ind}_F > \bar{ind}_R$, or a lower one, if $\bar{ind}_F < \bar{ind}_R$. Therefore, it measures how significant is the observed average value of the indicator for the female groups (or its estimate for the ICIS and VLDB communities). The lower are the p's, the more significant are the deviations.

The analysis starts by discussing the semantic centrality in order to outline a possible "theme segregation" that may be the most subtle one.

2 Semantic Centrality

Semantic centrality measures to what extent the topics characterizing an author's profile belong to the main stream or to some minor subjects. This index

[1] This was done for all the indicators with the exception of clan segregation where we followed a slightly different approach where random samples have the same dimension of the largest clans (see Section 7).

therefore measures how key the topics treated by her or him are and to what extent the topics in an author's papers concern the key topics (i.e. the most popular ones) in the conference papers as a whole. The semantic centrality of the author h_i is defined as follows:

$$\mathcal{SC}_{h_i} = \sum_{c_k} L_{h_i}(c_k) \cdot L_s(c_k); \quad (1)$$

where $L_{h_i}(c_k)$ is her or his (their hereafter) degree of interest in the topic c_k and $L_s(c_k)$ is the likelihood for the environment to provide some information on topic c_k [2]. This index spans the [0,1] range.

Figure 1 shows the distributions of the average semantic centrality of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 1 for all the considered communities, under the columns labelled by $\bar{\mathcal{SC}}_F$, $\bar{\mathcal{SC}}_M$, $\bar{\mathcal{SC}}_U$, and $\bar{\mathcal{SC}}_R$, respectively. In details, Figure 1(a) refers to the ITAIS community, Figure 1(b) refers to the SEBD community, Figure 1(c) refers to the ICIS community, and Figure 1(d) refers to the VLDB community. It is worth noting that both $\bar{\mathcal{SC}}_F$ and $\bar{\mathcal{SC}}_M$ are smaller than $\bar{\mathcal{SC}}_R$ in the ICIS and VLDB communities. This is possible owing to the presence of several authors of undetermined gender. In fact, as it can be seen in Figure 1(c) and Figure 1(d), $\bar{\mathcal{SC}}_U > \bar{\mathcal{SC}}_R$. The z_F values in Table 1 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of semantic centrality higher than the observed value for the female group (0.00632), by a random sampling of the same size, is 20.34%, which is the likelihood of obtaining a value higher than $\bar{\mathcal{SC}}_F$. Therefore, the *degree of belief* that the female group is performing better than the average group is weakly significant in this case. If any, there is a gender divide in favor of females. In other words the females tend to work on more "central" subjects.

In the SEBD community, the likelihood of achieving an average value of semantic centrality lower than the observed value for the female group (0.0084), by a random sampling of the same size, is 15.87%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{SC}}_F$. Therefore, the *degree of belief* is also weakly significant in this case, that is some gender divide in favor of males is observed: females tend to work on less "central" subjects.

In the ICIS community, the likelihood of achieving an average value of semantic centrality lower than the observed value for the female group (0.00198), by a random sampling of the same size, is 15.15%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{SC}}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant. Again, females tend to work on less "central" subjects.

In the VLDB community, the likelihood of achieving an average value of semantic centrality lower than the observed value for the female group (0.00271), by a random sampling of the same size, is 10.20%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{SC}}_F$. Again the *degree of belief* and, hence, the

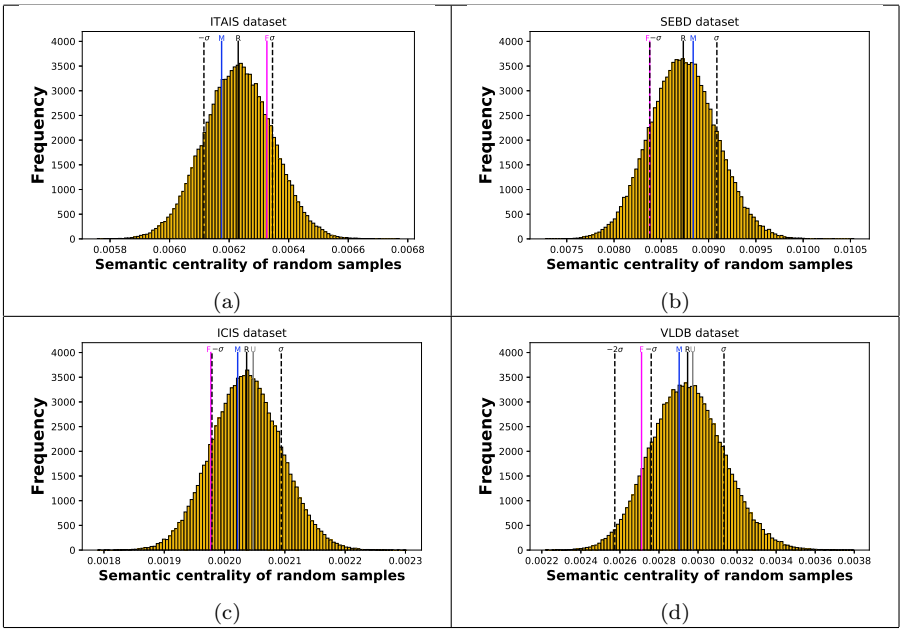

Fig. 1 The distributions of sample averages of the semantic centrality. The figure allows to estimate the *degree of belief* that the observed deviations for the female group are not accidental. The average values of semantic centrality characterizing females and males are also outlined. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

hypothesis of a genuine gender divide in favor of males are weakly significant. Also for this community, females tend to work on less "central" subjects.

Community	$\bar{\mathcal{SC}}_F$	$\bar{\mathcal{SC}}_M$	$\bar{\mathcal{SC}}_U$	$\bar{\mathcal{SC}}_R$	σ	z_F	*p-value*
ITAIS	0.00632	0.00617	—	0.00623	0.00012	0.84	20.34%
SEBD	0.0084	0.0088	—	0.0087	0.0004	-1.00	15.87%
ICIS	0.00198	0.00202	0.00205	0.00204	0.00006	-1.03	15.15%
VLDB	0.00271	0.00290	0.00297	0.00295	0.00019	-1.27	10.20%

Table 1 For each scientific community: $\bar{\mathcal{SC}}_F$ is the average semantic centrality value for females; $\bar{\mathcal{SC}}_M$ is the average semantic centrality value for males; $\bar{\mathcal{SC}}_U$ is the average semantic centrality value for undetermined authors; $\bar{\mathcal{SC}}_R$ is the average semantic centrality value for the random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average semantic centrality values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

In conclusion, all the communities do exhibit some degree of gender divide with respect to the semantics; however, remarkably, in the ITAIS community the female role is more "central".

3 Betweenness

Figure 2 shows the distributions of the average betweenness of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 2 for all the considered communities, under the columns labelled by $\bar{\mathcal{B}}_F$, $\bar{\mathcal{B}}_M$, $\bar{\mathcal{B}}_U$, and $\bar{\mathcal{B}}_R$, respectively. In details, Figure 2(a) refers to the ITAIS community, Figure 2(b) refers to the SEBD community, Figure 2(c) refers to the ICIS community, and Figure 2(d) refers to the VLDB community. The z_F values in Table 2 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of betweenness lower than the observed value for the female group (0.000089), by a random sampling of the same size, is 42.86%, which is the likelihood of obtaining a value lower than $\mathcal{B}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the SEBD community, the likelihood of achieving an average value of betweenness lower than the observed value for the female group (0.0033), by a random sampling of the same size, is 37.45%, which is the likelihood of obtaining a value lower than $\mathcal{B}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the ICIS community, the likelihood of achieving an average value of betweenness lower than the observed value for the female group (0.00031), by a random sampling of the same size, is 7.21%, which is the likelihood of obtaining a value lower than $\mathcal{B}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the VLDB community, the likelihood of achieving an average value of betweenness lower than the observed value for the female group (0.00031), by a random sampling of the same size, is 11.90%, which is the likelihood of obtaining a value lower than $\mathcal{B}_F$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

Community	$\bar{\mathcal{B}}_F$	$\bar{\mathcal{B}}_M$	$\bar{\mathcal{B}}_U$	$\bar{\mathcal{B}}_R$	σ	z_F	*p-value*
ITAIS	0.000089	0.000095	—	0.000093	0.000023	-0.18	42.86%
SEBD	0.0033	0.0037	—	0.0036	0.0008	-0.32	37.45%
ICIS	0.00031	0.00044	0.00044	0.00043	0.000083	-1.46	7.21%
VLDB	0.00031	0.00063	0.00053	0.00054	0.00019	-1.18	11.9%

Table 2 For each scientific community: $\bar{\mathcal{B}}_F$ is the average betweenness value for females; $\bar{\mathcal{B}}_M$ is the average betweenness value for males; $\bar{\mathcal{B}}_U$ is the average betweenness value for undetermined authors; $\bar{\mathcal{B}}_R$ is the average betweenness value for random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average betweenness values for each female group; *p-value* is the likelihood given by the complementary cumulative distribution function.

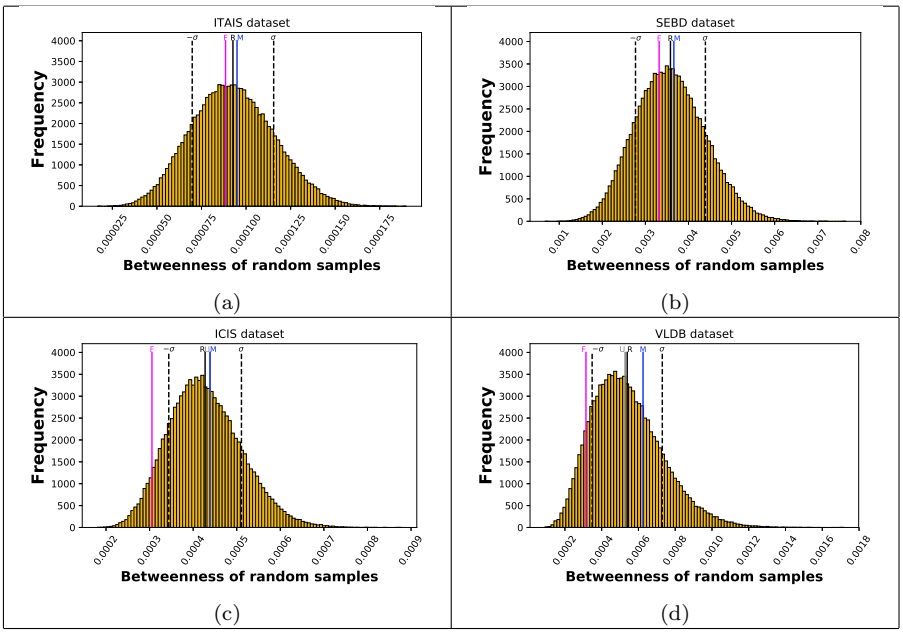

Fig. 2 The distributions of sample averages of the betweenness centrality. The figure allows to estimate the *degree of belief* that the observed deviations for the female group are not accidental. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Concerning the betweenness, while one observes some gender divide in favor of males in the international communities, the Italian ones (ITAIS and SEBD) do not provide evidence of such phenomenon.

4 Degree Centrality

Figure 3 shows the distributions of the average degree centrality of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 3 for all the considered communities, under the columns labelled by $\bar{D}_{cen,F}$, $\bar{D}_{cen,M}$, $\bar{D}_{cen,U}$, and $\bar{D}_{cen,R}$, respectively. In details, Figure 3(a) refers to the ITAIS community, Figure 3(b) refers to the SEBD community, Figure 3(c) refers to the ICIS community, and Figure 3(d) refers to the VLDB community. The z_F values in Table 3 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of degree centrality lower than the observed value for the female group (0.0029), by a random sampling of the same size, is 0.16%, which is the likelihood of obtaining a value lower than $\bar{D}_{cen,F}$. Therefore, the *degree of belief* and,

hence, the hypothesis of a genuine gender divide in favor of males are highly significant.

In the SEBD community, the likelihood of achieving an average value of degree centrality lower than the observed value for the female group (0.0081), by a random sampling of the same size, is 43.64%, which is the likelihood of obtaining a value lower than $\bar{D}_{cen,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the ICIS community, the likelihood of achieving an average value of degree centrality lower than the observed value for the female group (0.00062), by a random sampling of the same size, is 14.46%, which is the likelihood of obtaining a value lower than $\bar{D}_{cen,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the VLDB community, the likelihood of achieving an average value of degree centrality lower than the observed value for the female group (0.00114), by a random sampling of the same size, is 4.27%, which is the likelihood of obtaining a value lower than $\bar{D}_{cen,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are significant.

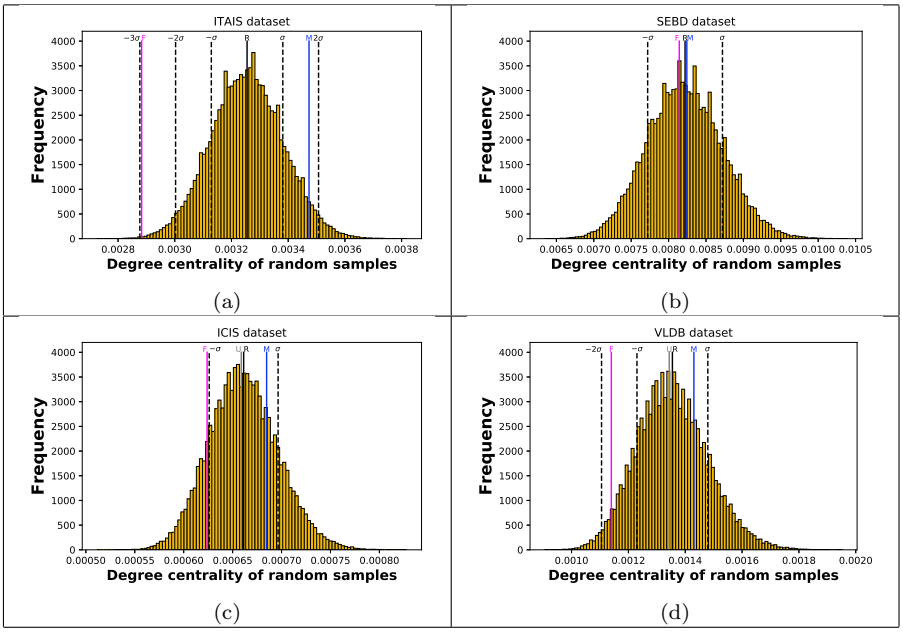

Fig. 3 Distributions to estimate the *degree of belief* of the average degree centrality values characterizing females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{D}_{cen,F}$	$\bar{D}_{cen,M}$	$\bar{D}_{cen,U}$	$\bar{D}_{cen,R}$	σ	z_F	*p-value*
ITAIS	0.0029	0.0035	—	0.0033	0.0001	-2.95	0.16%
SEBD	0.0081	0.0082	—	0.0082	0.0005	-0.16	43.64%
ICIS	0.00062	0.00068	0.00066	0.00066	0.000035	-1.06	14.46%
VLDB	0.00114	0.00143	0.00134	0.00135	0.00012	-1.72	4.27%

Table 3 For each scientific community: $\bar{D}_{cen,F}$ is the average degree centrality value for females; $\bar{D}_{cen,M}$ is the average degree centrality value for males; $\bar{D}_{cen,U}$ is the average degree centrality value for undetermined authors; $\bar{D}_{cen,R}$ is the average degree centrality value for random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average degree centrality values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

Concerning the degree centrality, while one observes some gender divide in favor of males in the international communities and in ITAIS, the SEBD community does not provide evidence of such phenomenon.

5 Closeness

Figure 4 shows the distributions of the average closeness of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 4 for all the considered communities, under the columns labelled by $\bar{Cl}_F$, $\bar{Cl}_M$, $\bar{Cl}_U$, and $\bar{Cl}_R$, respectively. In details, Figure 4(a) refers to the ITAIS community, Figure 4(b) refers to the SEBD community, Figure 4(c) refers to the ICIS community, and Figure 4(d) refers to the VLDB community. The z_F values in Table 4 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of closeness higher than the observed value for the female group (0.0107), by a random sampling of the same size, is 2.02%, which is the likelihood of obtaining a value higher than $\bar{Cl}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of females are significant.

In the SEBD community, the likelihood of achieving an average value of closeness lower than the observed value for the female group (0.102), by a random sampling of the same size, is 1.92%, which is the likelihood of obtaining a value lower than $\bar{Cl}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are significant.

In the ICIS community, the likelihood of achieving an average value of closeness higher than the observed value for the female group (0.085), by a random sampling of the same size, is 30.15%, which is the likelihood of obtaining a value higher than $\bar{Cl}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of females are weakly significant.

In the VLDB community, the likelihood of achieving an average value of closeness lower than the observed value for the female group (0.098), by a random sampling of the same size, is 11.51%, which is the likelihood of obtaining a value lower than $\bar{C}l_F$. The *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

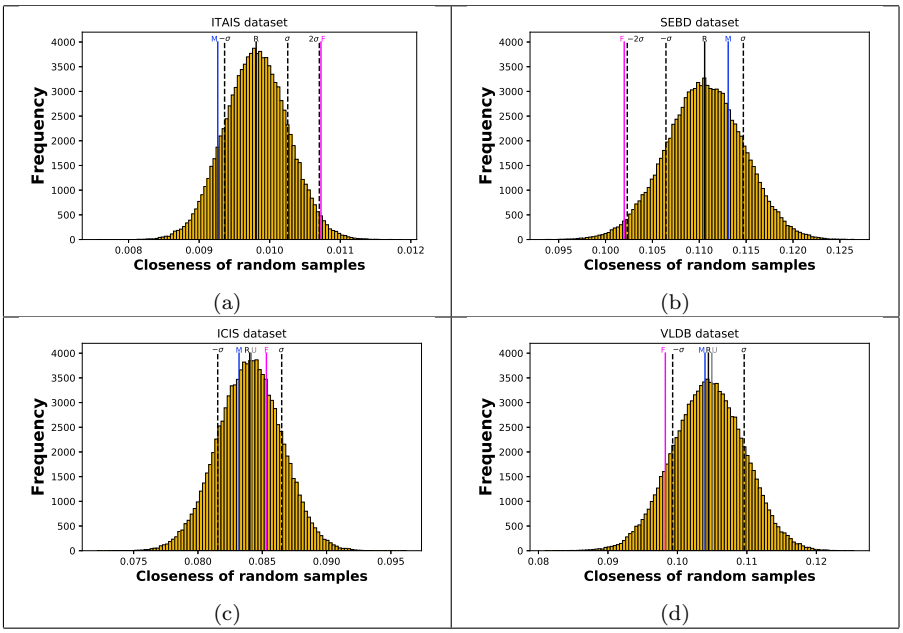

Fig. 4 Distributions to estimate the *degree of belief* of the computed average closeness values characterizing females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{C}l_F$	$\bar{C}l_M$	$\bar{C}l_U$	$\bar{C}l_R$	σ	z_F	*p-value*
ITAIS	0.0107	0.0093	—	0.0098	0.0004	2.05	2.02%
SEBD	0.102	0.113	—	0.111	0.004	-2.08	1.92%
ICIS	0.085	0.083	0.084	0.084	0.002	0.52	30.15%
VLDB	0.098	0.104	0.105	0.104	0.005	-1.20	11.51%

Table 4 For each scientific community: $\bar{C}l_F$ is the average closeness value for females; $\bar{C}l_M$ is the average closeness value for males; $\bar{C}l_U$ is the average closeness value for undetermined authors; $\bar{C}l_R$ is the average closeness value for random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average closeness values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

Concerning the closeness, while one observes some gender divide in favor of males in the computer science communities (SEBD and VLDB) where the

average values for female samples are smaller, in the information systems communities (ITAIS and ICIS) the average value for the female sample is higher.

6 Eigenvector Centrality

Figure 5 shows the distributions of the average eigenvector centrality of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 5 for all the considered communities, under the columns labelled by $\bar{E}_F$, $\bar{E}_M$, $\bar{E}_U$, and $\bar{E}_R$, respectively. In details, Figure 5(a) refers to the ITAIS community, Figure 5(b) refers to the SEBD community, Figure 5(c) refers to the ICIS community, and Figure 5(d) refers to the VLDB community. The z_F values in Table 5 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of eigenvector lower than the observed value for the female group (0.0012), by a random sampling of the same size, is 0.36%, which is the likelihood of obtaining a value lower than $\bar{E}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are highly significant.

In the SEBD community, the likelihood of achieving an average value of eigenvector higher than the observed value for the female group (0.0075), by a random sampling of the same size, is 32.64%, which is the likelihood of obtaining a value higher than $\bar{E}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the ICIS community, the likelihood of achieving an average value of eigenvector centrality lower than the observed value for the female group (0.0039), by a random sampling of the same size, is 33.72%, which is the likelihood of obtaining a value lower than $\bar{E}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the VLDB community, the likelihood of achieving an average value of eigenvector centrality lower than the observed value for the female group (0.000003), by a random sampling of the same size, is 14.23%, which is the likelihood of obtaining a value lower than $\bar{E}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

Concerning the eigenvector centrality, while one observes some gender divide in favor of males in the ITAIS and VLDB communities, the SEBD and ICIS communities do not provide evidence of any gender divide.

7 Clan segregation

Clan segregation ($\mathcal{CS}$) measures if there are clans where males or females are statistically prominent. A community is affected by clan segregation if the following two conditions apply:

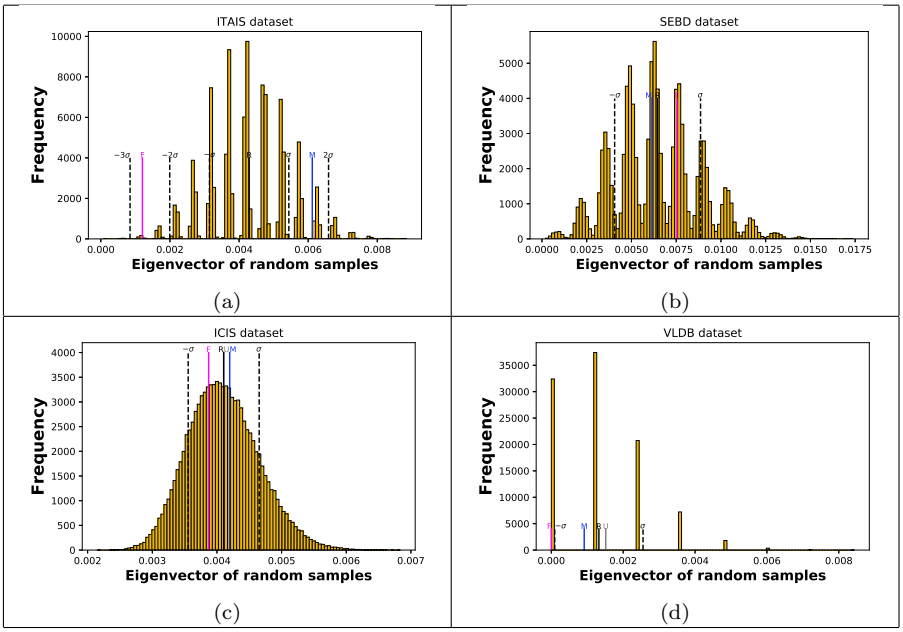

Fig. 5 Distributions to estimate the *degree of belief* of the computed average eigenvector values characterizing females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{E}_F$	$\bar{E}_M$	$\bar{E}_U$	$\bar{E}_R$	σ	z_F	*p-value*
ITAIS	0.0012	0.0061	—	0.0043	0.0011	-2.69	0.36%
SEBD	0.0075	0.0061	—	0.0065	0.0024	0.45	32.64%
ICIS	0.0039	0.0042	0.0041	0.0041	0.0005	-0.42	33.72%
VLDB	0.000003	0.000916	0.001514	0.001324	0.001228	-1.08	14.23%

Table 5 For each scientific community: $\bar{E}_F$ is the average eigenvector centrality value for females; $\bar{E}_M$ is the average eigenvector centrality value for males; $\bar{E}_U$ is the average eigenvector centrality value for undetermined authors; $\bar{E}_R$ is the average eigenvector centrality value for random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average eigenvector centrality values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

– the community is structured as clans (i.e. clusters) of researchers;
– a gender is statistically prominent in the clans with the highest sizes.

According to the above-mentioned conditions, we analyzed the structure of the four communities to the purpose of identifying the existence of clusters of researchers by using a python application based on the NetworkX[2] library. Statistics about the identified clans are presented in Table 6. In details, we included in the table the number of researchers in the community (**Persons**), the number of clans (**Clans**), the number of clans with clan size (*cs*) higher

[2] NetworkX url: `https://networkx.github.io`

than 19, the size of the largest clan (cs_{MAX}), the average clan size ($\bar{cs}$), the standard deviation (σ_{cs}), and the *normalized community entropy* $\hat{H}_c$. We define $\hat{H}_c$ as it follows:

$$\hat{H}_c = \frac{H_c}{H_{c,max}}, \tag{2}$$

where $H_c = -\sum_i (p_{cl_i} \cdot \ln p_{cl_i})$ is the *community entropy*; p_{cl_i} is the probability of a researcher to belong to the clan i; and $H_{c,max}$ is the maximum entropy of the community. The latter is the entropy of a completely disconnected community where every clan consists of only one researcher. The normalized community entropy spans the [0,1] range and measures the "state of disorder" of the community: 0 if all the researchers belong to only one clan and 1 if all the researchers belong to different clans. Figure 7 shows the distributions of clans in the four communities with respect to the number of persons belonging to them.

Com.	**Persons**	**Clans**	**Clans** ($cs > 19$)	cs_{MAX}	$\bar{cs}$	σ_{cs}	$\hat{H}_c$
ITAIS	1127	213	7	175 (15.53%)	5.29	13.29	0.64
SEBD	750	62	1	576 (76.80%)	12.10	72.25	0.21
ICIS	5702	699	3	3986 (69.90%)	8.16	150.58	0.29
VLDB	3932	407	4	2833 (72.05%)	9.66	140.15	0.26

Table 6 Summary of data concerning clans for each scientific community: community (**Com.**), overall number of persons (**Persons**), number of clans (**Clans**), number of clans with clan size (cs) higher than 19, maximum clan size, average clan size ($\bar{cs}$), standard deviation (σ_{cs}) of clan size, and normalized community entropy ($\hat{H}_c$).

We observe from the number of clans with size higher than 19, $\bar{cs}$, and $\hat{H}_c$ of Table 6 that ITAIS is the less ordered community where the largest clans have a similar size. Instead, SEBD, ICIS, and VLDB are characterized by a large clan and several other ones with negligible size.

7.1 Clan segregation: analysis of the largest clan

In order to assess clan segregation in SEBD, ICIS, and VLDB, we considered only the largest clan and we analyzed the presence of females or males from a statistical perspective. If a gender is statistically under-represented in that clan, we concluded that there is clan segregation in favor of the other gender. Instead, for ITAIS, we analyzed also all the 7 clans with size higher than 19 as only 15.53% of the researchers belong to the largest clan.

For the first analysis we tested the hypothesis of clan segregation in the largest clan against the hypothesis that no clan segregation is observed. Figure 7 shows the distributions of the number of females in random samples having the same size of the largest clan. Table 7 presents the related data, which include for each community: the size of the largest clan (cs), the number of

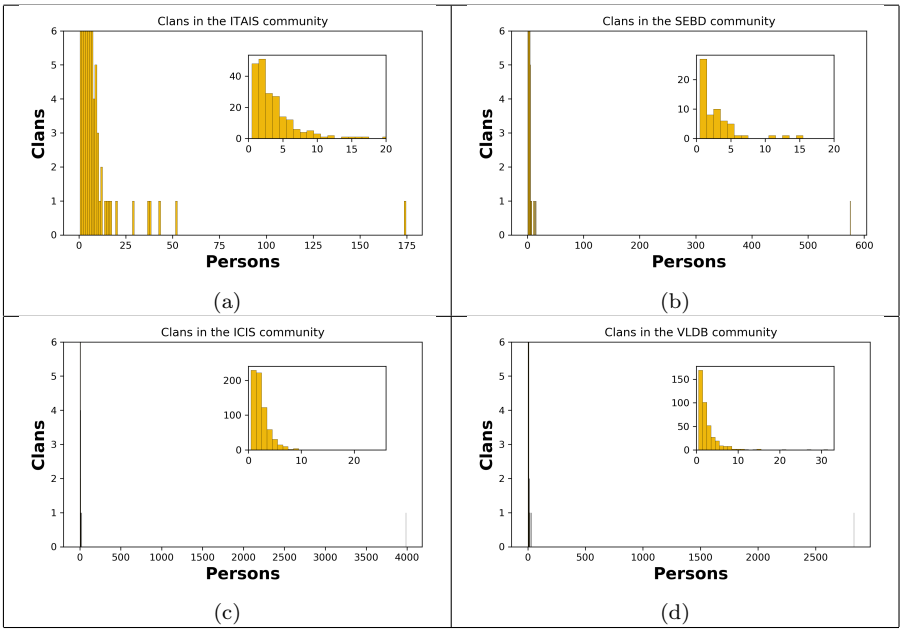

Fig. 6 Distributions of clans for the four communities with respect to the number of persons belonging to them. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

females (cs_F) and the number of males (cs_M) identified in the clan, the average value of females for the above mentioned random samples (cs_R), the standard deviation of the distribution of random samples (σ), the Z-score (z_F) and the corresponding p-value.

In the largest clan of the ITAIS community, the likelihood of achieving a number of females higher than the observed value (77), by a random sampling of the same size, is 2.00%, which is the likelihood of obtaining a value higher than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation in favor of females are significant.

In the largest clan of the SEBD community, the likelihood of achieving a number of females lower than the observed value (121), by a random sampling of the same size, is 1.11%, which is the likelihood of obtaining a value lower than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation in favor of males are significant.

In the largest clan of the ICIS community, the likelihood of achieving a number of females higher than the observed value (340), by a random sampling of the same size, is 40.50%, which is the likelihood of obtaining a value higher than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation in favor of females are not significant.

In the largest clan of the VLDB community, the likelihood of achieving a number of females lower than the observed value (111), by a random sampling of the same size, is 12.36%, which is the likelihood of obtaining a value lower

than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation in favor of males are weakly significant.

Community	cs	cs_F	cs_M	$\bar{cs}_R$	σ	z_F	p-$value$
ITAIS	175	77	98	64.91	5.87	2.06	2.00%
SEBD	576	121	455	132.11	4.86	-2.29	1.11%
ICIS	3986	340	810	337.68	9.64	0.24	40.50%
VLDB	2883	111	603	117.33	5.47	-1.16	12.36%

Table 7 Data concerning the analysis of the largest clan of the four analyzed communities. They include for each community: the size of the largest clan (cs), the number of females (cs_F) and the number of males (cs_M) identified in the clan, the average value of females for the random samples (cs_R), the standard deviation of the distribution of random samples (σ), the Z-score (z_F) and the corresponding p-value.

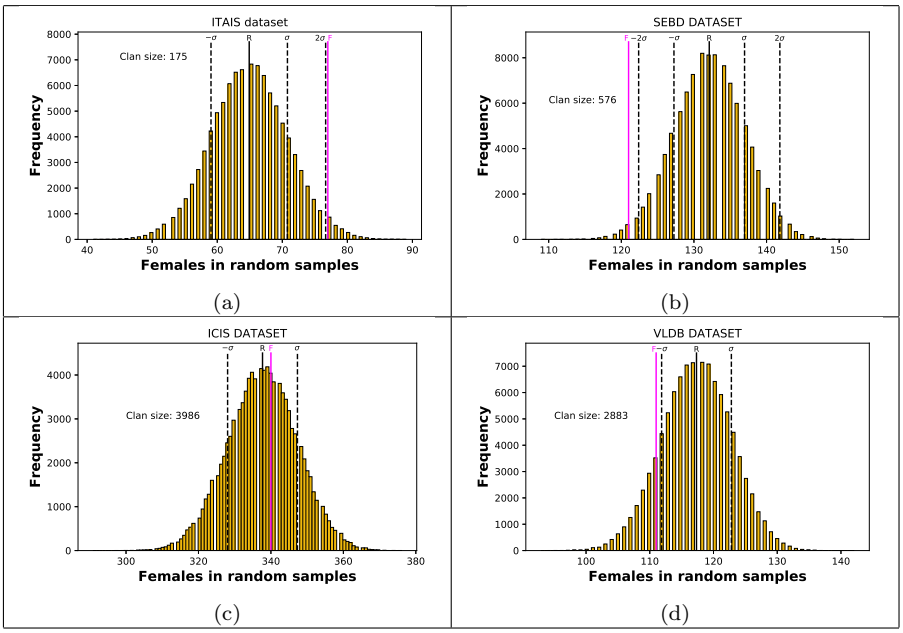

Fig. 7 Distributions of the number of females in random samples of the same size as the largest clan. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

7.2 Clan segregation: detailed analysis of the ITAIS community

As already mentioned, the ITAIS community presents 7 clans with size higher than 19. To this reason we analyzed all these clans with the same approach used

to analyze the largest clans of the four communities. Hence we tested again the hypothesis of clan segregation in the largest clan against the hypothesis that no clan segregation is observed.

Figure 8 shows the distributions of the number of females in random samples having the same size of the clans. This figure does not include the largest clan as this is already included in Figure 7.

Table 8 presents the related data, which include for each clan: the size of the clan (cs), the number of females (cs_F) and the number of males (cs_M) identified in the clan, the average value of females for the above mentioned random samples (cs_R), the standard deviation of the distribution of random samples (σ), the Z-score (z_F) and the corresponding p-value.

We already discussed the largest clan in the previous subsection. In that clan, the hypothesis of clan segregation in favor of females is significant.

In the clan with size 52, the likelihood of achieving a number of females lower than the observed value (19), by a random sampling of the same size, is 46.41%, which is the likelihood of obtaining a value lower than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation are not significant.

In the clan with size 43, the likelihood of achieving a number of females higher than the observed value (19), by a random sampling of the same size, is 16.28%, which is the likelihood of obtaining a value higher than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation in favor of females are weakly significant.

In the clan with size 38, the likelihood of achieving a number of females higher than the observed value (17), by a random sampling of the same size, is 15.92%, which is the likelihood of obtaining a value higher than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation in favor of females are weakly significant.

In the clan with size 37, the likelihood of achieving a number of females higher than the observed value (14), by a random sampling of the same size, is 46.17%, which is the likelihood of obtaining a value higher than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation are not significant.

In the clan with size 29, the likelihood of achieving a number of females higher than the observed value (12), by a random sampling of the same size, is 31.43%, which is the likelihood of obtaining a value higher than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation are not significant.

In the clan with size 20, the likelihood of achieving a number of females higher than the observed value (9), by a random sampling of the same size, is 4.72%, which is the likelihood of obtaining a value higher than $\bar{cs}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of clan segregation in favor of females are significant.

This study on clan segregation in the ITAIS community reveals that, despite the gender ratio in favor of males in the whole community, females are better positioned in the largest clans.

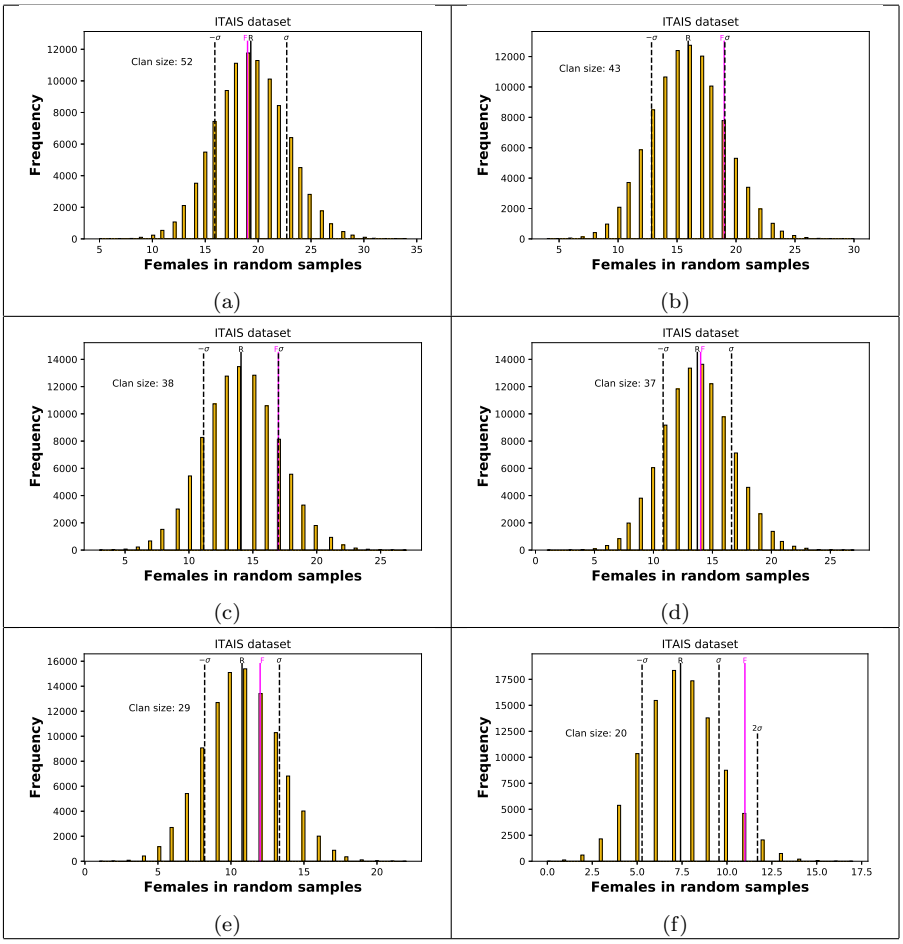

Fig. 8 Distributions of the number of females in random samples of the same size as six of the seven ITAIS largest clans (the largest one is not included as it is already in Figure 7).

8 Novelty

The novelty index ($\mathcal{N}$) measures to what extent an author contributes to the formation of the discipline by introducing novel topics. The novelty index of the author h_i is here defined as follows:

$$\mathcal{N}_{h_i} = \frac{1}{N_{c_k}} \cdot \sum_{c_k} \frac{\delta_{k,i}}{n_{c_k}}, \tag{3}$$

where $\delta_{k,i} = 1$ if the author h_i was one of the first authors to propose the topic c_k; $\delta_{k,i} = 0$ if the author h_i was not one of the first authors to propose the topic c_k; n_{c_k} is the number of the authors that first proposed the topic c_k; and N_{c_k} is the overall number of topics. This index spans the [0,1] range.

Clan	cs	cs_F	cs_M	$\bar{cs}_R$	σ	z_F	$p\text{-}value$
Clan #1	175	77	98	64.91	5.87	2.06	2.00%
Clan #2	52	19	33	19.30	3.99	-0.09	46.41%
Clan #3	43	19	24	15.95	3.11	0.98	16.28%
Clan #4	38	17	21	14.08	2.93	1.00	15.92%
Clan #5	37	14	23	13.72	2.90	0.10	46.17%
Clan #6	29	12	17	10.76	2.56	0.48	31.43%
Clan #7	20	9	11	7.42	2.14	1.67	4.72%

Table 8 Data concerning the analysis of the six largest clans of the ITAIS community. They include for each clan: the size of the clan (cs), the number of females (cs_F) and the number of males (cs_M) identified in the clan, the average value of females for the random samples (cs_R), the standard deviation of the distribution of random samples (σ), the Z-score (z_F) and the corresponding p-value.

Figure 9 shows the distributions of the average novelty index of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 9 for all the considered communities, under the columns labelled by $\bar{\mathcal{N}}_F$, $\bar{\mathcal{N}}_M$, $\bar{\mathcal{N}}_U$, and $\bar{\mathcal{N}}_R$, respectively. In details, Figure 9(a) refers to the ITAIS community, Figure 9(b) refers to the SEBD community, Figure 9(c) refers to the ICIS community, and Figure 9(d) refers to the VLDB community. The z_F values in Table 9 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of novelty higher than the observed value for the female group (0.00099), by a random sampling of the same size, is 4.09%, which is the likelihood of obtaining a value higher than $\bar{\mathcal{N}}_F$. Therefore, the *degree of belief* that the female group is performing better than the average group is significant in this case. There is a gender divide in favor of females. In other words the females tend to propose an higher number of novel topics.

In the SEBD community, the likelihood of achieving an average value of novelty lower than the observed value for the female group (0.00128), by a random sampling of the same size, is 36.32%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{N}}_F$. Therefore, the *degree of belief* is not significant in this case, that is gender divide in this community was not observed.

In the ICIS community, the likelihood of achieving an average value of novelty lower than the observed value for the female group (0.000170), by a random sampling of the same size, is 37.07%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{N}}_F$. Therefore, also in this case, the *degree of belief* is not significant, that is gender divide in this community was not observed.

In the VLDB community, the likelihood of achieving an average value of novelty lower than the observed value for the female group (0.00021), by a random sampling of the same size, is 17.11%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{N}}_F$. Here the *degree of belief* and, hence, the hypothesis

of a genuine gender divide in favor of males are weakly significant. In this community, females tend to propose a lower number of novel topics.

Community	$\bar{\mathcal{N}}_F$	$\bar{\mathcal{N}}_M$	$\bar{\mathcal{N}}_U$	$\bar{\mathcal{N}}_R$	σ	z_F	*p-value*
ITAIS	0.00099	0.00082	—	0.00089	6.13e-05	1.74	4.09%
SEBD	0.00128	0.00135	—	0.00133	0.00014	-0.35	36.32%
ICIS	0.000170	0.000163	0.000180	0.000175	1.56e-05.	-0.33	37.07%
VLDB	0.00021	0.00030	0.00024	0.00025	4.27e-05	-0.95	17.11%

Table 9 For each scientific community: $\bar{\mathcal{N}}_F$ is the average novelty index value for females; $\bar{\mathcal{N}}_M$ is the average novelty index value for males; $\bar{\mathcal{N}}_U$ is the average novelty index value for undetermined authors; $\bar{\mathcal{N}}_R$ is the average novelty index value for the random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average novelty index values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

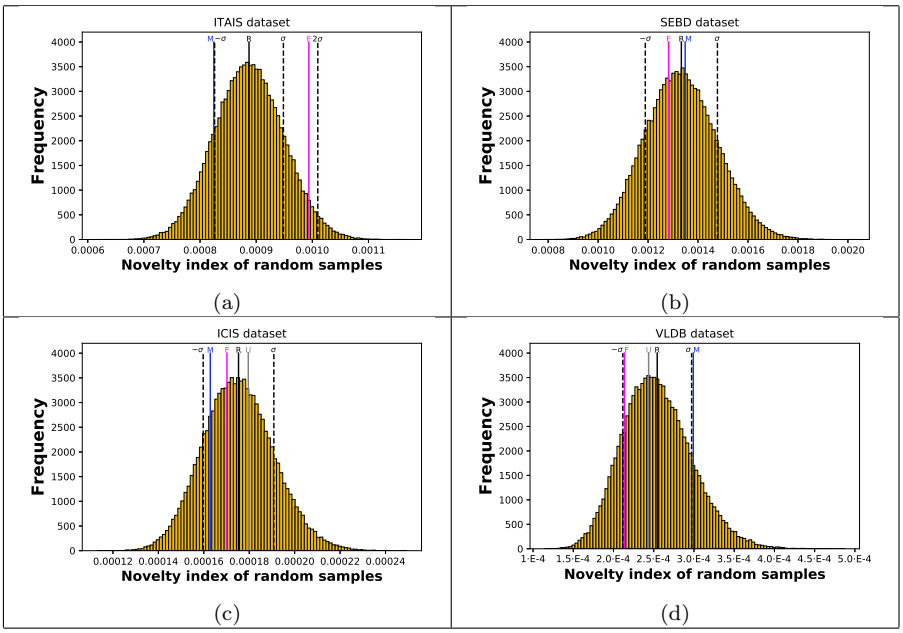

Fig. 9 The distributions of sample averages of the novelty index. The figure allows to estimate the *degree of belief* that the observed deviations for the female group are not accidental. The average values of novelty index characterizing females and males are also outlined. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

In conclusion, the SEBD and ICIS communities do not exhibit gender divide from the perspective of this index. Instead, females are more creative in

ITAIS and less creative in VLDB. Hence, females propose an higher number of novel topics in ITAIS and a lower one in VLDB.

9 Combinational Creativity

The combinational creativity index ($\mathcal{C}$) measures to what extent an author contributes to the formation of the discipline by introducing novel combinations of topics. The combinational creativity index of the author h_i is here defined as follows:

$$\mathcal{C}_{h_i} = \frac{1}{N_{p_{kl}}} \cdot \sum_{p_{kl}} \frac{\delta_{p_{kl},i}}{n_{p_{kl}}}, \tag{4}$$

where p_{kl} is the pair of topics (c_k, c_l); $\delta_{p_{kl},i} = 1$ if the author h_i was one of the first authors to propose p_{kl}; $\delta_{p_{kl},i} = 0$ if the author h_i was not one of the first authors to propose p_{kl}; $n_{p_{kl}}$ is the number of the authors that first proposed p_{kl}; and $N_{p_{kl}}$ is the overall number of detected pairs of topics. Also this index spans the [0,1] range.

Figure 10 shows the distributions of the average combinational creativiity index of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 10 for all the considered communities, under the columns labelled by $\bar{\mathcal{C}}_F$, $\bar{\mathcal{C}}_M$, $\bar{\mathcal{C}}_U$, and $\bar{\mathcal{C}}_R$, respectively. In details, Figure 10(a) refers to the ITAIS community, Figure 10(b) refers to the SEBD community, Figure 10(c) refers to the ICIS community, and Figure 10(d) refers to the VLDB community. The z_F values in Table 10 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of combinational creativity index higher than the observed value for the female group (0.0010), by a random sampling of the same size, is 0.80%, which is the likelihood of obtaining a value higher than $\bar{\mathcal{C}}_F$. Therefore, the *degree of belief* that the female group is performing better than the average group is significant in this case. There is a gender divide in favor of females. In other words the females propose an higher number of novel combinations of topics.

In the SEBD community, the likelihood of achieving an average value of combinational creativity index lower than the observed value for the female group (0.00123), by a random sampling of the same size, is 24.83%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{C}}_F$. Therefore, the *degree of belief* is weakly significant in this case, that is females tend to be less creative, at least from the combinational perspective.

In the ICIS community, the likelihood of achieving an average value of combinational creativity index lower than the observed value for the female group (0.000153), by a random sampling of the same size, is 4.01%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{C}}_F$. Therefore, the *degree of*

belief is significant in this case, that is females are less creative, at least from the combinational perspective.

In the VLDB community, the likelihood of achieving an average value of combinational creativity index lower than the observed value for the female group (0.000208), by a random sampling of the same size, is 9.68%, which is the likelihood of obtaining a value lower than $\bar{\mathcal{C}}_F$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant. Hence, in this community, females tend to propose a lower number of novel combination of topics.

Community	$\bar{\mathcal{C}}_F$	$\bar{\mathcal{C}}_M$	$\bar{\mathcal{C}}_U$	$\bar{\mathcal{C}}_R$	σ	z_F	*p-value*
ITAIS	0.0010	0.0008	—	0.0009	6.27e-05	2.41	0.80%
SEBD	0.00123	0.00136	—	0.00133	0.000150	-0.68	24.83%
ICIS	0.000153	0.000162	0.000182	0.000175	1.25e-05	-1.75	4.01%
VLDB	0.000208	0.000282	0.000249	0.000254	3.57e-05	-1.30	9.68%

Table 10 For each scientific community: $\bar{\mathcal{C}}_F$ is the average combinational creativity index value for females; $\bar{\mathcal{C}}_M$ is the average combinational creativity index value for males; $\bar{\mathcal{C}}_U$ is the average combinational creativity index value for undetermined authors; $\bar{\mathcal{C}}_R$ is the average combinational creativity index value for the random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average combinational creativity index values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

In conclusion, all communities do exhibit some degree of gender divide with respect to the capacity of introducing novel combinations of topics in the discipline; however, remarkably, in the ITAIS community the females are more creative.

10 Number of papers of all the authors

Figure 11 shows the distributions of the average number of papers for random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 11 for all the considered communities, under the columns labelled by $\bar{p}_{all,F}$, $\bar{p}_{all,M}$, $\bar{p}_{all,U}$, and $\bar{p}_{all,R}$, respectively. In details, Figure 11(a) refers to the ITAIS community, Figure 11(b) refers to the SEBD community, Figure 11(c) refers to the ICIS community, and Figure 11(d) refers to the VLDB community. The z_F values in Table 11 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of number of papers higher than the observed value for the female group (2.04), by a random sampling of the same size, is 13.79%, which is the likelihood of obtaining a value higher than $\bar{p}_{all,F}$. Therefore, the *degree of belief* and,

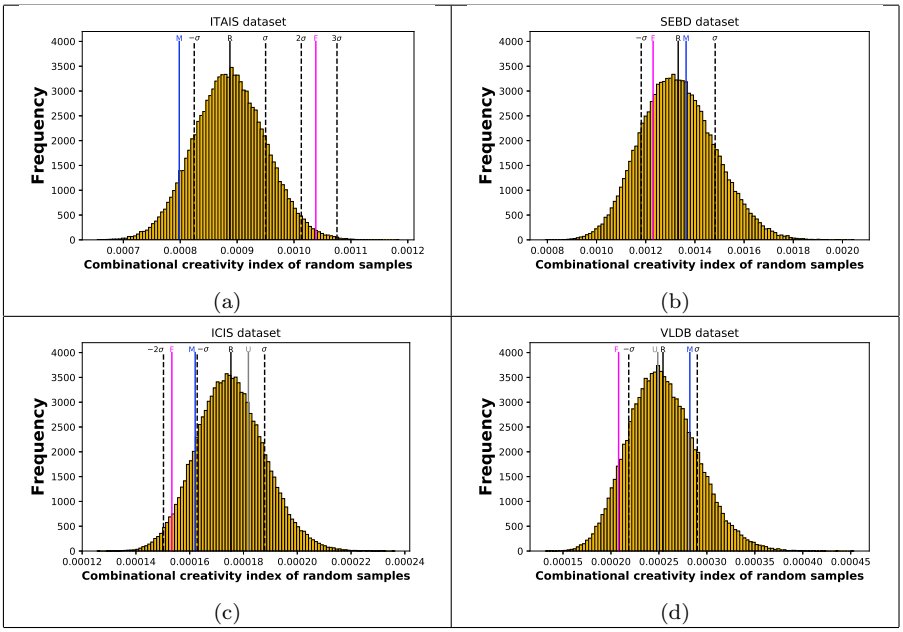

Fig. 10 The distributions of sample averages of the combinational creativity index. The figure allows to estimate the *degree of belief* that the observed deviations for the female group are not accidental. The average values of combinational creativity index characterizing females and males are also outlined. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

hence, the hypothesis of a genuine gender divide in favor of females are weakly significant.

In the SEBD community, the likelihood of achieving an average value of number of papers lower than the observed value for the female group (2.27), by a random sampling of the same size, is 38.59%, which is the likelihood of obtaining a value lower than $\bar{p}_{all,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the ICIS community, the likelihood of achieving an average value of number of papers lower than the observed value for the female group (1.89), by a random sampling of the same size, is 9.01%, which is the likelihood of obtaining a value lower than $\bar{p}_{all,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the VLDB community, the likelihood of achieving an average value of number of papers lower than the observed value for the female group (1.68), by a random sampling of the same size, is 6.43%, which is the likelihood of obtaining a value lower than $\bar{p}_{all,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are significant.

Concerning the number of papers of all the authors, while one observes some gender divide in the international communities where the average values

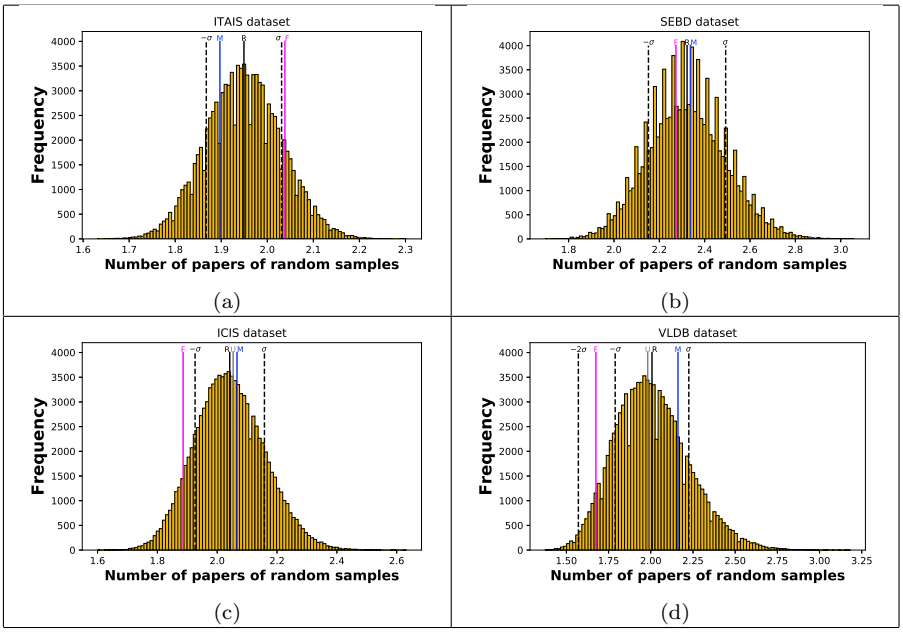

Fig. 11 Distributions to estimate the *degree of belief* of the computed average number of papers for females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{p}_{all,F}$	$\bar{p}_{all,M}$	$\bar{p}_{all,U}$	$\bar{p}_{all,R}$	σ	z_F	*p-value*
ITAIS	2.04	1.90	—	1.95	0.082	1.09	13.79%
SEBD	2.27	2.34	—	2.32	0.17	-0.29	38.59%
ICIS	1.89	2.07	2.05	2.04	0.12	-1.34	9.01%
VLDB	1.68	2.16	1.98	2.01	0.22	-1.52	6.43%

Table 11 For each scientific community: $\bar{p}_{all,F}$ is the average number of papers of females; $\bar{p}_{all,M}$ is the average number of papers of males; $\bar{p}_{all,U}$ is the average number of papers for undetermined authors; $\bar{p}_{all,R}$ is the average number of papers for the random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average number of papers for each group of females; the *p-value* is the likelihood given by the complementary cumulative distribution function.

for female samples are smaller and in the in the ITAIS community where it is higher, the SEBD community does not provide evidence of such phenomenon.

11 Degree of All the Authors

Figure 12 shows the distributions of the average degree of authors of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 12 for all the

considered communities, under the columns labelled by $\bar{D}_{st,F}$, $\bar{D}_{st,M}$, $\bar{D}_{st,U}$, and $\bar{D}_{st,R}$, respectively. In details, Figure 12(a) refers to the ITAIS community, Figure 12(b) refers to the SEBD community, Figure 12(c) refers to the ICIS community, and Figure 12(d) refers to the VLDB community. The z_F values in Table 12 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of degree of authors lower than the observed value for the female group (3.25), by a random sampling of the same size, is 0.16%, which is the likelihood of obtaining a value lower than $\bar{D}_{all,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are highly significant.

In the SEBD community, the likelihood of achieving an average value of degree of authors lower than the observed value for the female group (6.10), by a random sampling of the same size, is 43.64%, which is the likelihood of obtaining a value lower than $\bar{D}_{all,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the ICIS community, the likelihood of achieving an average value of degree of authors lower than the observed value for the female group (3.56), by a random sampling of the same size, is 14.46%, which is the likelihood of obtaining a value lower than $\bar{D}_{all,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the VLDB community, the likelihood of achieving an average value of degree of authors lower than the observed value for the female group (4.48), by a random sampling of the same size, is 4.17%, which is the likelihood of obtaining a value lower than $\bar{D}_{all,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are significant.

Community	$\bar{D}_{all,F}$	$\bar{D}_{all,M}$	$\bar{D}_{all,U}$	$\bar{D}_{all,R}$	σ	z_F	*p-value*
ITAIS	3.25	3.91	—	3.66	0.14	-2.94	0.16%
SEBD	6.10	6.17	—	6.16	0.38	-0.16	43.64%
ICIS	3.56	3.90	3.76	3.77	0.20	-1.06	14.46%
VLDB	4.48	5.62	5.28	5.32	0.49	-1.72	4.17%

Table 12 For each scientific community: $\bar{D}_{all,F}$ is the average degree of females; $\bar{D}_{all,M}$ is the average degree of males; $\bar{D}_{all,U}$ is the average degree for undetermined authors; $\bar{D}_{all,R}$ is the average degree for the random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average degree for each group of females; the *p-value* is the likelihood given by the complementary cumulative distribution function.

Concerning the degree of all the authors, while one observes some gender divide in favor of males in the international communities and in the ITAIS community where the average values for female samples are smaller, the SEBD community does not provide evidence of such phenomenon.

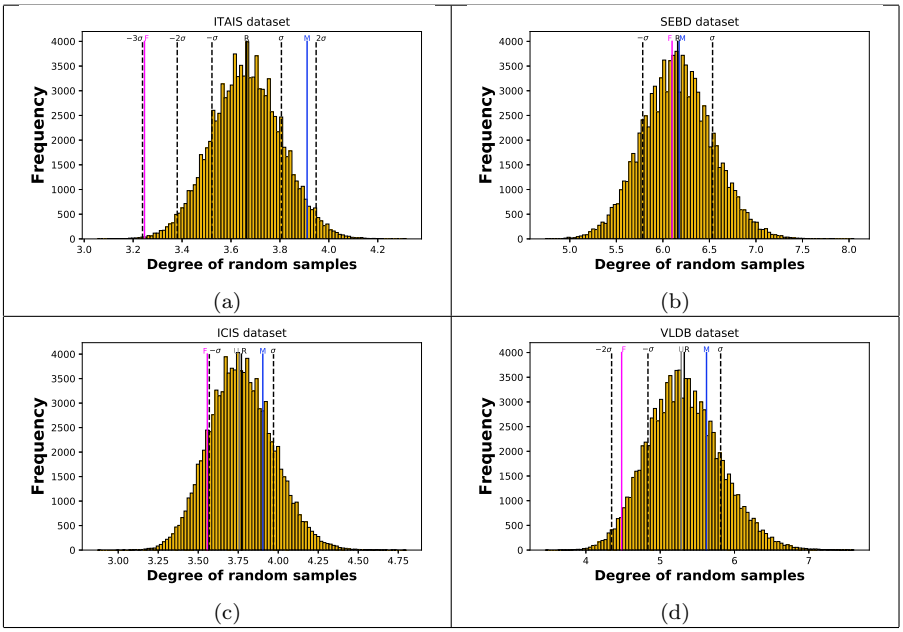

Fig. 12 Distributions to estimate the *degree of belief* of the average degree (i.e. number of coauthors) for females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

12 Number of Papers of Semantically Treatable Authors

This indicator refers only to semantically treatable authors. Figure 13 shows the distributions of the average number of papers of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 13 for all the considered communities, under the columns labelled by $\bar{p}_{st,F}$, $\bar{p}_{st,M}$, $\bar{p}_{st,U}$, and $\bar{p}_{st,R}$, respectively. In details, Figure 13(a) refers to the ITAIS community, Figure 13(b) refers to the SEBD community, Figure 13(c) refers to the ICIS community, and Figure 13(d) refers to the VLDB community. The z_F values in Table 13 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of number of papers higher than the observed value for the female group (3.99), by a random sampling of the same size, is 48.80%, which is the likelihood of obtaining a value higher than $\bar{p}_{st,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the SEBD community, the likelihood of achieving an average value of number of papers higher than the observed value for the female group (4.57), by a random sampling of the same size, is 39.36%, which is the likelihood of

obtaining a value higher than $\bar{p}_{st,F}$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the ICIS community, the likelihood of achieving an average value of number of papers lower than the observed value for the female group (3.91), by a random sampling of the same size, is 13.14%, which is the likelihood of obtaining a value lower than $\bar{p}_{st,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the VLDB community, the likelihood of achieving an average value of number of papers lower than the observed value for the female group (3.51), by a random sampling of the same size, is 10.20%, which is the likelihood of obtaining a value lower than $\bar{p}_{st,F}$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

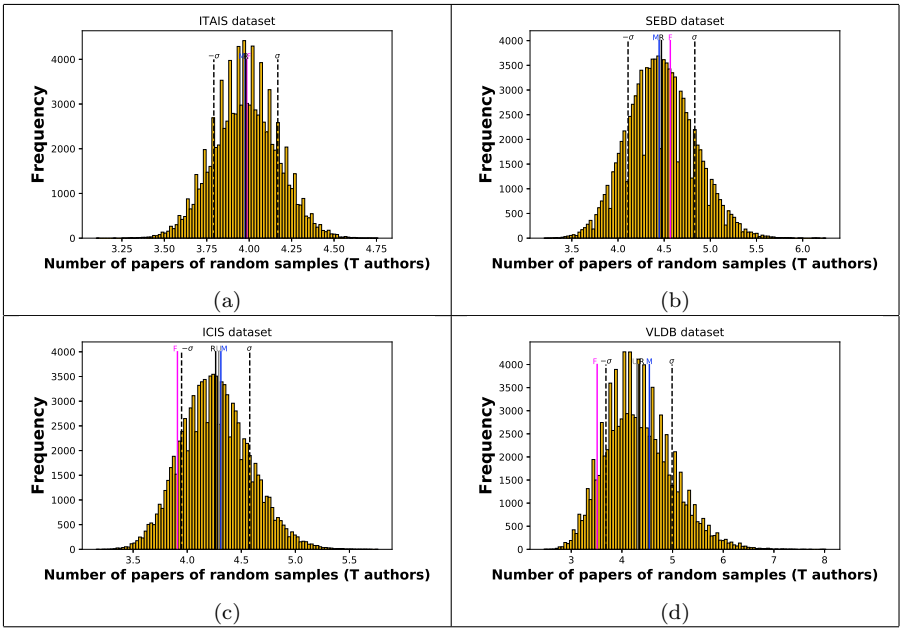

Fig. 13 Distributions to estimate the *degree of belief* of the average number of papers for semantically treatable females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Concerning the number of papers of semantically treatable authors, while one observes some gender divide in favor of males in the international communities where the average values for female samples are smaller, the Italian communities do not provide evidence of such phenomenon.

Community	$\bar{p}_{st,F}$	$\bar{p}_{st,M}$	$\bar{p}_{st,U}$	$\bar{p}_{st,R}$	σ_R	z_F	*p-value*
ITAIS	3.99	3.98	—	3.98	0.19	0.04	48.80%
SEBD	4.57	4.45	—	4.47	0.36	0.27	39.36%
ICIS	3.91	4.31	4.29	4.26	0.32	-1.12	13.14%
VLDB	3.51	4.54	4.31	4.34	0.65	-1.27	10.20%

Table 13 For each scientific community: $\bar{p}_{st,F}$ is the average number of papers of semantically treatable females; $\bar{p}_{st,M}$ is the average number of papers of semantically treatable males; $\bar{p}_{st,U}$ is the average number of papers for undetermined semantically treatable authors; $\bar{p}_{st,R}$ is the average number of papers for random groups of semantically treatable authors; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average number of papers for each group of semantically treatable females; the *p-value* is the likelihood given by the complementary cumulative distribution function.

13 Degree of Semantically Treatable Authors

This indicator refers only to semantically treatable authors. Figure 14 shows the distributions of the average degree of semantically treatable authors for random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 14 for all the considered communities, under the columns labelled by $\bar{D}_{st,F}$, $\bar{D}_{st,M}$, $\bar{D}_{st,U}$, and $\bar{D}_{st,R}$, respectively. In details, Figure 14(a) refers to the ITAIS community, Figure 14(b) refers to the SEBD community, Figure 14(c) refers to the ICIS community, and Figure 14(d) refers to the VLDB community. The z_F values in Table 14 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of degree of semantically treatable authors lower than the observed value for the female group (4.71), by a random sampling of the same size, is 14.69%, which is the likelihood of obtaining a value lower than $\bar{D}_{st,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the SEBD community, the likelihood of achieving an average value of degree of semantically treatable authors lower than the observed value for the female group (9.32), by a random sampling of the same size, is 33.00%, which is the likelihood of obtaining a value lower than $\bar{D}_{st,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the ICIS community, the likelihood of achieving an average value of degree of semantically treatable authors lower than the observed value for the female group (6.66), by a random sampling of the same size, is 19.49%, which is the likelihood of obtaining a value lower than $\bar{D}_{st,F}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the VLDB community, the likelihood of achieving an average value of degree of semantically treatable authors lower than the observed value for the female group (7.93), by a random sampling of the same size, is 16.85%, which

is the likelihood of obtaining a value lower than $\bar{D}_{st,F}$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

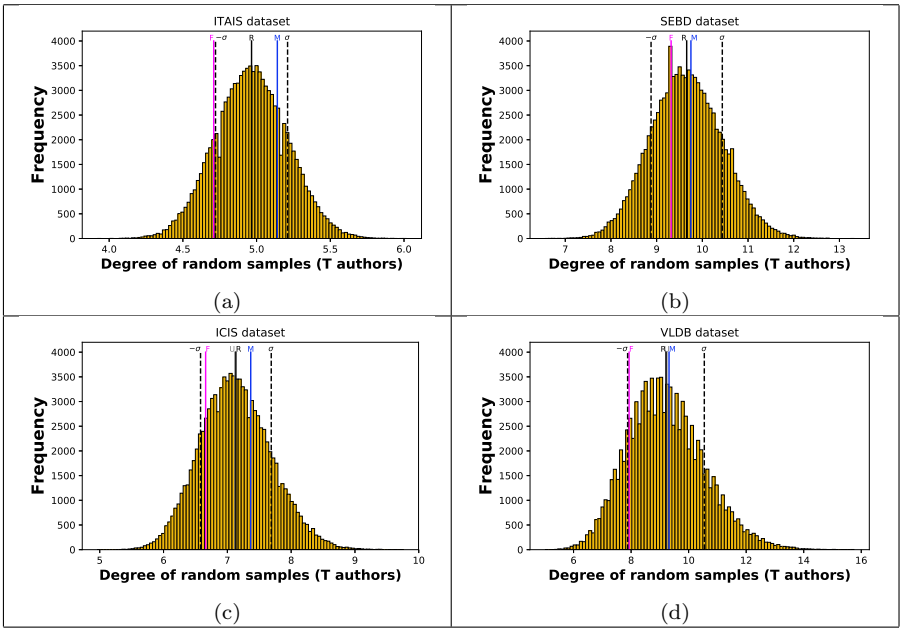

Fig. 14 Distributions to estimate the *degree of belief* of the average degree (i.e. number of coauthors) for semantically treatable females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{D}_{st,F}$	$\bar{D}_{st,M}$	$\bar{D}_{st,U}$	$\bar{D}_{st,R}$	σ	z_F	*p-value*
ITAIS	4.71	5.14	—	4.97	0.24	-1.05	14.69%
SEBD	9.32	9.75	—	9.66	0.78	-0.44	33.00%
ICIS	6.66	7.37	7.12	7.14	0.55	-0.86	19.49%
VLDB	7.93	9.32	9.24	9.21	1.33	-0.96	16.85%

Table 14 For each scientific community: $\bar{D}_{st,F}$ is the average degree of semantically treatable females; $\bar{D}_{st,M}$ is the average degree of semantically treatable males; $\bar{D}_{st,U}$ is the average degree of undetermined semantically treatable authors; $\bar{D}_{st,R}$ is the average degree for random groups of semantically treatable authors; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average degree for each group of semantically treatable females; the *p-value* is the likelihood given by the complementary cumulative distribution function.

Concerning the degree of semantically treatable authors, while one observes some gender divide in favor of males in the international communities and in

the ITAIS community where the average values for female samples are smaller, the SEBD community does not provide evidence of such phenomenon.

14 Neighbour Susceptibility

This indicator refers only to semantically treatable authors. Figure 15 shows the distributions of the average neighbour susceptibility of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 15 for all the considered communities, under the columns labelled by $\bar{x}_F$, $\bar{x}_M$, $\bar{x}_U$, and $\bar{x}_R$, respectively. In details, Figure 15(a) refers to the ITAIS community, Figure 15(b) refers to the SEBD community, Figure 15(c) refers to the ICIS community, and Figure 15(d) refers to the VLDB community. The z_F values in Table 15 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of neighbour susceptibility higher than the observed value for the female group (0.045), by a random sampling of the same size, is 33.72%, which is the likelihood of obtaining a value higher than $\bar{x}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the SEBD community, the likelihood of achieving an average value of neighbour susceptibility higher than the observed value for the female group (0.162), by a random sampling of the same size, is 1.11%, which is the likelihood of obtaining a value higher than $\bar{x}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are highly significant.

In the ICIS community, the likelihood of achieving an average value of neighbour susceptibility higher than the observed value for the female group (0.102), by a random sampling of the same size, is 38.59%, which is the likelihood of obtaining a value higher than $\bar{x}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the VLDB community, the likelihood of achieving an average value of neighbour susceptibility lower than the observed value for the female group (0.066), by a random sampling of the same size, is 39.36%, which is the likelihood of obtaining a value lower than $\bar{x}_F$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

Concerning the neighbour susceptibility of semantically treatable authors, while gender divide can be observed in the SEBD community, the other communities do not provide evidence of such phenomenon.

15 Trend Susceptibility

This indicator refers only to semantically treatable authors. Figure 16 shows the distributions of the average neighbour susceptibility of random samples of

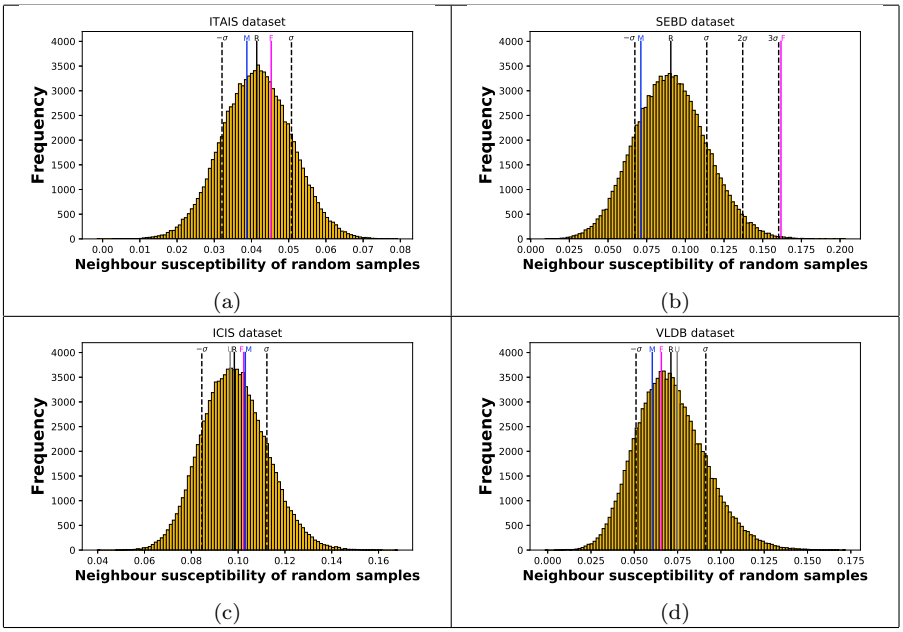

Fig. 15 Distributions to estimate the *degree of belief* of the average neighbour susceptibility values characterizing females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{x}_F$	$\bar{x}_M$	$\bar{x}_U$	$\bar{x}_R$	σ	z_F	*p-value*
ITAIS	0.045	0.039	—	0.041	0.009	0.42	33.72%
SEBD	0.162	0.071	—	0.091	0.023	3.06	0.11%
ICIS	0.102	0.103	0.097	0.098	0.014	0.29	38.59%
VLDB	0.066	0.060	0.075	0.071	0.020	-0.27	39.36%

Table 15 For each scientific community: $\bar{x}_F$ is the average neighbour susceptibility value for females; $\bar{x}_M$ is the average neighbour susceptibility value for males; $\bar{x}_U$ is the average neighbour susceptibility value for undetermined authors; $\bar{x}_R$ is the average neighbour susceptibility value for random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average neighbour susceptibility values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 16 for all the considered communities, under the columns labelled by $\bar{x}_{sF}$, $\bar{x}_{sM}$, $\bar{x}_{sU}$, and $\bar{x}_{sR}$, respectively. In details, Figure 16(a) refers to the ITAIS community, Figure 16(b) refers to the SEBD community, Figure 16(c) refers to the ICIS community, and Figure 16(d) refers to the VLDB community. The z_F values in Table 16 report the Z-scores.

Accordingly, in the ITAIS community, the likelihood of achieving an average value of trend susceptibility lower than the observed value for the female group (0.184), by a random sampling of the same size, is 31.56%, which is the likelihood of obtaining a value lower than $\bar{x}_{sF}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant.

In the SEBD community, the likelihood of achieving an average value of trend susceptibility lower than the observed value for the female group (0.124), by a random sampling of the same size, is 11.51%, which is the likelihood of obtaining a value lower than $\bar{x}_{sF}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are weakly significant.

In the ICIS community, the likelihood of achieving an average value of trend susceptibility lower than the observed value for the female group (0.095), by a random sampling of the same size, is 3.22%, which is the likelihood of obtaining a value lower than $\bar{x}_{sF}$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are weakly significant.

In the VLDB community, the likelihood of achieving an average value of trend susceptibility lower than the observed value for the female group (0.052), by a random sampling of the same size, is 20.32%, which is the likelihood of obtaining a value lower than $\bar{x}_{sF}$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide are weakly significant.

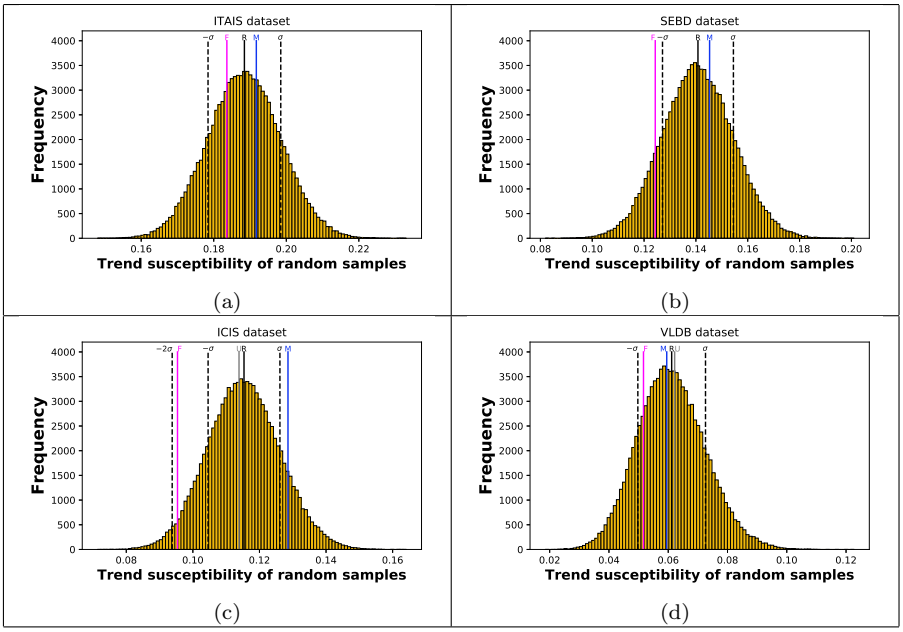

Fig. 16 Distributions to estimate the *degree of belief* of the average trend susceptibility values characterizing females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{x}_{sF}$	$\bar{x}_{sM}$	$\bar{x}_{sU}$	$\bar{x}_{sR}$	σ_R	z_F	*p-value*
ITAIS	0.184	0.192	...	0.188	0.010	-0.48	31.56%
SEBD	0.124	0.145	...	0.141	0.014	-1.20	11.51%
ICIS	0.095	0.129	0.114	0.115	0.011	-1.85	3.22%
VLDB	0.052	0.059	0.062	0.061	0.011	-0.833	20.32%

Table 16 For each scientific community: $\bar{x}_{sF}$ is the average trend susceptibility value for females; $\bar{x}_{sM}$ is the average trend susceptibility value for males; $\bar{x}_{sU}$ is the average trend susceptibility value for undetermined authors; $\bar{x}_{sR}$ is the average trend susceptibility value for random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average trend susceptibility values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

Concerning the trend susceptibility of semantically treatable authors, while one observes some gender divide in the international communities and in the SEBD community where the average values for female samples are smaller, such phenomenon is less evident in the ITAIS community.

16 Authority

This indicator refers only to semantically treatable authors. Figure 17 shows the distributions of the average authority of random samples of the same dimension of the female group, the average values for females, males, and undetermined authors (in the ICIS and VLDB communities only), and the average value for the above mentioned random samples. The average values for the different groups are also reported in Table 17 for all the considered communities, under the columns labelled by $\bar{a}_F$, $\bar{a}_M$, $\bar{a}_U$, and $\bar{a}_R$, respectively. In details, Figure 17(a) refers to the ITAIS community, Figure 17(b) refers to the SEBD community, Figure 17(c) refers to the ICIS community, and Figure 17(d) refers to the VLDB community. The z_F values in Table 17 report the Z-scores.

In the ITAIS community, the likelihood of achieving an average value of authority lower than the observed value for the female group (0.078), by a random sampling of the same size, is 18.94%, which is the likelihood of obtaining a value lower than $\bar{a}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the SEBD community, the likelihood of achieving an average value of authority lower than the observed value for the female group (0.215), by a random sampling of the same size, is 41.29%, which is the likelihood of obtaining a value lower than $\bar{a}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide are not significant..

In the ICIS community, the likelihood of achieving an average value of authority lower than the observed value for the female group (0.173), by a random sampling of the same size, is 6.18%, which is the likelihood of obtaining a value lower than $\bar{a}_F$. Therefore, the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

In the VLDB community, the likelihood of achieving an average value of authority lower than the observed value for the female group (0.119), by a random sampling of the same size, is 14.69%, which is the likelihood of obtaining a value lower than $\bar{a}_F$. Again the *degree of belief* and, hence, the hypothesis of a genuine gender divide in favor of males are weakly significant.

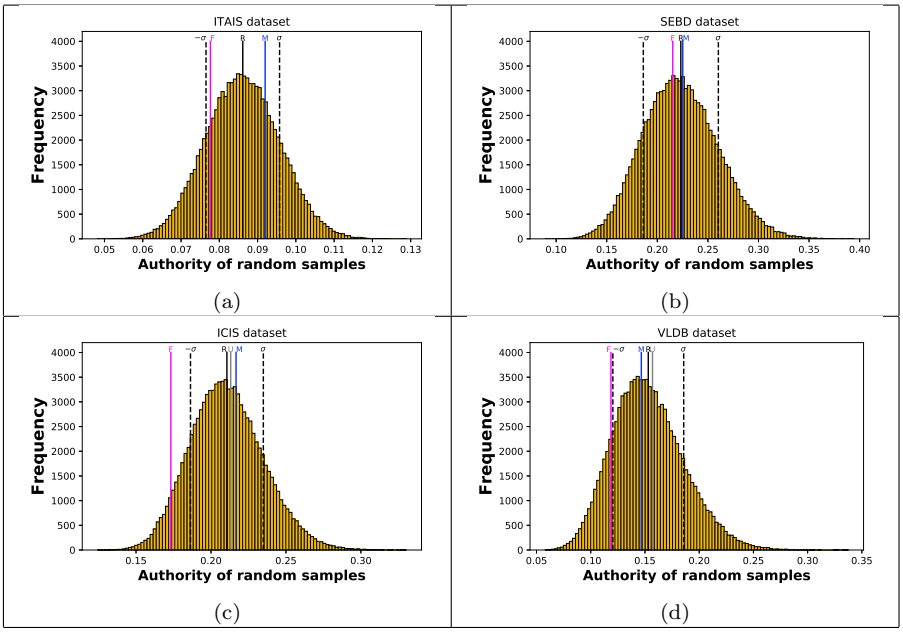

Fig. 17 Distributions to estimate the *degree of belief* of the computed average authority values characterizing females and males. They refer, respectively, to (a) ITAIS, (b) SEBD, (c) ICIS, and (d) VLDB.

Community	$\bar{a}_F$	$\bar{a}_M$	$\bar{a}_U$	$\bar{a}_R$	σ_R	z_F	*p-value*
ITAIS	0.078	0.092	—	0.086	0.010	-0.88	18.94%
SEBD	0.215	0.225	—	0.223	0.037	-0.22	41.29%
ICIS	0.173	0.217	0.213	0.211	0.024	-1.54	6.18%
VLDB	0.119	0.147	0.157	0.153	0.033	-1.05	14.69%

Table 17 For each scientific community: $\bar{a}_F$ is the average authority value for females; $\bar{a}_M$ is the average authority value for males; $\bar{a}_U$ is the average authority value for undetermined authors; $\bar{a}_R$ is the average authority value for random samples; σ is the standard deviation of the different averages of the random samples; z_F is the Z-score of the standard normal distribution corresponding to the average authority values for each female group; the *p-value* is the likelihood given by the complementary cumulative distribution function.

Concerning the authority of semantically treatable authors, while one observes some gender divide in favor of males in the international communities

and in the ITAIS community where the average values for female samples are smaller, the SEBD community does not provide evidence of such phenomenon.

17 Summary of the Results

Table 18, Table 19, Table 20, and Table 21 show, respectively, a summary of the results for each community together with harvey balls representing the *degree of belief* (of the observed deviation) for each indicator[3] that depends on the *p-value*. The lower are the p's, the more significant are the deviations. In the tables, ind_i stands for the type of indicator (e.g., $\bar{x}$, $\bar{\mathcal{B}}$) and $ind_{i,F}$, $ind_{i,M}$, and $ind_{i,R}$ are, respectively, the value of the indicator for males, females, and random groups.

The above mentioned harvey balls represent how much significant is the *degree of belief*. This depends on the distance between ind_{iF} and ind_{iR} and the σ value. Therefore, considering the interval $ind_{iR} - \Delta < ind_{iF} < ind_{iR} + \Delta$:

- The visual symbol ◔ corresponds to $\Delta < \sigma/2$, which reflects a not significant *degree of belief* and, therefore, there is not a clear cut evidence of gender divide;
- The visual symbol ◑ corresponds to $\sigma/2 < \Delta < 3/2 \cdot \sigma$, which reflects a weakly significant *degree of belief*;
- The visual symbol ◕ corresponds to $3/2 \cdot \sigma < \Delta < 5/2 \cdot \sigma$, which reflects a significant *degree of belief*;
- The visual symbol ● corresponds to $5/2 \cdot \sigma < \Delta < 7/2 \cdot \sigma$, which reflects an highly significant *degree of belief*.

Emoticons were used in the tables to represent female affirmation reported in the column labelled accordingly (i.e. 🙂 for gender neutrality, 🙂 😊 for $ind_{i,F} > ind_{i,R}$, or ☹ for $ind_{i,F} < ind_{i,R}$).

Finally Table 24 presents a summary of the directions of gender divide (if any) for all the indicators included in the gender diversity framework for all the communities. Gender divide direction $GD_{\nearrow}$ is reported in the column labelled accordingly. M represents the case there is gender divide and the indicator value is higher for males; F represents the case there is gender divide and the indicator value is higher for females; EQ represents the case of gender equity; and **-** represents the case the indicator value is not available.

[3] The considered indicators are: $\bar{\mathcal{SC}}$, $\bar{\mathcal{B}}$, $\bar{D}_{cen}$, $\bar{Cl}$, $\bar{E}$, $\bar{\mathcal{N}}$, $\bar{\mathcal{C}}$, p_{all}, $\bar{D}_{all}$, $\bar{p}_{st}$, $\bar{D}_{st}$, $\bar{x}$, $\bar{x}_s$, and $\bar{a}$.

ind_i	$ind_{i,F}$	$ind_{i,M}$	$ind_{i,R}$	*p-value*	*Degree of belief*	*Female Affirmation*
$\bar{\mathcal{SC}}$	0.00632	0.00617	0.00623	20.34%		
$\bar{\mathcal{B}}$	0.000089	0.000095	0.000093	42.86%		
$\bar{D}_{cen}$	0.0029	0.0035	0.0033	0.16%		
$\bar{Cl}$	0.0107	0.0093	0.0098	2.02%		
$\bar{E}$	0.0012	0.0061	0.0043	0.36%		
$\bar{\mathcal{N}}$	0.00099	0.00082	0.00089	4.09%		
$\bar{\mathcal{C}}$	0.0010	0.0008	0.0009	0.80%		
$\bar{p}_{all}$	2.04	1.90	1.95	13.79%		
$\bar{D}_{all}$	3.25	3.91	3.66	0.16%		
$\bar{p}_{st}$	3.99	3.98	3.98	48.80%		
$\bar{D}_{st}$	4.71	5.14	4.97	14.69%		
$\bar{x}$	0.045	0.039	0.041	33.72%		
$\bar{x}_s$	0.184	0.192	0.188	31.56%		
$\bar{a}$	0.078	0.092	0.086	18.94%		

Table 18 Summary table of the results for the ITAIS community. ind_i stands for the type of indicator (e.g., $\bar{x}$, $\bar{\mathcal{B}}$). $ind_{i,F}$, $ind_{i,M}$, and $ind_{i,R}$ are, respectively, the value of the indicator for males, females, and random groups. The *degree of belief (of the observed deviation)* for each indicator is reported under the column labelled by *degree of belief*. Female affirmation is reported in the column labelled accordingly. 🙂 represents the case of gender neutrality, i.e. not significant deviation. 🙂 🙂 represents the case of female affirmation, i.e. $ind_{i,F} > ind_{i,R}$. 🙁 represents the case of male affirmation, i.e. $ind_{i,F} < ind_{i,R}$.

ind_i	$ind_{i,F}$	$ind_{i,M}$	$ind_{i,R}$	*p-value*	*Degree of Belief*	*Female Affirmation*
$\bar{\mathcal{SC}}$	0.0084	0.0088	0.0087	15.87%		
$\bar{\mathcal{B}}$	0.0033	0.0037	0.0036	37.45%		
$\bar{D}_{cen}$	0.0081	0.0082	0.0082	43.64%		
$\bar{Cl}$	0.102	0.113	0.111	1.92%		
$\bar{E}$	0.0075	0.0061	0.0065	32.64%		
$\bar{\mathcal{N}}$	0.00128	0.00135	0.00133	36.32%		
$\bar{\mathcal{C}}$	0.00123	0.00136	0.00133	24.83%		
$\bar{p}_{all}$	2.27	2.34	2.32	38.59%		
$\bar{D}_{all}$	6.10	6.17	6.16	43.64%		
$\bar{p}_{st}$	4.57	4.45	4.47	39.36%		
$\bar{D}_{st}$	9.32	9.75	9.66	33.00%		
$\bar{x}$	0.162	0.071	0.091	1.11%		
$\bar{x}_s$	0.124	0.145	0.141	11.51%		
$\bar{a}$	0.215	0.225	0.223	41.29%		

Table 19 Summary table of the results for the SEBD community. ind_i stands for the type of indicator (e.g., $\bar{x}$, $\bar{\mathcal{B}}$). $ind_{i,F}$, $ind_{i,M}$, and $ind_{i,R}$ are, respectively, the value of the indicator for males, females, and random groups. The *degree of belief (of the observed deviation)* for each indicator is reported under the column labelled by *degree of belief*. Female affirmation is reported in the column labelled accordingly. represents the case of gender neutrality, i.e. not significant deviation. represents the case of female affirmation, i.e. $ind_{i,F} > ind_{i,R}$. represents the case of male affirmation, i.e. $ind_{i,F} < ind_{i,R}$.

ind_i	$ind_{i,F}$	$ind_{i,M}$	$ind_{i,R}$	*p-value*	*Degree of belief*	*Female Affirmation*
$\bar{\mathcal{SC}}$	0.00198	0.00202	0.00204	15.15%		
$\bar{\mathcal{B}}$	0.00031	0.00044	0.00043	7.21%		
$\bar{D}_{cen}$	0.00062	0.00068	0.00066	14.46%		
$\bar{Cl}$	0.085	0.083	0.084	30.15%		
$\bar{E}$	0.0039	0.0042	0.0041	33.72%		
$\bar{\mathcal{N}}$	0.000170	0.000163	0.000175	37.07%		
$\bar{\mathcal{C}}$	0.000153	0.000162	0.000175	4.01%		
$\bar{p}_{all}$	1.89	2.07	2.04	9.01%		
$\bar{D}_{all}$	3.56	3.90	3.77	14.46%		
$\bar{p}_{st}$	3.91	4.31	4.26	13.14%		
$\bar{D}_{st}$	6.66	7.37	7.14	19.49%		
$\bar{x}$	0.102	0.103	0.098	38.59%		
$\bar{x}_s$	0.095	0.129	0.115	3.22%		
$\bar{a}$	0.173	0.217	0.211	6.18%		

Table 20 Summary table of the results for the ICIS community. ind_i stands for the type of indicator (e.g., $\bar{x}$, $\bar{\mathcal{B}}$). $ind_{i,F}$, $ind_{i,M}$, and $ind_{i,R}$ are, respectively, the value of the indicator for males, females, and random groups. The *degree of belief (of the observed deviation)* for each indicator is reported under the column labelled by *degree of belief*. Female affirmation is reported in the column labelled accordingly. represents the case of gender neutrality, i.e. not significant deviation. represents the case of female affirmation, i.e. $ind_{i,F} > ind_{i,R}$. represents the case of male affirmation, i.e. $ind_{i,F} < ind_{i,R}$.

ind_i	$ind_{i,F}$	$ind_{i,M}$	$ind_{i,R}$	*p-value*	*Degree of belief*	*Female Affirmation*
$\bar{\mathcal{SC}}$	0.00271	0.00290	0.00295	10.20%		
$\bar{\mathcal{B}}$	0.00031	0.00063	0.00054	11.9%		
$\bar{D}_{cen}$	0.00114	0.00143	0.000135	4.27%		
$\bar{Cl}$	0.098	0.104	0.104	11.51%		
$\bar{E}$	0.000003	0.000916	0.001324	14.23%		
$\bar{\mathcal{N}}$	0.00021	0.00030	0.00025	17.11%		
$\bar{\mathcal{C}}$	0.000208	0.000282	0.000254	9.68%		
$\bar{p}_{all}$	1.68	2.16	2.01	6.43%		
$\bar{D}_{all}$	4.48	5.62	5.32	4.17%		
$\bar{p}_{st}$	3.51	4.54	4.34	10.20%		
$\bar{D}_{st}$	7.93	9.32	9.21	16.85%		
$\bar{x}$	0.066	0.060	0.071	39.36%		
$\bar{x}_s$	0.052	0.059	0.061	20.32%		
$\bar{a}$	0.119	0.147	0.153	14.69%		

Table 21 Summary table of the results for the VLDB community. ind_i stands for the type of indicator (e.g., $\bar{x}$, $\bar{\mathcal{B}}$). $ind_{i,F}$, $ind_{i,M}$, and $ind_{i,R}$ are, respectively, the value of the indicator for males, females, and random groups. The *degree of belief (of the observed deviation)* for each indicator is reported under the column labelled by *degree of belief*. Female affirmation is reported in the column labelled accordingly. represents the case of gender neutrality, i.e. not significant deviation. represents the case of male affirmation, i.e. $ind_{i,F} < ind_{i,R}$.

Community	cs_F	cs_M	cs_R	*p-value*	*Degree of belief*	*Female Affirmation*
ITAIS	77	98	64.91	2.00%		
SEBD	121	455	132.11	1.11%		
ICIS	340	810	337.68	40.50%		
VLDB	111	603	117.33	12.36%		

Table 22 Summary table of the results concerning clan segregation for all the communities. cs_F and cs_M are, respectively, the number of females and the number of males in the largest clan; (cs_R) is the average value of females for the random samples with the same size of the largest clan. The *degree of belief (of the observed deviation)* is reported under the column labelled by *degree of belief*. Female affirmation is reported in the column labelled accordingly. represents the case of gender neutrality, i.e. not significant deviation.   represents the case of female affirmation, i.e. $ind_{i,F} > ind_{i,R}$. represents the case of male affirmation, i.e. $ind_{i,F} < ind_{i,R}$.

ind_i	FA ITAIS	FA SEBD	FA ICIS	FA VLDB
$\bar{\mathcal{SC}}$	🙂 😊	🙁	🙁	🙁
$\bar{\mathcal{B}}$	🙂	🙂	🙁	🙁
$\bar{D}_{cen}$	🙁	🙂	🙁	🙁
$\bar{Cl}$	🙂 😊	🙁	🙂 😊	🙁
$\bar{E}$	🙁	🙂	🙂	🙁
$\bar{\mathcal{CS}}$	🙂 😊	🙁	🙂	🙁
$\bar{\mathcal{N}}$	🙂 😊	🙂	🙂	🙁
$\bar{\mathcal{C}}$	🙂 😊	🙁	🙁	🙁
$\bar{p}_{all}$	🙂 😊	🙂	🙁	🙁
$\bar{D}_{all}$	🙁	🙂	🙁	🙁
$\bar{p}_{st}$	🙂	🙂	🙁	🙁
$\bar{D}_{st}$	🙁	🙂	🙁	🙁
$\bar{x}$	🙂	🙂 😊	🙂	🙂
$\bar{x}_s$	🙂	🙁	🙁	🙁
$\bar{a}$	🙁	🙂	🙁	🙁

Table 23 Summary table of the results of female affirmation for the all the communities. Female affirmation (FA) is reported in the column labelled accordingly. 🙂 represents the case of gender neutrality, i.e. not significant deviation. 🙂 😊 represents the case of female affirmation, i.e. $ind_{i,F} > ind_{i,R}$. 🙁 represents the case of male affirmation, i.e. $ind_{i,F} < ind_{i,R}$.

ind_i	**Description**	$GD_{\nearrow ITAIS}$	$GD_{\nearrow SEBD}$	$GD_{\nearrow ICIS}$	$GD_{\nearrow VLDB}$
$\mathcal{SC}$	Semantic Centrality	F	M	M	M
$\mathcal{P}$	Polarity	EQ	M	-	-
TS	Topics segregation	EQ	EQ	-	-
GR	Gender Ratio	M	M	M	M
$\mathcal{B}$	Betweenness	EQ	EQ	M	M
D_{cen}	Degree Centrality	M	EQ	M	M
Cl	Closeness	F	M	F	M
E	EigenCentrality	M	EQ	EQ	M
$\mathcal{CS}$	Clan Segregation	F	M	EQ	M
$\mathcal{N}$	Novelty	F	EQ	EQ	M
$\mathcal{C}$	Combinational Creativity	F	M	M	M
p_{all}	Number of papers	F	EQ	M	M
D_{all}	Degree	M	EQ	M	M
$\bar{x}$	Neighbour susceptibility	EQ	F	EQ	EQ
$\bar{x}_s$	Trend susceptibility	EQ	M	M	M
$\bar{a}$	Authority	M	EQ	M	M

Table 24 Summary table of gender divide direction ($GD_{\nearrow}$). M represents the case there is gender divide and the indicator value is higher for males; F represents the case there is gender divide and the indicator value is higher for females; EQ represents the case of gender equity; and - represents the case the indicator value is not available.

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