



# The “invisible hand”: network effects of peer review on scientific collaboration

Pierpaolo Dondio (Dublin Institute of Technology, Ireland)  
Francisco Grimaldo (University of Valencia, Spain/Comunitat Valenciana)  
Niccolò Casnici & Flaminio Squazzoni (University of Brescia, Italy)

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[peereinfo@peere.org](mailto:peereinfo@peere.org)





# Motivation and aim/1 : Measuring Bias via Network

Human decisions are biased, so peer-review is (probably) biased.

Using the JASSS dataset, our aim was to verify if a series of **network-based features** extracted from the co-authorship network are related to the outcome of the peer-review process.

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# Motivation and aim/2: The effect of peer review

Peer review may shape scientific collaboration patterns by embodying implicit coordination signals that can inform scientists' collaboration strategies, either intentionally or unintentionally

Peer review can contribute to change scientific collaboration patterns by connecting scientists

Does the dynamic of the network over time provide any evidence/footprint of this?



# Research questions

## 1. Closeness and neutrality

Does the distance between authors and referees in the co-authorship network have an impact on the acceptance/rejection of an article?

## 2. Closeness and success

Does the distance between authors and referees in the co-authorship network predict the success of an article?

## 3. Closeness over the time

Is the peer review process changing the structure of the co-authorship network over the time as if it were an “invisible hand” on the scientific collaboration structure?





# The JASSS dataset

## Reviews

Full Text of **3.025** reviews by  
**989** referees covering **1.433**  
submission by **1.252** authors  
(**3.508** distinct author-referee  
couples)

## Submitted Manuscripts

**2072** submission from 1998 to 2015  
(PDF, Doc, Images)

## Published Papers

**474** published papers. Available online  
at [www.jasss.surrey.ac.uk](http://www.jasss.surrey.ac.uk)

## Other Data and Metadata

Reviews decisions, editor decisions,  
paper keywords, authors bio & research  
interests, referees bio & research  
interests. All timestamped

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# The co-author network



920 paper submitted to round 1  
1.678 individuals: 842 authors  
only, 387 referees only, 449  
authors and referees



2.995.959 publications,  
1.572.297 authors, 4.313  
conferences and 1.415 journals



160.000.000 indexed documents  
More than 80% of the scientific  
production covered

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# Computing the referee/author closeness

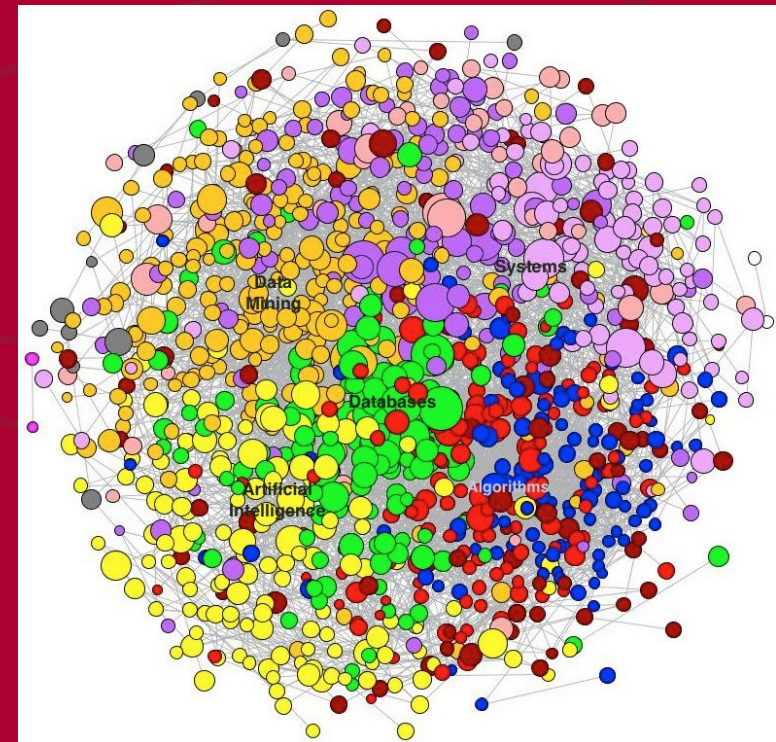


All JASSS authors  
have an entry in  
DBLP



Scholar made the  
estimated distances  
more reliable, due to  
the multidisciplinary  
orientation of JASSS

1.3 million nodes  
18 millions edges



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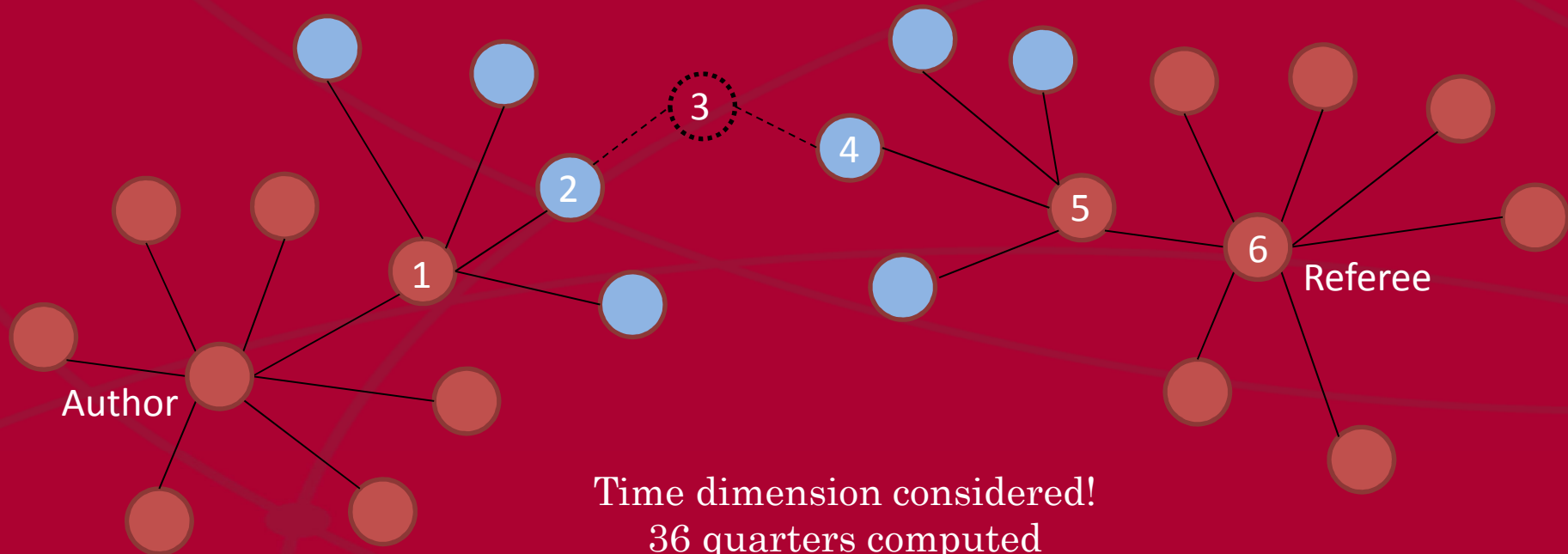




# Google Scholar Lower Bound Heuristics



- Expand author and referee node 1 step
- If there is overlapping, we have a new distance
- If there is no overlapping, we have an upper bound
- Expand (1 step) the smaller set (repeat up to 3 steps, maximum 30 nodes expanded for each new node)



Time dimension considered!  
36 quarters computed

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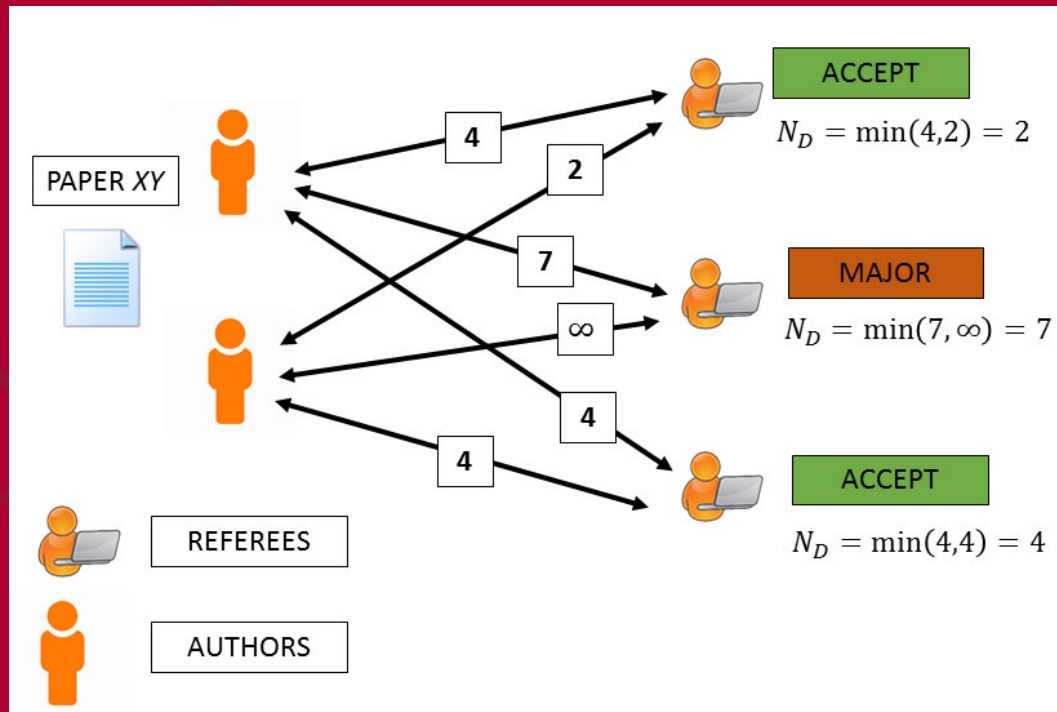






# About the referee/author closeness

For each referee and each paper's authors, we considered the **geodesic distances** between the referee and the authors and select the minimum.



- The network distance is the minimum of the distances referee/author for the paper *xy*
- If  $N_D \leq 3$ , we assumed that the author and referee were **close** to each other

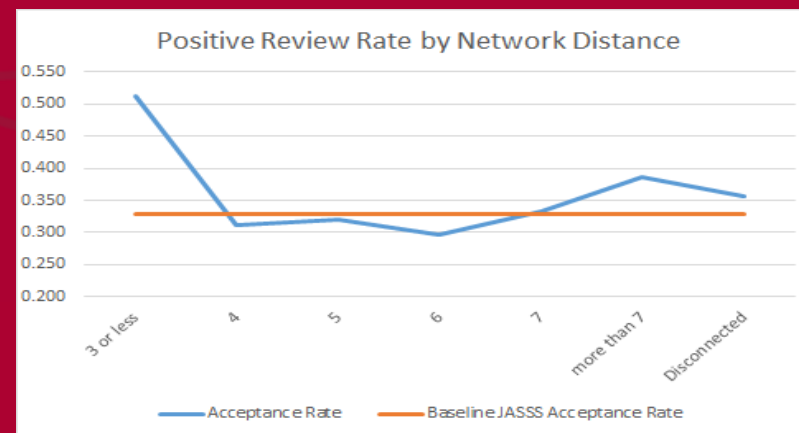


# 1. Closeness and neutrality: results

Recommendation	Far	Close
Positive Review (accept or minor)	532 (32.69%)	69 (51.11%)
Negative Reviews (reject, revise or major)	1095 (67.31%)	66 (48.89%)

**Table 3.** Network Distance vs. Acceptance rate.

Network Distance	Acceptance Rate	Baseline acceptance rate
<3	0.511	0.329
4	0.335	0.329
5	0.319	0.329
6	0.296	0.329
7	0.332	0.329
>7	0.387	0.329
Disconnected	0.357	0.329



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# Results:

## 2. Closeness and manuscript success

### Manuscript success

Citations in Google Scholar. Crawled 244 published papers in JASSS. Average number of citations = 40.82

Recommendation	Distance	Average Citations	t-value
Negative Review	Close	73.5 (*)	2.3
	Far	36.55	
Positive Review	Close	38.08	-0.39
	Far	40.86	

(15 papers)



# Closeness and negative reviews

1. There is less probability to have a negative recommendation from a close referee (Friendship bias? Topic bias? )

2. On the other hand, when:

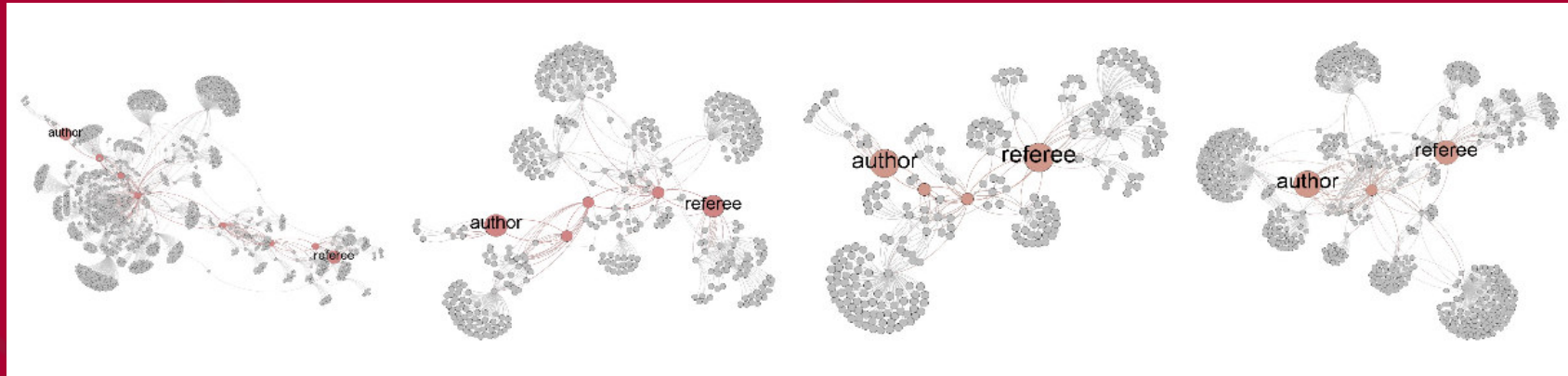
- the recommendation was negative
- it came from a close referee
- and the article was published regardless the referees' recommendations

The paper got more citations than the average  
(Competition bias?, Different Research Schools? Closer expertise → Harsher Review/Critiques)



# Does peer review increase connections between scientists?

We wanted to understand if the network distance between author and referee(s) decreased faster, slower or similarly as the overall network of co-authorship



Does it happen systematically?  
Does it happen more for author-referee couples?

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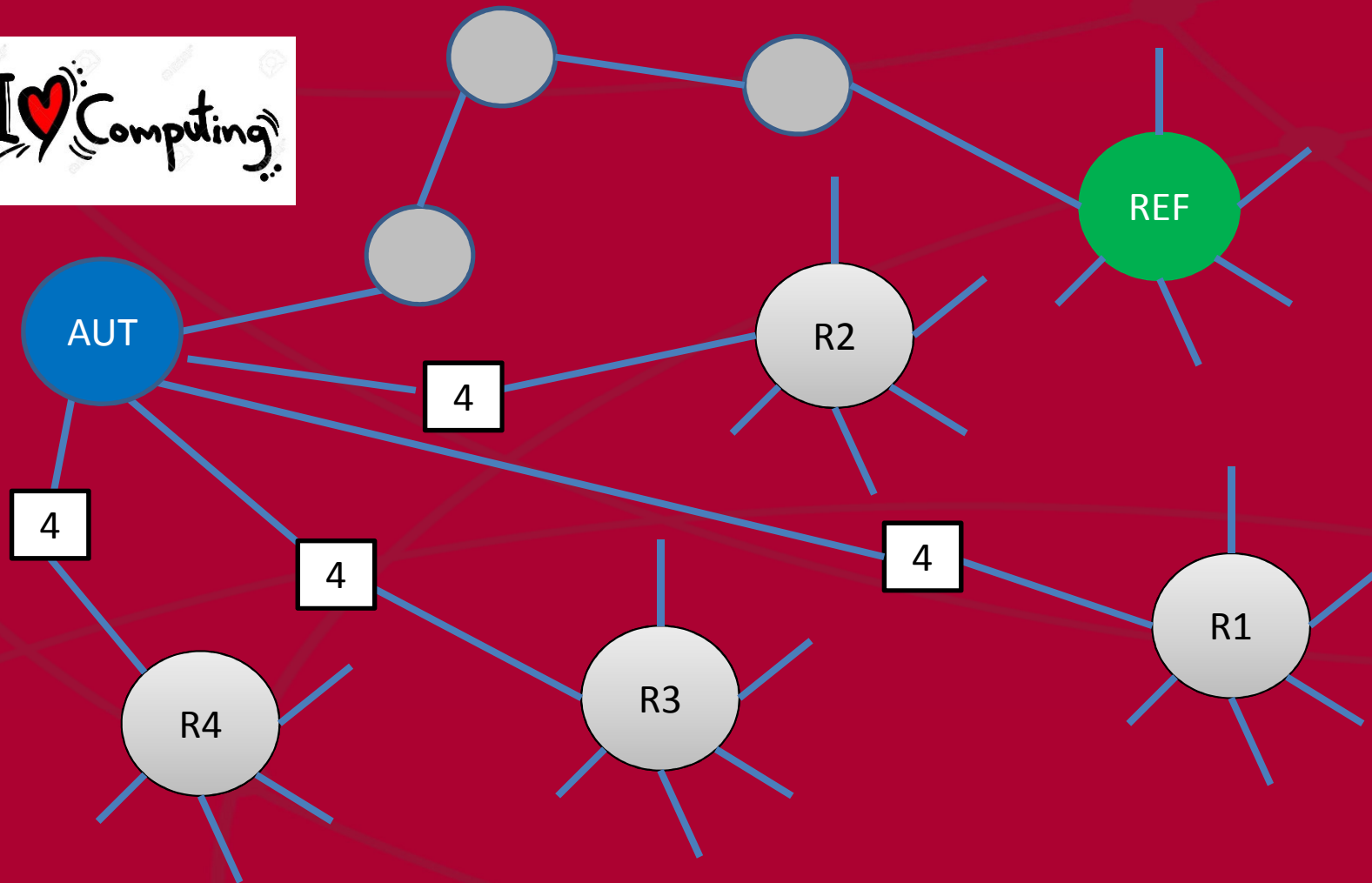
# Methodology

For each of the 1772 (*Aut*, *Ref*) couple referee – closest author:

- Select 100 random nodes in the network with:
  - Same distance from the author *Aut* as *Ref*
  - Comparable degree with *Ref* ( $d_{Ref} \pm 10\%$ )
- Collect and compare the geodesic distances over time between *Aut* and *Ref* and between *Aut* and nodes in the random sample



# Methodology



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# Results:

## 3. Closeness over the time

We found that it took on average 2 years for each journal's reviewer-author couple to reduce its distance to 1 unit.

The JASSS couples always showed higher reductions

Average reduction in number of steps by year

Year	JASSS	Random	t-test
1	0.78	0.46	4.37
2	1.03	0.81	2.88
3	1.43	1.21	2.75
5	1.6	1.45	1.53
10	3.32	3.08	1.73



# Results:

## 3. Closeness over the time (2)

99 couples had a distance >3 at time of review but they reduced their distance  $\leq 3$  afterwards. They represented 6.12% of the couples JASSS referees-authors. The same reduction happened in only 0.72% of the couples in the random samples

284 couples had a distance >4 at time of review but they reduced their distance to 4 afterwards. They represented 16% of the JASSS couples referees-authors. The same reduction happened in only 4.54% of the couples in the random samples

28 couples reduced their distance to 2 degrees of separation (1.2 in the random set), 7 arrived to step 1 by establishing direct collaboration after having reviewed a respective submission a year early (0.2 random).



# Conclusions

- Closeness has an effect both on the type of recommendation
- Embeddedness into collaboration relationships plays a key role in the peer review process
- The analysis of co-authorship network over time suggests that peer review might change the social structure of the community: bridging new collaborations and reducing distances





# Limitations and future work

- We just had a structural “footprint” of the bias. Other complementary methods should be used to investigate more
- We didn’t have data about unpublished manuscripts in JASSS.
- JASSS refers to a relatively small and inter-disciplinary community. Do other communities behave differently?
- Further simulation to investigate the effect of peer-review on the structure of the network. Ideas: look at nodes cited by each paper, field of research of random nodes, accept/reject decision...



Thank you



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AND GET  
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