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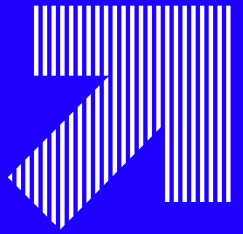

Evaluation of Crowdsourced Peer Review using Synthetic Data and Simulations

Michael Soprano, Eddy Maddalena, Francesca Da Ros, Maria Elena Zuliani, Stefano Mizzaro

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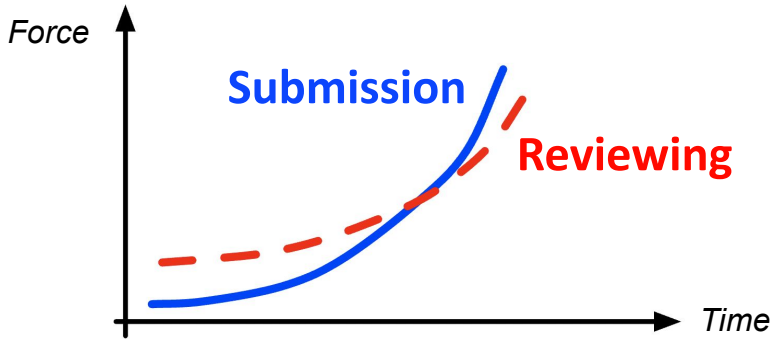
Scholarly Publishing and Peer Review

- **Scholarly publishing** allows for the **dissemination of knowledge**
- The process depends on **peer review**
- Researchers author **scientific articles**
- **Peers with equal expertise evaluate** their articles
- **Peer review** has been **facing challenges** for a while



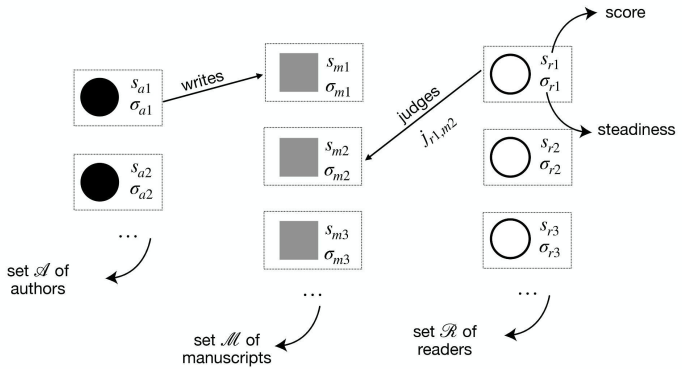
What Can Be Done?

- We have **plenty of readers**!
- **Readers read articles**, and **form opinions**
- Using **many readers instead of a few referees**
  - A form of *crowdsourcing*
- Mizzaro proposed **crowdsourcing peer review to readers**
- The **approach proposed** is called *Readersourcing*

Mizzaro, S. (2012), Journal of the American Society for Information Science and Technology. J Am Soc Inf Sci Tec, 63: 1666-1672. https://doi.org/10.1002/asi.22668

Readersourcing

- **Readersourcing** involves **three key entities**: *manuscripts*, *authors*, and *readers*
- ***Readers* assign a numerical *judgment*** to *manuscripts* written by *authors*
- **Each entity has** a **score** (s) and a **steadiness** (σ) value **based on judgment aggregation**
- The **co-determination algorithm evaluates** both **article quality** and **scholarly reputation**



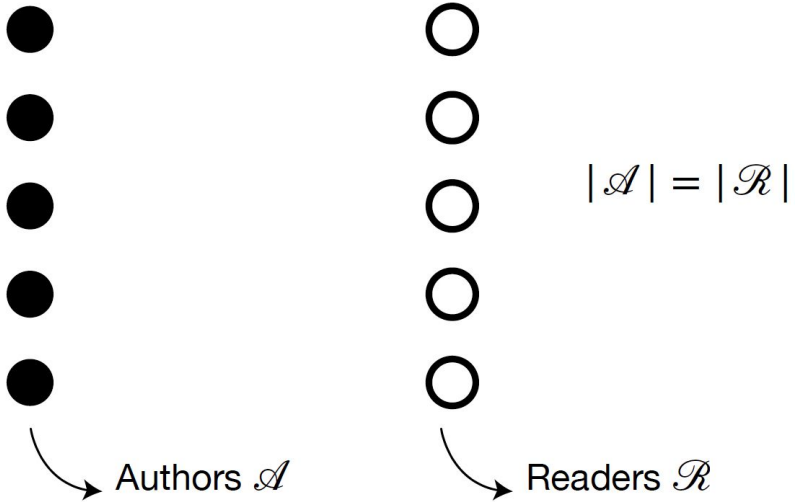
Mizzaro, S. (2003), Quality control in scholarly publishing: A new proposal. J. Am. Soc. Inf. Sci., 54: 989-1005. https://doi.org/10.1002/asi.10296

Aims

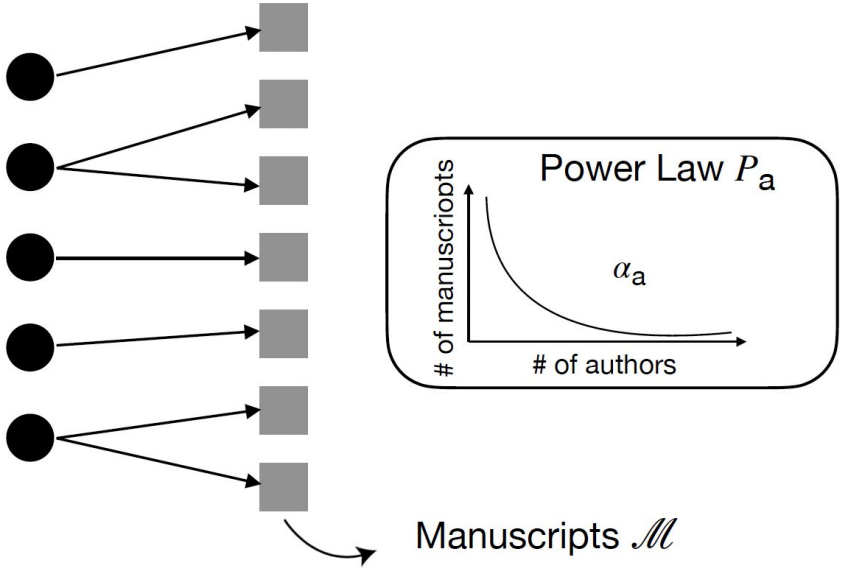
- The **effect of Readersourcing algorithm** on the **computed quantities** remains **largely unexplored**
- We evaluate Readersourcing through **simulations in a scholarly publishing scenario using a probabilistic approach**
- How effectively does **Readersourcing capture distinct aspects of judgments?**
- What is the **impact of simulation parameters on computed quantities?**

Simulation Flow

Step 1: Generate authors and readers

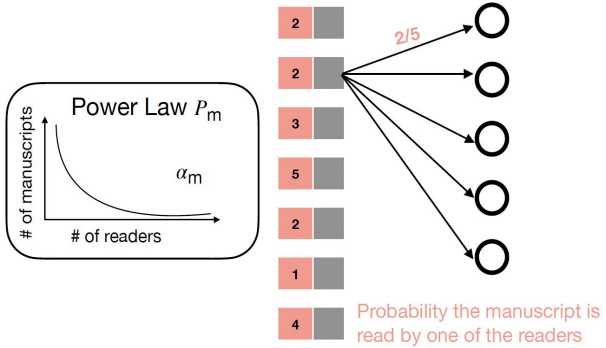


Step 2: Authors publish manuscripts following P_a

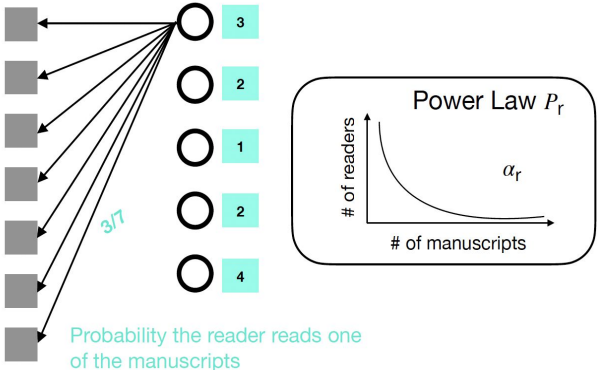


Simulation Flow

Step 3: Manuscripts are read following P_{m}

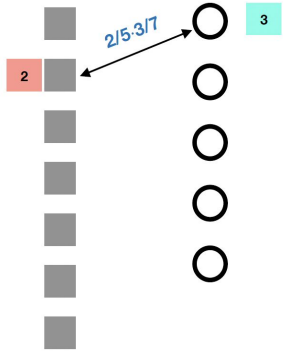


Step 4: Readers read following P_{r}



Step 5: The association between readers and manuscripts follows $P_{\text{r,m}}$

Joint probability between P_{r} and P_{m}

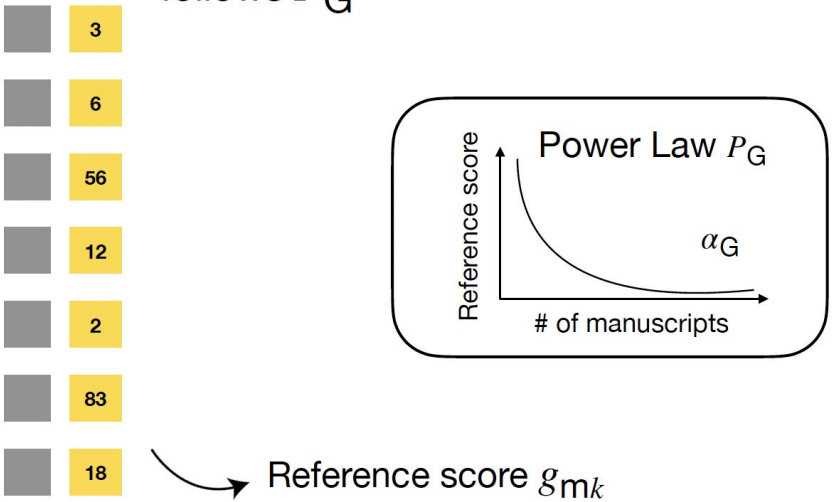


The **joint probability** is the product of the two probabilities, assuming **event independence**

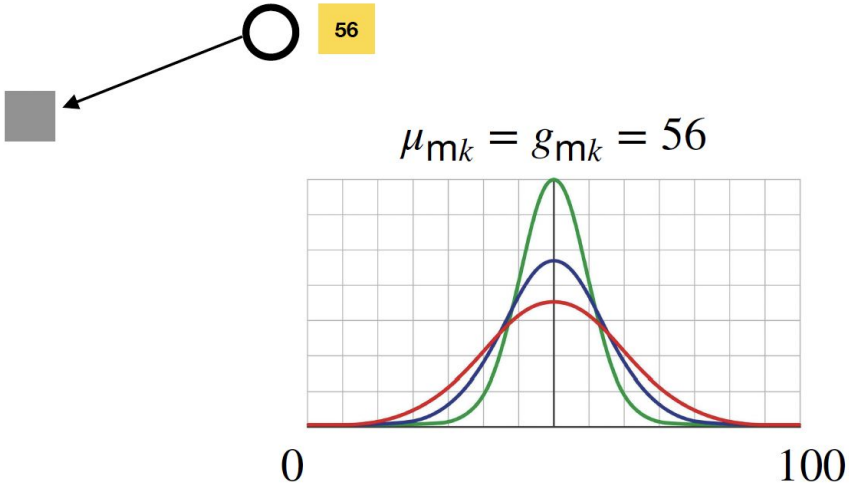
$$P(\text{manuscript } k \text{ is read by reader } l) = P(\text{reader } l \text{ reads any manuscript}) \times P(\text{manuscript } k \text{ is read by any reader})$$

Simulation Flow

Step 6: Manuscripts have a reference score that follows P_G



Step 7: Judgments follow a Gaussian distribution



Experimental Setup

- We generate a **set of simulation configurations** by empirically selecting **discrete values for six parameters**
- The **total number of configurations** is given by
  - 1 population size x 81 α values x 4 st. dev. values = 324
  - We run each configuration 10 times to account for stochasticity
- We **run around 3,000 simulations**, targeting 250 authors/readers
- We analyze **synthetic judgments** and **six computed quantities** in Readersourcing (score and steadiness for each entity)

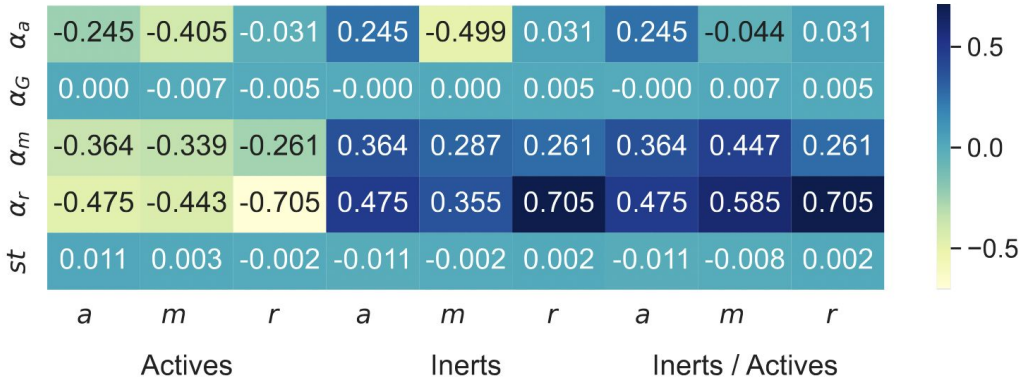
Active and Inert Entities

- The **probabilistic model may generate entities that do not "participate"**, we called them *inerts*
  - Unread manuscripts, readers who do not provide judgments, ...
- We first **quantify inerts** and then **exclude them** from the simulation flow

Statistic	Active Authors	Active Manuscripts	Active Readers
mean	214	1844	162
min	175	899	115
25%	208	1557	150
50%	216	1811	163
75%	223	2110	176
max	241	3340	206

Effect of the Probabilistic Approach

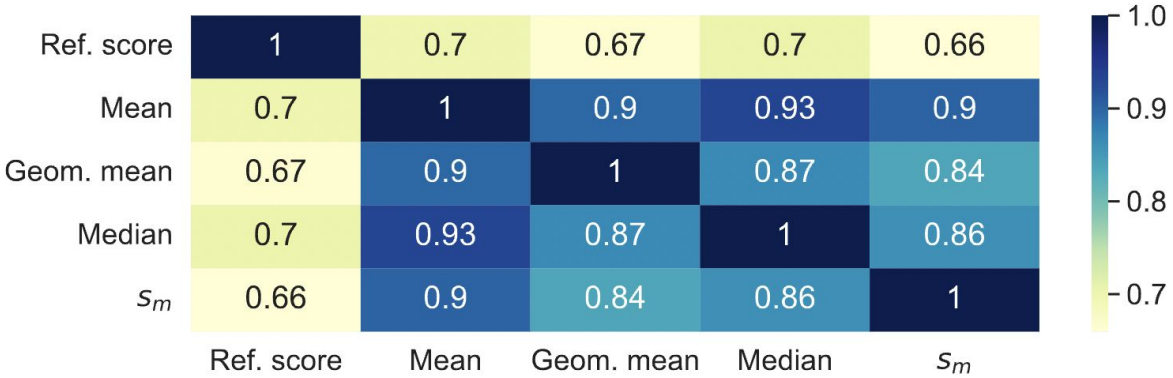
- **Some simulation parameters influence** the number of **active and inert entities**
- **Understanding these effects helps tune parameters** to minimize inerts and refine experimental designs



Kendall's τ correlation values w.r.t to the number of active and inert entities, and the inert-to-active ratio

Comparison with Simpler Aggregation Strategies

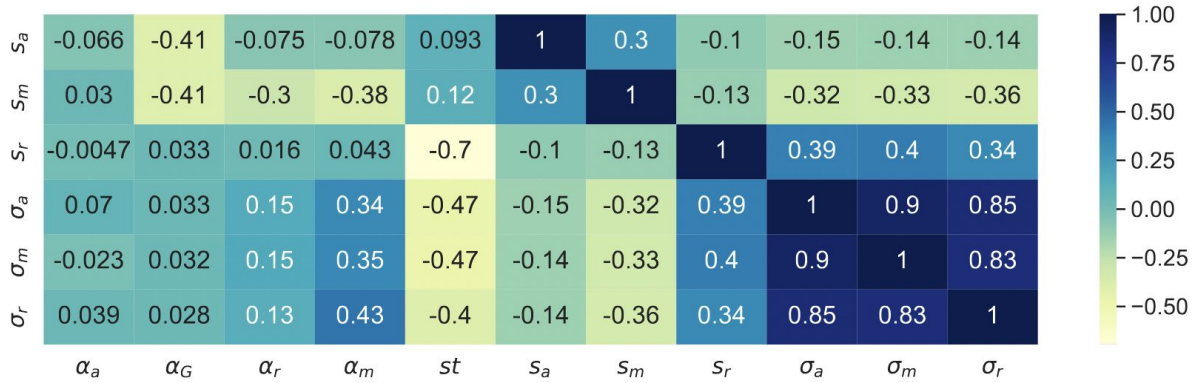
- **Weak correlation with the reference score** suggests an **alternative judgment dimension**
- **Strong correlation with aggregation strategies** reflects **overall judgment trends**
  - "Readersourcing captures a different perspective"



Kendall's τ correlation values w.r.t. the reference score, aggregated judgments, and the manuscript score

Impact of Model Components on Quantities

- Strong steadiness correlation indicates **system-wide consistency**
- Feature importance analysis links **higher manuscript scores to more consistent judgments**
- ANOVA shows **standard deviation affects score steadiness**



Kendall's τ correlation values w.r.t. simulation parameters, scores, and steadiness values

Conclusions

- We design a **simulation flow to evaluate Readersourcing**
- Readersourcing provides **insights beyond simple aggregation strategies** and shows **system-level properties**
- Future work includes **comparisons with other models** and **simulating more complex scenarios**

Acknowledgments

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