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Exploring the role of rejection in scholarly knowledge production: Insights from granular interaction thinking and information theory

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Key points

- Rejection is an essential part of the scholarly publishing process, acting as a filter to distinguish between robust and less credible scientific works.
- While rejection helps reduce entropy and increase the likelihood of disseminating useful knowledge, the process is not devoid of subjectivity.
- Providing more informative rejection letters and encouraging humility among editors and reviewers are essential to enhance the efficiency of knowledge production as they help ensure that valuable scientific contributions are not overlooked.

Keywords: granular interactions thinking, information theory, knowledge production, rejection mechanism, scientific publishing

THE VALUE OF THE REJECTION PROCESS

Rejection is an inevitable challenge that all scholars face when they enter academia. The rejections encountered during editorial evaluations and peer-review processes are typically seen as a filtering mechanism that helps distinguish between perceived qualified and perceived ineligible scientific works. Scientific works perceived as useful and reliable will proceed to publication, and those deemed ineligible will be excluded. Here, 'perceived useful and reliable scientific works' and 'perceived ineligible works' highlight the subjectivity inherent in evaluation processes driven by editors and reviewers. In this article, we aim to elaborate on the advantages and limitations of the rejection process through the lens of Shannon's information theory (Shannon, 1948) and the theory of granular interaction thinking (Vuong & Nguyen, 2024a), which is based on the worldviews of quantum mechanics and the mindsponge theory (Hertog, 2023; Rovelli, 2018; Susskind & Friedman, 2014; Vuong, 2023).

The theory of granular interactions thinking suggests that humans' psychological products are generated through the interactions of quanta at fundamental levels, making their features analogous to quantum mechanics [2]:

- Granularity: Information in a system, including human psychological systems, is finite.
- Relationality: All events occur through interactions with other systems, meaning psychological processes involve the interaction between existing information within the mind and newly absorbed information from the environment.
- Indeterminacy: The future is probabilistically, rather than unequivocally, determined by the past, making psychological products, including knowledge creation, inherently probabilistic.

Given the finite information each person can process, knowledge production appears to be a dynamic, multi-state process requiring contributions from many individuals. Knowledge generated in former states (demonstrated by State 1) can be used as resources for knowledge production in subsequent states (demonstrated by State 2). In other words, knowledge is produced through the interactions between new observations, theoretical formulations, and useful knowledge accumulated in previous states of knowledge production. For instance, reaching the current stage of utilizing solar energy (which accounts for only 4.5% of total global electricity generation) has involved contributions

of knowledge from myriad societies (e.g., Ancient Egypt, Ancient Greece, Ancient Rome) and great individuals (e.g., Archimedes, Mikhail Vasilyevich Lomonosov, Edmond Becquerel, Heinrich Hertz, Albert Einstein) over the course of 28 centuries (Petrova-Koch, 2020).

As the future is probabilistically determined by the past but not unequivocally, maximizing the probability that useful knowledge (or scientific works) can be transmitted from State 1 to State 2 is crucial for upholding the effectiveness of the knowledge production process. Journal and book publishing aim to store and disseminate perceived useful scientific works in State 1 for potential reuse in State 2, thereby facilitating new knowledge generation. Although the rejection process imposes a mental burden on scholars, it is essential for achieving this goal.

Such a knowledge transmission process can be reflected through Shannon's information theory. According to Shannon (1948), the entropy (missing information or uncertainty) $H(X)$ of a random variable X with possible outcomes $\{x_1,x_2,...,x_n\}$ and corresponding probabilities $\{P(x_1),P(x_2),...,P(x_n)\}$ is calculated as:

$$H(X) = -\sum_{i=1}^{n} P(x_i)\log_2 P(x_i)$$

$P(x_i)$ is the probability of the outcome x_i. Each probability $P(x_i)$ represents how likely each outcome x_i is to occur.

In the context of knowledge production, the variable X can be interpreted as knowledge in State 1, with i number of scientific works. Each scientific work has its $P(x_i)$ probability to be stored and disseminated for subsequent knowledge production process in State 2.

Scenario 1: Assuming that there was no rejection process, all scientific works would be published regardless of their usefulness and reliability. In this case, all the scientific works might have the same probability of being stored and disseminated, $P(x_i) = \frac{1}{n}$. Then, the probability of all scientific works being reused would be equivalent to $\frac{1}{n}$. In this scenario, the entropy would also be maximized as the entropy (missing information or uncertainty) of the knowledge system might also rise monotonously with the increase in the number of scientific works i. In other words, the chance of identifying useful and reliable scientific works for subsequent knowledge-generation processes would be highly uncertain.

Scenario 2: When the rejection process is applied, editors and reviewers invest their energy in evaluating the usefulness and reliability of scientific works, accepting those qualified for publication and rejecting those deemed unqualified. By being published in journals or books, these scientific works have a higher probability of being stored and disseminated in State 1 and eventually reused in State 2. For works that are rejected, they will likely continue to be submitted to other journals, sent for publication in other information dissemination modalities (e.g., preprint repositories, personal blogs, conference proceedings, institutional repositories), or remain unpublished (Casnici et al., 2017). Scientific works that are published on other information dissemination platforms generally have less visibility and credibility than peer-reviewed journals and books. Thus, their probability of being stored, disseminated, and reused is lower.

This process reduces entropy during the knowledge transmission from State 1 to State 2, increasing the chance of reusing useful and reliable scientific works. However, due to the finite energy of physical systems, scientific works that are less likely to be reused will be eliminated over time. Although the aim of the rejection process is to filter out ineligible scientific content, there exists the possibility that this will lead to the loss of useful information (see Fig. 1).

WHY IS INTELLECTUAL HUMILITY CRITICAL?

The effectiveness of the rejection mechanism in filtering out ineligible content largely relies on the evaluations of editors and reviewers. The preciseness of the evaluation process, however, is constrained by several limitations. One primary limitation is subjectivity, which challenges the commonly held belief in the objectivity of the peer-review system. Editors and reviewers, being human, are inevitably influenced by personal biases, prejudices, and their own limited expertise (Smith, 2006). This subjectivity may result in the rejection of scientific works that are useful and reliable but do not align with the editors' and reviewers' pool of knowledge or worldviews (Vuong, 2023). Although rejected scientific works can be submitted to other journals or other forms of information dissemination platforms, a certain number of rejected scientific works are never published. If useful and reliable scientific works are rejected and never published, this represents a loss to the knowledge accumulation process.

Science emerges from the act of intellectual humility (Rovelli, 2018): 'not trusting blindly in our past knowledge and our intuition'. Without such humility, scientific progress would not happen, as new ideas would be rejected and suppressed. Indeed, much groundbreaking scientific knowledge is born out of doubt. Some ideas may even seem unbelievable based on the evidence and tools available at the time, yet they ultimately lead to a more accurate understanding of the world. For instance, the revolutionary heliocentric theory proposed by astronomer Nicolaus Copernicus was initially met with scepticism (Copernicus, 1543). It wasn't until several decades later that Johannes Kepler and Galileo Galilei provided the first supporting evidence for Copernican heliocentrism. The idea that Earth revolves around the sun only became widely accepted after Isaac Newton formulated the universal law of gravitation and the laws of mechanics (Kobe, 1998). Similarly, without the humility and openness to new ideas demonstrated by some physicists, the 1905 paper on special relativity by 25-year-old Albert Einstein might have been completely rejected and forgotten, given its direct challenge to the notion of ether (Wills, 2016). Thus, maintaining intellectual humility during the evaluation process is crucial for editors and reviewers in order to reduce the chance they reject valuable scientific works.

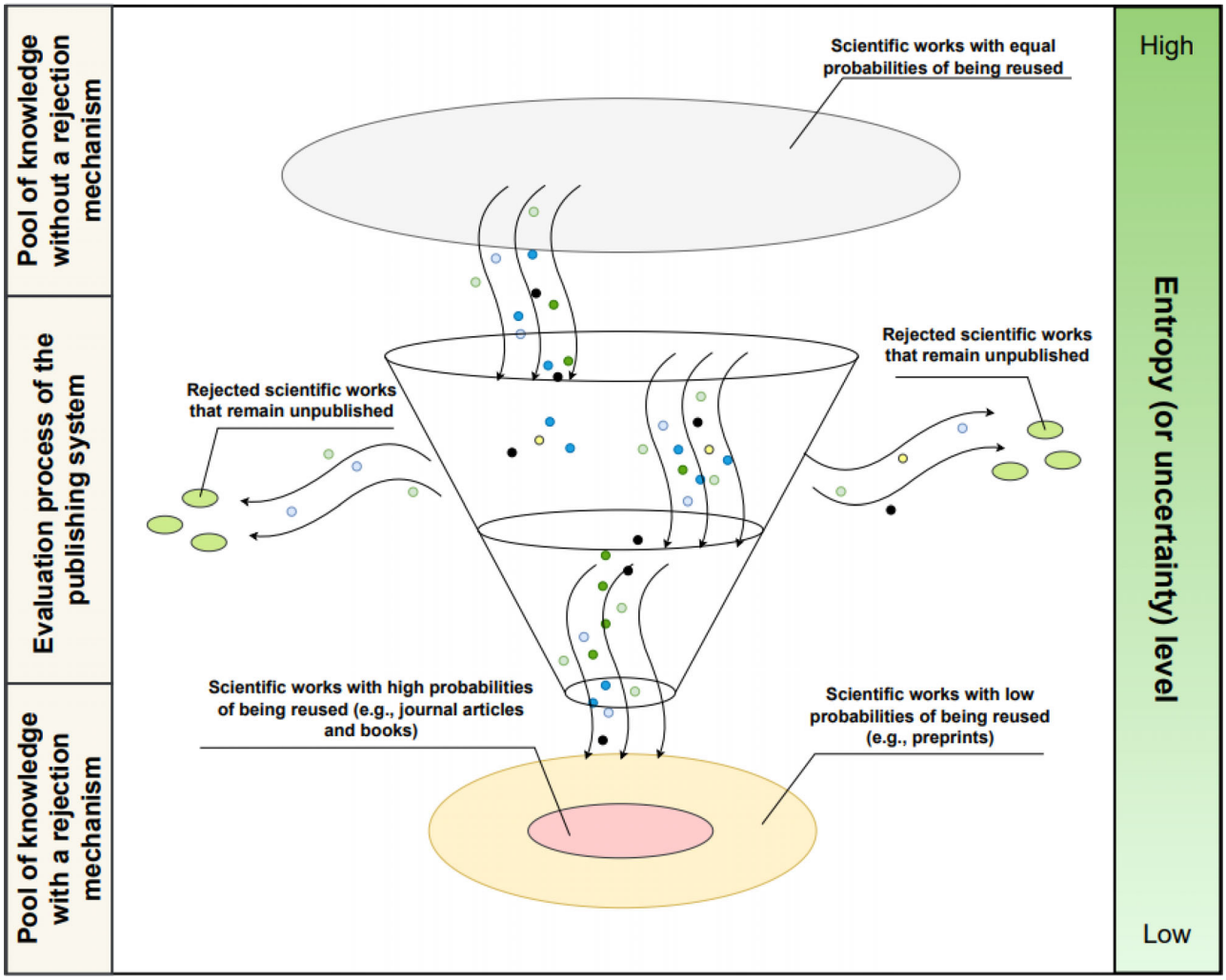

FIGURE 1 The difference between pools of knowledge with and without a rejection process. Conceptualized based on Vuong and Nguyen (2024b).

Furthermore, in the digital age, reducing the likelihood of rejecting useful and reliable research becomes even more crucial. With the rapid advancement of information technology, new information dissemination platforms are emerging. If these new platforms increasingly demonstrate their value in providing useful and reliable scientific knowledge, the role of journals and books will diminish.

The current scientific community's consensus on the value of the publishing system has been shaped by the perceived contributions of this system to knowledge storage and dissemination, as well as through education and lived experiences (Vuong & Nguyen, 2024b). This consensus grants journals the authority to determine which knowledge is trustworthy, turning editors and reviewers into gatekeepers and embedding rejection as a common practice within the publishing system. However, as the research community recognizes that many valuable and reliable studies are being published on alternative knowledge dissemination platforms (e.g., as technical reports, theses, dissertations, working papers, preprints), questions will arise regarding the effectiveness of the rejection process and the true value of academic publishing.

In fact, there exist a number of valuable scientific works that have not been published in journals or books but are still widely reused. Some notable works include three preprints posted on *arXiv* by mathematician Grigori Perelman (Perelman, 2002, 2003a, 2003b). These preprints are among the most significant contributions in the 21st century, as they provide proofs for the 100-year-old Poincaré conjecture and Thurston's geometrization conjecture. Perelman was offered the Fields Medal in 2006 and the first Clay Mathematics Institute's Millennium Prize Problems for these contributions, but he refused. According to Google Scholar, all three preprints of Grigori Perelman have been cited more than 1000 times, and the 2002 preprint has received more than 3000 citations. Notably, his preprints were written with many technical details omitted, deviating from the typical style expected in academic mathematical publications. Perhaps his

decision to post on *arXiv* instead of submitting his work to a journal might have been a way to reduce the uncertainty of whether his work would be published.

If more seminal works like Perelman's continue to emerge in unconventional knowledge dissemination platforms, and research increasingly shows little difference between journals and other information dissemination platforms (e.g., preprints) (Carneiro et al., 2020; Janda et al., 2022), the scientific community's consensus on the value of the conventional publishing system might shift. Subsequently, it would lead to changes in the patterns and habits of how research is published and how scientific knowledge is consumed. Over time, this could make traditional tools used as proxies for the impact and reliability of scientific content (e.g., indexing, Journal Impact Factor, and CiteScore) less effective in informing decision-making.

THE NECESSITY OF TRANSPARENT REJECTION LETTERS

Requiring editors and reviewers to provide more transparent rejection letters (or recommendations) is a good way to reinforce the values of intellectual humility in the evaluation process. Rejection is a necessary process in academic publishing to reduce entropy (or uncertainty) in the knowledge pool. This means that the rejection process aims to filter out the specific units of information—the submitted paper or book—rather than targeting the researcher's competence, knowledge, research direction, or approach. Ambiguous rejection decisions create uncertainty about why a study was not accepted, leading to challenges to the author's self-esteem, identity, and career resilience (Horn, 2016; Walker, 2019).

Moreover, in the context of a publishing landscape that is becoming more complex, transparent rejection letters are increasingly important. The pervasive 'publish or perish' culture in academia drives scientists into a relentless race for more publications, which has led to many unethical practices such as peer-review manipulation (e.g., exploiting Special Issue publishing and author-suggested reviewers, submitting multiple versions of a manuscript to different journals, and creating fake reviewer accounts) (Kulkarni, 2016). Editors and reviewers often focus on a study's contribution, methodology, logic, and presentation, as they are not always able to verify the reproducibility and validity of the findings. This has contributed to the publication of non-reproducible studies, exacerbating the reproducibility crisis (Fidler & Wilcox, 2018). The recent incorporation of generative artificial intelligence (AI) into academic writing further complicates the evaluation process, as distinguishing between content generated by humans and AI is challenging and will become even more so in the future (Casal & Kessler, 2023). Consequently, the number of retracted scientific papers, including those published in prestigious journals like *Nature*, *Science*, *PNAS*, *The New England Journal of Medicine*, and *The Lancet*, has increased (Vuong, 2020a, 2020b).

For these reasons, tremendous pressure is placed on the academic publishing system to safeguard the knowledge pool from studies tainted by ethical misconduct (e.g., duplicate publications, plagiarism, lack of proper credit, ownership disputes, publication of papers generated by paper mills, authorship conflicts, interference with the review process, or citation manipulation) and scientific distortion (e.g., data manipulation, fraudulent data, unsupported conclusions, questionable data validity, non-replicability, or data errors). These pressures make editors and reviewers less likely to take risks and more inclined to reject scientific works with which they are unfamiliar.

In this context, transparent rejections are required to reduce the scientists' uncertainty in the decision-making process regarding rejected works. Rejection letters that clearly explain the reasons for rejection can help researchers find more suitable journals or revise and improve their work for a higher chance of publication elsewhere. In some cases, if editors or reviewers can suggest alternative journals that might be a better fit for the rejected research, it could reduce the risk of information loss or even help researchers avoid submission to predatory journals (Richtig et al., 2018).

CONCLUSION

In the current publishing system, rejection functions as a mechanism to reduce entropy (or uncertainty) and increase the likelihood of disseminating useful and reliable knowledge. However, the effectiveness of this mechanism is limited by the inherent subjectivity of editors and reviewers, which can lead to the loss of valuable scientific information. As the publishing landscape becomes increasingly complex, editors and reviewers face significant pressure to identify and reject studies with ethical misconduct or scientific distortion, further increasing the risk of information loss.

Given these challenges, we propose two recommendations. First, intellectual humility should be emphasized in the evaluation process, making editors and reviewers less likely to reject valuable scientific works that are novel but may not align with their worldviews. Second, rejection letters should be more transparent and informative to reduce the uncertainty caused by rejection. This approach will help mitigate the mental strain on authors, enabling them to understand their studies' weaknesses and find more suitable venues for publication, ultimately increasing the likelihood that valuable scientific contributions will reach later stages of knowledge production.

AUTHOR CONTRIBUTIONS

Conceptualization: Quan-Hoang Vuong. *Formal analysis*: Minh-Hoang Nguyen. *Investigation*: Minh-Hoang Nguyen. *Resources*: Minh-Hoang Nguyen. *Writing—original draft preparation*: Quan-Hoang Vuong and Minh-Hoang Nguyen. *Writing—review and editing*: Quan-Hoang Vuong and Minh-Hoang Nguyen. *Supervision*: Quan-Hoang Vuong. *Project administration*: Quan-Hoang Vuong. All authors have read and agreed to the published version of the manuscript.

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The authors have nothing to report.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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