The Value of a Dual Anonymous System for Reducing Bias in Reviews of Planetary Research and Analysis Proposals and Scientific Papers

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Summary: Reviewer anonymous paper and proposal review systems, in which the author does not know the identity of the reviewer, have been in place for many decades. This system enables the reviewer to more freely provide scientific analysis of the proposed work without concern about the potentially negative consequences of the author knowing their identity. Dual anonymous review systems, in which neither the submitting party nor the reviewing party are known to each other, have the potential to improve the success rate of scientific proposal and paper acceptance with underrepresented or marginalized groups. Often conscious or unconscious bias can occur on the behalf of the reviewer, in which a person's capabilities are inferred based on their gender, ethnicity, age, affiliation or relative newness to the field. Authors who are in some way different from the reviewer may undergo excess scrutiny, and authors who are similar to the reviewer may be given the benefit of the doubt, even if the reviewer is not conscious they are behaving in that manner. Concealing the identity of the proposal or paper author removes the potential for unconscious bias and allows for the work to be evaluated on its own merit. In some cases, bias can work in the favor of an author, as for example when the author is given dispensation for being inexperienced, a student, or new to the field, or if NASA chooses to train proposers from underrepresented groups. These benefits may be chosen to be exercised in specific situations; however, in most cases scientists would agree that placing everyone on equal footing is preferred. The Space Science Telescope Institute (STScI) observed significant improvements in the amount of telescope time awarded to female scientists under their dual anonymous review system (Johnson et al. 2020). NASA has planned a dual anonymous review system for several upcoming proposal calls, and the journal *Nature* has engaged in some experiments with double blind reviewing. ***We recommend that given the STScI success, NASA should continue to experiment with the dual anonymous review process for research and analysis (R&A) proposals. Furthermore, we call on NASA and scientists to encourage journals they publish in to engage in dual anonymous review experiments and evaluate how this impacts the scientific success of underrepresented groups.***

Background and Previous Success

Proposal Funding Disparity: In the last decade, selection rates for NASA scientific research proposals have declined (reference: Henry Throop at OPAG 9/3/2020: https://www.lpi.usra.edu/opag/meetings/opag2020fall/presentations/Throop_6016.pdf). Planetary science research funding, which is sourced primarily from NASA, is insufficient in and of itself to support the growing size of the planetary science community. The effect of declining selection rates is particularly acutely felt by those who are marginalized and those without access to a strong network, proposal support, research needs like laboratories and computing/internet resources (see Milazzo Digital Divide white paper), or name recognition in review panels. Moreover, metrics linked to the proposer's identity that help boost a proposal's chances, such as number of publications or well-known advisors, are known to be biased. This cycle is self-perpetuating, as lack of grant awards further decreases a scientist's chances of being retained and promoted at their home institution.

Dual Anonymous Reviews: As discussed in the Astronomy and Astrophysics 2020 Decadal Survey White paper, “Adopting Dual Anonymous Practices in the Reviews for Resource Allocation in Astronomy” (Strolger et al. 2020), dual anonymous reviews are increasing in popularity within the science community (Kmietowicz 2008). The objective is to reduce bias in the ratings of reviewers by removing demographic information about the authors that could trigger bias, such as gender, race, career stage, institution, or nationality (Strolger et al. 2020). Despite suggestions that anonymous processes are ineffective at hiding the identity of authors, they are still highly regarded by many people in the scientific community (Mulligan, Hall, & Raphael 2013), and studies that have tested the accuracy of author “guessing” have concluded that dual anonymous reviewing can be effective in protecting anonymity (Hill & Provost 2003, Justice et al. 1998). Studies of the impact of dual-anonymous reviews are limited but promising (Johnson et al. 2020). There is evidence that interventions that implement dual anonymous over single anonymous processes decrease bias related to gender (Breda & Hillion 2016; Budden et al. 2008), institution, author prestige (Lee, Om, & Koh, 2000; Ross et al. 2006), age (Lee et al. 2016), and country of origin (Ross et al. 2006).

Space Telescope Science Institute (STScI) Dual Anonymous Experiment Success: [THIS SECTION DRAWS DIRECTLY from the Astronomy and Astrophysics 2020 Decadal Survey White paper, “Adopting Dual Anonymous Practices in the Reviews for Resource Allocation in Astronomy” (Strolger et al. 2020)] The STScI hired an independent consultant, Dr. Stefanie Johnson (Univ of Colorado), who has worked with businesses and science groups in dealing with conscious and unconscious bias, to observe and assess the HST peer-review process from Cycles 25-28 (Johnson et al. 2020). In the first round of independent grading done prior to the in-person review (which sets the agenda for the in-person discussion), Johnson, and her then graduate student Jessica Kirk, found no evidence of gender bias in which proposals made it to the discussion stage. It was only in the in-person discussions that bias became evident, potentially because much of the in-person discussion on a given proposal focused on the track record of the proposers, rather than on the science presented in the proposal. Johnson and Kirk recommended implementing some anonymous process at the discussion stage to refocus the dialogue.

Changes in the instructions to proposers: The process that STScI adopted took many lessons from the anonymous review of manuscripts for science journals. To facilitate such a review, proposals must be crafted from the start with anonymity in mind. Proposals should not include statements that directly identify the proposing team or participants within, including identifying self-references, or claim ownership of past work. This generally encourages proposers to write in a more passive voice, e.g., using phrases such as “As Doe et al. have shown. . .” as opposed to “As we have shown in Doe et al. . .”, and therefore requires some additional preparatory effort from investigators. STScI provides guidelines in its Calls for Proposals to help investigators adequately anonymize their submissions. Proposers who do not make sufficient efforts to anonymize their submissions run the risk of having their proposal rejected for non-compliance.

Figure 1. In each observing cycle, from 11 to 27 (2001- 2019), HST proposals led by men (light blue bars) have had better success rates than those led by women (dark blue bars), while this gap closed from 5% in Cycles 11-25 to 1% in Cycles 26-28 when the dual-anonymous process was implemented. Data source: STScI

Changes in the instructions to reviewers: Panelists were reminded that the primary objective of these reviews is to identify and select the most compelling science, not to reward the best science teams. Their evaluations at every stage of the review must be based on the scientific merit of the proposals, not the experience, expertise, or relative merit of the proposers. As such, the panelists are highly discouraged from delving into the identities of the investigators. STScI provides guidelines to reviewers to help focus their ratings and discussions. These practices are also implemented by NASA.

The role of levelers: The practice of preserving anonymity in this type of review was expected to be unfamiliar to many in the community, as it is currently contrary to what is typically expected in similar reviews for other observatories and agencies. With this in mind, observers were stationed in the rooms of each panel with the sole objective of keeping the panel focused on the scientific merit of each proposal. These levelers were not listening for issues pertaining to the science, rather they were focused on the discussion itself. If the discussion veered to comments on the proposing team, their past work, their validity, or their identities, the leveler's job was to refocus that discussion. *NASA program managers typically act in the role of levelers in R&A and mission proposal reviews.*

Conflicts of interest: A collateral benefit to dual anonymous reviews is that it greatly simplifies conflicts of interest issues– in principle, if the reviewer does not know who the proposers are then there could not be a conflict of interest. In practice, however, there are several interpersonal situations for which it is still prudent to track conflicts and avoid the perception of bias, even if identities are not evident. In the STScI system, reviewers are deemed conflicted on proposals by family members and collaborators (or competitors) whom they have worked with (or against) in the last 3 years. Panelists are required to declare any additional conflicts as they become aware of them. Reviewers are excluded

from the discussion or ranking of proposals on which they are conflicted. Conflicts of interest are similarly handled for NASA proposals, but also include institutional conflicts (working or applying to work at the same institution as proposal team members requesting funding). Some exceptions to this may be made under the NASA dual anonymous system.

A separate review of expertise: To demonstrate competency in the execution of science programs and the dissemination of those results, the STSci peer review has an additional round of expertise review. Proposers are required to submit a Team Expertise and Background exposition with their proposal submissions. This free-form exposition is not anonymous, and is meant to describe work to be done, relevant expertise of team members, or a summary of results from relevant past programs. It could also contain a description of an analysis plan, including a description of the effort and the proposed roles of the investigators. After the anonymous scientific ranking is complete, the review panel is given the list of investigators (alphabetized, with no indication of principal investigator; there may still be bias risk against the entire team, it should be noted) and the Team Expertise and Background sections and asked to provide feedback on the team's qualifications.

STSci EARLY RESULTS AND LESSONS LEARNED: The dual anonymous review process has been in place for STSci over three Cycles, 26-28, typically for over 1000 PIs in each cycle. Over this time, there is a correlation between the dual anonymous process and female-led proposal funding rates. In particular, the funding rate percentage gap between male-submitted and female-submitted proposals decreased from 5% to 1% (Fig. 1; Johnson et al. 2020). Analysis of reviewers over 4 cycles revealed that male reviewers ranked female-led proposals worse under reviewer anonymous than they did under the dual anonymous system (Johnson et al. 2020).

Fig. 2. Success rate by institution type for ROSES programs in NASA pilot (ADAP + Earth USPI + Habitable Worlds + Heliophysics Guest Investigator). Credit: NASA.

Planetary R&A Program Strategies: NASA is implementing dual anonymous reviews for the Habitable Worlds R&A program in the 4th quarter of the 2020 fiscal year. Thus, data do not yet exist for their relative success. It is hoped by NASA HQ that the dual anonymous process could remove the disparity in funding rates between typical or resourced institutions vs atypical institutions, or it could highlight other reasons for the disparity (Fig. 2).

Proposed Actions

We appreciate NASA's willingness to experiment with the dual anonymous review process for the Habitable Worlds R&A program, and encourage NASA to test this process on other R&A programs. We encourage proposers and reviewers to change their practices so that this new type of review can be conducted properly. We encourage NASA to record data through statistical best practices (as in Johnson et al. 2020), evaluate the results, and hold themselves accountable for reaching the goals they themselves have set. We encourage journals to follow the example of the *Planetary Science Journal* by implementing this process in select special issues or time frames and to collect and analyze data on the process comparatively with non-anonymous submissions through statistical best practices so that the impact on underrepresented groups can be correctly evaluated. We recommend the following actions:

Recommendation I: We encourage NASA to follow through on the dual anonymous review process for the Habitable Worlds research and analysis program and to consider other research and analysis programs, such as instrument development, which tends to be consistently non-diverse, on which to test this program.

Recommendation II: We encourage NASA to collect data on the programs that use the dual anonymous review system in comparison with those that do not. This would include demographic data so that the impacts on underrepresented groups can be correctly evaluated.

Recommendation III: We encourage journals to implement the dual anonymous process at least in certain special issues or over certain time frames, and compare the results with non-anonymous submissions using statistically sound practices, to ascertain the benefit to underrepresented groups. Journals and the community should work to:

- Try to legally/ethically obtain data on submissions so that the level of representation of groups can be ascertained.
- Use statistically sound practices to evaluate the differences in dual anonymous submission and acceptance rates among underrepresented groups compared with non-anonymous submissions.
- Report to the community the results of their analysis of dual anonymous system in a transparent manner.
- Authors choose platforms where the dual anonymous process can be tested.

Recommendation IV: We encourage reviewers and authors of proposals and papers in these dual anonymous experiments to approach the process willingly and with best effort so that the benefits and downsides of the process can be properly evaluated. NASA and journals should:

- Educate the community on the potential benefits of the dual anonymous process.
- Educate the community on specific requirements and strategies for writing and reviewing proposals and papers in the dual anonymous system.

Conclusions

While bias is only one of a number of the barriers that exist for underrepresented groups, it is clear that addressing bias through a dual anonymous review process improved results for women in the STScI study (Johnson et al. 2020). In particular, the dual anonymous review process would be the clearest way to ensure that success is due to merit (Johnson et al. 2020). NASA must do everything in their power to stop perpetuating bias and live up to their stated goals within the grant selection process, and the dual anonymous review process is an important step in that direction. The ultimate goal behind encouraging the use of the dual anonymous review system is to create an environment that is equally conducive to the success of all people. With success equally available to all, the planetary science research community will be one that can realize the potential of all contributors. Only with universally accessible success can NASA speedily achieve its research and exploration goals.

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