This article was downloaded by: [University of California Santa Barbara] On: 09 April 2013, At: 14:08 Publisher: Routledge Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Psychological Inquiry: An International Journal for the Advancement of Psychological Theory

Publication details, including instructions for authors and subscription information: <u>http://www.tandfonline.com/loi/hpli20</u>

Modernizing Science: Comments on Nosek and Bar-Anan (2012)

Benjamin W. Mooneyham^a, Michael S. Franklin^a, Michael D. Mrazek^a & Jonathan W. Schooler^a

^a Department of Psychological & Brain Sciences, University of California, Santa Barbara, California

Version of record first published: 10 Sep 2012.

To cite this article: Benjamin W. Mooneyham, Michael S. Franklin, Michael D. Mrazek & Jonathan W. Schooler (2012): Modernizing Science: Comments on Nosek and Bar-Anan (2012), Psychological Inquiry: An International Journal for the Advancement of Psychological Theory, 23:3, 281-284

To link to this article: <u>http://dx.doi.org/10.1080/1047840X.2012.705246</u>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.tandfonline.com/page/terms-and-conditions

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.



Modernizing Science: Comments on Nosek and Bar-Anan (2012)

Benjamin W. Mooneyham, Michael S. Franklin, Michael D. Mrazek, and Jonathan W. Schooler

Department of Psychological & Brain Sciences, University of California, Santa Barbara, California

Technology and science have long been the reciprocal beneficiaries of one another. Science advances technology and in turn technology advances science. The benefits of science for technology are clearly evident in the introduction of the Internet, which would not exist were it not for the scientific advances underpinning it. In turn, science has been the beneficiary of the many affordances of the Internet. E-mail has greatly enhanced scientists' capacity for communication with one another. Web pages and open access journals have increased the accessibility of scientific publications. Search engines have facilitated scientists' ability to identify research relevant to their interests. Data collection sites (e.g., Mechanical Turk) have provided unprecedented access to human participants. Furthermore, sites for the logging of experimental designs and results (e.g., clinicaltrials.gov) have begun to increase the transparency of the scientific process. However, although science has begun to realize the potential affordances of the Internet, it has not realized the full potential for advancement that the Internet allows.

Brian A. Nosek and Yoav Bar-Anan's (this issue) discussion of a scientific utopia provides one possible vision for the more radical advances to the dissemination of science that the Internet might allow. In their vision, which they see as gradually unfolding in a series of six steps, scientific journals themselves would be replaced with an Internet-based system of evaluation and distribution of scientific research. The commendable goal of their vision is to enable research findings to become more rapidly and broadly disseminated; to increase the fairness and transparency of the review process; and to enable the continual updating and improvement of published methodologies, analyses, and results. Although we commend Nosek and Bar-Anan's efforts to conceive of ways in which the affordances of the Internet can enable science to abandon its archaic vestiges of increasingly obsolete technologies, we also note that one person's utopia may be another's dystopia; the "new reality" described by Nosek and Bar-Anan may seem simple and streamlined to some, yet appear dauntingly complicated and burdensome to others (indeed, this is a difference of opinion that the authors of this reply have experienced firsthand). Therefore, although we applaud Nosek and Bar-Anan for their thorough explication of what they believe to be the necessary changes for our field, we believe that formulating the best solutions to the shortcomings of science in general and psychology in particular requires collective deliberation regarding the many alternative approaches that might be taken. In this spirit of open discussion, we suggest some alternative ways of taking advantage of the Internet to improve many aspects of the scientific process without necessarily requiring a broad overhaul of the scientific system as it currently stands.

What, then, are the shortcomings of the current system, and how can they be overcome? We believe that there are several aspects of the current process of conducting and disseminating science that are in need of improvement. These shortcomings (several of which are interrelated) include large lag times for publication, nontransparency (of both the review process and the representation of reported hypotheses/methods/ analyses/results), the irreproducibility of experimental results, and the lack of access to unpublished (and/or statistically nonsignificant) research.

The current system of publishing scientific information relies first and foremost on peer-reviewed journals; these journals limit the extent of information dissemination by producing large delays between the submission of an article for publication and its actual appearance in print, imposing page limits that are unnecessary in the digital age of the Internet, and exerting a bias against publishing null results. Moreover, the pressure to publish in peer-reviewed journals is so great that researchers may feel forced to massage their results in such ways as to make them appear most significant and impactful, often at the cost of the transparency with which they detail their hypotheses, methods, and analyses (John, Loewenstein, & Prelec, 2012; Simons, Nelson, & Simonsohn, 2011). This further complicates any attempts at replication, as key details are often omitted and points of theoretical or analytical conflict are often assuaged in the process of presenting results for publication. Even presenting a research finding in the best possible light does not necessarily mean that it will be more likely to be published by a given journal, however, as the decision rests in the hand of the reviewers, who often disagree with each other and who also may be subject to personal biases toward accepting (or rejecting) particular authors, theories, or findings based on their own personal views.

A final and particularly pressing concern with the present system is its limited usefulness in addressing the reproducibility of scientific findings (Ioannidis, 2005; Schooler, 2011). Although the natural process of scientific replication may eventually weed out findings that are not robust, the present system is not well suited for efficiently doing so, and is particularly ill-equipped to address the peculiar way in which the magnitudes of effect sizes tend to decline with repetitions. It is an intriguing fact that similar declines in effect sizes over time have been observed in a host of domains. Metaanalyses in parapsychology (Bierman, 2001; Storm, Tressoldi, & Di Risio, 2012), ecological and evolutionary biology (Barto & Rillig, 2012; Jennions & Møller, 2002), genetics (Zöllner & Pritchard, 2007), mental health treatments (Kemp et al., 2010), and medicine (Ioannidis & Panagiotou, 2011) have revealed striking declines in the magnitude of reported effect sizes as a function of the year in which the study was conducted. There are a number of potential explanations for the decline effect, including regressing to the mean, publication bias, unreported aspects of methods, exclusive reporting of findings consistent with hypotheses, changes in researcher enthusiasm, more rigorous methodologies used in later studies, measurement error resulting from experimenter bias, and the general difficulty of publishing failures of replication. However, the contribution of these alternative accounts to the decline effect is impossible to determine because all of these accounts make alternative assumptions about the extent and nature of unpublished research (Schooler, 2011).

The issues that we have just outlined appear to be deeply rooted in the system of peer-reviewed journals. However, we do not believe that this system must be abolished in order for these issues to be overcome. In fact, we contend that with modest alterations, peer review journals (and the publishers associated with them) can and should continue to exist largely as they do today. Rather we argue these peer-reviewed journals should coexist with another entity: a repository for scientific findings featuring free and open access, (nearly) open commentary, and the opportunity for continual updating and revision of submissions.¹ We believe that such a database, existing alongside peer-reviewed journals, could address many of the issues that currently exist within the system while requiring only modest changes in the way that researchers go about their dayto-day business.

the valuable function of filtering out less "significant" findings so that the current state of psychology can be made more comprehensible, the irreproducibility problem and other associated "file-drawer" issues (such as the decline effect) can only be examined and/or alleviated with greater access to the enormous volume of research that remains unpublished under the current system (Ioannidis, 2005; Schooler, 2011). As such, we believe that the best and simplest solution is (as suggested by Nosek and Bar-Anan) to create a free and open online repository of experimental reports to which anyone working within psychology can submit (perhaps using Nosek and Bar-Anan's qualification that the ability to submit and/or comment would require membership to a professional society). In one possible instantiation, studies could even be "pre-logged": researchers state a priori their methods and hypotheses before running their experiments. In any instantiation, however, an open repository could provide an opportunity not afforded by the current system, which is for openly accessible commentary/criticism and for the fluid updating and amending of reported research. The open system could easily be formulated so that submitted study reports could be commented on by members of the community, and perhaps rated by an upvote/downvote mechanism. Raw data could also be made accessible to members. Original posts could, in response to comments made by other professionals, be edited by the original submitter, and the history of comments and changes made visible to all members. Comments could also be upvoted/downvoted, thus making more important comments more visible and establishing a mechanism through which individuals would be able to gain esteem and recognition by their meaningful contributions through criticism and commentary (this opportunity for those who may not have the resources to perform as much research to have an impact in the field was insightfully introduced by Nosek and Bar-Anan as well).

Although peer review journals currently perform

Critically, this free repository could be developed to complement rather than replace peer-reviewed journals. The repository would greatly enhance the transparency of the scientific process, and in so doing would serve four main purposes: (a) allow researchers to keep up to date with all of the research (both "successful" and not) occurring within their particular subfield(s), (b) increase accessibility of data for meta-analytic purposes and to examine issues surrounding the reproducibility of effects (e.g., the decline effect), (c) provide a forum for the open discussion and improvement of research, and (d) encourage researchers to reveal the full details of their research programs, thereby revealing the various nuances and complexities of paradigms that often get omitted from current discussion. However, in this dual-system, peer-reviewed journals would maintain

¹Nosek is in the process of developing a data repository website very much in the spirit of the one proposed here. Readers who want more details or the opportunity to contribute to the beta version should visit http://openscienceframework.org/.

a high level of importance by acting as gatekeepers for disseminating the most important and significant findings to a more general public and by acting as a platform to increase the visibility and prestige of the best researchers and their work. Universities and individuals alike could subscribe to journals of interest, and this would help them stay up to date on important and significant findings across a more general range of areas, but researchers could also rely on the open repository to stay more informed about research that pertains to their more narrow focus.

There are of course a number of challenges that a web-based open repository of scientific findings might face. Chief among them is encouraging scientists to use it. Many scientists might see such a repository as undue burden, creating needless busy work, with little benefit. There are, however, a number of ways in which scientists might be encouraged to use a scientific repository. One possibility would be for major journals to jointly agree that scientists must pre-log their studies if their work is to be published in those journals. Although seemingly far-fetched, such an agreement is precisely what happened in the medical field, where the top journals have all agreed that researchers must log the details of the methodologies of their clinical trials ahead of time, and report their findings afterward, if they want their work to be published. Although some difficulties with clinicatrials.gov have been observed (e.g., the results of a significant proportion of logged studies that are not published have never been made available), it nevertheless has proven to be effective in greatly enhancing the transparency of medical research.

A second approach for encouraging the adoption of an open repository would be to make compliance attractive to scientists. This could be achieved by highlighting the utility of the process for enhancing both the conducting and publishing of research. An open repository would help the conducting of research by providing a platform for recording all aspects of a research program. Such a platform would provide a system of record keeping that researchers could rely on to ensure the continued fidelity of their research program across lab members and over time. An open repository could also help with identifying higher-integrity research as studies that have been submitted to the repository could perhaps be recognized somehow by peer-reviewed journals. Researchers would then naturally want to log their studies in order to ensure that the resulting manuscripts would be maximally competitive.

A second possible concern with an open repository is that peer-reviewed journals might suffer as a result, as researchers may opt to skip this previously necessary stage in the process of scientific dissemination. However, we do not think this is likely to be the case, as acceptance by peer-reviewed journals will still increase the perceived merit of the research, thus perpetuating the pressure to submit for peer review in addition to posting research to the repository. Careful consideration will nevertheless be required to ensure that the open repository does not impinge on the proprietary ownership that many journals hold over published research. Fortunately, the International Committee of Medical Journal Editors' embrace of clinicaltrials.gov offers a clear precedent for how peer-reviewed journals and an open repository might coexist.

Although we believe that a complementary system consisting of a web-based repository and the current peer review journal system may be the most natural way to enhance the scientific process, we acknowledge that peer review publication could also be significantly improved by two relatively simple adjustments to the present system: (a) switching to online-only publication (thus eliminating page constraints, allowing for more detailed and comprehensive reports, and shortening publication lag times), and (b) making the peer reviews viewable alongside articles online (increasing the transparency of the review process and increasing the pressure on reviewers to be just and thorough in their consideration of articles for publication).

Such a dual system—a web based open repository of findings and a peer review journal system—would greatly enhance the transparency and accessibility of research while keeping the current system largely intact. People could still rely on peer-reviewed journals to filter/deliver the most important findings, and publication in these journals would still convey prestige, but the rate of transmission would increase and both the research and the process of publication would become more transparent. Such improvements would be substantial and could feasibly be made through the two major steps of (a) establishing an open online repository and (b) having peer-reviewed journals switch to online-only publication and visible peer reviews.

Although this proposal would likely produce many positive changes and new opportunities, we do not suggest that this is the only program of change that the field should consider. Indeed, many readers may prefer the systematic propositions of Nosek and Bar-Anan to our own. The proposal discussed here has not even been met with universal agreement by the authors of this commentary, as there are concerns about how these two systems could coexist and about whether making all research available and dynamic would actually make the processes of scientific dissemination and integration more efficient or whether it would make the literature simply too vast and convoluted to manage or comprehend. However, we feel inclined to offer a different view from Nosek and Bar-Anan's, despite our own differences in opinion about this alternative approach, in order to emphasize the importance of considering each possible approach to reform and of establishing an open forum for the discussion of these ideas.

Collective action is needed in order to institute changes of the magnitude just described and in Nosek and Bar-Anan's proposal, but this action is likely to proceed only if the plan in place is established through a democratic process of collaboration and cooperation. We must keep in mind that the best solution may not be the one that requires the most change. We have long applied our critical minds to inquiries of the individual, and we are sure to improve our field by giving equal effort to examining and discussing the ideal state of our science.

Note

Address correspondence to Benjamin W. Mooneyham, Department of Psychological & Brain Sciences, University of California, Santa Barbara, CA 93106. E-mail: mooneyham@psych.ucsb.edu

References

- Barto, E. K., & Rillig, M. C. (2012). Dissemination biases in ecology: Effect sizes matter more than quality. *Oikos*, 121, 228–235. doi:10.1111/j.1600–0706.2011.19401.x
- Bierman, D. J. (2001). On the nature of anomalous phenomena. In P. Van Loocke (Ed.), *The physical nature of consciousness* (pp. 269–292). Amsterdam, the Netherlands: Benjamins.
- Ioannidis, J. P. A. (2005). Why most published research findings are false. *PLoS Medicine*, 2, e124. doi:10.1371/journal. pmed.0020124

- Ioannidis, J. P. A., & Panagiotou, O. A. (2011). Comparison of effect sizes associated with biomarkers reported in highly cited individual articles and in subsequent meta-analyses. *Journal of the American Medical Association*, 305, 2200. doi:10.1001/jama.2011.713
- Jennions, M., & Møller, A. (2002). How much variance can be explained by ecologists and evolutionary biologists? *Oecologia*, 132, 492–500. doi:10.1007/s00442–002-0952–2
- John, L. K., Loewenstein, G., & Prelec, D. (2012). Measuring the prevalence of questionable research practices with incentives for truth telling. *Psychological Science*, 23, 524–532. doi:10.1177/0956797611430953
- Kemp, A. S., Schooler, N. R., Kalali, A. H., Alphs, L., Anand, R., Awad, G., Davidson, M., ... Vermeulen, A. (2010). What is causing the reduced drug-placebo difference in recent schizophrenia clinical trials and what can be done about it? *Schizophrenia Bulletin*, 36, 504–509. doi:10.1093/ schbul/sbn110
- Schooler, J. (2011). Unpublished results hide the decline effect. *Nature*, 470(7335), 437.
- Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). Falsepositive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science*, 22, 1359–1366. doi:10.1177/ 0956797611417632
- Storm, L., Tressoldi, P. E., & Di Risio, L. (2010). Meta-analysis of free-response studies, 1992–2008: Assessing the noise reduction model in parapsychology. *Psychological Bulletin*, 136, 471–485. doi:10.1037/a0019457
- Zöllner, S., & Pritchard, J. K. (2007). Overcoming the winner's curse: Estimating penetrance parameters from case-control data. *The American Journal of Human Genetics*, 80, 605–615. doi:10.1086/512821