Fake collaborations: Interdisciplinary science can undermine research integrity

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Abstract: Funding agencies and academic institutions are increasing their emphasis on interdisciplinary collaborations as an important scientific method for answering complex societal questions. We argue that participating in these initiatives can make one party to behaviors that risk the integrity of one's research. We suggest steps that researchers, institutions, and funding agencies can take to ameliorate this situation.

Keywords: interdisciplinary, multidisciplinary, multiple discipline research, replication, open science, integrity

In a scientific landscape where replicability is problematic (Open Science Collaboration, 2015), where FAIR data (Wilkinson et al., 2016), open science and pre-registration are daily topics (Nosek et al., 2015; Nosek, Spies, & Motyl, 2012) -- in short where the integrity of its researchers is increasingly called upon -- we find it astonishing how little attention is paid to the probity of interdisciplinary research collaborations. Interdisciplinary research is an increasingly popular part of the scientific endeavor, with local, national, and international funding initiatives investing in its development. Using our own experiences as junior (RSH) and senior (AK) researchers in interdisciplinary research, and examples from the 'team science'-literature, we seek to draw attention to the fact that the system through which interdisciplinary collaborations are funded risks evoking behaviors that undermine research integrity. This is particularly important for Psychological Science, which throughout its history has proven to be a particularly multi-discipline field. For example, in RSH's experimental psychology division alone, there are researchers with a background in psychology, physics, biology, movement science, and artificial intelligence.

Towards interdisciplinary science

Across science as a whole, there is an increasing trend towards multi-author and multi-university collaborative work (Jones, Wuchty, & Uzzi, 2008; Stokols, Hall, Taylor, & Moser, 2008; Wuchty, Jones, & Uzzi, 2007). Interdisciplinary research (along with multidisciplinary and transdisciplinary, see Box 1) is foundational to this movement. As Callard and Fitzgerald (2015) put it: *"you might have well been told, as we both have been variously told, by your mentors, supervisors, university, or research institute, that interdisciplinarity is the future"* (p.7).

This has certainly been said to us at some point. What is often added is that interdisciplinary research is deemed necessary in order to tackle complex societal issues

(Falk-Krzesinski et al., 2011). As such, funding agencies are increasingly channeling their limited resources towards interdisciplinary programs, and research institutions are implementing programs to ensure that they can compete and secure their fair share of the funds. For example the Dutch National Science Agenda was founded in 2015 with the intent *"to build bridges between various scientific, innovation and policy agendas and to **facilitate collaboration between the various actors across the entire chain of research and innovation**"* (<https://www.nwo.nl/en/policies/dutch+national+research+agenda>). And Utrecht University states in its current strategic plan: *"We have generated focus in our research and reinforced the connections between research and societal issues. An **interdisciplinary approach** is key, because we believe that solutions to societal issues are most likely to be found through close collaboration between disciplines"* (<https://www.uu.nl/en/organisation/strategic-plan-2016-2020>). Similarly, Canada's Natural Sciences and Engineering Research Council has a budget of \$1.26 billion, a third of which is ear-marked for interdisciplinary research; and a new national initiative, the New Frontiers in Research Fund, has invested an additional \$275 million for interdisciplinary research. Echoing this acceleration towards interdisciplinary collaboration, AK's home institution, The University of British Columbia, has identified it as a central priority (see "Shaping UBC's Next Century", <https://strategicplan.ubc.ca>), writing *"Continued success requires both disciplinary depth and collaboration within and **across disciplines** and communities"*. Accordingly, UBC has created the Grants for Catalyzing Research Clusters *"to enable the formation and growth of **interdisciplinary clusters** of research excellence in pursuit of societal impact"*.

Clearly, our national funding agencies and home institutions, which cut across all disciplines and are representative of the much broader community, are investing in interdisciplinary collaborations. Yet, we will argue that there are risks to the manner in which

these investments are made. Below we describe our personal experiences, which suggest to us that in the pursuit of team-science research funds there is a very real risk of being party to scientific deception. This of course flies directly in the face of the field's movement towards greater scientific transparency, openness, and honesty; and risks not only the integrity of individual scientists, but that of research institutions and funding agencies themselves.

Our stories

Years ago, when I (RSH) was working abroad, I was approached by several colleagues to take part in a seed-grant application for innovative collaborations in the psychology department. At first, I was flummoxed. How could I possibly be a more attractive collaborator than some of my more experienced colleagues? I ultimately discovered that I was approached because the application required three collaborators across three different divisions within the department; and my affiliation with both experimental *and* developmental psychology made me an appealing collaborator because I could be considered 'external' with respect to the grant, and thereby tick the interdisciplinary box, while remaining 'internal' to the rest of the team and thereby avoid any 'disruption' to their functional homogeneity. In short, the aim was to appear interdisciplinary for the purpose of securing the grant but in practice create a team that was united within a single discipline.

My (AK) story is similar, but perhaps more extreme. As a senior researcher at UBC and also as an administrator in the VP Research and Innovation Office, I'm often asked to help adjudicate UBC's interdisciplinary grants program. On two occasions in the past three years I have been shocked to discover my name listed on a research team without my foreknowledge or approval. In both situations I pointed this out and the grants were triaged. I am confident that many individuals reading this will be able to think of less extreme occasions when they have been asked to be part of a grant for the sake of 'optics', that is, to

give the false impression that the team is more rounded and interdisciplinary than it really is; perhaps even with the 'promise' that if the grant is funded, some money (but no collaborative request) will be directed their way.

Our stories are corroborated by similar experiences shared by other researchers. For example, Callard and Fitzgerald (2015) describe how they started talking at an interdisciplinary workshop, being two social scientists from different disciplines (cultural geography and sociology). They *"were not, as it turned out, having an interdisciplinary conversation with one another at all. In fact, what 'interdisciplinarity' meant in this space, despite some loose talk, was actually something quite specific ... It essentially meant a neuroscientist plus some others"* (p. 2). In other words, the form of the interdisciplinary collaboration was pre-decided on and any deviations might be construed as disruptions to the respective research lines.

The problem

We do not mean to suggest that interdisciplinary research in itself is inauthentic. Rather, we think that *forming* interdisciplinary collaborations for the purposes of grant attainment can be problematic in the current funding landscape. Moreover, we think that there is a serious problem in establishing the authenticity of interdisciplinary collaborations and that this problem is compounded by funding agencies and institutions increasing their investment in it. The responsibility for this problem lies both in the hands of the funding agencies and institutions, as well as in the hands of the researchers.

When funding agencies introduce calls for interdisciplinary grant proposals, it is often with an extremely short time line (e.g., in Canada the New Frontiers program was announced in December 6th, 2018, just before the winter holidays, with a notice of intent deadline of January 11th, 2019, and a submission deadline of February 14th, 2019). Moreover, the nature

of the interdisciplinary collaborations is often enforced by requiring researchers to be from a set number of different disciplines. While short deadlines and such 'bean counting' in team membership may facilitate the process of allocating research funds for the agencies and institutions, they can encourage behavior on the part of the researchers that may be dubious.

Because research funds are limited, diverting funds to interdisciplinary work may tempt scientists to participate in a charade that their team exists beyond the application itself, a risk that is simply compounded when the funding timeline is extraordinarily short. Investing large amounts of dollars with a short deadline only invites researchers to put together teams that are not authentic. This of course is completely incompatible with the concurrent expectation that scientists be honest and upfront with their research work, including, but not limited to, being transparent with their data collection, analyses, and interpretations. Furthermore, when funding agencies judge interdisciplinary collaborations by 'counting beans'; i.e. one researcher each from disciplines X, Y and Z, rather than having researchers motivate the interdisciplinary nature of the research project, one risks ending up in a "*Have you got a neuroscientist yet?*" sort of situation (Callard & Fitzgerald, 2015, p. 2-3, 82). Indeed, while we think everyone will accept that writing a grant based on fabricated pilot data is fraudulent, it is reasonable to ask to what extent it is any less unethical to submit a grant built around a team that does not exist beyond the paper it is written on?

One might argue that this problem is not unique to interdisciplinary grant proposals but occurs also for grant proposals with a within-discipline focus. While it is indeed unlikely that inauthentic collaborations are unique to interdisciplinary collaborations, there are reasons why we believe they may be more likely to occur for interdisciplinary teams. Although forming collaborations in general thrives on the timing and patience in communication between researchers (Borgida & Zweigenhaft, 2017), forming *interdisciplinary* collaborations, not only requires time, but also many iterations (Klein, 2008). This is because

the role of each partner in a project is likely to change over time as members of the team adjust, and then readjust, from their within-discipline work towards the interdisciplinary research goal. With the inertia in running pre-existing student projects and theses, as well as maintaining active multi-year grant applications, these iterations of team-related adjustments are time-consuming. It is not surprising, therefore, that insufficient time and lack of communication have been identified specifically as prime barriers to successful *interdisciplinary* collaborations (Choi & Pak, 2007).

The necessity of time, two-way communication, and iterations in research goals, are undermined when funding agencies roll out large investments for interdisciplinary research. Moreover, such grants usually do not announce funding a year or more in advance. Rather, deadlines are routinely on the order of a handful of months, or as in the extraordinary Canadian example, weeks. Although there are many research grants that are recurring on a yearly basis and can thus be anticipated, new interdisciplinary initiatives such as those highlighted above may not be easy to anticipate. In essence, funding agencies and researchers are operating at different timescales. Importantly, it may be problematic for the funders as well. Without the opportunity for researchers to iterate their collaborations, grant proposals are only likely to scratch the surface of what interdisciplinary depths might be mined. Thus, we believe that in the current funding landscape interdisciplinary proposals are, at best, unlikely to realize their potential, and at worse, they risk putting forward teams that are inauthentic and misleading.

Finally, the burden of the problem is not shared equally among all research ranks. The pressure on junior scientists is particularly profound. For someone interested in interdisciplinary collaborations to solve scientific problems, the current landscape of interdisciplinary collaborations and grant applications is rife with complexities that are confusing if not contradictory. On the one hand, an emerging researcher may feel that they

are competing with other researchers that create 'dream-teams' that have no functional reality. On the other hand, to authentically participate in an interdisciplinary collaboration can carry its own risks, and funding success for interdisciplinary collaborations is still limited (Bromham, Dinnage, & Hua, 2016). Developing collaborations requires a significant investment of one's time and effort, and of course, there is no guarantee that it will deliver the necessary results and research publications. Moreover, junior researchers are often expected to demonstrate the ability to 'stand on their own two feet', which means that the real value of those potential successful collaborations to one's career are double-edged. For instance, how can an emerging researcher balance independence and interdisciplinary collaboration in larger research teams, particularly when that large team might include former collaborators or mentors?

Fostering successful interdisciplinary collaborations

Interdisciplinary research can be incredibly impactful, both for society (Bornmann, 2012) and for science (Uzzi, Mukherjee, Stringer, & Ben Jones, 2013; van Noorden, 2015). Yet, the saying "the more interdisciplinary, the better" does not always hold (Larivière & Gingras, 2010; Yegros-Yegros, Rafols, & D'Este, 2015). The important question is how we, as researchers, universities, and funding agencies, can foster true and meaningful interdisciplinary collaborations.

In our view, successful and meaningful interdisciplinary collaborations and grant applications share the following three characteristics. First, they arise bottom-up, from scientists who meet and happen to like each other's research. This works because researchers are motivated and interested in each other's research questions. Indeed, such collaborations tend to be more successful than formally assigned interdisciplinary research teams (Choi & Pak, 2007). Critically, they cannot be rushed.

Second, large research teams are *not necessarily* the key to success, a point that finds corroboration in the differential contributions to science for small and large teams. Where large research teams tend to develop existing ideas, small teams are more successful in disrupting science with new ideas and opportunities (Wu, Wang, & Evans, 2019). Moreover, by keeping interdisciplinary teams small, the relative responsibility of each member increases. This has the twofold advantage of increasing the objective value of any junior member who is part of the team and reducing the likelihood that one or more members will be an inauthentic addition. When team members are personally committed and the roles and responsibilities are clearly articulated, interdisciplinary collaborations thrive (Choi & Pak, 2007).

Third, it needs to be recognized that interdisciplinarity research is rarely symmetrical amongst all participants (Leahey, 2016). More often than not, there is a researcher who is driving the collaboration, for whom the success of the collaboration is perhaps most important. Thus, it is unrealistic for funding agencies to expect a uniform distribution of responsibility and relevance for all involved disciplines, particularly when time constraints are severe.

How can these goals be realized? In short, how can real, interdisciplinary collaborative research be facilitated by researchers, universities, and funding agencies? To begin, researchers can clarify the nature of the interdisciplinary research they plan to conduct. What is the interdisciplinary nature of the research problem and what blend of skills and expertise is needed to solve the problem? In addition, researchers need to be honest about the state of the interdisciplinarity team. Has initial contact just been made, is the team recently formed, or is it already well-established? The field would also benefit by all members of the interdisciplinary team making an explicit statement that the (proposed) collaboration is authentic. This will encourage good scientific practice and trust. And in this way, one's name,

and one's integrity, is explicitly linked to the application, much in the way that authors now identify their contribution to a research article when it is published. Finally, researchers could push back on the timelines posed by institutions and funding agencies alike, although we realize that to do so convincingly might require a large number of researchers to unite and speak out.

For institutions, one way to facilitate meaningful interdisciplinary collaborations is to set the bar very low for the creation of collaborative work, e.g., by supporting the travel of faculty members and students between different labs and institutions. In our experience, nothing, absolutely nothing, beats meeting face-to-face and spending time with one or more possible collaborators. Seed funds might be useful in fostering early collaborations, although we caution against using bean-counting tactics to determine the interdisciplinary nature of a collaborations. Better to require that researchers drive this. Finally, institutions are the crucial link between individual researchers and funding agencies, and they have a responsibility to facilitate the push back against funding agencies' timelines and to educate agencies on the realities and risks of their timelines.

As should be evident by now, we believe that funding agencies need to put out more realistic timelines for interdisciplinary grant proposals, and interdisciplinarity should be defined and established bottom-up by the researchers -- not by counting the number of researchers involved from each research field and ticking off the different faculties or disciplines. Moreover, funding opportunities could be organized such that they are not just built around issues (innovation, impact, risk, etc.), but also around different team sizes and stages of development, e.g. early team formation, small team development, large established teams, etc. And as teams change and evolve over time, one must continue to be vigilant that they are authentic, i.e., that their description aligns with their reality.

In sum, we hope that the issues raised here help to bring into the light the fact that researchers, institutions, and agencies currently risk being party to scientific misconduct. We also hope that the measures we have proposed will help to move the dialogue forward with the aim of promoting and facilitating meaningful interdisciplinary collaborations. Indeed, we feel that by raising the problem faced by researchers, institutions, and funding agencies, as well as possible solutions, that there is a profound and real opportunity to deepen interdisciplinary collaboration as a whole and increase its value for science and society.

Box 1. Multidisciplinarity, interdisciplinarity, transdisciplinarity

Researchers looking to collaborate across disciplines may be faced with a number of different terms: multiple disciplinary research, multidisciplinary research, interdisciplinary research, transdisciplinary research, and so forth. What do these terms mean, and how do they differ? In a literature review, (Choi & Pak, 2006) have investigated how these terms are used and have proposed clear definitions: '*Multiple disciplinary research*' is used to refer to any collaboration among researchers from different disciplines. It is the umbrella term, under which the different -disciplinary terms fall. '*Multidisciplinary research*' involves researchers that stay within their own discipline boundaries but combine knowledge from different disciplines. '*Interdisciplinary research*' integrates research from multiples disciplines into a coherent agenda. And '*transdisciplinary research*' combines natural, social, and health sciences into a humanities context, transcending traditional discipline boundaries. These definitions by Choi and Pak are characterized by Fawcett (2013) as 'additive', 'integrative', and 'holistic' respectively. In this article, we have chosen to use the term interdisciplinary research, as it seems to best capture the mentality of approach by funding agencies and universities. Note also that 'interdisciplinarity' assumes that multiple disciplines come together. Yet, it can be tricky to define what constitutes a discipline (Callard & Fitzgerald,

2015) and some 'disciplines' are more interdisciplinary by nature (van Noorden, 2015). Is psychological science one discipline?

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References

- Borgida, E., & Zweigenhaft, R. (Eds.). (2017). *Collaboration in Psychological Science: Behind the Scenes*. New York: Worth Publishers.
- Bornmann, L. (2012). What is societal impact of research and how can it be assessed? a literature survey. *Journal of the American Society for Information Science and Technology*, 64(2), 217–233. <http://doi.org/10.1002/asi.22803>
- Bromham, L., Dinnage, R., & Hua, X. (2016). Interdisciplinary research has consistently lower funding success. *Nature*, 534(7609), 684–687. <http://doi.org/10.1038/nature18315>
- Callard, F., & Fitzgerald, Des. (2015). *Rethinking Interdisciplinarity across the Social Sciences and Neurosciences* (pp. 1–168). Houndmills, Basingstoke: Palgrave Macmillan. <http://doi.org/10.1057/9781137407962.0001>
- Choi, B. C. K., & Pak, A. W. P. (2006). Multidisciplinarity, interdisciplinarity, and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. *Clinical and Investigative Medicine*, 29(6), 351–364.
- Choi, B. C. K., & Pak, A. W. P. (2007). Multidisciplinarity, interdisciplinarity, and transdisciplinarity in health research, services, education and policy: 2. Promoters, barriers, and strategies of enhancement. *Clinical and Investigative Medicine*, 30(6), E224–E232.
- Falk-Krzesinski, H. J., Contractor, N., Fiore, S. M., Hall, K. L., Kane, C., Keyton, J., et al. (2011). Mapping a research agenda for the science of team science. *Research Evaluation*, 20(2), 145–158. <http://doi.org/10.3152/095820211X12941371876580>
- Fawcett, J. (2013). Thoughts About Multidisciplinary, Interdisciplinary, and Transdisciplinary Research. *Nursing Science Quarterly*, 26(4), 376–379. <http://doi.org/10.1177/0894318413500408>

- Klein, J. T. (2008). Evaluation of Interdisciplinary and Transdisciplinary Research. *American Journal of Preventive Medicine*, 35(2S), S116–S123. <http://doi.org/10.1016/j.amepre.2008.05.010>
- Larivière, V., & Gingras, Y. (2010). On the relationship between interdisciplinarity and scientific impact. *Journal of the American Society for Information Science and Technology*, 61(1), 126–131. <http://doi.org/10.1002/asi.21226>
- Leahey, E. (2016). From Sole Investigator to Team Scientist: Trends in the Practice and Study of Research Collaboration. *Annual Review of Sociology*, 42, 81–100. <http://doi.org/10.1146/annurev-soc-081715-074219>
- Nosek, B. A., Alter, G., Banks, G. C., Borsboom, D., Bowman, S. D., Breckler, S. J., et al. (2015). Promoting an open research culture. *Science*, 348(6242), 1422–1425. <http://doi.org/10.1126/science.aab3847>
- Nosek, B. A., Spies, J. R., & Motyl, M. (2012). Scientific Utopia: II. Restructuring Incentives and Practices to Promote Truth Over Publishability. *Perspectives on Psychological Science*, 7(6), 615–631. <http://doi.org/10.1177/1745691612459058>
- Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251), aac4716–aac4716. <http://doi.org/10.1126/science.aac4716>
- Uzzi, B., Mukherjee, S., Stringer, M., & Ben Jones. (2013). Atypical combinations and scientific impact. *Science*, 342(6157), 468–472. <http://doi.org/10.1126/science.1243651>
- van Noorden, R. (2015). Interdisciplinary research by the numbers. *Nature*, 525, 306–307.
- Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., et al. (2016). Comment: The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data*, 3, 1–9. <http://doi.org/10.1038/sdata.2016.18>
- Wu, L., Wang, D., & Evans, J. A. (2019). Large teams develop and small teams disrupt science and technology. *Nature*, 566, 378–382. <http://doi.org/10.1038/s41586-019-0941-9>
- Yegros-Yegros, A., Rafols, I., & D’Este, P. (2015). Does Interdisciplinary Research Lead to Higher Citation Impact? The Different Effect of Proximal and Distal Interdisciplinarity. *PLOS One*, 10(8), 1–21. <http://doi.org/10.1371/journal.pone.0135095>