The Value of Open-Mindedness and Intellectual Humility for Interdisciplinary Research

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Abstract: Academic research is increasingly centering on interdisciplinary work. Strong interdisciplinary research (SIR), involving researchers from very different fields, such as scientists and humanists, is often encouraged, if not required, by funding agencies. I argue that two intellectual virtues, open-mindedness and intellectual humility, are crucial for overcoming obstacles to SIR and achieving success. In part I, I provide a primer on intellectual virtue and the two virtues in question. In part II, I distinguish SIR from weak interdisciplinary research (WIR), which involves research teams from neighboring fields, such as physics and chemistry, and from disciplinary research (DR), which involves researchers from the same discipline. I also outline what counts as success in SIR, and explain why it's more challenging to attain than in WIR and DR. In part III, I explain how both intellectual virtues are essential for achieving success in SIR and for overcoming obstacles that can arise in its pursuit.

Keywords: open-mindedness, intellectual humility, strong interdisciplinary research.

Introduction

In our day and age, academic research is increasingly centering on inter-disciplinary work. Many funding agencies as well as universities are encouraging scholars from different disciplines to work together as teams on research projects that focus on a single question or problem or inter-related set of questions or problems. For example, I recently participated in a project that brought together philosophers, social scientists, and engineers to investigate social perceptions that prevent the use of recycled wastewater in communities. Clean water is essential for a flourishing life, and in communities in which it can be a scarce commodity, the use of recycled wastewater can greatly increase the quality of life. Yet, ignorance and fear on the part of community members can prevent them from benefitting from this resource. Our project sought to know why and how best to communicate with populations to increase their understanding and assuage their fear.

Like many other projects, ours brought together 'hard' scientists, social scientists, humanists, and, because the project was planned for the state of Oklahoma in the United States, which has a large indigenous population, tribal representatives. It provides an example of how people with expertise from many diverse backgrounds can form a research team to investigate an issue of practical importance. Other research projects are more focused on the theoretical realm. For example, teams of scientists and theologians can be brought together to discuss aspects of the question of whether science and religion are truly opposed. Physicists and philosophers can tackle whether and how quantum physics is relevant to the question of free will. Ecologists and biologists can team up with religious scholars and philosophers to discuss ways in which exposure to nature can enhance spirituality. The possibilities seem limitless.

In the rest of this article, I will discuss some of the 'nitty-gritty' aspects of interdisciplinary research, focusing on issues such as the obstacles that strongly interdisciplinary teams can face, how and why such teams can be successful, and indeed, what counts as 'success' in these endeavors. I will call research that brings together practitioners from very

different fields 'strongly interdisciplinary research' (SIR), and research that brings together practitioners from closely related fields, such as physicists and chemists, 'weakly interdisciplinary research' (WIR). I will call research that involves practitioners of a single discipline 'disciplinary research' (DR). I will argue, first, that what counts as success in SIR is different and more complex than what is taken to be success in either DR or WIR. Second, and following from what counts as success in SIR, I will argue that two intellectual virtues – open-mindedness and intellectual humility – can aid in overcoming obstacles and facilitating success.

In part I, I offer a brief primer on intellectual virtue, and define open-mindedness and intellectual humility. In part II, I offer a conception of success that I think is appropriate for SIR and explain how it differs from what researchers engaged in WIR or DR might plausibly regard as success. In part III, I explain how both intellectual virtues are essential for achieving success in SIR and for overcoming obstacles that can arise in the course of pursuing SIR. In taking this approach, I do not mean to imply that the two virtues being discussed here are not important for WIR or DR – they are. My central aim is to show how crucial they are for success in SIR – the type of challenging research that is being so strongly encouraged today.

1. Intellectual Virtue

Though intellectual virtues have, in some sense, always been a part of western philosophical traditions, they came on the scene writ large with the rise of virtue epistemology in the twentieth century. Epistemology is the philosophical subdiscipline that deals with questions of knowledge. According to the *Stanford Encyclopedia of Philosophy*:

> Contemporary virtue epistemology . . . is a diverse collection of approaches to epistemology. At least two central tendencies are discernible among the approaches. First, they view epistemology as a normative discipline. Second, they view intellectual agents and communities as the primary focus of epistemic evaluation, with a focus on the intellectual virtues and vices embodied in and expressed by these agents and communities (Turri, et. al. 2021).

There are two main subdivisions of virtue epistemology: virtue reliabilism and virtue responsibilism. Reliabilist virtue epistemology, championed by Ernest Sosa (2009, 2011), takes capacities and faculties, such as perception, memory, and attention, to be virtues. Responsibilist virtue epistemology, pioneered by James Montmarquet (1993), Linda Zagzebski (1996), and Lorraine Code (2020), considers traits, such as open-mindedness, intellectual humility, and curiosity, to be virtues. Traits such as these and others are virtues if and only if they are oriented toward achieving epistemic goods such as truth, knowledge, and understanding. As Zagzebski (1996, 137) explains, such traits are virtues just in case their possessor is motivated to achieve epistemic goods, and the traits are reliably successful in achieving the targets at which they aim. So, for example, one's open-mindedness is an intellectual virtue if and only if one is open-minded because one wants to know the truth and is reliably successful in achieving that end. One can do this by learning new things, expanding one's belief sets, embracing new knowledge, and so on. If one is motivated to attain these epistemic goods, and one exercises one's open-mindedness in the right way, that is, one's open-mindedness reliably enables one to achieve these goods, one can be said to possess the virtue of open-mindedness.

My own view, one with which virtue epistemologists would agree, is that traits need not be directly aimed at such abstract epistemic goods as truth, knowledge, and understanding in order to be considered intellectual virtues. Someone might have the virtue of open-mindedness if she loves to read and to learn new things. These proximate or immediate aims are sufficient to render her open-mindedness a virtue, provided that she is sufficiently critical not to believe everything that she reads. As for this last point, the virtue of open-mindedness should avoid the vice of gullibility, and critical reflection enables its possessor to do that. My main point, however, is that ordinary people who do not have lofty epistemic goals can nonetheless possess intellectual virtues. This occurs because aims that are more immediately applicable to many people's lives, such as wanting to read and learn, help them to achieve more abstract epistemic ends, such as increasing their knowledge and learning the truth.

They can attain these more abstract ends indirectly, through the pursuit of more immediate goals that lead to them. Given this background, let us now take a closer look at open-mindedness and intellectual humility.

Several philosophers have discussed open-mindededness (see, e.g., Battaly 2004, Riggs 2010, Baehr 2011, and Carter and Gordon 2014). My aim is not to engage too deeply with the virtue epistemological literature, but to draw on extant definitions for the purposes of this article, which concerns the value of open-mindedness and intellectual humility for SIR. Consequently, let me say without argument that I find Baehr (2011)'s account to be the most promising because of its clarity and thoroughness, even though it has been critiqued by Carter and Gordon (2014, 213–214). Baehr (2014, 152) offers this definition of open-mindedness (also quoted at Carter and Gordon 2014, 212):

> (OM) An open-minded person is characteristically (a) willing and (within limits) able (b) to transcend a default cognitive standpoint (c) in order to take up or take seriously the merits of (d) a cognitive standpoint.

We can see how this works in the case of the ordinary person who loves to read and learn new things. Engaging in these activities prompts her to move beyond what she already knows, to take up new perspectives – perhaps those of characters in novels, or, in nonfiction, of persons whose viewpoints differ from hers. Of course, she need not agree with or acquiesce to every new perspective that she encounters, but she must be seriously willing to consider their merits in order to be considered open-minded.

As noted above, virtue epistemologists recognize that traits such as open-mindedness are not always intellectual virtues. Baehr (2011, 160; emphasis his) addresses this concern by adding a necessary condition to his definition (quoted also at Carter and Gordon 2014, 212):

> (R3) A person S's engaging in the activity characteristic of open-mindedness under circumstances C is intellectually virtuous *only if* it is reasonable for S to believe that engaging in this activity in C may be helpful for reaching the truth.

(R3) places an important limit on Baehr's definition. Suppose, for example, that our open-minded person is reading a biography of Hitler that seeks to explore his perspective, psychology, and so on. Without (R3), the definition of open-mindedness would have us believe that our reader must seriously consider Hitler's perspectives on such topics as the Jews, the thousand-year Reich, and so on. Our reader, we might think, should be loathe to give serious consideration to such morally abhorrent views. (R3) exonerates her from this, even implying that were she to do so, she would not be *virtuously* open-minded. This is because our reader has independent evidence that Hitler's views that the Jews were evil were false, that the thousand-year Reich was neither necessary nor possible, and so on, and it would be unreasonable for her to give serious consideration to Hitler's false ideas. Open-mindedness to known falsehoods is not an intellectual virtue.

Finally, Baehr (2011, 161) understands the reasonableness condition as follows (quoted also at Carter and Gordon 2014, 213):

> Its being "reasonable" for S [who accepts a proposition P] to think that being open-minded in C may be helpful for reaching the truth is generally a function of the comparative strength of S's grounds concerning: (1) P itself; (2) S's own reliability relative to the propositional domain to which P belongs; and (3) the reliability of the source of the argument or evidence against P.

Two remarks about the reasonableness condition merit mention. First, Baehr (2011, 161, n. 28) offers three brief remarks that clarify it. Only one of these is relevant for our purposes, namely, that the condition applies only to cases of intellectual disagreement or dispute. Baehr does not think it applies to other cases in which open-mindedness is relevant that do not involve disputes, such as understanding new subject matters, or trying to explain perplexing data.

Second, Carter and Gordon (2014, 213) critique the account by arguing that the reasonableness condition gives rise to an infinite regress. They offer a stronger and a weaker argument to support their claim. The stronger argument begins with the observation that one cannot be open-minded in C, vis-à-vis P, if not also, at the same time being open-minded

about (1–3), above, that is, the reasonableness condition. Carter and Gordon (2014, 213) ask us to consider a case in which S is open-minded in C, vis-à-vis P, but is dogmatic about (1–3). In order to be virtuously open-minded, however, it would have to be reasonable for S to be open-minded about whether (1–3) would be helpful for reaching the truth about (1–3). This reasonableness about whether (1-3) would be helpful for reaching the truth about (1–3), would be a function of (1*–3*), about which S would have to be open-minded in order to be open-minded about (1-3), and so on, *ad infinitum*. The weaker argument asks us to consider whether being open-minded in C vis-à-vis P entails being open-minded with respect to any of (1–3), for example, (1) P itself (Carter and Gordon 2014, 213–214). One cannot block the regress in this way, the authors claim, for it's absurd to think that one could be open-minded in C vis-à-vis P while being dogmatic about P itself.

Even if Baehr's account is damaged or undermined by the regress arguments, it is nonetheless useful for our purposes. That is because it invites us to think about what the reasonableness conditions require in cases of disagreement in SIR contexts. It could also be useful for thinking about what virtuous open-mindedness would amount to in cases of non-disagreement in which one must rely on the expertise of others for knowledge about new domains or evidence against propositions that one would otherwise be inclined to believe. In SIR contexts, open-mindedness is not unaffected by the intellectual humility of members of research teams that hail from different disciplines. To intellectual humility we now turn.

In Snow (2019), I reviewed and critiqued eight conceptions of intellectual humility.[1] One of these, offered by Whitcomb, et. al. (2017) is the strongest of the eight and provides a promising conception with which to explore SIR. (Again, I adopt this view for the purpose of this article without extensive argumentation). Whitcomb et. al. (2017, 520) call their approach the 'limitations-owning' view:

> *Limitations-Owning.* IH [Intellectual humility] consists in proper attentiveness to, and owning of, one's intellectual limitations.

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[1]   My discussion of Whitcomb et. al. (2017) draws on this work.

And,

> IH is an intellectual virtue just when one is appropriately attentive to, and owns, one's intellectual limitations because one is appropriately motivated to pursue epistemic goods, e.g., truth, knowledge, and understanding.

They write: "[…] owning an intellectual limitation consists in a dispositional profile that includes cognitive, behavioral, motivational, and affective responses to an awareness of one's limitations" (Whitcomb et. al. 2017, 518). They discuss each type of response (Whitcomb et. al. 2017, 517–518). A cognitive disposition to owning one's limitations consists in dispositions to believe and accept one's limitations. Behavioral responses include being disposed to admit when one has made a mistake, avoiding pretense, deferring to others, seeking more information, drawing inferences carefully, and judiciously considering counterevidence. Motivational responses include acknowledging one's weaknesses and working to overcome them. Finally, affective responses include feeling regret or dismay upon acknowledging them.

The authors admit (2017, 528–534) that their view says nothing about appropriate attitudes to intellectual strengths. They argue that it is rationally impossible for someone to be both intellectually arrogant and intellectually humble but acknowledge that it is both metaphysically and humanly possible (Whitcomb et. al. 2017, 533). If someone is arrogant about his intellectual strengths, but humble about his intellectual limitations, we could not justifiably say that he is intellectually humble *tout court*.

One can certainly raise questions about the limitations-owning view. For example, the authors argue that, on their view, owning one's limitations *characteristically* involves feeling regret or dismay, but not hostility, about them (Whitcomb et. al. 2017: 519; emphasis theirs). I take it that the emphasis placed on 'characteristically' is meant to convey that the intellectually humble person need not always, in every instance, feel regret or dismay about her limitations, but should feel that way on a fairly regular basis, as part of her epistemic make-up, and on important occasions when her limitations come into play. I take it they are not claiming that

we should feel regret or dismay simply because of the fact that we possess intellectual limitations. This would be unreasonable. We are finite, fallible creatures, and would not be human if we lacked limitations. What kind of limitations-owning, then, is at stake?

Moreover, must or should we feel regret and dismay when acknowledging our ownership of some intellectual limitations? I can own limitations about the reliability of my memory for train schedules without feeling any negative emotions, and, unless knowledge of train schedules is important to me for some reason, that is as it should be. By contrast, I own limitations in my mathematical abilities with some regret and dismay, because being better at math would have enhanced my career prospects. Finally, if I am a member of a research group and my lack of knowledge of some important research data causes our project to fail, I should feel a high degree of regret and dismay, not only because of my intellectual limitation, but because of its consequences for the research. My point is that not all the limitations in our knowledge that we can and should own should cause us to have negative emotions. Whether and to what extent we should feel negative emotions in owning our limitations should be indexed to their importance in our lives, plans, careers, and so on. A further point can be made: there are occasions on which owning our limitations can be a precondition for positive emotions, such as joy at the prospect of learning new things. Suppose that I, as a philosopher, join a research team comprised of neuroscientists and psychologists. I might initially feel regret at my lack of knowledge of these fields, but, if I love knowledge, I can and should become enthused at the prospect of learning more from experts.

2. Success in SIR Distinguished from Success in WIR and DR

I suggest that success in SIR be understood as follows:

> (SSIR) Success in SIR consists in bringing the knowledge of various disciplines to bear on solving a research problem, making progress toward a solution, ruling out putative solutions, or generating greater understanding of a research thesis, thereby advancing knowledge in a way that could not be attained through either WIR or DR.

What is the rationale for adopting this conception of success in SIR? The rationale is grounded in the purpose of research, which I take to be two-fold: to produce and transmit new knowledge. To avow that the purpose of research is to produce new knowledge seems uncontroversial; to claim that its purpose is also to transmit new knowledge requires a word of explanation. The transmission of new knowledge is, of course, dependent on its production. We cannot transmit new knowledge if it is not produced. But why transmit it? Unless new knowledge must be kept secret for some compelling reason, say, national security interests, the transmission of new knowledge is justified for three main reasons. First, sharing new knowledge obtained through research helps to stimulate more research and further learning, thereby adding to the common store of knowledge, both theoretical ideas and practical applications. Mention of practical applications leads to the second reason for transmitting new knowledge: sharing new knowledge can improve our overall standards of living, through the development of new medicine, health care technologies, engineering advances, and so on. (Think of the old phrase, "Better living through chemistry.") Finally, transmitting new knowledge is part and parcel of the expansion and extension, through generations, of cultural heritages. Especially through new knowledge brought about by research in the humanities, we expand our understanding and appreciation of literature, music, art, history, philosophy, and religion, thereby adding to the collective wisdom that these disciplines provide about the human condition, our relations with nature, and so on. A world that did not continue dialogues about such topics as Greek philosophy, Renaissance paintings, Russian literature, Chinese calligraphy, Baroque music, the history of science, African American spirituals, Art Deco architecture, and other topics comprising the rich tapestry of the cultural heritage of humankind would be impoverished indeed.

Success in SIR contributes to the production and transmission of new knowledge (legitimate needs for secrecy aside) and thus, contributes to the purposes of research. How does success in SIR differ from success in WIR and DR? Success in SIR differs in two respects: (1) what success demands of researchers, or what it looks like materially, can vary from SIR

to WIR to DR; and (2) the bar for success shifts from one context to another. Recall that SIR occurs when research teams are composed of individuals from very different disciplines, for example, the humanities and the sciences. WIR, by contrast, occurs when research teams are composed of people whose disciplines are 'near neighbors.' By 'near neighbors,' I have in mind teams composed entirely of scientists from different fields, for example, from physics, chemistry, biology, or its subfields, or by 'pure' or theoretical scientists who practice in these fields who partner with applied scientists in engineering or physiology, for example. Success in SIR requires that larger gaps between disciplinary areas be bridged. This speaks to the first respect in which SIR differs from WIR (and DR). It might be easier for scientists who use approximately the same methodologies, for example, to collaborate in making headway on a research problem, than it would be for scientists and humanists, who come from different disciplines with different methodologies, training, and so on, to make similar progress. The gaps in conceptualizations, vocabulary, methods, and even understanding of what the problem is are likely to be larger and more difficult to surmount. This is owing in part to the fact that disciplinary training can be highly specialized. Considerable intellectual ability and effort can be required for someone to acquire expertise in both physiology and religion, for example. Of course, this can and has been done, but it is not easy. Success in SIR advances knowledge by bringing together significantly different disciplinary fields. Since WIR does not do this, what count as its successes will be different, more specialized, and arguably, less rich in content and narrower in scope than successes obtained through SIR. This addresses the second difference noted earlier. The bar for success in SIR is higher than for WIR (and DR).

Success in DR is obtained when knowledge is advanced by collaboration among practitioners of the same discipline. Even here, we should note scope for bridging content or even methodological gaps. Psychologists interested in Freudian psychoanalysis approach their field very differently from those engaged in psychometrics or organizational psychology. But these gaps are entirely intradisciplinary, and research results will remain entirely within the field of psychology, broadly construed.

3. Obstacles and Success in SIR: Roles for Open-mindedness and Intellectual Humility

To introduce this section, I offer the following by way of background. I was the principal investigator or co-principal investigator on two multi-million research projects funded by the Templeton Religion Trust, the "Self, Motivation, and Virtue Project," (https://smvproject.com/), and the "Self, Virtue, and Public Life Project". Each project funded at least ten interdisciplinary teams composed of scientists and humanists who were charged with conducting SIR. In addition to the requirement that teams be composed as stated, 'deep integration' was mandated of the teams. Deep integration requires that members of each team be fully and equally invested in the project from inception to completion. It was meant to prevent three main problems that I had seen (and continue to see) occur in allegedly interdisciplinary projects. The first is including a practitioner of a discipline in a project as a consultant by way of afterthought, then not taking advantage of her expertise. For example, I recall a project spearheaded by an anthropologist who enlisted a philosopher as a consultant. She confided that she was never consulted. The second problem is enlisting a practitioner of another discipline, consulting, then eschewing her advice. I was brought in as a philosopher on a project led by a psychologist, who routinely substituted his judgment for mine on philosophical issues, going so far as to use his own misreadings of contemporary philosophers on issues pertinent to the project instead of my own better-informed interpretations. Finally, I have been aware of two projects run by psychologists who enlisted philosophers, but the philosophers were not in the subfields appropriate to the research area and thus, could not bring the relevant expertise to bear on the project. Their inclusion in the projects seemed to be more a matter of convenience than of a genuine attempt to find appropriately qualified project personnel. (In fairness, I should note that it is sometimes challenging for members of one discipline to find appropriately qualified practitioners of disciplines with which they're unfamiliar).

The point of these remarks is that researchers must be motivated to undertake deep integration in order to be maximally successful at SIR. Otherwise, they risk not being able truly to mine the resources of different disciplines. Suppose that a team commits to undertaking deep integration throughout the life of their project. What obstacles might they face, and how can the two virtues under consideration help to ameliorate them and facilitate success?

I list five main obstacles that I have seen hinder the success of SIR. They are not mutually exclusive, and the list is by no means exhaustive. They are serious cognitive obstacles and can also involve motivational deficiencies on the part of team members. I offer the list along with possible causes of each, as well as the intellectual virtues that can provide antidotes.

1. Ignorance of the subject matter (e.g., concepts, methodologies, etc.) of another discipline.
2. Misunderstanding the subject matter of another discipline.
3. Superficiality in approaching the subject matter of another discipline.
4. Failure adequately to engage with colleagues across disciplines.
5. Failure to develop shared understandings of relevant concepts.

Obstacle 1: Ignorance of the subject matter of another discipline. This is a rather serious cognitive deficit that can easily undermine interdisciplinary work. Of course, one presupposes that team members from another discipline, say, psychology, do not have a thorough understanding of other disciplines, say, philosophy, and vice versa. What I have in mind by listing this as an obstacle is cases in which members of different disciplines are not truly interested in learning what other disciplines have to offer that is relevant to the project at hand. This can be due to a variety of cognitive deficiencies that involve possible motivational problems, for example: viewing the other discipline as not worth knowing; seeing the practitioner of the other discipline as inadequately informed about her field; or simple laziness. In addition, a lack of time to engage with the subject matter of the other field could be a practical obstacle, but one would think

that an adequately motivated team member would make time to learn what she needs to know relative to the project.

Open-mindedness and intellectual humility are clear antidotes for all of the causes of these obstacles. Intellectual humility, for example, requires that we own our limitations with respect to a field in which we lack expertise, while not mandating that we underestimate our strengths in our own discipline.[2] Regarding open-mindedness, Baehr's reasonableness conditions are relevant. If we commit to undertake a research project requiring deep integration with practitioners of another discipline, it is unreasonable of us not to be skeptical about our epistemic reliability with respect to a subject domain in which we lack expertise, and to defer to the judgment of a colleague with expertise in that domain, other things being equal.[3]

Obstacle 2: Misunderstanding the subject matter of another discipline. Obstacle 2 is more serious than a mere lack of understanding. Lack of understanding is simply ignorance; misunderstanding is error. In this case, as in the first, the first three causes could be at work: viewing the other discipline as not worth knowing; seeing the practitioner of the other discipline as inadequately informed about her field; or laziness. These deficits could cause one to proceed without due care in one's efforts to understand the other discipline, or not to value and take full advantage of the expertise of one's team members in the other discipline. Intellectual humility as well as open-mindedness can go some way toward correcting these deficiencies.

There are other cases, however, in which this obstacle is created by intellectual arrogance. I have in mind the case I previously described in

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[2]   It is worth noting that another benefit of intellectual humility in this context is that it requires us to own our limitations with respect to our field of expertise. We need to recognize that our discipline's way of studying a phenomenon or concept is not the only legitimate way. We need to own both that "I'm not an expert in that other field," and "My own field does not have an epistemic monopoly on the target phenomenon." I am grateful to an anonymous reviewer for pointing this out.

[3]   The *'ceteris paribus'* clause is meant to apply to cases in which we have good reasons for doubting the expertise of a team member in another area. Good reasons might include their lack of experience in the field, their lack of publications, judgments about which they have been shown to be wrong, and so on. In other words, one must have an evidentiary basis for doubting the expertise of practitioners of other disciplines.

which my colleague in psychology routinely substituted his judgment for mine on philosophical issues. This and related issues, such as exploring another field without consulting or heeding the guidance of subject matter experts on one's team, can lead to avoidable errors in the project, and bespeak a lack of due deference toward one's colleagues in another field. Owning one's limitations with respect to the discipline in question, acknowledging that one is a beginner relative to practitioners in the other field, and recognizing that one is unreasonable if one does not at least give one's colleagues a fair hearing, are possible remedies.

Obstacle 3: Superficiality in approaching the subject matter of another discipline. Obstacle 3 can rightly be seen as a cause of obstacles 1 and 2, but also merits mention as an obstacle in its own right that can create serious problems for the success of a research project. It can occur when practitioners of one discipline do not understand or appreciate the requirement for depth and detail that is standardly expected of another discipline. This deficiency is caused by a lack of open-mindedness with respect to the standards that regulate what counts as good work in a discipline and can significantly undermine the publications prospects of a research project. In addition to open-mindedness, intellectual humility, or deferring to those who know the standards governing expectations in a field, can help team members to take a deeper, more engaged approach with the other discipline. Team members can thereby contribute to, rather than undermine, publications prospects for their project.

Obstacle 4: Failure adequately to engage with colleagues across disciplines. We have already noted some of the causes of obstacle 4, namely, not viewing the subject matter of another discipline as worthwhile, or not trusting or taking seriously the expertise of team members in that discipline. That said, I wish to discuss obstacle 4 in conjunction with *Obstacle 5: Failure to develop shared understandings of relevant concepts.* Effective communication among interdisciplinary team members is of the utmost importance to the success of SIR projects. The most serious threat to effective communication is the failure to develop a shared vocabulary. Team members who "talk past" each other, who use technical terms without adequately explaining their meanings, or worse, who use the same

terms, but with different meanings, do not advance their project, but sow misunderstanding and confusion. The antidote to obstacles 4 and 5 is a commitment on behalf of all team members to engage with others and develop shared understandings with open-mindedness and intellectual humility.

Conclusion

In this article, I've discussed the intellectual virtues of open-mindedness and intellectual humility, distinguished success in SIR from success in WIR and DR, and noted five obstacles to achieving success in SIR. I've also discussed likely causes of these obstacles and have identified open-mindedness and intellectual humility as possible correctives. Both Aristotle and the contemporary virtue ethicist Philippa Foot identified virtues as correctives to natural human tendencies – vices – that can lead us astray ethically. Vices can also lead us astray intellectually. SIR is susceptible to many of these. In the SIR context, intellectual virtues are indispensable in helping us achieve new knowledge.

Acknowledgments

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