Cross-disciplinary localization: a philosophical approach

Stephen Crowley, Sanford D. Eigenbrode, Michael O'Rourke & J. D. Wulfhorst

Localization aims to adapt a product so that it feels "natural" to end-users in a target locale. This suggests that without localization, the product will feel foreign due to differences in knowledge — epistemic differences — between the source and target locales. These differences arise because culture and language frame how we understand our experiences and how we think of ourselves as a collective. Classic examples of localization are international, involving differences in language and culture, but localization can be required intra-nationally when the nation in question comprises more than one language and culture, as is true of many contemporary nation-states. The United States is certainly one of these nations embedding a large number of indigenous and imported languages and overlapping cultures.

The need for localization within one nation may also arise in contexts such as that of scientific research, a complex process of constructing new knowledge out of the combination of old knowledge, observation and, in many cases, experimentation. As with language and culture in their traditional senses, the diverse interests, motivations and histories of scientific endeavor have generated a fragmented landscape of research languages and cultures. Most scientific researchers train in one discipline, acquiring a specialized way of working with the world. As a consequence, interactions within scientific disciplines are usually coherent. While there will be disagreements, accepted methods for resolving these evolve and emerge.

Step outside your discipline, though, and you're in a foreign land. The world these other disciplinary investigators inhabit is an unfamiliar place, and they use technical languages and research methods that can be quite mysterious. So why do it? Why leave familiar disciplinary environs to work in cross-disciplinary situations that require grappling with differences in research culture and language? A number of motivations spur researchers to engage in cross-disciplinary work, and among these two stand out. First, it has become evident that many complex, modern problems require cross-disciplinary attention. Hunger, poverty and the sustainable use of natural resources are three examples of complex, global issues that have required and will continue to require the combined attention of many scientific and humanistic disciplines. Second, US funding agencies such as the National Science Foundation (NSF) and the National Institutes for Health have made cross-disciplinary research a priority, creating initiatives such as the NSF Integrative Graduate Education and Research Traineeship program. Then-NSF director Arden Bement emphasized the point this way: "Developing effective ways to transcend traditional boundaries, and bring very different scientific cultures together for the benefit of science and society, without compromising excellence, is a critically important challenge for the Foundation."

Thus, cross-disciplinary research combines the promise of impact with the promise of funding, and the result has been a larger number of investigators venturing into this new territory.

Stephan Crowley is a professor of philosophy at Boise State University. Sanford D. Eigenbrode received his Ph.D. from Cornell and conducts research on chemical ecology of insects, plant-insect interactions, chemical and structural plant attributes. Michael O'Rourke is professor of philosophy, faculty in Neuroscience and Environmental Science, and Fellow in the Microelectronic Research and Communications Institute at the University of Idaho. J. D. Wulfhorst is an associate professor in agricultural economics and rural sociology at the University of Idaho.

But the shift toward cross-disciplinary research has not yet precipitated a corresponding shift in reflection on the research process. There is a need for teams of localizers who can bridge the cultural and linguistic barriers between disciplines, helping collaborators achieve a level of mutual understanding and a capacity for effective communication.

Crossing research disciplines

Research disciplines are home to practitioners focused on augmenting what we know about their domains of interest. They feature commitment to certain methods for formulating and testing hypotheses, confirmation regimens for evaluating hypotheses in light of collected evidence and privileged modes of understanding. These traditions are buttressed by social institutions such as scientific societies, conferences and journals. Chemical ecologists, for example, investigate the chemical interactions between different parts of an ecosystem, adopting a reductionist view of causal processes while employing quantitative, experimental methods; they combine field collection with laboratory experimentation that aims at replication and mathematical confirmation. By contrast, rural sociologists focus on human systems and social structures in rural areas, often employing qualitative, observational methods in case study approaches. Their research downplays replication in pursuit of behavioral patterns and tendencies that emerge across human populations.

This illustrates several dimensions in which research disciplines vary: investigative focus, research methods, confirmation standards and systematic complexity. These variations could be classified from a philosopher's perspective into metaphysical dimensions (that is, dimensions related to the fundamental nature of the world) and epistemological dimensions. According to Hilary Kornblith, the former concern what the world is "that we may know it," and the latter concern who we are "that we may know the world." Among the metaphysical differences that divide disciplines are topic of study; whether or not the topic is understood to be independent of investigators or dependent on them; whether or not values are an intrinsic part of the world under investigation; and whether one can reduce complex phenomena to

simpler, atomic parts for explanatory purposes. Among the epistemological differences are whether or not investigators in a particular discipline regard themselves as basic or applied scientists; what methods of discovery they employ in their work; and what confirmation standards they use to determine whether knowledge has been gained.

When one is conducting disciplinary research, a particular set of assumptions

Collaborative, cross-disciplinary research is so attractive precisely because it can combine different perspectives into integrative solutions of real-world problems. Sensitive collaborators are needed here, not 'Renaissance' researchers, and it is localization that yields this sensitivity.

forms the background against which one works; however, when representatives of different disciplines work together on a problem, differences regarding these matters can get in the way of successful collaboration. The fundamental problem is knowledge-based. Representatives of different disciplines are part of different cultures and speak about their knowledge in different ways, making effective communication difficult. One way around this would be to train everyone in the research ways of the others, but this is almost never feasible. Collaborative, cross-disciplinary research is so attractive precisely because it can combine different perspectives into integrative solutions of real-world problems. Sensitive collaborators are needed here, not "Renaissance" researchers, and it is localization that yields this sensitivity. By making the different cultures seem natural to the collaborators, disciplinary localization produces mutual understanding, and this supports effective

research communication across disciplinary lines. The localization found here is special in a number of respects, not the least of which is the fact that it is reciprocal between any two disciplines represented in the cross-disciplinary collaboration.

The Toolbox approach

Cross-disciplinary research collaborations are not new, and so it should come as no surprise that the problem of disciplinary localization is often solved by successful collaborators. These solutions will tend to be *ad hoc* and *sui generis*, crafted to fit the mix of disciplines and the mix of personalities involved. But when localization doesn't happen organically, the divides between as few as two researchers can generate miscommunication, misunderstanding and ultimately project failure. But knowing that localization is required, why not explicitly intervene and work in a conscious, systematic way toward its achievement? This is the motivation behind the Toolbox approach, a philosophically-based intervention designed to reconcile disparate disciplines in a way that produces mutual understanding among research collaborators. The idea behind this approach is that structured dialogue about research assumptions can lay the various cultures open to view, helping collaborators to appreciate the orientations of their colleagues. This dialogue takes place on the common ground they share as scientists, reached by philosophical abstraction away from specific, disciplinary differences.

The primary elements of the Toolbox approach are the instrument and the workshop. The Toolbox instrument is a structured set of 34 prompts designed to trace the framing elements of a scientist's research perspective. These prompts are categorized into two broad groups, the epistemological and the metaphysical. Each of these categories is subdivided into three parts, with each part consisting of a core question that captures the characteristic feature of that part and five or six statements that reveal specific aspects of this feature. The Epistemology category is subdivided into Motivation, Methodology and Confirmation, capturing the three stages of the research process, from what the researchers bring to a research project, through how they operate as researchers, to how they identify knowledge when

III. Confirmation

Core Question: What types of evidentiary support are required for knowledge?

12. There are strict requirements for the validity of measurements.

| Disagree | | Agree | 1 | 2 | 3 | 4 | 5 | | I don't know | N/A |

13. There are strict requirements for determining when empirical data confirm a tested hypothesis.

| Disagree | | Agree | 1 | 2 | 3 | 4 | 5 | | I don't know | N/A |

14. Validation of evidence requires replication.

| Disagree | | Agree | 1 | 2 | 3 | 4 | 5 | | I don't know | N/A |

15. Unreplicated results can be validated if confirmed by a combination of several different methods.

| Disagree | | Agree | 1 | 2 | 3 | 4 | 5 | | I don't know | N/A |

16. Research interpretations must address uncertainty.

| Disagree | | Agree | 1 | 2 | 3 | 4 | 5 | | I don't know | N/A |

17. The members of this team have similar views concerning the confirmation core question.

| Disagree | | Agree | 1 | 2 | 3 | 4 | 5 | | I don't know | N/A |

Figure 1: A questionnaire designed to point out potential differences in the theoretical approaches of collaborative researchers.

they have it. The Metaphysics category is subdivided into Reality, Values and Reductionism, capturing three aspects of the world under investigation that can divide researchers, namely, whether the world is independent of the investigators, whether values are an essential part of the world, and whether the world can be reduced for explanatory purposes to more basic elements.

To illustrate, consider the Confirmation section of the Epistemology category (Figure 1). The core question expresses the main theme of this section: what does knowledge in a given discipline require? The generality of this question is intended to ease those using the instrument into the section by clarifying what is meant by confirmation. The remaining statements are designed to reveal aspects of the process of confirmation that can divide representatives of different disciplines, such as the nature of measurement and the role of replication.

The categories and their subdivisions represent abstractions necessary to structure a productive dialogue among research collaborators. The resulting Toolbox is a piece of "philosophical technology" that guides those who use it to conceptual common ground on which they can stand with fellow scientists and discuss their research perspectives.

The instrument is deployed in a two-hour dialogue among research collaborators that takes place in a workshop or roundtable setting. Each workshop begins with a framing introduction by a facilitator. After the introduction, each collaborator is asked to score the statements, adopting the perspective of his or her own discipline. For those who have several, the discipline he or she chooses should be the one(s) he or she represents in the project. Once the statements have been scored, the collaborators are invited to discuss them, beginning anywhere.

The point of the workshop is two-fold. First, and more importantly, it aims to add value to the participants' research collaboration by enabling them to localize their disciplines for each other in dialogue. Second, as part of a research project (NSF SES-0823058, 2008-2011), it is the primary focus of a data collection effort designed to assess the impact of this approach on intragroup communication in cross-disciplinary research collaborations.

The Toolbox approach is a localization effort that aims to make the research disciplines of cross-disciplinary collaborators seem "natural" by generating shared understanding of research assumptions through dialogue. The localization effort is structured and guided, but the real localization work is conducted by the participants themselves as they talk their way around their various disciplinary research perspectives. The philosophical abstraction embodied in the instrument moves the participants away from their different disciplinary locales toward common ground that is well away from the potentially contentious project zone. By becoming familiar with their colleagues' approaches to knowledge and research, the participants can begin to see their project collectively — through

the eyes of their collaborators as well as their own eyes — and can thereby communicate more effectively with one another about project business. For more information about the Toolbox instrument and workshops, visit www.cals. uidaho.edu/toolbox.

Analyzing localization in cross-disciplinary research

The Toolbox approach is a philosophical effort that enables cross-disciplinary research collaborators to forge connections between different disciplinary worldviews by supplying a common, abstract point of view on their scientific research assumptions. Disciplinary perspectives are localized here, adapted to seem natural or at least understandable to representatives of other disciplines. The Toolbox instrument focuses workshop participants on the languages, epistemic cultures and research practices of their collaborators, thereby making it possible for them to see their collective project from the different disciplinary perspectives that constitute their collaboration. The Toolbox team has done the conceptual advance work, supplying the tools, used by those who really have a stake in the project, to localize their disciplines for each other. The upshot should be a greater degree of mutual understanding, and through this, the ability to communicate about project details more efficiently and effectively.

A number of analytic points can be made about localization of this type, and here are four important ones. First, localization occurs in the context of Toolbox workshops at three levels: the collaborators, the collaboration and their stakeholders. The collaborators are the primary localizers, taking charge of representing their own disciplines and educating their colleagues about them. They make their disciplines available to their collaborators, and they bring the disciplines of their collaborators home to themselves. At this level, localization is reciprocal between any two representatives of different disciplines. Even when there are two representatives of the same discipline, their efforts at localizing the other disciplines in the collaboration may differ, given differences in their own perspectives that go beyond their disciplinary identity.

Localization also occurs at the level of the collaboration, where the product

will be mutual understanding of their joint project. This collective interface will help to constitute their identity as a collaboration, and will facilitate the flow of information back and forth between researchers. Finally, there is localization at the level of the stakeholder. Typically, external stakeholders are not represented at the table in these workshops, but often their points of view are. As such, these points of view are available for integration into the research worldviews of those previously unfamiliar with them. While the stakeholders may not profit epistemically from the workshops themselves, their interests in the research are advanced by virtue of the localization efforts of the researchers.

Second, differences in the degree of integration required by a collaboration will have implications for the nature of the localization efforts. It is a commonplace in theoretical discussions of interdisciplinarity to distinguish between different types of collaborations on the basis of epistemic integration. Multidisciplinary efforts require the least, interdisciplinary efforts require more, and transdisciplinary efforts require the most. We use "cross-disciplinary" to remain neutral about the degree of integration.

While it is difficult to predict the degree to which localization takes place in a given workshop – depending on factors such as personality and interest – the importance of successful disciplinary localization to a collaborative project varies directly with the degree of integration required by that project. Transdisciplinary collaborations will typically require a much greater degree of mutual understanding than multidisciplinary efforts, where most of the researchers can do their own thing without having to worry about integrating it with the work of their collaborators. By putting localization in the hands of the collaborators, this approach supports them in negotiating the appropriate level of integration for their project.

Third, typical cross-disciplinary collaborators will possess disparate specialized information and knowledge. This is precisely why collaboration is so appealing. Collective effort reflects the contributions of the requisite disciplines without any one investigator having to master them all. There is even reason, from decision theory, to believe that

the combination of limited, individual efforts is superior in efficiency and productivity to the solitary effort of a less limited, more capable individual. The age of the "Renaissance" researcher has passed, made a quaint vestige of yesteryear by the hyperspecialization of modern science and the explosion of information required to address most complex, real-world problems. It is in collaboration that we can bring to bear the information required for cross-disciplinary projects, but for this to work, the information poverty that marks a collaborator's limited perspective must not get in the way of the collective effort. Toolbox-driven localization enables collaborators to minimize the potentially deleterious effects of this form of information poverty by producing familiarity with the research assumptions that underpin the constituent disciplines, even though much about the disciplines will remain unilluminated. Localization requires not merely having information in common but having a shared appreciation of that information, and the Toolbox approach works to engender this by focusing on the conceptual framework within which information is shared.

Finally, the Toolbox approach is marked by its broad applicability. By abstracting away from specific, disciplinary difference while cleaving to the conceptual foundation of scientific research, the Toolbox instrument embeds statements that will be meaningful to many practicing scientists. There is no one discipline that must be present in a collaboration for the Toolbox to be relevant, nor is there even a requirement that the constituent disciplines be significantly different. So long as there is a need for disciplinary localization within a scientific research collaboration, the Toolbox workshop should be relevant and useful.

That said, it is not universal technology. If collaborations involve those outside the sciences, such as certain humanists or artists, or if they involve stakeholders who are not researchers, the statements will cease to get at fundamental commitments that shape the participants' epistemic cultures. We believe that the Toolbox approach would still have value for such collaborations, although a different instrument would have to be devised with them in mind.

Conclusion

As it is typically used within the pages of *MultiLingual*, localization describes product adaptation into an international language and culture found in a target locale. Given this, use of the concept in the context of cross-disciplinary, collaborative research might seem metaphorical, but we submit that it is not. Disciplinary perspectives are adapted by the collaborative to produce a collective outlook that will underwrite their joint research effort. Each disciplinary perspective features its own language and culture, and each serves as both a source and a target locale. When disciplinary localization takes place in this context, a collective interface is produced by the collaborators that enable them to communicate effectively even though they may not know much about the nature of the other disciplines involved. We have described one way to achieve this type of localization. This approach is not required, of course, as localization can and often does happen organically, but the early returns suggest that it can facilitate the development of more efficient research communication through mutual understanding.

For those willing to engage in explicit, philosophical dialogue, the Toolbox approach can facilitate localization and thereby foster epistemic synthesis across a collaborative effort. As cross-disciplinary research projects grow in number, prominence, and funding support in North America and beyond, disciplinary localization efforts will become more and more necessary. The Toolbox approach represents an early entry into this market, one that trades on the power of philosophy to create common ground.

References

Eigenbrode, S. D., O'Rourke, M., Wulfhorst, J.D., Althoff, D., Goldberg, C., Merrill, K., Morse, W., Nielsen-Pincus, M., Stephens, J., Winowiecki, L., Bosque-Pérez, N. 2007. "Employing philosophical dialogue in collaborative science." *BioScience* 57: 55-64.

Kornblith, H. 1993. *Inductive Inference and Its Natural Ground.* Cambridge, Mass.: MIT Press.

National Science Foundation. 2007. "NSF appoints new Director of Office of Integrative Activities." Press Release 07-186. (www.nsf.gov/news/news_summ .jsp?cntn_id=110850&org=NSF&from=news, 15 Jan. 2008).