Interdisciplinarity, multidisciplinarity and everything in between

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Outline

- What is a discipline?
- From multidisciplinarity (MD) to interdisciplinarity (ID) and beyond
- ID as knowledge integration
- MD as diversity
- Conclusions

Dual nature of disciplines

Intellectual

- The so called “disciplinary matrix” is part of normal science – it enables the cumulative generation of scientific knowledge (Kuhn 1962).
- Not just the subject matter of inquiry but a particular approach to it (e.g., the economic approach to human behavior, Becker 1976).

Institutional

- Academic departments (versus centers, institutes and labs)
- The main function is education (degrees as “licenses”).
  - The identities and interests of professions outside universities
  - Minedu and labor markets
- Scientific societies and journals

What are scientific communities?

Specialties within and between disciplines

- are united by shared concepts, epistemic values and goals.
- are arenas for disagreement and dissent – controversy.
- are bound together by mutual epistemic responsibilities, that is, obligations to justify claims so that they meet at least some of the community’s shared standards.
- may overlap and individual scientists may belong to several communities either simultaneously or in succession.

Is there a problem with disciplines?

- Specialization: Specialists are thought to pursue inward-looking and increasingly narrow research agendas.
  - Criticism: Scientific expertise and practice is necessarily domain specific because research problems need to be cognitively manageable.
- Disciplining: Disciplines are not thought to be ideal social units for creativity and innovation.
  - Criticism: There is room for both tradition and innovation (Kuhn 1977). The disciplinary matrix can be revised and changed (Kuhn 1962).
- Isolation: Disciplines are thought to be isolated silos.
  - Criticism: Researchers constantly import and export ideas across disciplinary boundaries.

The discovery of Helicobacter pylori

Why was the discovery made so late?

- Peptic ulcers are often due to an infection caused by Helicobacter pylori - they can be cured by using antibiotics (Barry Marshall and Robin Warren in 1983 and 1984).
  - The discovery challenged the longstanding medical doctrine holding that ulcers were caused primarily by stress, spicy foods, and too much acid.
- The discovery was made possible by collaboration across specialties: Marshall is a gastroenterologist and Warren is a pathologist (and their research group included specialists from other fields) (Thagard 1999).

Definitions in flux

- Multidisciplinarity involves the juxtaposition of two or more disciplinary perspectives on a single problem or object of study.
- Interdisciplinarity involves some degree of integration of concepts, methods, data or theories from two or more disciplines.
- Transdisciplinarity involves interaction with extra-academic stakeholders (before, during and after the research project) and integration of their perspectives into research.
  - Stakeholders are not merely human subjects of research or the end users of knowledge.
- Scientific imperialism: a harmful form of cross-disciplinary interaction.

Measuring multi- and interdisciplinarity

- Citations across disciplinary boundaries
- Co-authored papers across disciplinary boundaries
- Transfer of metaphors, concepts, theories, models, templates, methods, technologies etc.
- Multi/Interdisciplinary journals
- Multi/Interdisciplinary units in universities (e.g., research groups, labs, centers)
  - Multi/Interdisciplinarity is sometimes a transitional stage: many Studies programs/units are well on their way to becoming disciplines.

The promise and limits of ID research

- Interdisciplinary research is expected to provide solutions to complex social, environmental and technological problems by combining or integrating epistemic resources from two or more disciplines.
- Interdisciplinary research is expected to increase the societal relevance of research.
- Interdisciplinary research is associated with high levels of creativity, progress, innovation, and scientific breakthroughs.

>>> What are the success stories? Is there a difference between top-down and bottom-up ID?

Example: ecology and economics

- Ecologists and resource economists have developed integrated models for sustainable forest and fisheries management.
- The success of the collaboration is partly due to a framework the collaborators have built to combine models from the two disciplines.
- The framework preserves for the most part the structure of the respective models.
- "The key feature of this framework is a formal (mathematical) but largely modular coupling between abstract economic models of optimization and ecological models of population growth." (420)

MacLeod, M. and Nagatsu, M. 2016. Model Coupling in Resource Economics: Conditions for Effective Interdisciplinary Collaboration. Philosophy of Science 83: 412-433.

Successful ID collaboration: an analysis

- Epistemic benefit: a more complex and accurate model which could not have been produced within either discipline.
- Clear division of labor and distribution of tasks between the two groups: The collaboration provided the two groups with a platform for combining specialized knowledge and expertise, and it preserved to a large extent their familiar model-building practices.
- Relations of trust: The integration of elements from the two disciplines is facilitated by relations of trust between collaborators (Wagenknecht 2014).

Successful ID collaboration: an analysis

- Much research on ID collaboration focuses on cross-disciplinary communication and its difficulties (e.g., O'Rourke and Crowley 2013).
- In the case of the economic-ecological modelling, the success of the collaboration is partly due to a clear structure for interactions that limits and organizes tasks and keeps them firmly within the expertise of participants.
- "Having a framework like this in place that relies on preexisting models and processes of modeling cuts down the need to produce and agree on novel model-building frameworks and novel concepts—often considered a hallmark of interdisciplinary collaborative research—that require novel practices" (MacLeod and Nagatsu 2016, 428).

Difficulties in ID collaboration

Institutional

- Research on interdisciplinary science has for the most part concentrated on the institutional obstacles that discourage or hamper interdisciplinary work.
- "Trading zones" (Galison 1997) and "interactional expertise" (Collins and Evans 2002) are proposed as solutions.

Cognitive

- The opacity of domain specific expertise and practice to non-specialists is to some extent unavoidable - cognitive systems are designed for specific tasks.
- Conflicting epistemic values, e.g., economists are more theory-driven, ecologists more data-driven (MacLeod 2018).

Benefits, costs and risks

- Benefits: More examples of successful ID collaborations with substantial knowledge integration?
- Costs: Due to the necessarily domain-specific nature of expertise and practice, collaborators need to spend some time and effort in understanding others' contributions. Relations of trust are necessary in ID collaborations but they cannot replace the need for cross-disciplinary communication.
- Risks: Existing peer review systems devalue interdisciplinary contributions, and academic promotion systems devalue work published in interdisciplinary journals.

Diversity within and across disciplines

When is diversity epistemically beneficial and why?

- A group is cognitively diverse when its members have, for example, different domains of expertise, research styles and skills, methods, theoretical perspectives on the subject matter of inquiry, or access to different bodies of empirical evidence.
- Sometimes cognitive diversity reflects social diversity.
- A group is socially diverse when its members have different value orientations or social locations, such as gender, ethnic identity, nationality, race, etc.

Benefit #1: Distribution of research effort

- Cognitive diversity can be epistemically beneficial by generating a distribution of research efforts in a domain.
- Such a distribution is fruitful especially when it is not (yet) possible to tell which theory (or theories) will be most successful empirically, or which method (or methods) will lead to a breakthrough.
- When competing theories have different epistemic virtues or when different methods have complementary advantages, it is more reasonable to distribute resources among the theories or the methods than to allocate all available resources to one theory or method (Kitcher 1990).

Benefit #2: Criticism

- Cognitive diversity can be epistemically beneficial by generating critical exchanges in the community (Longino 1990).
- Criticism can improve scientific research in many ways:
  - It helps identify and correct false beliefs or biased accounts of the subject matter of inquiry.
  - Even when criticism does not give a reason to reject a view, it is valuable by forcing scientists to provide better arguments for their view or to communicate their view more clearly and effectively. Criticism helps scientists avoid dogmatism.
  - Criticism is potentially a source of creativity.

Benefit #3: Access to distributed information

- Social diversity is an epistemic resource when information that is relevant for understanding complex phenomena is dispersed across society and distributed asymmetrically depending on individuals' social class, occupation, gender, race, ethnic identity, etc.
- The more complex societies are in terms of the division of labor and the more unequal citizens are in terms of their economic resources, education and health, the more radically different the social experiences of citizens are likely to be.
- The more pluralistic societies are in terms of political values and religious affiliations and the more multicultural they are in terms of ethnic identities and languages, the more likely it is that the social experiences of citizens will diverge.

Conclusions

Interdisciplinarity:

- Paradoxically, the success of ID collaborations is partly due a division of labor that preserves domain specific expertise and practice, and enables scientists to pursue their disciplinary interests in addition to contributing to the collaboration.

Multidisciplinary:

- The advantages are similar to the benefits of cognitive and social diversity: Distribution of research efforts, criticism and creativity, access to socially distributed information.

Diversity can be beneficial without researchers collaborating or sharing an object of study or a theme.

Selected literature

- O'Rourke, M., and Crowley, S. 2013. Philosophical intervention and cross-disciplinary science: the story of the Toolbox Project. Synthese 190: 1937–1954.
- MacLeod, M. 2018. What makes interdisciplinarity difficult? Some consequences of domain specificity in interdisciplinary practice. Synthese 195: 697–720.
- Mäki, U. 2016. Philosophy of interdisciplinarity. What? Why? How? European Journal for Philosophy of Science 6 (3): 327-342.
- Rolin, K. 2019. The epistemic significance of diversity. In The Routledge Handbook of Social Epistemology, eds. Miranda Fricker, Peter J. Graham, David Henderson, and Nikolaj J. L. L. Pedersen. New York and London: Routledge, 158-166.