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Feedbacks as a bridging concept for advancing transdisciplinary sustainability research

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The emergence of transformation as a core component in sustainability science and practice has opened an exciting space for transdisciplinary research. Yet, the mainstreaming of transformation has also exposed epistemological rifts between diverse research perspectives, presenting significant challenges for transdisciplinary teams. Using coral reef social–ecological systems as an example, we explore how these points of tension may be addressed using a three stage process: Firstly, promoting epistemological transparency, where different kinds of knowledge framings are made explicit; secondly, employing feedbacks as a bridging concept to effectively engage with complex system dynamics from multiple perspectives; and finally, encouraging plurality, rather than the unification of epistemologies, to foster innovative, diverse, and sustainable pathways during this formative moment for global environmental sustainability.

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Introduction

Most scholars looking critically at sustainability agree that growing inequality, environmental degradation, and climate change will not be remedied through incremental adjustments to the status quo. Instead, they believe that more fundamental transformations in broader social, political, and economic systems are needed [1]. Interest in societal transformation has opened exciting spaces for collaborative, diverse, and inclusive research that seeks equitable and sustainable development pathways [2,3••,4,5]. Transdisciplinary research — which addresses questions of broad societal interest and fosters integration not only among researchers from different disciplines but also with individuals and organizations from outside academia — is particularly attuned to sustainability [6–8].

Despite having shared objectives, the surge in interest in transdisciplinary research has exposed epistemological fissures within and between research communities, presenting challenges for transdisciplinary teams [9]. Fundamental differences in the way that knowledge is generated and interpreted, which translate into differences on how research is framed and conducted, can impede dialogue. Similarly, the dominance of one approach can systematically marginalize contributions from other paradigms [10]. For example, Cote and Nightingale suggest that the authority of ecological notions of resilience for understanding social–ecological system sustainability, 'has led to a kind of social analysis that hides the possibility to ask important questions about the roles of power and culture' [11, p. 479]. Narrow analyses can mean that critical insights are lost; and as a result, research recommendations may exacerbate unintended consequences, unsustainable practices, and inequality.

We explore how these points of tension may be overcome using a three-stage process. First, we call for greater epistemological transparency, where different worldviews are made explicit. Second, we propose the notion of feedbacks as a useful heuristic to facilitate transdisciplinary dialogue, accommodate a diversity of perspectives, and shift research focus onto difficult-to-identify relationships and interactions that shape sustainability. Third, we make the case for epistemological plurality as a step towards operationalizing the transdisciplinary research that is required to support the transformative turn in sustainability science.

Epistemological transparency

Everyone has an accent, except me.

Like accents, all researchers have an epistemological perspective; a set of beliefs about what constitutes

knowledge, how it is produced, and how it should be applied. Through epistemology, which is developed (in part) during our disciplinary training, we define what counts as legitimate research questions (conceptual framing), how the objects and processes of study are considered to relate to one another and to the world (theoretical framing) and the appropriate techniques and tools used to investigate a particular question (methodological framing) [12].

The degree to which these framings are similar or divergent within a research group can deeply affect transdisciplinary research [13]. First, some perspectives are founded on mutually exclusive beliefs, making transdisciplinary dialogue problematic. For example, the aim of establishing generalized principles for building resilience [14] stands in direct contrast to many critical social scientists' rejection of prescriptive approaches to global environmental change [15]. Second, some kinds of knowledge may be disregarded or distrusted by some researchers; differences between qualitative and quantitative approaches to social science, for example, may derail collaborative research efforts. Third, different analytical entry points can yield vastly divergent insights on the same phenomena, leading to calls for reflection on 'what can be known and also what *cannot* be known by using a particular method or model' [16••, p. 42]. In response to these challenges, transdisciplinary researchers are increasingly required to work beyond a single epistemology and become 'multilingual', or at least able to interpret and integrate research findings from different paradigms.

A useful entry point for transdisciplinary collaboration is to make individual framings explicit — a process that we refer to as epistemological transparency. Yet, this process is complicated by the difficulties that most researchers have in situating their own perspective within a broader context or continuum of world views. Many do not, or cannot, concisely define their own epistemology and are surprised if someone questions an approach that follows disciplinary norms. Collaborators must often infer a researcher's perspective from their language, questions, methods, and publication outlets.

Most successful transdisciplinary initiatives begin with a period of trust and relationship building. It is important during this early period that differences in epistemologies are discussed and that approaches to working together are established. These approaches must meet project demands without compromising disciplinary integrity. For example, a social scientist who usually works only with qualitative interview data may agree to collect some quantitative data during household surveys; or an ecologist might agree to stratify coral transects by fishers' use-zones rather than placing them randomly. As an exercise to facilitate epistemological transparency, teams may need to engage deliberately with some key disciplinary

Table 1

Examples of key differences between research paradigms in sustainability science.

	Critical social science	Social–ecological systems	Natural science
Prioritized objectives	Social equality; identification of social, political, or economic drivers of a resource management 'problem'	Often some particular outcome: for example, resolution of a resource management problem	Conservation of biodiversity, either generally or specifically; ecological sustainability
Research questions	Is sustainability a relevant problem? How does ideology affect sustainability? How does sustainability discourse shape social and ecological interactions and outcomes?	How resilient are current interactions between people and resources?	How can the decline of species X be halted? What are the drivers of unsustainable processes? How do they affect the system and how might they change in the future?
Basic assumptions	Knowledge gained by observation and subjective interpretation; seeks to bring about change by exposing and questioning dominant narratives	Knowledge gained in different ways in different disciplines, but favours systems explanations and quantitative analyses	Knowledge gained by confronting hypothesis with quantitative empirical data
Case selection	Positive selection based on the dependent variable; often single, in-depth case study	Dictated by perspective on how the system operates; may be single, in-depth case study or comparative	Random selection based on independent variables, often comparative across multiple cases
	Smaller *n*		Larger *n*
Methods	Qualitative, ethnographic, interviews	Mixed	Quantitative, modelling
Example: potential solutions to management of Kakadu National Park, Australia	Recognize and resist colonial ideology; return land to Binninj and Mungay owners	Undertake co-management that recognizes both biodiversity and cultural/spiritual values of land	Recognize importance of biodiversity and set land aside for nature as a National Park

Note: The column headings are meant as examples of the types of perspectives that individual teams members might bring to a project. Naming a perspective is less important than understanding collaborators' objectives, assumptions, and methods.