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# Coupling Human Information and Knowledge Systems with social–ecological systems change: Reframing research, education, and policy for sustainability

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## ARTICLE INFO

### Article history:

Received 4 January 2012

Received in revised form

28 July 2012

Accepted 12 November 2012

Published on line 21 December 2012

### Keywords:

Complexity

Ideal types

Human Information and Knowledge Systems (HIKS)

Social–ecological systems (SES)

Sustainability learning

Worldviews

## ABSTRACT

The rapid acceleration and intensity of global environmental change places great demands on humanity for developing innovative views and processes for the integration of knowledge in ways that are conducive to sustainability learning. In this paper, we argue that in order to develop robust sustainability learning feedbacks between knowledge and action we need the coupling of Human Information and Knowledge Systems (HIKS) with social–ecological systems (SES) dynamics. In particular, a substantial change in core worldviews and understandings about the nature of HIKS and how they relate to SES is required. Changing such epistemological and ontological assumptions of the quality of robust social–ecological knowledge is a first step for the emergence of transformative pathways towards sustainability in research, education, and policy. To enhance our understanding of such complexity, we describe two general ideal-type worldviews of HIKS and their relationships with SES in Western culture. One worldview understands information and knowledge systems as evolving in a closed, ahistorical, social–ecologically disembodied linear space, in ways which can be reduced to a single form of representation. The other worldview understands information and knowledge systems as operating in an open space composed of multiple and diverse patterns of hybrid social–ecological practices and configurations, inevitably embedded in specific times, spaces and contextual conditions. We argue that the open, but socio–ecologically embodied worldview is better suited to support sustainability learning and transformation.

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*‘The moderns do not know where they live.  
They have no world to reside in. They are homeless’.*  
Bruno Latour (2009)

## 1. Introduction

Human Information and Knowledge Systems and biophysical systems are part of a single unit: the global social–ecological

system. However, knowing what the boundaries, components, and relationships between the apparently different parts of this system is not an easy task. In a similar way, attempts to separate mind and body, has occupied a large share of the Western scientific endeavour since its very beginning. The academic battles to separate the two types of systems, and to reduce them endlessly into distinct parts, continue to the present (Midgley, 2006). To a great extent, the most pressing difficulties that science now confronts when trying to provide

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<http://dx.doi.org/10.1016/j.envsci.2012.11.005>

valid knowledge to cope with global problems of unsustainability are not purely ‘scientific’, or at least not in the traditional sense. They relate to a number of assumptions, beliefs and values that scientists use to construct their models and theories and generate their results (which often produce analyses relevant only to their own disciplines). At present, the production of scientific and technological knowledge tends to occur without adequate reference or “sustainability validation” regarding the social–ecological contexts in which the knowledge and the innovations would ultimately be utilised. Consequently, rather than society developing and harnessing knowledge consistent with the social–ecological conditions and requirements of sustainability, innovations tend to drive unexpected and often undesired negative effects, often on a large scale. To overcome the destructive tendencies that these prevalent ecologically detached worldviews and practices have on human imagination and creativity, we need new coupled epistemologies and a new ontology of knowledge: one that acknowledges and uses the essential and intrinsic value of multiple sources and configurations of information and knowledge systems that are relevant for sustainability. Specifically, by coupled epistemologies, we mean that the knowledge of the human system and conditions must be considered simultaneously and at a corresponding multiple scales with knowledge of the social–ecological systems.

The rapid acceleration of global change is creating urgent demands for new ways of understanding knowledge, as well as for development of new procedures to couple the dynamics of Human Information and Knowledge Systems with the dynamics of global environmental change (see also Cash et al., 2003). In this paper, we introduce the concept of ‘Human Information and Knowledge Systems’ (HIKS) to address the limitations imposed on our thinking and understanding with regard to sustainability. One limitation stems from the apparently irresistible drive to separate the realities of the world into (a) the information pools and knowledge produced and stored solely by human society and (b) the accumulated information in biophysical systems.<sup>1</sup> The other limitation has to do with the view of knowledge as advancing within closed, finite system, the gaps of which can eventually be filled. In particular, we argue that producing more science under the same assumptions and procedures of scientific organisation will not yield the type of results that we need in facing the global unsustainability crisis. Rather, a radical transformation in core worldviews about the nature and dynamics of HIKS and their relationships with social–ecological systems (SES) dynamics (Berkes et al., 2003) is required. The situation is not one that can be addressed by a simple or linear shift in current organisational patterns now, followed by a long, relaxing plateau without further change. Learning to learn, to modify what we have learned, and to promote adaptive thinking must be the goals of the trajectory of learning throughout everyone’s lifetime.

<sup>1</sup> The information in the bio-geo-sphere is there by virtue of its historical record, actual (dynamic) processes, and genetic data. Humanity struggles to access that information by observation and adds it to our human working knowledge of the ecological system. What is lacking is the acknowledgement of the interlinkages and the understanding and integration of our evolving insights into the bio-geo-sphere with the human social sphere.

The arguments presented in this paper can be seen as a meta-analysis of a large number of insights gained over a decade of EU research, integrated assessment, and sustainable development (see Section 4). The overall aim is to provide a relatively simple, synthetic and visual representation of a very complex area of scientific inquiry in a way that can be easily communicated. This meta-analysis is also intended to help develop robust narratives about the transformation and reconfiguration of HIKS so that they can be meaningfully coupled with the dynamics of global environmental change. While important programmes on trying to understand the complexity of coupled human and natural systems are underway (Liu et al., 2007), the role played by cultural worldviews and information systems remains under-researched.

In the present article we first briefly summarise our understanding and position with regard to the general concepts of information and knowledge systems and their relationships with learning, global change and sustainability. We will argue that the reorientation and transformation of Human Information and Knowledge Systems to meet the current sustainability challenges requires a complex systems perspective that is both holistic and dynamic, and above all, is linked to a social–ecological system that is recognisable by those agents that produce or use such knowledge. Secondly, we will introduce the ideal-type heuristics, in line with Weberian sociology, to provide a simplified characterisation of two general worldviews of knowledge systems currently observable in Western science, education and policy. These are, on one hand, a view whereby the progress of knowledge is understood as necessitating a translation into a single language that can be used to fill a hypothetical closed knowledge space (‘the knowledge gap-filling model’); and on the other, a view whereby multiple configurations of knowledge are not only possible, but urgently necessary to support progress towards sustainability. Under the latter view, multiple constellations of valid knowledge are seen to operate in an open space and the process of knowledge integration does not require their reduction to a single mode of representation.<sup>2</sup> In the next section, we argue that the latter view is better aligned and suited for ongoing international projects in sustainability science, education, and policy and finally end with a succinct conclusion.

## 2. Information and knowledge systems, global change and sustainability

Ideas and concepts such as the coming of the Anthropocene Age, the great acceleration, or ‘planetary boundaries’ are but

<sup>2</sup> The characterisation of worldviews with regard to how environmental issues are understood is not new in sociological research. Among the most prominent examples is the distinction between the “New Ecological Paradigm vs the Human Exceptionalist Paradigm” as specified by Van Liere, Dunlap and colleagues (the “NEP-HEP”; see Olsen et al., 1992; Dunlap, 2008). However, in this paper we do not look at ecological worldviews in general, but focus specifically on how information and knowledge systems are conceived and how such ideas can affect social–ecological systems (SES) interactions and governance interventions. See Section 4.

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