Transforming nature-society relations through innovations in research praxis: a coevolutionary systems approach

Book Section

Transforming nature-society relations through innovations in research praxis

A co-evolutionary systems approach

Ray L. Ison

Appreciating our context

At this historical moment when the evidence of widespread systemic failure is pervasive, ranging from financial to ecosystem collapse, there is good reason to reflect on our circumstances. The typical way to engage in such a reflection is to look outside ourselves at situations 'out there'. When we look we see and name carbon pollution, consumerism, inequality, human induced climate change, poverty, social alienation and habitat and biodiversity destruction. We are very adept at analyzing and naming problems or issues but we are not good at reflecting on what it is that we, as individuals, cultural groups, or as a species, do when we do what we do (Ison, 2010).

This paper is an invitation to the reader to reflect on what it is that they do when they do what they do. I acknowledge that many find this difficult as the practices associated with accepting the invitation are not commonplace in our daily living. Developing answers involves not only thinking but thinking about our thinking, or as I would have it, our doing! In this exploration of our contemporary context I want to draw attention to three matters: (i) how co-evolution is understood and thus what agency we might have in shaping trajectories for future nature – society relationships; (ii) how research as a form of practice is understood and (iii) how we choose to engage with situations in our attempts to change them for the better. I introduce several heuristic devices, or conceptual models, as a basis for exploring our understanding of these matters.

In the second part of the paper I introduce four forms of practice developed in research with colleagues and students; all are purposeful practices I consider relevant to attempts to innovate in governing (which includes managing) our co-evolutionary future. They are: (i) Rapid, multi-perspective appraisal, which has been developed in a series of research and consultancy settings over 20 years. It is based on

the assumption that when engaging with complex situations individuals only ever develop a partial appreciation (because of their traditions of understandings and the boundary judgments that are made). This practice can be used to better formulate research questions, research design, stakeholder engagement and for systemic staff induction; (ii) Metaphorical inquiry, developed on the understanding that human beings live in language and that all language is metaphorical; (iii) Social learning, a new paradigm for systemic governance, including for natural resources management (NRM), which moves beyond information provision, consultation and stakeholder participation to address the systemic complexity associated with multiple stakeholders attempting to transform their situations and (iv) systemic inquiry, an institution (as is a project or program) and an approach, or practice, currently being researched and developed as an antidote to living and operating in a projectified world.

A foundation for all four practices is systems thinking in practice (STiP), based on contemporary appreciations of the concept 'system'. How STiP can guide transformative praxis, or sustainable-development research praxis, is explored. The understandings on which these four practices are built have profound implications for the practices of researchers as we face an uncertain future and challenges to contemporary forms of democracy and capitalism (Hanauer and Beinhocker, 2014).

Adaptation as co-evolution

From my perspective the greatest challenge we as a species face is whether or not we can conserve, over time, our structural coupling with the biophysical world, with each other and with other species in a manner that conserves elements of quality. Structural coupling is a term which describes the co-evolutionary trajectory of a structure determined system with its medium or niche (Figure 1; Maturana and Varela, 1987).

Understanding structural coupling involves the ability to distinguish between domains, and in so doing taking a 'double look'. This also involves relational thinking. In Figure 1 the "observer eye", commonly used by Humberto Maturana (see Maturana, 2007), makes the point that the observer is always part of the system or the description, and that we can take different looks. As Bunnell (2008) points out: 'the circular arrow represents a living system in recursive autopoiesis (its constitutive domain, or physiology). The living system as a whole also has a reciprocal adaptive relationship with its niche (its relational domain or behavior).' Thus 'a living system cannot persist as such without conserving both. Yet we cannot claim that one causes the other, nor can we explain either in terms of the other, even though what takes place in one does alter the

dynamics of the other. Pedagogically this figure serves as a touchstone for noting the difference between the generative domain and the phenomenal domain – and for recognizing that confusing these looks leads to troublesome misunderstandings'.

Figure 1. *Two looks of an observer in noting the generative domain, or the resultant phenomenon in a different domain*
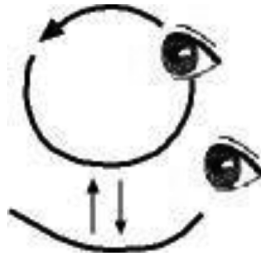
This figure depicts Maturana's iconic representation of a living system that remains conserved as such, as long as both autopoiesis and adaptation (structural coupling) persist.

Source: adapted from Bunnell, 2008, p. xiii.

The nature and dynamics of relational thinking and co-evolution can be understood through exploring certain phenomena and metaphors. Consider the question: How is walking conserved over time as a practice? From a relational thinking perspective the best answer is that the relationship between an organism (moving its legs in a particular way) and a medium (e.g. the floor, path, etc.) is conserved. Walking as a practice arises in the relationship between the two; when the relational dynamics break down then walking is no longer conserved.

Understanding co-evolution as the conservation of structural coupling is relevant to many conceptual and praxis (theory-informed practical action) fields. Collins and Ison (2009a) note that the word 'adaptation' has always been important in scientific fields associated with evolution, ecology and environmental change. At the level of metaphor they claim two possible conceptions of 'adaptation' are possible. Both have significant practical and policy implications but the implications differ. The first metaphor, and the most widespread understanding, is that of 'adaptation as fitting into'. In this metaphor something (predetermined) is fitted into a situation (also predetermined or knowable in advance) to which it is fit-able or suited, like when doing a jigsaw.

The other metaphor is that of 'adaptation as a good pair of shoes'. To appreciate this metaphor, consider what makes a good pair of shoes at a given moment? Usually it is because they have been worn in, they are comfortable, flexible etc. But these same shoes may not be a good pair of

shoes if they were put in a cupboard for a year before wearing them again. Why? Because a person's feet will have changed over the year but not the foot coupled to the shoes! Within this metaphor a good pair of shoes arises from the recurrent interactions between shoes and feet – this exemplifies co-evolution e.g. of a species and its niche. The process could be understood by expanding Figure 1 to depict the changing nature of structural coupling over time – a process in which there is mutual influence.

Within this understanding of the dynamics of co-evolution, a relevant metaphor is 'adaptation as co-evolution'. Rather than seeing adaptation as one way, co-evolution is different – the idea of a separate environment is set aside in favor of processes of mutual interaction which in human social systems can be seen as processes of learning and development (Ison, 2010). In an elaboration the shoes can also be understood as mediating the relationship between the foot (i.e. organism or social system) and the medium (i.e., the floor or biophysical environment). Thus in metaphorical terms a shoe can be understood as a form of technology or institution (in the institutional economics sense) that mediates relationships between a social and biophysical system i.e., influences the trajectory and quality of structural coupling.

Framing our contemporary concerns in terms of the on-going maintenance of structural coupling moves the focus away from widespread commitments to linear, causal thinking to systemic, relational, circular thinking and causation. Within this alternative framing nature and society could be understood as mutually self-creating and our research concerns might shift to questions regarding trajectory and the qualities of the relational dynamics. A simple way of understanding the latter can be the loss of amenity/experience many now encounter when they find it unacceptable that their children or grandchildren swim in the local river or drink at a local spring. In the breakdown of the quality of the relationship between humans and nature both what it means to be human and what is the nature of nature change.
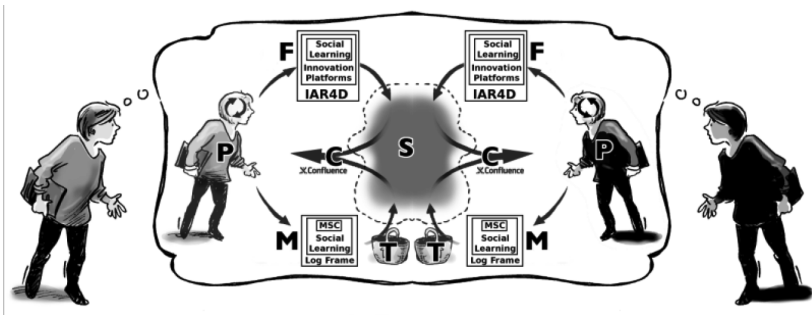
Research practice

The term praxeology means to develop a theory of practical action. This field of scholarship is, I contend, underdeveloped (but see Colvin *et al*., 2014) and in part accounts for why it is difficult to orchestrate effective action amongst individuals who have different disciplinary backgrounds (Ison, 2008a). As a means of reflecting on what it is we do when we engage in research practice a number of heuristics have been developed to explore the systemic, relational nature of research praxis (Ison, 2008a; 2010; Ison *et al*., 2014b). Figure 2 is designed to be used heuristically. In its simplest form research practice involves a

researcher/practitioner (P) with a framework of ideas (F), a methodology (M) and situation of concern (S)…a 'real world' situation. Of course no researcher is ever outside the research situation even though they may claim to be (i.e., thus claiming to be objective). Researchers are always socially situated and rarely is a researcher practicing alone – hence the configuration of practice depicted in Figure 2.

I do not propose to unpack this heuristic further here as it has been done extensively elsewhere. However I do want to highlight how unaware most researchers seem to be in relation to the agency they have in making framing choices about their situations of concern (see below). In other words we conserve the mainstream view of research practice which privileges the view that situations have 'real' properties independent of the relational engagement with the situation by an observer(s). Of course history shows this is an adequate framing choice for some situations, but it is certainly not adequate for the range of contemporary situations outlined above (Ison *et al*., 2014b).

Figure 2. *A heuristic model of research as a form of practice*

In this example learning in a two person project team comprising research practitioners (P) with agreement about a common theoretical framework (F; where IAR4D is Integrated Agricultural Research for Development) and methodological approach (M, where MSC is Most Significant Change), employing particular techniques (T) and committed to capturing joint learning (C, using a particular IT platform called Confluence).

Source: Ison *et al*., 2013b following Ison 2010, Blackmore, Ison & Jiggins 2007 and Checkland 1985.

If we consider Figure 2 systemically, as a whole then there are emergent properties of this practice; these include the possibility of:

- learning about each or all of P, F, M, S, T and C;
- considering the conduct of the research – the act of connecting all of the elements as a form of performance – e.g. how effective was the research (first-order effectiveness)?

- taking a meta or second order perspective on the researching system-environment relationship (as depicted in Figure 1 and in Figure 2 by the person(s) operating at two levels).

This heuristic (Figure 2) can be used to explore other aspects of research practice – by introducing more and different actors e.g. co-researchers etc.; by reflecting on the implications of epistemological awareness, but perhaps most importantly, for becoming aware of the means of engaging with situations in which research practice is being conducted.

How we choose to engage with situations

There is a rich literature on engaging with situations (Armson, 2011; Ison, 2010; McCool and Guthrie, 2001; Zwaan, 1999). Historically the main predisposition of researchers has been to refer to the 'problem' without awareness of the literature on the social construction of 'problems' and the realization that the 'problem metaphor' also conceals the idea of opportunities and other framing choices. The choice of framing for a situation cannot be divorced from an individual or group's epistemological, theoretical and methodological commitments. Thus for some researchers the situation of interest is a reality independent of the observer in which some phenomena or a phenomenon is of concern (Ison, 2008a). Others, as exemplified within the field of systems scholarship, have coined neologisms to describe situations with particular features (Ison *et al*., 2014b). Ackoff (1974) distinguished between messes and difficulties; Rittel and Webber (1973) between wicked and tame problems and Schön (1995) between the 'swamp' of real life issues and the high ground of continued 'technical rationality'. What is interesting is that all of these authors had experienced the uncertainty and complexity of 'planning' as an arena of praxis. From these experiences they coined different terms to describe what was, basically, the same set of phenomena that they had experienced (see Ison *et al*., 2014b where the implications of these framing choices are explored in detail).

A more recent neologism, beginning to be conserved amongst researchers who claim commitments to 'complexity theories', is the 'complex adaptive system' (e.g. Plsek & Greenhalgh, 2001; Ison & Schlindwein, 2006). From my perspective this is best seen as part of a lineage of responding to situations which are experienced as uncertain, complex, contested, interconnected (see Steyaert & Jiggins, 2007) by the practice of coining a neologism and reifying the situation as 'some thing'. From my perspective what makes this particular set of neologisms interesting is that they all characterize a particular type

of situation in which most forms of contemporary practice – across all domains – seem inadequate. Climate change adaptation is a case in point as well as hunger, food security etc. Ison (2008a) also suggests that taking up and institutionalizing trans-disciplinary research within the current national and international R&D systems can also be considered in this light.

Ironically, forty years after Rittel and Webber (1973) first coined the term 'wicked problems' there are well argued exhortations to develop capacities to manage 'wicked problems' beginning to appear in policy circles (e.g. APSC, 2007; Head, 2008; Head and Alford, 2013). These exhortations may, or may not, be linked to the need to introduce and institutionalize complexity and systems thinking perspectives (Ison *et al*., 2014b).

Let me exemplify these claims by exploring how we can choose to engage with agricultural situations and thus with practices designed to generate sustainable animal production technologies and practices. In this section I draw on the innovative and radical ideas that informed the development of student-centered learning approaches at the former agriculture faculty at the University of Western Sydney (Hawkesbury) (Bawden *et al*., 1985).

How agriculture is conceptualized determines how agricultural research is framed and thus what constitutes an innovation – a change for the better. Figure 3 depicts a model that conceptualizes dynamic autotrophic (plants), heterotrophic (animals) and decomposing sub-systems being managed but managed for a social purpose. Developed at Hawkesbury (Bawden *et al*., 1985), the model builds on agroecosystems analysis (Conway, 1985) and Checkland's (1999) concept of human activity systems and was used for teaching and research for many years. This conceptualization enables an exploration of the question of purpose (of research, farming, cropping animal production etc.) and how purpose for farming systems is attributed differently by different stakeholders. Because we each have different histories and thus mental models, the question of purpose underpins conceptually many of the issues associated with participation. In the past, researchers have often mistakenly attributed purpose (e.g. profit maximization in the case of farm management economists) in isolation from those affected by their attributions. Similarly dairy scientists have, from my perspective, too often focused on optimizing rumen efficiency at the expense of herd or whole farm viability and sustainability (see Pearson & Ison, 1997).

Figure 3. *A version of the Hawkesbury conceptual model of farming as a human activity system depicted as a human activity system co-evolving with a changing environment*
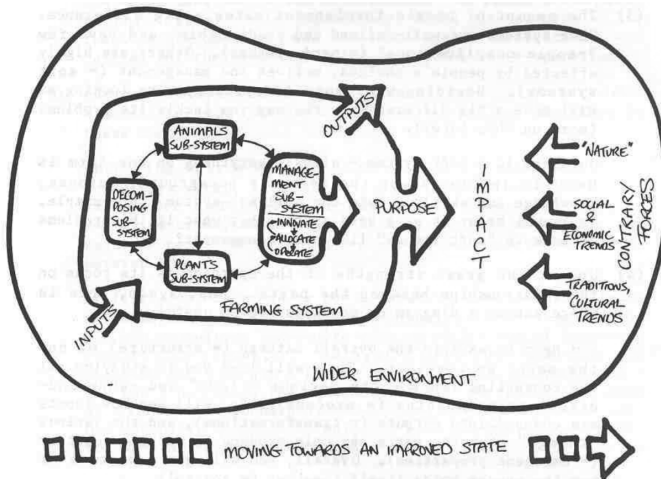
Source: see Bawden & Packham, 1993.

The other feature of note from the Hawkesbury conceptual model was the coupling of a farming system with a wider environment which together changed over time – an example of co-evolution with, not adaptation to, an environment (Ison, 2003). In Figure 3 a number of forces are depicted as 'impacting' on this co-evolutionary process (in later versions of the figure these were changed to double-headed arrows in recognition that 'forces' had the potential to act in different ways). This conceptualization contrasts with understandings of agriculture or farming in which implicitly or explicitly the only measure of performance is productivity (or efficiency) and agricultural practice or agricultural enhancement is seen as purely a scientific or technological endeavor. Exploring this model, i.e., using it heuristically, enables different stakeholders to reveal how they are conceptualizing agriculture or farming as a system of concern. Engaging with questions of purpose also enables boundary shifts in thinking such as, for example, moving to a 'livelihood system' of which farming is part, rather than 'farming' being *the* system of interest.

My own early experiences of farming, international development and the innovations at Hawkesbury were important influences in shaping my research trajectory over the succeeding 28 years after leaving Hawkesbury (see Ison & Russell, 2000). In the next section I describe four practices arising from this 28 year program that researchers could employ if they wished to develop a systemic, co-evolutionary praxis.

Practices relevant to a co-evolutionary future

Rapid, multi-perspective appraisal

Rapid, multi-perspective appraisal is a way of engaging with situations that acknowledges complexity and uncertainty and recognizes that all human beings have traditions of understanding out of which they think and act (see Ison & Russell, 2007). In part this research was inspired by the work of Robert Chambers and others who developed Rapid Rural Appraisal (RRA), later Participatory Rural Appraisal (PRA) and then later still, Participatory Learning and Action (PLA). My motivation however grew out of my own experiences of development failure (Ison & Russell, 2000) and my conviction that similar phenomena operated in my own country i.e., Australia. I also became more aware of the social construction of problems and how, all too often, these were formulated from a narrow, non-systemic perspective that led to research that was either irrelevant or not utilized. A particular limitation that soon appeared to me in my academic career was the limitations of narrow disciplinary perspectives (Figure 4).

Figure 4. *A series of abstractions from a particular situation from the perspectives of disciplinary experts*
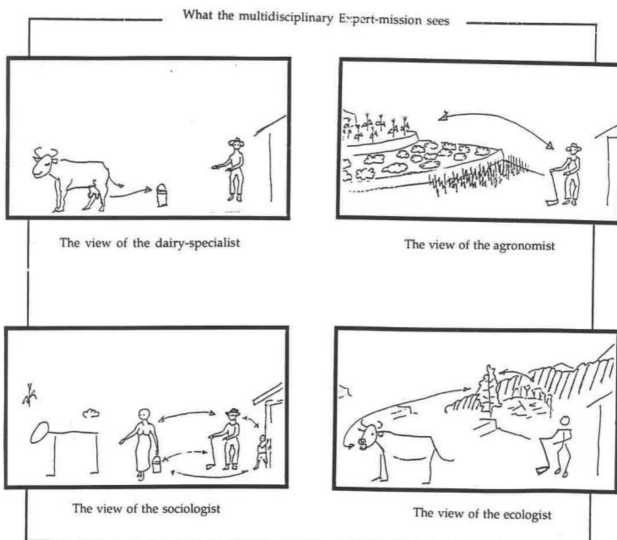

One can add these perspectives together (multidisciplinarity) or actively synthesize or articulate the implications of the differences (interdisciplinarity).

Source: Adapted from Pearson & Ison 1997 from original work by Ueli Scheuermeir.

In our adaptive research on RRA and PRA we were able to successfully design and conduct multi- and interdisciplinary engagements between different disciplinary experts and local people and thus to: (i) value different perspectives and knowledges; (ii) better understand the systemic dynamics of local situations; (iii) build stakeholding in research activity; (iv) remove commonly held misconceptions held by city-based experts about rural realities and (v) develop more appropriate research hypotheses systemically situated in the lives and circumstances of the intended beneficiaries (e.g. Figure 5; Ison & Ampt, 1992; Ampt, 1993; Webber & Ison, 1995).

Figure 5. *The basis for a research program: a conceptual model of the systemic factors giving rise to a late summer-autumn feed gap for livestock derived from a PRA conducted in the Forbes Shire, NSW*
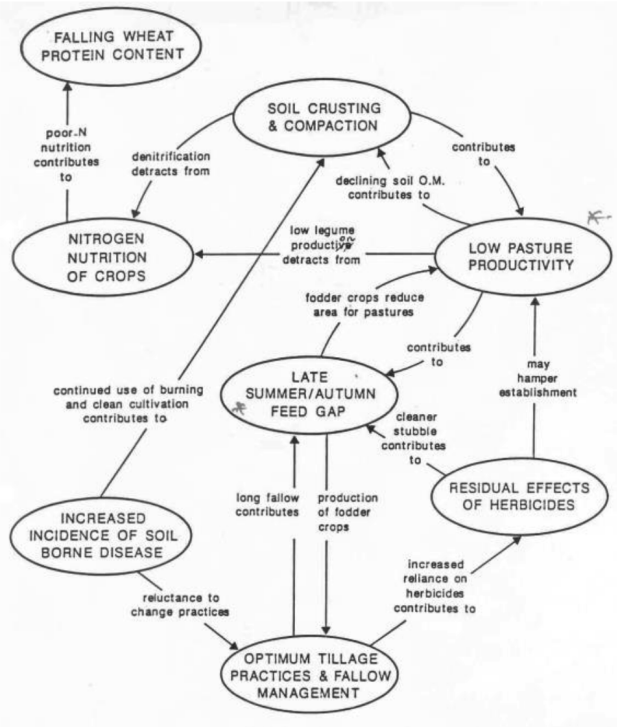
Source: Ison & Ampt, 1992.

Designed and managed appropriately rapid, multi-perspective appraisal can be a means to generate co-researching relationships and to generate genuine interdisciplinary collaboration. It can also become a

means to break out of the limitations of the linear transfer of technology trap (see Russell *et al*., 1991; Ison & Russell, 2007). This work has been further developed for use in organizational settings such as for staff induction where rather than being the subjects of induction, new employees become active co-inquirers into the systemic nature of an organization (Armson *et al*., 2001). Because our approach is inquiry based and recognizes the complexity of the situation, systemic understandings of an organization can be built, as well as personal networks, which increase staff effectiveness. The traditional induction model falls into the trap that considers there is a single, knowable organization which can be introduced to new staff by senior management.

Metaphorical inquiry

Ison (2005) and McClintock *et al*. (2004) outline the nature and rationale for our research on, and with, metaphor; this research is also built on an appreciation of the last 40 years of cognitive science research and the propositions that all human beings live in language and that all language is metaphorical (Lakoff and Johnson, 1999). Our concern has been to develop ways of appreciating and working with metaphors in which the broader research agenda has been to develop a praxiology for systemic governance in the context of sustainable development through systems thinking in practice (McClintock, 1996; McClintock *et al*., 2003; 2004; Helme, 2002; Ison, 2002; Ison *et al*., 2015).

McClintock (1996) elaborates on how we understand and use metaphor. His starting assumption was that different 'countrysides' could emerge from different ways of working with people because an explicit focus on metaphors and researching with people provokes different understandings and practices. His research began with the proposition that considering different metaphors is a way of appreciating diverse understandings and creating opportunities to learn for participants – to become both responsible and response-able. It is also a way of exploring the context of a situation before formulating problems or opportunities for purposeful action, a basic starting point for systems practice for environmental decision making (Blackmore and Morris, 2001). Metaphors provide a way to understand our understandings and how we use language because our ordinary conceptual system, in terms of which we think and act, is metaphorical in nature. Paying attention to metaphors-in-use is a way we can reflect on our own traditions of understanding (McClintock *et al.*, 2003; 2004).

Metaphors both reveal and conceal, but because we live in language it is sometimes difficult to reflect on our-metaphors-in-use. Being aware of the metaphors we do use can improve our understandings of research

situations and the choices we have in describing them (Ison *et al*., 2013a). The strategy of *mirroring* particular metaphors or metaphor clusters thus holds open the possibility for reflection and learning (Figure 6). For example, as outlined by McClintock (1996), the metaphor countryside-as-a-tapestry reveals the experience of countryside as a visually pleasing pattern, of local character and diversity, and of what is lost when landscapes are dominated by monocultures. However, the metaphor conceals the smell, danger, noise and activity of people making a living. By exploring metaphors, we can make part of our language use 'picturable' and thus rationally visible, publicly discussible and debatable, as well as a psychological instrument which can be a practical resource 'with which and through which we can think and act' (Shotter, 1993). It may also be used to explore and trigger enthusiasms – where enthusiasm is a predisposition to action (Russell & Ison 2007).

Figure 5. *A metaphor cluster generated in England in 1994-6 where the metaphor is read as:* farming or farmer as*.........*
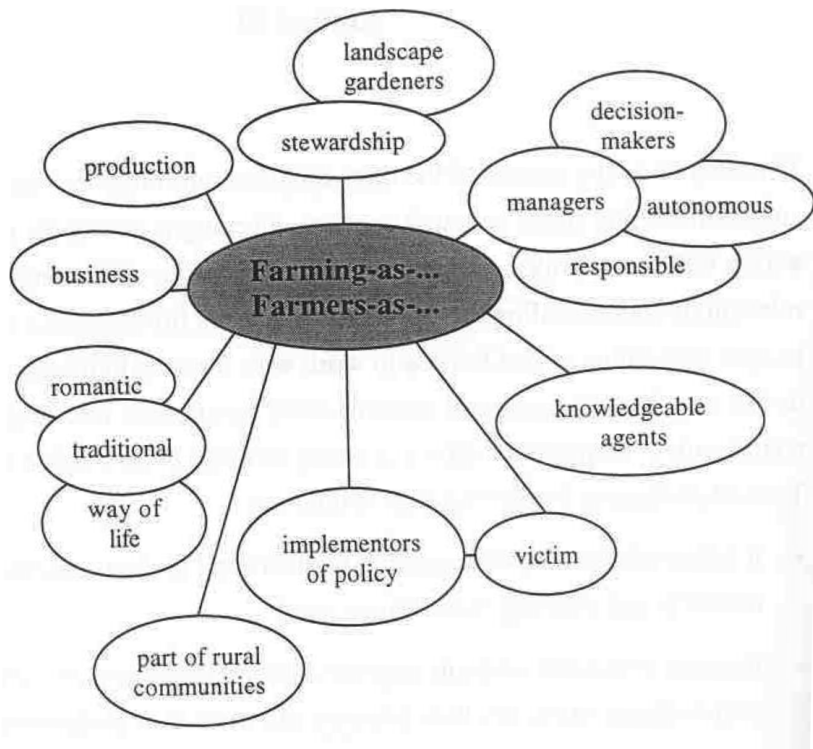
Source: McClintock, 1996.

McClintock's (1996) conclusions contribute to an agenda for meeting demands for increased transparency and participation in environmental decision-making. This in turn requires the building of social and relational capital through processes of social learning (see below). McClintock (1996) identified two parallel ways for working with metaphor: acting as practitioner-narrator and practitioner-facilitator (practitioner here can be translated as researcher, advisor, manager, community worker or government agent). The role of practitioner-narrator includes the following steps:

1. Make initial distinctions around the metaphors in present use (e.g. for landscapes, lifestyles, products, events).

2. Bring forth metaphors of the practice context.

3. Explore the metaphors by considering revealed and concealed aspects.

4. Judge enabling and disabling metaphors and identify alternatives.

5. Iterate, involving different people, different sources of metaphors, or different issues.

A practitioner-facilitator can use metaphors to create a space for understandings to emerge. A six-step process has been proposed:

1. Propose initial distinctions around metaphors and anticipate ways in which the distinctions can be meaningful.

2. Consider activities for jointly bringing forth and exploring metaphors (in workshops or on farm walks).

3. Consider activities to jointly juxtapose metaphors and consider what each metaphor implies and does not imply (a proxy for revealed and concealed aspects).

4. Revisit the distinctions around metaphors and propose further distinctions around judging metaphors, choosing between metaphors, and dominant and reified metaphors.

5. Consider activities to facilitate processes of 'moving between metaphors'.

6. Iterate steps 1 to 5.

Metaphorical inquiry can also be used to explore theoretical entailments of propositions, projects, policies etc. (Ison *et al.*, 2013a; 2015). For example, in work reported in Ison (2002) when policy makers responsible for a new 'knowledge transfer strategy' were engaged through a process of exploring their metaphors in use.

Social learning

For many years now there has been concern about stakeholder participation in R&D. This is a genuine concern but unfortunately

many participatory approaches have been poorly managed or have not been judged effective by those involved (High *et al*., 2008). Based on my own experiences I have come to the view that participation is a necessary but not sufficient ingredient of systemic, co-evolutionary practices (Ison *et al*., 2006). For this reason we have turned our attention to social learning. As outlined by Collins & Ison (2009b) 'while the 'social' in social learning refers to the collective process that can take place through interactions among multiple interdependent stakeholders who are given proper facilitation, institutional support and a conducive policy environment, the findings of the SLIM[1] project suggest that social learning can be understood as one or all of the following (adapted from SLIM, 2004):

1. The accommodation of differences as to what is at issue amongst multiple actors in a situation of concern leading to articulated mutual expectations and the building of relational capital. If social learning is at work, then convergence in perspective and relational capital generate agreement on concerted action for managing complex natural resource issues. Social learning may thus result in sustainable resource use.

2. The process of co-creation of knowledge, which provides insight into the causes of, and the means required to transform, a situation. Social learning is thus an integral part of the make-up of concerted action.

3. The change of behaviors and actions resulting from understanding something through action ('knowing') and leading to concerted action. Social learning is thus an emergent property of the process to transform a situation.'

4   The title for a governance mechanism which policy makers can employ.

Social learning, like a good concert orchestra, is about creating an effective performance amongst multiple stakeholders. The key need social learning addresses, is: how can effective performances amongst multiple stakeholders in situations usefully framed as 'wicked problem' situations be orchestrated? This involves the transformation of complex situations to improved situations through changes in understanding and practices of those involved (Figure 6).

---

[1] Social Learning for the Integrated Managing and sustainable use of water at catchment scale, a EU-funded framework project.

Figure 6.
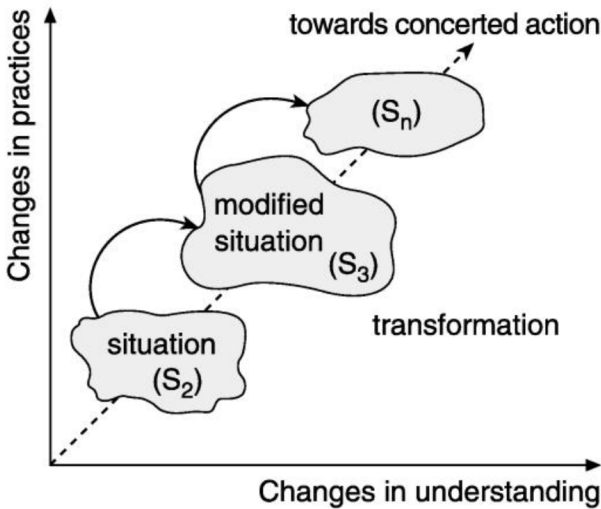
Situations characterized by complexity, uncertainty interdependencies, multiple stakeholders and thus perspectives can be transformed through concerted action by stakeholders who build their stakeholding and relational capital in the process. This leads to changed understandings (knowledge in action) and practices (S = situation; S1, not in the figure refers, to the history of the current situation, S2, transformed through joint action to S3 etc.).

Source: SLIM, 2004.

Systems-based social learning research provides one of the few theoretical and praxis frameworks capable of dealing with 'wicked problem' challenges such as climate change adaptation and the global water crisis. This is an area for further research; we need to better understand how social learning and systemic approaches can be introduced and sustained so that they effect ongoing social and institutional transformations that are viable (Colvin *et al*., 2014; Ison *et al*., 2014a).

Systemic inquiry – an antidote to living in a 'projectified world'

Systemic inquiry is a particular means of facilitating movement towards social learning (see above). It can be seen as a meta-platform or process for 'project or program managing' in that it has a focus on (i) understanding situations in context and especially the history of the situation; (ii) addressing questions of purpose; (iii) clarifying and distinguishing 'what' from 'how' as well as addressing 'why'; (iv) facilitating action that is purposeful and which is systemically desirable and culturally feasible and (v) developing a means to orchestrate practices across space and time which continue to address a phenomenon

or phenomena of social concern when it is unclear at the start as to what would constitute an improvement. We have used systemic inquiry as a basis for a research contract with the Environment Agency (England & Wales) and as a conceptual model of how to structure and evaluate our research activities in a context that is dynamic, uncertain and with many interdependencies (see Collins, Ison & Blackmore, 2005; Collins and Ison, 2010; Ison, 2010). In research from 2003-8 with the Environment Agency in the UK, responsible for implementing river basin planning within the European Water Framework Directive we found the use of particular project management methods (e.g. PRINCE2) to seriously constrain social learning and the systemic appreciation of what had to be done. Contemporary projects are designed for certainty, regularity, and the mistaken belief that all 'wicked problems' can be tamed within a project.

Systemic inquiry builds on, and extends Churchman's (1971) epistemological assumptions; it is concerned with the design of inquiring (or learning) systems and is grounded in various traditions of systems scholarship including second-order cybernetics and applied systems studies (Ison *et al*., 2007). Churchman (1971) addressed the design of inquiring systems. He reflected that the tendency, then prevalent, was to bolster science and its research as the paradigmatic exemplar of an inquiring system. He rejected this and observed that '… reflective learning in the literal sense… is the thinking about thinking, doubting about doubting, learning about learning, and (hopefully), knowing about knowing' (p. 17). He defined 'inquiry' as an activity which produces knowledge (p. 8); put another way inquiry facilitates a particular way of knowing which, when enacted, makes a difference. As Churchman (1971) observed, when exploring the metaphor of a 'library of science', the common definition of science as a systematic collection of knowledge is 'almost entirely useless for the purposes of designing inquiring systems… in other words knowledge resides in the user not in the collection… it is how the user reacts to the collection …that matters' (p. 10).

Systemic inquiry is an approach to managing complexity which is adaptive to changing circumstances and which draws explicitly on understandings of systems thinking, action research, cooperative inquiry and adaptive management. It is a key element of doing systemic development through which particular transformations – personal, social, situational – are realized (Ison *et al*., 2007). There is still much more to be done however in understanding how best to set up and institutionalize 'systemic inquiries' and to develop the praxis skills that are necessary to make them effective.

Contemporary systems thinking in practice (STiP) as a praxis foundation

The four practices outlined above rest conceptually and practically on contemporary systems theory as elucidated in Ison (2010). More precisely my work draws on both systems and cybernetics intellectual traditions which I call 'cyber-systemics'. It is not possible here to do justice to the recent literature in this field but for a French-oriented international audience I wish to draw attention to some important distinctions that now inform parts of the Anglo-Saxon cyber-systemics community. Drawing on the works of Checkland (1999) and earlier theorists such as Churchman (1971) with roots back to pragmatic philosophy, especially Dewey, as well as Husserl's phenomenology (Checkland, 1981) two distinct lineages can be discerned in both the systems and cybernetics fields. I refer to these as the systemic and systematic traditions (Figure 7; Ison, 2008b; Ison, 2010).

Figure 7. *The systemic and systematic traditions understood as a duality, a totality*
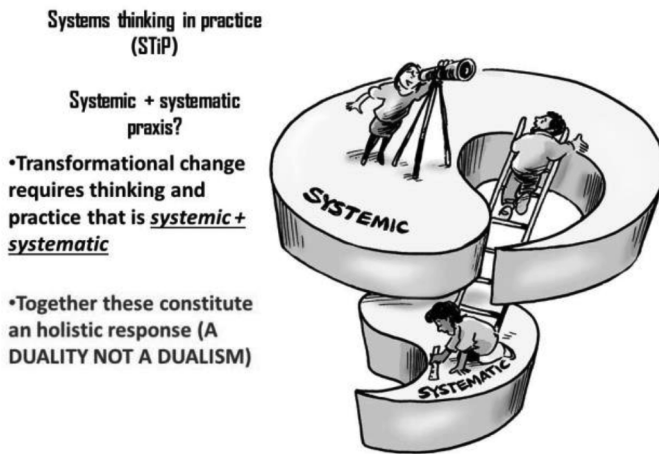
Source: Adapted from Ison, 2010.

Those with commitments to a systemic lineage appreciate that systems are brought forth by someone in a context as an epistemological device for learning about a situation of concern – where transformation is desired. Within this lineage a practitioner, or practitioners, make a framing choice to engage with a situation systemically through the generation of systems

as epistemological devices. In doing this a boundary judgment (to the system of interest) is made that distinguishes a system from a context (or environment) realizing not a thing called 'system' but a system – environment relationship mediated by a boundary judgment. Further, epistemologically aware cyber-systemicists understand that they can choose to act **as if** systems were real, discoverable, describable etc. In this case epistemological awareness and pluralism opens up more choices for practitioners concerned with situational transformation than does praxis committed knowingly or not to seeing systems as ontologies – things in the world. Similar understandings shape practitioner reflexivity in intellectual communities that are sometimes referred to as second (in contrast to first) order cybernetics.

Implications for sustainable development research praxis and nature-science relationships

Part of my purpose with this paper was to create the circumstances for readers to reflect upon what it is that they do when they do what they do. This inward look is far too rare in science and technology organisations (Ison *et al*., 2014c). As I remarked earlier it is much easier to look outside ourselves. When we look we see across the globe many current or recent examples of systemic failure or issues that need to be addressed systemically. These include: (i) the Global Financial Crisis; (ii) the spread of Ebola; (iii) the lack of a global agreement on climate change; (iv) the rise of Islamic State in Iraq and Syria. There are undoubtedly more. Not all would agree that these are examples of systemic failure, suggesting that most are usefully framed as 'wicked' or 'super wicked' problems' (Levin *et al*., 2012). I would suggest there are at least seven transformational challenges that need to be addressed to overcome systemic failure in doing what we do. These include: (i) widespread lack of epistemic awareness in domains of practice and policy development; (ii) a lack of awareness of the implications of living in language; (iii) inappropriate measures of performance for systems of interest (e.g. GDP understood as measure of performance for nation states – see Buchanan, 2013); (iv) little awareness of the implications of reification – the creation of 'things' such as the environment, resources, systems etc.; (v) lack of congruence between what is espoused and what others experience in individual and group practice; (vi) failures to institutionalize systems understandings and practices in manners that create demand pull and sustain institutionalization; and (vii) a focus on scientism at the expense of design (Metcalf, 2014).

Maturana and Varela (1987) argue that the transformation of our way of 'seeing' is a vital prerequisite for 'doing' things differently, because what we *do* in this world essentially reflects the way we '*see*' or construe

situations and phenomena in it. Wider appreciation of this aspect of the human condition is needed; it could be argued that it is the primary concern of research praxis for sustainable development because the contemporary issues we humans face, and the incidence of systemic failure, suggest that in doing what we do there is no longer room to do the wrong thing righter! Evidence shows that science and technology can exacerbate complexity and uncertainty rather than ameliorating (Hubert and Ison, 2011).

Conceptualizing innovation for sustainable development as a systemic co-evolutionary domain is a means to acknowledge the inherent uncertainty, complexity, interrelatedness, multiple stakeholdings and thus perspectives present in research situations. To frame situations in this way is a choice we can make. This strengthens a case for considering the understandings and practices that give rise to the praxiologies I have outlined in this paper. However, undertaking these shifts involves abandoning certainty (the search for a nineteenth century appreciation of 'objectivity') and being open to inquiry and surprise. This is difficult for many. A temptation is to reach for a new theory or set of explanations, such as some of those proffered under the guise of complexity science, in the belief that they offer a new form of certainty (Ison & Schlindwein, 2006). This should be avoided unless they are deployed to widen a praxis repertoire.

Systems thinking in practice (STiP) which attends to perspectives, multiple partial views, assumptions, framings, traps…and much more… still has much to contribute – I hope NSS, through this book, and its continuing activity can facilitate communications across the cultural and epistemological divides that characterize so much research praxis and which constrains reflexive innovation and transformation.

Acknowlegements

Bibliography

Ackoff, R.L., *Redesigning the Future*, New York, Wiley, 1974.

Ampt, P.R., *Problem identification for agronomic research: an evaluation of RRA*, University of Sydney, Unpublished MScAgr Thesis, 1993.

Armson, R., *Growing Wings On The Way: Systems Thinking For Messy Situations*, Axminster, Triarchy Press, 2011.

Armson, R., Ison, R. L., Short, L., Ramage, M. & Reynolds, M., "Rapid institutional appraisal (RIA): a systemic approach to staff development", *Systems Practice & Action Research*, 14, 2001, pp. 763-777.

APSC (Australian Public Service Commission), *Tackling Wicked Problems. A Public Policy Perspective*, Canberra, Australian Government/Australian Public Service Commission, 2007, 38 p.

Bawden, R.J., Ison, R.L., Macadam, R.D., Packham, R.G. & Valentine, I., *A research paradigm for systems agriculture. In Farming Systems Research. Australian Expertise for Third World Agriculture*, Canberra, Ed. J.V. Remenyi, ACIAR, 1985, pp. 31-42.

Bawden, R.J. & Packham, R.G., "Systemic praxis in the education of the agricultural practitioner", *Systems Practice*, 6, 1993, pp. 7-19.

Blackmore, C.P. and Morris, R.M., "Systems and Environmental Decision Making – Postgraduate Open Learning with the Open University", *Systemic Practice and Action Research*, 14(6), 2001, pp. 681-695.

Blackmore, C.P., Ison, R.L. & Jiggins, J., "Social learning: an alternative policy instrument for managing in the context of Europe's water", Editorial, Special Edition, *Environmental Science & Policy*, 10(6), 2007, pp. 493-498.

Buchanan, Mark, *Forecast. What Physics, Meteorology, and the Natural Sciences Can Teach Us About Economics*, London Bloomsbury Publishing, 2013.

Bunnell, P., "Editor's Foreword", in Maturana, H., *The Origin of Humanness in the Biology of Love*, Exeter, Imprint Academic Press, 2008, pp. v-xxii.

Checkland, P.B., *Systems Thinking. Systems Practice*, Chichester, Wiley, 1981.

Checkland, P.B., "From optimizing to learning. A development of systems thinking for the 1990's", *Journal of Operations Research Society*, 36(9), 1985, pp. 757-767.

Checkland, P.B., "Soft Systems Methodology: a 30-year retrospective", in Checkland, P. & Scholes, J., *Soft Systems Methodology in Action*, Chichester, John Wiley & Sons, 1999.

Churchman, C. W., *The Design of Inquiring Systems: Basic Concepts of Systems and Organization*, London, Basic Books, 1971.

Collins, K.B. & Ison, R.L., "Living with environmental change: adaptation as social learning", Editorial, Special Edition, *Environmental Policy & Governance*, 19, 2009a, pp. 351-357.

Collins, K.B. & Ison, R.L., "Jumping off Arnstein's ladder: social learning as a new policy paradigm for climate change adaptation", *Environmental Policy & Governance*, 19(6), 2009b, pp. 358-373.

Collins, K.B. & Ison, R.L., "Trusting emergence: Some experiences of learning about integrated catchment science with the Environment Agency of England and Wales", *Water Resources Management*, 24(4), 2010, pp. 669-688.

Collins, K.B., Ison, R.L. and Blackmore, C.P., *River basin planning project: social learning (Phase 1)*, Bristol, Environment Agency (see www.environment-agency.gov.uk), 2005.

Colvin, J., Blackmore, C., Chimbuya, S., Collins, K., Dent, M., Goss, J., Ison, R., Roggero, P.P. and Seddaiu, G., "In search of systemic innovation for sustainable development: A design praxis emerging from a decade of social learning inquiry", *Research Policy*, 43, 2014, pp. 760-771.

Conway, G., Agroecosystems Analysis, *Agricultural Administration*, 20, 1985, pp. 31-35.

Hanauer, Nick & Eric Beinhocker, "Capitalism Redefined. What prosperity is, where growth comes from, why markets work – and how we resolve the tension between a prosperous world and a moral one", *Democracy*, Issue #31, Winter 2014, see http://www.democracyjournal.org/31/capitalism-redefined.php?page=all Accessed 24*th* November, 2014.

Head, B.W., "Wicked Problems in Public Policy", *Public Policy*, 3(2), 2008, pp. 101-118.

Head, B.W. and Alford, J., "Wicked Problems: Implications for Public Policy and Management", *Administration and Society*, 2013, DOI: 10.1177/0095399713481601.

Helme, M., *Appreciating metaphor for participatory practice: constructivist inquiries in a children and young people's justice organisation*, PhD Thesis, Systems Discipline, Centre for Complexity and Change, The Open University, 2002.

High, C., Ison, R., Blackmore, C. & Nemes, G., "Starting off right: Reframing participation though stakeholder analysis and the politics of invitation", *Proc. Working Group 13 'The OECD's New Rural Paradigm'*, XII World Congress of Rural Sociology, Seoul, Korea, 2008.

Hubert, B. & Ison, R.L., "Institutionalising understandings: from resource sufficiency to functional integrity", in Kammili, T., Hubert, B. & Tourrand, J.-F. (eds.), *A paradigm shift in livestock management: from Resource Sufficiency to Functional Integrity*, France, Lirac, Cardère éditeur, 2011, pp. 11-16.

Ison, R.L., "Some reflections on a knowledge transfer strategy: a systemic inquiry", in *Farming and Rural Systems Research and Extension*, Proceedings Fifth IFSA European Symposium, Florence, April 2002.

Ison, R.L., "Developments in theory and practice of the concept of agroecosystems", *EISFORIA* (Publication of the Graduate Program of Agroecosystems of the Centre of Agrarian Sciences of the Federal University of Santa Caterina, Brazil), 1(2), 2003, pp. 122-158.

Ison, R.L., "Traditions of understanding: language, dialogue and experience", in Meg Keen, Valerie A. Brown & Rob Dyball (eds.), *Social Learning*

in Environmental Management. Towards a Sustainable Future, London, Earthscan, 2005, pp. 22-40.

Ison, R.L., "Methodological challenges of trans-disciplinary research: some systemic reflections", *Natures Sciences Sociétés*, 16, 2008, pp. 241-251.

Ison, R.L., "Systems thinking and practice for action research", in Reason, P., & Bradbury, H. (eds.), *The Sage Handbook of Action Research Participative Inquiry and Practice* (2*nd* ed.), London, Sage Publications, 2008b, pp. 139-158.

Ison, R.L., "Understandings and practices for a complex, coevolutionary systems approach", Proc. International Symposium: Selected Topics on Complex Systems engineering applied to Sustainable Animal Production. Instituto Tecnológico del Valle de Morelia, in Morelia Michoacán, Mexico, 2008c.

Ison, R., *Systems Practice: How to Act in a Climate-Change World*, London, Springer, 2010.

Ison, R.L. & Ampt, P.R., "Rapid rural appraisal: a participatory problem formulation method relevant to Australian agriculture", *Agricultural Systems*, 38, 1992, pp. 363-386

Ison, R.L. & Russell, D.B., "Exploring some distinctions for the design of learning systems", *Cybernetics and Human Knowing*, 7(4), 2000, pp. 43-56.

Ison, R.L. & Schlindwein, S., "History repeats itself: current traps in complexity practice from a systems perspective", Proc. 12th Australia New Zealand Systems Society (ANZSYS) Conference, "Sustaining our Social and Natural Capital", 3*rd* – 6*th* December 2006.

Ison, R.L. & Russell, D.B. (eds.), *Agricultural Extension and Rural Development: Breaking Out of Knowledge Transfer Traditions*, UK, Cambridge, Cambridge University Press, 2007, 239 p.

Ison, R., Blackmore, C. and Iaquinto, B.L., "Towards systemic and adaptive governance: Exploring the revealing and concealing aspects of contemporary social-learning metaphors", *Ecological Economics*, 87, 2013a, pp. 34-42.

Ison, R., Grant, A. and Bawden, R., "Scenario praxis for systemic governance: a critical framework", *Environment and Planning*, C 32, 2014a, pp. 623-640.

Ison, R.L., Collins, K.B. & Wallis, P., "Institutionalising social learning: Towards systemic and adaptive governance", *Environmental Science and Policy*, 2014b.

Ison, R.L., Allan, C. & Collins, K.B., "Reframing water governance praxis: does reflection on metaphors have a role?", *Environment & Planning C: Government & Policy*, 33, pp. 1697-1713, 2015.

Ison, R.L., Blackmore, C.P., Morris, R.M. with the course team, "Starting off systemically in environmental decision making", in *Environmental Decision Making: a Systems Approach (T863) Book 2*, The Open University, Milton Keynes, 2006, 268 p. (ISBN 9780749202651 – see: http://www.ouw.co.uk/bin/ouwsdll.dll?COURSET863_Environment).

Ison, R.L., Bawden, R.D., Mackenzie, B., Packham, R.G., Sriskandarajah, N. and Armson, R., From sustainable to systemic development: an inquiry into transformations in discourse and praxis, Invited Keynote Paper, Australia New Zealand Systems Conference 2007, "Systemic development: local solutions in a global environment", New Zealand, Auckland, 2-5 December 2007.

Ison, R.L., Carberry, P., Davies, J., Hall, A., McMillan, L., Maru, Y., Pengelly, B., Reichelt, N., Stirzaker, R., Wallis, P., Watson, I., Webb, S., "Programs, projects and learning inquiries: institutional mediation of innovation in research for development", *Outlook on Agriculture*, 43(3), 2014c, pp. 165-172.

Ison, R.L., Wallis, P., Bruce, C., Stirzaker, R. and Maru, Y., "Enhancing learning from AFSI research: Notes for the Field", *MSI Report* 13/10, Australia, Melbourne, Monash Sustainability Institute, 2013b.

Lakoff, G., Johnson, M., *Philosophy in the flesh: The embodied mind and its challenge to western thought*, New York, Basic Books, 1999.

Levin, K., Cashore, B., Bernstein, S., Auld, G., "Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change", *Policy Sciences*, 45(2), 2012, pp. 123-152

Maturana, H., "Systemic versus genetic determination", *Constructivst Foundations*, 3(1), 2007, pp. 21-26.

Maturana, H. & Varela, F., *The Tree of Knowledge: The biological roots of human understanding*, Boston, New Science Library, Shambala Publications, 1987.

McClintock, D., *Metaphors that inspire 'researching with people': UK farming, countrysides and diverse stakeholder contexts*, PhD Thesis, The Open University, 1996.

McClintock, D., Ison, R.L. & Armson, R., "Conceptual metaphors: a review with implications for human understandings and systems practice", *Cybernetics and Human Knowing*, 11(1), 2004, pp. 25-47.

McClintock, D., Ison, R.L. & Armson, R., "Metaphors of research and researching with people", *Journal of Environmental Planning & Management*, 46(5), 2003, pp. 715-731.

McCool, S.F. and Guthrie, K., "Mapping the dimensions of successful public participation in messy natural resources management situations", *Society and Natural Resources*, 14, 2001, pp. 309-323.

Metcalf, G. (ed.), *Social Systems and Design*, Tokyo, Springer, 2014.

Pearson, C.J. & Ison, R.L., *Agronomy of Grassland Systems*, UK, Cambridge, Cambridge University Press, 1997, 222 p.

Plsek, P., Greenhalgh, T., "The challenge of complexity in health care", *British Medical Journal*, 323, 2001, pp. 625-8.

Rittel, H.W.J., Webber, M.M., "Dilemmas in a general theory of planning", *Policy Science*, 4, 1973, pp. 155-69.

Russell, D.B., Ison, R.L., Gamble, D.R. & Williams, R.K., *Analyse Critique de la Theorie et de la Pratique de Vulgarisation Rurale en Australie*, France, INRA, 1991, 79 p.

Schön, D.A., "The new scholarship requires a new epistemology", *Change*, November/December, 1995, pp. 27-34.

Shotter, J., *Conversational Realities: Constructing Life Through Language*, London, Sage, 1993.

SLIM, *SLIM Framework: Social Learning as a Policy Approach for Sustainable Use of Water* (available at http://slim.open.ac.uk), 2004, 41 p.

Steyaert, P., Jiggins, J., "Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice", *Environmental Science and Policy*, 10(6), 2007, pp. 575-586.

Steyaert, P., Barzman, M.S., Brives, H., Ollivier, G., Billaud, J.P., Hubert, B., "The role of knowledge and research in facilitating social learning among stakeholders in natural resources management in the French Atlantic coastal wetlands", *Environmental Science and Policy* 10(6), 2007, pp. 537-550.

Webber, L.M. & Ison, R.L., "Participatory rural appraisal design: conceptual and process issues", *Agricultural Systems*, 47, 1995, pp. 107-31.

Zwaan, R.A., "Situation models: The mental leap into imagined worlds", *Current Directions in Psychological Science*, 8(1), 1999, pp. 15-18.