Systems Practice, Vol. 6, No. 1, 1993

Systemic Praxis in the Education of the Agricultural Systems Practitioner[1]

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Received August 28, 1992

This paper describes the context and the systemic experiential theories that have informed the praxis of educating agricultural systems practitioners. The praxis has involved a process of action research with students and with clients in farming and other rural community organizations. The praxis encourages learners to bring a range of methodologies of inquiry to bear upon problematic issues, contingent upon the nature of such issues. Informed by a number of different theories, and by reflecting on our own work, an earlier model of a nested hierarchy of systems of inquiry has been reconstructed to become a more useful guide to educational strategies: Each contingent methodology can now be seen to have its own learning, meta-learning, and epistemic learning dimensions. A key to enriched learning for responsible changes in agriculture and rural development lies in the facilitation of the consciousness of, and competency at, such a systemic pluralism of methodologies.

KEY WORDS: agriculture and rural development; praxis; systems education; learning; methodological pluralism.

The most important feature of the systems approach is that it is committed to ascertaining not simply that the decision maker's choices lead to his desired ends, but whether they lead to ends which are ethically defensible.

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1. PROLOGUE

A dozen or so years ago, a group of us at Hawkesbury decided that much that was being regarded as agricultural development in Australia and around the world was increasingly incongruent with the environments in which it was being

[1] Paper first presented at the 1991 annual meeting of the International Society for the Systems Sciences, Östersund, Sweden.

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0894-9859/93/0200-0007$07.00/0

pursued, and that this was in large measure a function of the prevailing paradigm of agricultural science. We posited that phenomena such as land degradation, the chemical pollution of food and waterways, the resistance to biocide by pests and pathogens, the deterioration of rural communities, and increasing farm indebtedness were just a number of symptoms of a common malaise inflicting agriculture as a whole—a malaise which had at its heart an inappropriate disposition of agricultural scientists which concentrated on the "desired end" of productivity growth rather than on land utilization patterns that were "ethically defensible."

We agreed with the contemporaneous submission by Kenneth Dahlberg (1979) that "the conceptual maps that most people have of agriculture fail to recognise it as the basic interface between people and their environments." And we were determined to reconstruct our own conceptual maps which embraced the vital interrelationships between farmers and both their land and their communities, all within a context of the "irreducibility of wholes."

In other words, we intuitively accepted the view that somehow, somewhere, systems thinking and holistic philosophies would be of use to us in dealing with the complexity and seeming deterioration of the agriculture/environment complex. Indeed we hoped that we would be able to illustrate strongly the contention that "systems thinking is an attempt, within the broad sense of science, to retain much of that tradition but to supplement it by tackling the problems of irreducible complexity via a form of thinking based on wholes and their properties which complements scientific reductionism" (Checkland, 1981).

The conundrum we faced was that we ourselves were victims of the deficiencies we recognized in the conventional paradigm of agricultural science: In some senses there is nothing more paradoxical than a paradigm which is so inadequate in its construction of nature and of the way nature is known that it cannot recognize its own inadequacies. As scientists reared in the traditions of positivism, reductionism, and empiricism, we found it extremely difficult to articulate the nature of the changes we sought. Indeed our first attempts at "radical" curriculum reform were much more noted for their systematics than their systemics!

Essentially, for several years we merely substituted the teaching of systems for the teaching of subjects. An early model that we published (Bawden *et al.*, 1984) (Fig. 1) reveals this paradigmatic entrapment, with agricultural ecology dominating as the new discipline and elements of classical plant, soil, and animal sciences, management science, climatology, economics, sociology, and anthropology all patently evident. Obvious, too, was our continuing commitment to the mechanistic concept of an integrated ecosystem "moving" in the direction of an imposed purpose and, in the event, creating impacts with the "forces" of nature and of society.

Here was a conceptual map, we argued at the time, that captured the

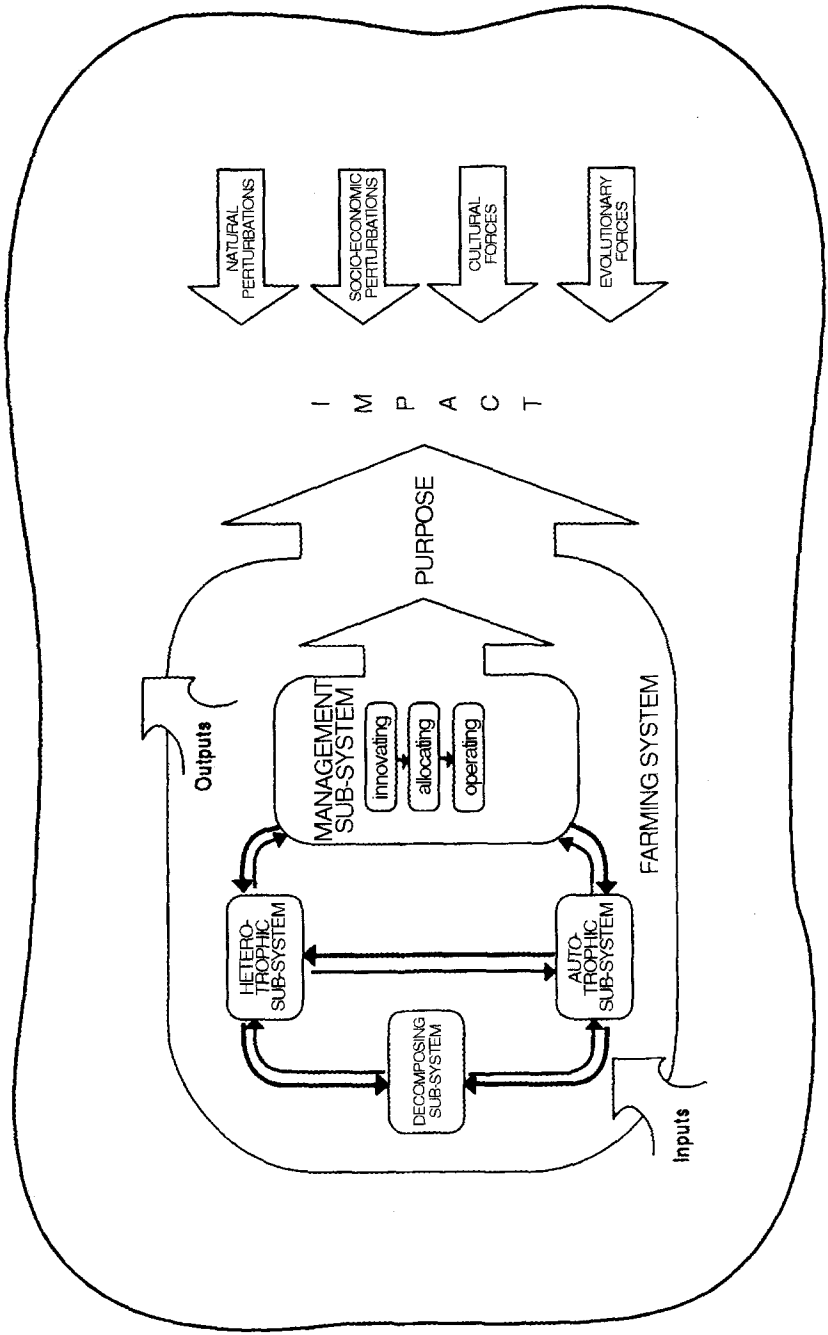

Fig. 1. A model of farming as a managed cybernetic ecosystem (from Bawden *et al.*, 1984).

essence of Dahlberg's critique, that was consistent with the notion which was beginning to circulate at the time of the farm as a managed ecosystem. We had little difficulty in accommodating the notion of the agro-ecosystem, as a transformed natural ecosystem whose complexity "at least in terms of its dynamic consequences, can be captured by four systems properties which together describe the essential behaviour of agro-ecosystems" (Conway, 1985). Indeed we were by now encouraging our students to be conscious of the need to address these four properties of productivity, stability, sustainability, and equitability and, also, discovering that while they were "relatively easy to define, (they were) . . . not equally easy to measure" (Conway, 1986).

2. DEVELOPING A SYSTEMIC, EXPERIENTIAL PROGRAM

2.1. The Turning Point

Our conceptual liberation from this mechanistic view came during the third year of the first intake into our remodeled curriculum, when the students, for whom we had been promising "learning autonomy," decided to accept it! To that point we had been guilty of continuing the reductionist separation of the students from their environments, in order to reduce the complexity of the issues they had to face. It was true that we had adopted experiential strategies from the start and that students were expected to learn their way through simulated problems and structured projects. But we were there, simulating the problems, structuring the projects, sneaking in key concepts from our disciplines, and indeed still behaving like good old didactic pedants while pretending to be experiential facilitators. We were still natural scientists wedded to a view of agriculture as a technical endeavor even if our ontological perspective had shifted to embrace the idea of the farm as a cybernetic system whose performance could be scientifically optimized.

The real constraint was that we were not effective role models for our students. By and large, we were not out in the community learning how to bring systems thinking and practices to bear on complex rural issues, as we were expecting our students to. Our major preoccupation was dealing with our own internal faculty matters, developing new teams for each new freshman intake, organizing the accreditation of new programs, and above all, learning about and actively promulgating the systemic theories and philosophies we really wanted to espouse.

In sum, our own systemic praxis was severely limited: We were neither true systemic agriculturalists nor indeed systemic educators! But we shared a passionate commitment to be both: With the launch of a curriculum endeavor aimed at the development of a competent Systems Agriculturist, the die was cast. Convinced of the need for radical change in the way we approached edu-

cation, we unanimously agreed as a faculty to adopt a systemic model of experiential learning as the process of inquiry which would pervade our learning community (Packham *et al.*, 1989). Experiential strategies would allow us, and all who studied with us, not only to explore new issues in agricultural and rural development in a truly participative manner, but also to explore new issues in how to be more effective in exploring new issues! In this context we would also become far more interested in the cybernetics of cybernetics (Smith, 1982) than of the cybernetics of systems *qua* systems.

2.2. The First True Steps to Autonomy

By the third year of the first intake of students, a number of the senior faculty were concerned about an increasing mismatch between what have been referred to as espoused theories and theories-in-action (Argyris and Schon, 1978). There was an increasing feeling that the rhetoric of the autonomously learning, systemic student was far removed from the reality. Certainly we had a model framework for the analysis of the agro-ecosystem but really we were soundly stuck in what we would now recognize as the Operational Level of Systems Management (Ulrich, 1988): "This is the level of non-social, *instrumental* action. It is concerned with the efficient employment of *things* rather than the development of inter-personal relationships." In our work on the analysis of farms and indeed of our own faculty organization and educational paradigm, we were reflecting techniques appropriate to the optimizing strategies of systems analysis and systems engineering, approaches which, as Ulrich (1988) emphasizes, "share an orientation that is better called systematic rather than systemic: They systemize the problem-solving process within a conventional framework of instrumental reasoning." They also reflected an onotological preoccupation without a concomitant epistemological concern.

One of us (R.P.), along with a senior colleague, invited a number of senior students to join in an analysis of our Faculty of Agriculture in which we would bring the soft systems methodology developed by Checkland and his colleagues at Lancaster University in the United Kingdom (Checkland and Scholes, 1990) to bear on the "mess" of issues which we felt surrounded the faculty. The details of that project have been published elsewhere (Macadam and Packham, 1989). Suffice it to state here that it was to have a profound effect on our systemic transformation in triggering the need to explore epistemological dimensions of systems theories.

Students would now be encouraged to bring a range of different methodologies of inquiry, ranging from reductionistic to systemic, to bear upon problematic issues contingent upon their nature. And the use of the word "methodologies" in this context is advised: Now we would accept that the "escape" from the epistemologies of positivism and reductionism dictated the need for

explicitly different philosophical stances. As Oliga (1988) has observed of methodological analysis, "it represents a bridging activity that aims at forging a correspondence between paradigmatic ontological assumptions and particular epistemological positions taken." It has allowed our students, working in concert with farmer "clients" and other agriculturalists and rural development professionals, plus faculty, to adopt what has been referred to in a somewhat different though related context as "methodological pluralism" (Norgaard, 1990). It has also examined the sort of strong epistemological heterogeneity so supported by Churchman (1971) and, more recently, by Reason and Rowan (1981). In our conception of this multiplicity of methodologies for human inquiry, we portray them as a "nested" hierarchy of different inquiring systems, linked, as it were, to each other, through a "spiral" moving "up" from the experimental methods of reductionist science through reductionist technology, through "hard" systems—analysis and engineering—to soft systems methodology (Bawden, 1985) (Fig. 2). Each system of inquiry is regarded as a variation on the basic theme of experiential learning—a dynamic process integrating "finding out" with "taking action for change"—where the differences in process reflect significantly different epistemological, ontological, and methodological assumptions.

Of particular importance to the Hawkesbury approach has been our reconstruction of the notions of research and extension as variations of "action researching or learning systems" (Bawden, 1990). The farm as a ("hard") rationally managed ecosystem is one thing; the farm as a ("soft") researching system learning to coevolve with its environment is quite another.

3. REFLECTING ON OUR SYSTEMIC PRAXIS

3.1. Ourselves as Systemic Action Researchers

Encouraged first by our students, then by our clients in farming and other rural communities and organizations, we have been building an impressive network of action researching projects or systems. Many of these have to do with helping others reconstrue their relationships—interpersonal as well as with the land. These developments have seen us move through Ulrich's (1988) "second" level of strategic systems management, to embrace what he refers to as "Normative Systems Management." As Ulrich (1988) has stated, "While strategic systems thinking takes account of the subjective rationality of other agents coproducing its outcome, it does so with an eye to the effective steering of complex systems (management of complexity) rather than to the ways in which the interests of others may be touched (management of conflict). Its orientation is utilitarian not communicative."

The contemporary issues of agriculture and its relationships with its envi-

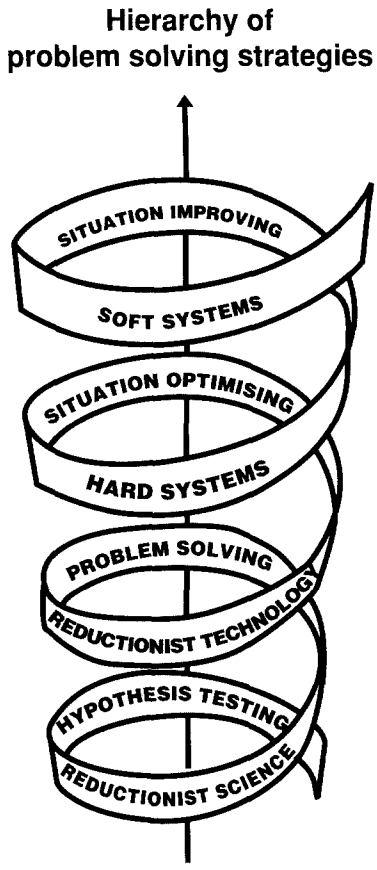

Fig. 2. The Hawkesbury spiral: a nested hierarchy of systems of inquiry (adapted from Bawden, 1985).

ronments—the stewardship of, and rights to land, the welfare of animals, the safety of the farm workplace, the quality of food, the practices of trade, and the quality of the resource base—are all issues replete with conflicting needs and interests, demanding communicative action. As Eckholm (1976) has pointed out, "Land use patterns are an expression of deep political, economic and cultural structure; they do not change when an ecologist or forester sounds the alarm that a country is losing its resource base." It is through involvement with issues of this kind that we all have come to recognize the poignancy of Churchman's (1971) proposition about the systems approach and the importance of ethical defensibility. We are all now embroiled (students, faculty, and "clients" alike) in issues which have ethical, aesthetic, and epistemic issues looming as

large as any other dimensions pertinent to decisions: The challenge lies in facilitating ways of dealing with the issues in a collaborative, communicative way.

As we are using collaborative projects in rural Australia and elsewhere to develop our praxis as systemic agriculturists, so too are we focusing intraspectively on the continuing evolution of our faculty as an "educational system." We have recognized the utility of Banathy's (1988) systems model approach, to education, and we are conscious of the advantages of his "system-environment lens," "functions/structure lens," and "process-focused lens," as a means to examine problematic situations systemically, just as we appreciate the systems management model of Ulrich (1988).

A particularly vital insight for all of our work was provided by Peter Checkland's (1988) call for the shift in systemicity "from the world to the process of inquiry into the world" and from optimization to learning as the key transformation for systemic praxis (Checkland, 1985). Indeed the whole notion of praxis—of the recursive relationship between "finding out" and "taking action"—can sensibly be captured only as as emergent property of "an inquiring system."

The notion that learning can be considered as occurring at different "levels," each of which represents a different "logical type," was proposed by Bateson (1972). He variously proposed up to four levels (0, 1, 2, and 3), recognizing that each level provided the context for the other levels nested within it. This was a powerful model for our understanding of learning and its link to systemic thinking and the ecology of minds. Our own learning was further informed by the work of the cognitive psychologists Kitchener (1983) and Salner (1986).

Kitchener's (1983) model discriminates among three levels of cognition: cognition, meta-cognition, and epistemic cognition. At the first level, individuals compute, memorize, read, etc.; at the second, meta-cognitive level, individuals monitor their own progress while engaged in the first-order tasks; at the third, epistemic level, they reflect on the limits of knowing, the certainty of knowing, and criteria of knowing. Thus it is epistemic assumptions that influence how individuals understand the nature of problems and enable them to decide what kinds of strategies are appropriate for solving them.

Salner (1986) uses Kitchener's model to propose that systemic learning requires "a certain way of thinking that is independent of the content of systems concepts" and that such learning requires competence at the epistemic level. She contends that where meta-cognition is concerned with thinking about thinking, at the epistemic level of cognition the concern is thinking about and evaluating the foundations of thought itself. This is a crucial proposition with extremely important connotations for education: Essentially it means that (a) one cannot "teach" a systemic epistemology to a mind not yet ready to accept it and (b) the acceptance of a systemic stance involves exploration by the learner,

of the nature of knowledge—in other words, to use systemic ideas cognitively, one first needs an epistemic flexibility. Salner also links this idea with the developmental model of Perry (1970), who suggests three broad categories of epistemic development. These are dualism, when knowledge is seen to reside in the external world and is either right or wrong; *multiplicity*, where rather than a single absolute truth, there are as many truths as there are people; and *contextual relativism*, where there is an awareness of the importance of contexts in defining truth and value, and epistemologically truth is determined dialectically and interactively. From this perspective Perry's developmental categories can be reconstrued as different styles of enquiring systems.

Parallels to these models of learning and development can be found in the adult learning theory of Mezirow (1981), with insights added by the recent critique of his theory by Clark and Wilson (1991). Mezirow also proposed three levels of learning; learning within meaning perspectives, learning by changing meaning perspectives, and learning through the transformation of meaning perspectives. He draws on the work of Habermas (1972) to underpin his theory, the goal of which is to derive meaning from experience in order to provide grounds for action.

Clark and Wilson (1991) are concerned that "this theory has apparently appropriated Habermas's epistemology without incorporating its radical social critique and consequent demand for collective social action . . . in the process of attempting to construe meaning from experience through critical reflection and rational discourse, Mezirow systematically seeks to remove the very element which brings meaning to experience: Context." This critique brings Mezirow's work into line with systems approaches, where the system and its environment (context) are logically inseparable if one is attempting to be holistic.

Drawing on the work of Hawkesworth (1989), Clark and Wilson (1991) further note that "although humans aspire to unmediated knowledge of the world, the nature of perception precludes such direct access. The only possible access is through theory-laden conventions that organise and structure observations by according meaning to observed events, bestowing relevance and significance on phenomena indicating possible strategies for proposed solutions." This view would be supported from a biological systems perspective by the work of Maturana and Varela (1988) and from a systems philosophy perspective by the notions of critical heuristics (Ulrich, 1987).

Embracing these many ideas has allowed us to reconstruct our "nested spiral of action researching systems." Informed by these and other critical concepts and theories, as well as through reflection on our own experiences as a critical learning community (faculty, students, and "clients" together), we have reconstructed our model of the nested spiral of action researching systems (Fig. 2) in ways which make it even more useful as a guide to educational strategies: Each of our "inquiring systems"—our contingent methodologies—now has its

own learning, meta-learning, and epistemic-learning dimensions, which, following a notion of Argyris and Schon (1978), we illustrate as "loops" but conceptualize as a hierarchy of systems and subsystems within the total suprasystem of human inquiry (Fig. 3). Each will have its own emergent properties of learning, allowing the insights of surprise through novel patterns of thinking, changes in learner disposition, and the synergies of cooperative inquiry.

The key to enriched learning and action researching for responsible changes in agriculture and rural development, then, lies in the facilitation of the consciousness of, and competency at, such a systemic pluralism of methodologies: systems theories and practices and practical philosophy as integrated wholes.

Our quest for sounder methodological pluralism continues unabated, to the benefit, we hope, of ethically defensible agricultural and rural development.

3.2. And the Challenges that Remain

Details of the evolution of the Hawkesbury systemic approach to agricultural praxis and of its education strategies and supporting theories have been presented elsewhere (cf. Bawden *et al.*, 1985; Bawden and Valentine, 1984; Macadam and Bawden, 1985; Packham *et al.*, 1989; Bawden, 1990). It is important to emphasize here that such changes have not been met without conflict: Indeed conflict is such an integral part of our ethos that we would probably be concerned if we detected its diminution.

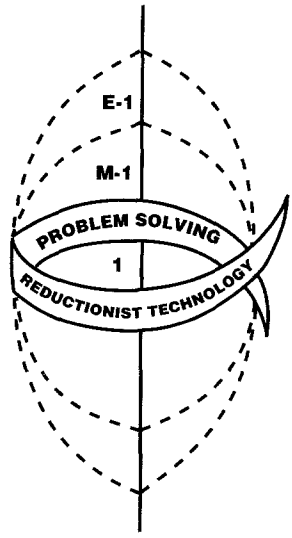

Fig. 3. "Loops" or a systems hierarchy of learning in each system of inquiry.

Part of the conflict relates to specific methodological issues, and we share with others many of the critiques of the soft systems methodology: its inherent functionalism (Jackson, 1982), its idealism (Rosenhead, 1984), and the lack of ethical dimensions (Atkinson, 1989). Exploration of these and other issues have led to further learning both through our own experiences and readings and through specific reference by writers such as Checkland (1985, 1986, 1988), Atkinson and Checkland (1988), Atkinson (1989), and Ulrich (1988).

The challenges that remain include the fights against what Churchman (1979) called the "enemies of systems rationality" as well as the power of conventional paradigms of research, extension, and education.

4. CONCLUSIONS

We could do no better than to conclude with Ulrich (1988) in his call for a research program for systems thinking, systems practice, and practical philosophy:

> We should develop a conceptual framework that would:
>
> a. assign an adequate place to, and yield proper standards of improvement for, all kinds of systems methodologies—conventional "hard" systems tools as well as newer "soft" and (anticipated) "critical" systems methodologies;
> b. help us to deal critically with the theories of social reality, and corresponding concepts of rational social action, implied by each type of systems methodology; and
> c. finally, embed the application of these tools within well-defined institutional and procedural arrangements for rational debate among the various parties involved in, and affected by, a decision.

Our conceptual map has now changed dramatically to accommodate these directions and dimensions—and most importantly, the way we have embraced the essential shift in systemicity. Our early agro-ecosystem construct, born of a "hard" systems tradition, has not proved particularly liberating: With others (e.g., Vayda and McKay, 1975; Engelberg and Boyarsky, 1979), we are increasingly skeptical of the cybernetic ecosystem as an accurate ontological portrayal of the organization of nature. Furthermore, the idea of the farmer as a "rational" manager of purposeful plant/animal relationships is fairly poverty stricken. The notion of a purposeful agro-ecosystem moving around in a field of environmental forces like some ideological tectonic plate, in its attempts to be more productive, stable, sustainable and equitable, is equally bereft of utility. The model's inadequacy has been reinforced by other systems initiatives in agriculture. Our work in the education of systems agriculturalists, for example, has paralleled a major international research initiative, particularly at the International Agricultural Research Centres, conducted within the rubric of Farming Systems Research and Development (FSR&D). Much has been claimed for this approach as holistic and integrated agricultural science: Yet close inspection reveals that it suffers

the same restrictions as that imposed by our agro-ecosystem construct. In this context, Brouwer and Jansen (1989) have recently submitted that "in FSR, the hard systems approach should be discarded and a critical alternative approach should be developed instead." Our position is not that the hard systems approach—or what we have called ontosystemics (Bawden, 1991)—should be abandoned: We posit that it does, however, need contextualizing. Entering the exploration of an issue from a "soft"—or episystemic (Bawden, 1991)—perspective allows the agriculturalist first to create a "critical heuristic," which integrates consultants/scientists with participants/clients into a human inquiry or action researching system.

Through collaboration, the actors comprising this human activity system can share learning methodologies, epistemological and ontological stances, ethical and aesthetic perspectives, and at base, enthusiasms. As an inquiring system, the group of participants can explore the messy issues which seem to contribute to the sense of unease which promoted the collaboration in the first place. It can identify other systems which promise insights and strategies for improvements, and among these might lie "agro-ecosystem" models which can be "manipulated" in the quest for performance optimization. More often, however, it seems to lead to transformations of a more profound nature in the way participant/clients go about making new sense of the worlds around them!

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