

Applying Systems to Capacity-Building in Participatory, Ecologically Informed Planning

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Abstract

Environmental legislation such as the European Union Water Framework Directive calls for more effective stakeholder and public participation in planning. Achieving the ambitious objectives of such legislation will require changes in behavior from a wide range of people. This adds impetus to call for more effective participation in planning, as people's motivation to change is linked to their understanding.

Recent policy reviews have identified a lack of skilled practitioners able to engage stakeholders in such planning as a major barrier to sustainable development in the UK. Developing effective training in facilitation and a supporting learning resource would help address this lack. This research in the NorthWest of England aims to develop a participatory process for ecological planning, which is based on a systems thinking framework, into a transferable methodology available to a range of practitioners. This will be approached through action research in 2006, and is supported by the Environment Agency and Manchester City Council. A literature review will examine best practices. The researchers will work with trainee facilitators to engage stakeholder and community participation in planning projects. Training techniques, to enable the facilitators to learn how best to use the process, will be developed and evaluated. Sources of data will include:

- In-depth, semi-structured 'before and after' interviews with trainee facilitators;
- Analysis of data collected during the action research from participant observation; and
- In-depth workshops with stakeholders to test and develop the training approaches.

The application of systems thinking principles to capacity building in participatory, ecological design will be explored in this research. In this paper a conceptual model based on systems thinking principles is developed for analysis of results from the ongoing empirical research. This builds on work to explore the teaching of ecological principles in design education, the development of living systems thinking in relationship to ecological design and eco-literacy, and recent applications of complexity theory principles to learning and innovation in organizations. This conceptual framework is developed within the contexts of shifts of the roles of practitioners in spatial planning.

Keywords: Participatory planning; ecological design; capacity building

Introduction

Sustainability is often heard as a goal, but it is widely agreed that it is hard to achieve this goal in practice. At the same time, there is increased pressure for more effective community and stakeholder participation in planning, but debate about the best way to mobilize and utilize such participation. Reflecting a global shift in awareness of the value of community and stakeholder participation in planning, several significant changes in policy have recently been enacted. The Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters entered into force in October 2001, and now has 40 signatories (UN ECE, 1998). Recent environmental legislation, such as the European Union Water Framework Directive, calls for more effective stakeholder and public participation in planning. Achieving the ambitious objectives of such legislation will require changes in behavior from a wide range of people. This adds impetus to call for more effective participation in planning, as people's motivation to change is linked to their understanding (Ison et al., 1997; Meppem and Gill, 1998).

Recent policy reviews have identified a lack of skilled practitioners able to engage stakeholders in such planning as a major barrier to sustainable development in the UK. The CABE report, *Building Sustainable Communities: Developing the Skills We Need*, states:

"The lack of relevant skills is the single biggest barrier to the development of sustainable communities... in particular, in the discipline of managing community involvement in the design and development processes" (Commission for Architecture and the Built Environment, 2003, pg. 3 - 4).

The Egan Review - Skills for Sustainable Communities lists nearly eighty occupations that are involved in the processes of "planning, delivering and maintaining sustainable communities", and discusses an urgent need to develop the skills required to deliver sustainable communities in all of these occupations (Office of the Deputy Prime Minister, 2004). In response to these reviews, nine Regional Centres for Excellence in Regeneration and a national Academy for Sustainable Communities have been launched (Academy for Sustainable Communities, 2006; Barton, 2006).

Several research projects have assessed participatory processes and their effectiveness (e.g. Aldred and Jacobs, 2000; Burton et al., 2004; Lowndes and Stoker, 1998; Oels, 2003; Tippett et al., 2005; Webler, 1995; Webler et al., 1995). A review of literature, however, has highlighted that little empirical research has been conducted on the efficacy of training practitioners for capacity building in the skills required to deliver the meaningful participation and integrated planning called for in recent shifts in policy. Developing effective training in facilitation and an accessible learning resource to support facilitators in their work would help address this lack.

This research in the NorthWest of England aims to develop a participatory process for ecological planning, which is based on a systems thinking framework (Tippett, 2005b), into a transferable methodology available to a range of practitioners. This will be approached through action research in 2006, and is supported by the Environment Agency and Manchester City Council. A literature review will examine best practices. The researchers will work with trainee facilitators to engage stakeholder and community participation in planning projects. Training techniques, to enable the facilitators to learn how best to use the process, will be developed and evaluated. Sources of data will include:

- In-depth, semi-structured 'before and after' interviews with trainee facilitators;
- Analysis of data collected during the action research from participant observation;
- Trainee facilitators' journals and debriefing feedback; and
- In-depth workshops with stakeholders to test and develop the training approaches.

The application of systems thinking principles to capacity building in participatory, ecological design will be explored in this research. In this paper a conceptual model based on systems thinking principles is developed for analysis of results from the ongoing empirical research. This builds on work to explore the teaching of ecological principles in design education (Johnson and Hill, 2002; Karr, 2002; Pulliam, 2002), Capra's (2002) development of living systems thinking in relationship to ecological design and eco-literacy, and recent applications of complexity theory principles to learning and innovation in organizations (Van der Walt, 2006; Webb et al., 2006).

As this is an early stage in the research, this paper is exploratory and largely theoretical in nature. It is intended as a thought experiment to support current empirical research.

Capacity Building

"The skills, aptitudes and attitudes necessary to industrialise the earth, however, are not necessarily the same as those that will be needed to heal the earth or to build durable economies and good communities. Resolution of the great ecological challenges of the next century will require us to reconsider the substance, process, and purpose of education at all levels" (Orr, 1994, pg. 77).

Participation in decision making and developing a shared understanding of problems and options, may increase the likelihood of changing behavior (Allen et al., 2002). This relates to a shift in understanding of the process of planning, which has been termed 'planning as learning' (e.g. Therivel and Partidario, 2000). Discussing findings from the research in the Global Environmental Change Programme (Economic & Social Research Council, 2000), Allen (2002) states "Consequently, environmental policy itself has come to be seen as a learning process where the interaction between policy makers and stakeholders is as important as the rules themselves".

Capacity building is defined as "strengthening people's capacity to determine their own values and priorities, and to organize themselves to act on these" (Gensamo, 2002, pg. 6). It consists of developing awareness, knowledge, skills and operational capability by actors to achieve their purpose. A process of capacity building to help stakeholders move towards sustainable communities offers opportunities to deliver several objectives at once. As discussed in Downie and Elrick (2000, pg. 251), community planning in environmental issues offers the opportunity to weave together policy objectives of "social inclusion, lifelong learning and active citizenship". Much of the development of participatory methodologies has originated in "less industrialized regions" of the world, and this link between participation and capacity building is stressed as a key benefit of participatory planning (e.g. Roberts, 2002).

Wilcox (1994, pg. 52) reminds us that effective participation requires skilled facilitation. Discussing the implementation of the European Union Water Framework Directive (WFD), Jones (2001) states that "river basin authorities must be prepared to devote time to careful planning and to invest meaningful financial and human resources. Such investment has the potential to be extremely cost-effective in terms of the benefits derived from WFD implementation". If this investment includes attention to capacity building in stakeholders, not only can some of the costs for continuous involvement be born by stakeholders and partnerships, but also the quality of the participation and plans is likely to be enhanced.

Learning is an essential component of management. Whilst it is individuals who learn, they do so in social groups. Social learning can be seen as a "combination of adaptive management and political change" (Lee, 1993, pg. 8). It is "a dynamic process which enables individuals to engage in new ways of thinking together to address problems such as the unsustainable use of water" (Social Learning for the Integrated Management and sustainable use of water at catchment scale - SLIM Project, 2003). Social learning can be seen as a desirable outcome from participation in planning, and a necessary component of political change (e.g. Sabatier and Jenkins-Smith, 1999).

A participatory planning process that encourages participants to develop plans requires the development of new skills. Skilled designers and planners will also be required to develop new ideas, to integrate complex technical information with the meanings and concepts that emerge from participatory planning into achievable plans and strategies. These designers will need to develop skills of communication and ecological planning in addition to the more traditional skills of design, drafting, and engineering.

New forms of production suggested by ecological design will require new forms of economic and social structures. Soderqvist et al (2000, pg. 1) suggest that in addition to formal means of changing behavior, such as laws and regulations, “*social norms, codes and other informal constraints for human behaviour*” will be required. Capacity building can thus be seen to be necessary for both individuals and organizations. It is necessary for professionals involved in facilitating participatory approaches and stakeholder involvement, as well as for projects involved in all aspects of changing the environment, from engineers to planners to economic developers. It is also essential that capacity building takes place at the community level, to enable community members to effectively contribute to the sustainable development of their neighborhoods. In this research, the research participants are starting from a good knowledge of landscape and ecological processes, and have some experience of running workshops. Further research is planned to test capacity building concepts for people with different levels of knowledge and experience.

The concept of capital is inherent in economic theory. It implies an accumulation, a build up of wealth, from which interest can be derived. Several sociologists have extended the concept from financial capital, defined as monetary wealth, to include human capital, defined as skills and education. The link between human capital, or skills and knowledge, and the economy was highlighted in the 1995 World Bank’s report. The ‘Wealth Index’ compared the financial and manufactured capital reflected on global balance sheets with the total value of human capital. It was found that the human capital was worth three times the more tangible measures of capital (World Bank, 1995).

In the oft-quoted article *Bowling Alone*, Putnam (1995, pg. 67) defines social capital as “*networks, norms and social trust that facilitate coordination and cooperation for mutual benefit*”. He sees it as a holistic, emergent property associated with places, which develops above the level of individual. Networks constitute the irreplaceable social capital of a city, which once lost can only be replaced by a slow rebuilding of the networks (Jacobs, 1961). Gilchrist (2000, pg. 264) emphasizes the role of developing well-connected networks to “*shape an integrated and dynamic social and organisational environment*”.

Foucault (1982, pg. 224) reminds us “*power relations are rooted in the system of social networks*”. Building social capital involves a process of stratification and consolidation, which can allow the more advantaged to “*reproduce and consolidate advantage*” (White, 2002, pg. 256). Policy networks, for instance, can serve to consolidate the voices of those ‘in’ the network, making it harder for the views of those ‘outside’ the network to be heard, they “*privilege certain interests, not only by according them access but also by favouring their preferred policy outcomes*” (Rhodes, 2001, pg. 10). Participatory processes can help to enhance the voices of the already powerful in decision making (e.g. Cooke and Kothari, 2001). Social capital can help to maintain conditions of inequality. This understanding helps to avoid blaming poor people for not using their capital, it may exist at the community level, but does not necessarily allow them to rise above the institutionalized networks from which they are excluded (White, 2002).

In a landmark, decades long, study into regional governance in Italy the existence of social capital and civic engagement was seen to be a prerequisite for successful governmental structure. Commenting on this study Putnam (1993, pg. 101) suggests that there is an “*almost perfect correlation between civil engagement and effective government*”. De Tocqueville contended that an abundance of civil associations contributed to the stability of American democracy. Civil associations, he insisted, were more crucial than political associations to a democratic society (de Tocqueville, 1969).

There is a reciprocal relationship between social capital and participation in democracy. The act of participation creates relationships and networks, which can help to build social capital. At the same time, the social capital may be the necessary prerequisite for civic engagement, and development of the “*cultural will to solve community problems collaboratively*” (Wilson, 1997, pg. 747). O’Riordan (1998, pg. 99) discusses the value of attempts to measure natural capital in stimulating debate about sustainability and encouraging “*society to look more carefully at those phenomena which society has never sought properly to measure or to care for in a comprehensive way*”. He goes on to suggest that “*the coupling of social and natural capital accounts is likely to be a concept that will attract political attention in the near future*” and gives examples of the interrelationship between these two areas in South Africa’s transition to a more democratic society. In this analysis capacity building is posited as an essential step in terms of improving the possibility for ecological sustainability. In a reciprocal relationship, the involvement of stakeholders in the process of ecological planning can in and of itself provide a powerful mechanism for capacity building. To be effective, capacity building requires careful attention to the forms of engagement and the design of participation events.

Systems thinking principles and capacity building for integrated planning

The report, *The Law of Sustainable Development* produced by the European Commission, explores the ‘legal theory of sustainable development’ and states: “*today, no serious study and application of the principles of sustainable development is possible without the help of systems science*” (Decleris, 2000, pg. 8).

There are three major strands of systems thinking, first order cybernetics, or ‘hard systems’, ‘soft systems’ and second order cybernetics, which combines insights from the first two strands. Hard systems approaches are concerned with information theory, feedback and control. Methods include attempts to model interactions, based largely in engineering, mathematical modeling and operational research (Maiteny and Ison, 2000). Studies often have a clear objective of optimizing a particular system, such as the early work during World War II planning military operations, e.g. intercepting aircrafts with missiles. In urban planning systems thinking had a major impact in the 1960’s, with a shift of understanding of the city from a series of spaces to be designed as fairly static blueprints mainly concerned with spatial features, to a complex set of interacting, dynamic forces (Hall, 2002). The application of hard systems modeling to urban systems, including traffic planning and housing allocation, was developed by planning theorists (McLoughlin, 1969) and continues to have an impact on environmental management systems such as Environmental Impact Assessment (Taylor, 1998) and River Basin Management (e.g. Franklin et al., 2001; Huffman, 2001; Knott and Haywood, 2001).

Soft systems methodologies include the perceptions of actors in the system, and are concerned with systems within systems. Unlike ‘hard systems’ approaches, systems are not seen as actual ‘things in the world’, but rather as constructs that are ‘brought into being’ by observers, thus including the worldview of the actors within them (Ison et al., 1997). Ison (1998) suggests that the definition of a system “*an integrated whole... whose essential properties arise from the relationships between its parts*” needs to include the concept that it is “*distinguished by an observer*”. Beer (1980) states “*A system is not something presented to the observer, it is something recognized by him*”. Soft systems approaches are based on a learning paradigm. Checkland (1991, pg. 285), author of *Systems Thinking, Systems Practice*, says, “*The unquestioned prime value embodied in ‘a systems approach’ is that continuous, never-ending learning is a good thing*”. Soft systems methodology emerged initially from the application of insights of systems engineering to social problems, and the realization that a description of real world systems as ‘machines’, in need of engineering to be able to better meet their objectives, was inadequate. Instead, systems were seen as including purposeful human actors, which were behaving in ways that were meaningful to them (Checkland, 2000).

Second order cybernetics incorporate general principles derived from biology which can be applied to other systems and “*a theory of the observer that emphasizes the interpreted and constructed nature of social reality*” (Mingers, 1997, pg. 304). Second order cybernetics includes insights from hard and soft systems perspectives.

Conceptions of science and the nature of living systems influence understanding of human culture. A shift in scientific paradigm could have profound implications for the organization of society and its relationship to natural systems. These implications are explored in the book *Gaia: A Way of Knowing, Political Implications of the New Biology* (Thompson, 1987).

Lakoff and Johnson (1999) illuminate the way humans construct meaning through metaphor. The important role of metaphor in the creation of meaning, and the role of mental models in filtering information, suggests that changing the metaphors used in planning is central to a shift in both our conceptions of planning and the way in which we can plan. Metaphors are not merely useful mental constructs, but can provide a powerful generative framework for rethinking the way in which humans interact with the environment. In a review of shifts towards sustainability in leading organizations, Doppelt (2003) argues that changes in mental models and assumptions are essential. They facilitate the organizational and cultural change he suggests is necessary to achieve changes in management and practice.

Earlier applications of new metaphors to reconceptualise fields of inquiry based on paradigms of systems thinking include:

- Jouni’s (2001) application of ecosystem metaphors to industry;
- an application of the metaphor of the living cell to community based rehabilitation for people with disabilities (Johnstone, 2003);
- thinking of democracy and consciousness from a perspective of the lessons of evolution (Banathy, 2003b);
- and applying an understanding of networks to understanding possible antidotes to terrorism (Ackoff and Strumpfer, 2003).

Concepts of systems thinking have also had a profound influence on the field of ecosystem management, in helping to understand “*the complexity of ecological and organizational systems*” (Wondollock and Yaffee, 2000, pg. 15). ‘Whole ecosystem approaches’ have yielded valuable insights in applications ranging from forestry to fishery management, to integrating indigenous concepts of nature with ‘modern’ modeling and management of wildlife populations (e.g. Kendrick, 2003; Seixas and Berkes, 2003; Trospen, 2003).

Research instigated by the Resilience Network explores systems concepts such as resilience, scale and emergence in relationship to ‘social-ecological system change’ (Berkes et al., 2003). The ‘Shire Conference’ brought together leading practitioners in the fields of landscape design, planning and ecology to explore the possible implications of the new paradigms for the art and practice of landscape planning (Pulliam, 2002). The book developed from the conference discussions concludes that both ideas about nature and the relationships between humans and nature are shifting. It highlights the advantages and the difficulties of bringing ecology into a closer relationship with design as a ‘framework for learning’ (Hill and Johnson, 2002).

In the research discussed here, an assumption is made that moves towards sustainable communities will require a holistic approach, and that the principles of second order systems thinking will be useful in this endeavor. The application of systems principles in a participatory planning process tested in action research in Manchester, UK are explored in Tippet (2005a; 2005b). The current research builds on this earlier research, extending it to look at ways of developing the skills necessary to implement such holistic planning.

In this paper, concepts of systems thinking are used as a structure to conceptualize capacity building in practitioners, in order to enable integrated planning. This endeavor starts with the assumption that any social-political system in which capacity building for participatory planning is intended will be inherently complex, thus developing understanding of these systems may be aided by annals of living systems principles.

In this emergent theoretical framework, eight major concepts of second order cybernetics based on a living systems paradigm are explored, namely:

1. requisite variety and the value of diversity;
2. holism and networks of relationships;
3. self similarity and links across levels of scale,
4. process and pattern;
5. self-organization and emergence;
6. unpredictability and triggers of change;

7. history and context;
8. and cognition as the process characterizing living systems.

These principles are derived from the synthesis of ideas in Capra (1996), building on the Santiago school of cognition (Maturana, 1992; Maturana and Bunnell, 1999a, b; Maturana and Varela, 1987) and the related cognitive work of Lakoff and Johnson (1980; 1999). They have been refined through the development of the DesignWays process of participatory planning and the action research testing this process in North England described above (see also <http://www.holocene.net/designways.htm>).

Ways these principles can help to develop new approaches in capacity building for integrated, participatory planning are explored below. Further sources of these ideas and reflections on the thinking behind the principles are detailed. This is seen as the first stage of developing a conceptual framework for analysis of the empirical data emerging from this action research, and as such will be refined through reflection and testing against the data in the next stage of analysis.

The following is a set of skills that the authors have developed as key for practitioners to be able to facilitate participatory, integrated planning, leading towards sustainable communities. This set of skills has emerged from research conducted by Tippet, testing an integrated approach to participatory planning, and in her work as a lecturer in spatial planning at the University of Manchester, as the key skills a planner would require in a post-modern world (based on developments in planning theory, including: Attfield, 1991; Baum, 2003; Beatley, 1994; Dear, 1986; Flyvberg, 2003; Forester, 1989; Imrie and Hall, 2001; Sandercock, 2003; Taylor, 1998). This is an initial set of skills, which will be further refined in the next phase of this research.

Awareness

- Observation and analysis of social processes
- Observation and analysis of ecological processes
- Openness to surprise and new ideas
- Ability to ask questions
- Knowledge of statutory, regulatory issues, plan making process – levers for, and barriers to, change

Critical thinking

- Uncover and explore assumptions – both your own and those of others
- Explore and be aware of differing cultural norms
- Ability to ask questions of the bigger picture – global issues and possible implications of decisions for economic vitality, social equity and ecological integrity
- Awareness of the many ways that power is enacted – formally and informally

Creativity

- Use of different types of knowledge
- Asking questions at a deeper level to generate new solutions
- Cultivating different ways looking at issues
- Adopting a flexible approach to process design in response to situations as they arise
- Linking vision and general principles to context – the particulars of a place/situation
- Facilitating/ enabling
- Encouraging others to develop their skills and knowledge base
- Creating the conditions for dialogue and questioning
- Bringing people and types of knowledge together to develop a shared understanding of problems and options
- Mapping stakeholders and being aware of possible diversities
- Communication and facilitation skills

Integration

- Develop shared understandings between disciplines
- Ecological design skills
- Multi-criteria decision making skills
- Adaptive management approach – assessment and readjustment of management in light of changes
- Leadership and governance skills
- Ability to link planning and thinking across different levels of scale

Ethical development

- Questioning your own values
- Reflecting on your role as a practitioner and citizen
- Being aware of possible consequences of actions
- Creating the conditions for learning cycles – being open to feedback and creating opportunities for reflection
- Humbleness and openness to admitting error
- Ability to use imagination
- Capacity for empathy, especially for others from different backgrounds to yourself
- Developing pragmatic judgment – ask yourself what you like, how you work as a human as a yardstick for judgment

The following section explores key concepts in living systems paradigm and how they might contribute to developing an effective model for capacity building in these skills.

1. Requisite Variety

Variety in ecosystems is essential for innovation. The word 'requisite' implies enough diversity to give a system the ability to react to change (Ashby, 1957). Discussing the need for a 'flexibility budget' Bateson (1972, pg. 497) said, *"pathologies of our time may broadly be said to be the accumulated results of...the eating up of flexibility in response to stresses of one sort or another"*. The concept of resilience is increasingly seen as essential in designing sustainable communities (Berkes et al., 2003).

Capacity building will require work in a variety of settings and contexts. Appropriate techniques for capacity building will vary according to the nature of the work, size and type of the project and the stage in the process. A wide range of methods have been pioneered for ways for people to interact, including new types of events and support frameworks.

In addition to the practical considerations of needing to adapt training and support for capacity building to each situation, the process of training needs to take into account the fact that people have a range of ways of learning, and that effective training will tap into and use a variety of means of promoting this learning. The originator of the theory of 'multiple intelligences', Gardner (2000, pg. 4), suggests, *"humans possess a range of capacities and potentials"*. The intelligences that Gardner initially identified are:

- logical-mathematical intelligence;
- linguistic intelligence;
- spatial intelligence;
- musical intelligence;
- bodily-kinaesthetic intelligence;
- intra-personal intelligence (ability to understand own emotions and motivation);
- and interpersonal intelligence (ability to understand motivations in social setting).

In addition, in a recent book, he has added:

- naturalist intelligence (ability to recognize and classify different patterns and forms of life in the environment), and
- existential intelligence is proposed as a possible further candidate.

Gardner (2001) writes that using multiple intelligences in learning means that lessons are *"much more likely to remain with us, embedded in our neural networks, and to be usable in flexible and innovative ways"*. This insight has profound implications for capacity building, emphasizing the need to develop new skills in ways that tap into these intelligences. In addition, capacity building processes can encourage participants to become more aware of their own strengths and weaknesses in learning styles, and to think how this affects their approach to facilitating the involvement of others.

2. Holism and Networks

The study of ecology has led to an understanding of ecosystems as networks of relationships, including the relationships of food webs, bio-geological nutrient flows and species' interactions with habitat. It involves understanding hierarchies of networks, in which an organism (a network of relationships of cells and organs) cannot be seen as a separate entity from the ecosystem in which it is embedded, which is a part of the larger network of relationships in the biosphere.

A central tenet of systems thinking is that 'the whole is greater than the sum of its parts'. This has emerged from a realization of the limitations of reductionism. This approach has produced much valuable knowledge, but comes across serious limitations in terms of understanding the properties of complex systems. To help meet this challenge of integration, practitioners need to learn to enable participants to explore and experience connections between different areas of knowledge. This requires new approaches that make connections visible, preferably which incorporate multiple intelligences to help participants to develop a deep understanding of these connections.

Castells (1996) writes of the 'rise of the network society'. This rise is influenced by the impact of the internet on communication, and the increased role of partnership working in many aspects of public life (e.g. Carley and Christie, 2000). A recent increase in interest in open source forms of knowledge creation may have profound impacts on the way we organize and share knowledge (e.g. Behlendorf, 1999; Keats, 2003; Peizer, 2003; Weber, 2004). Open source intellectual property allows people to use ideas without locking them up as proprietary intellectual property. This makes ideas easily accessible and can encourage many people's creativity to be harnessed in ongoing development. As open source models are extended to domains outside software development, there are many questions as to how best to develop structures that maintain consistency and encourage sharing of improvements and innovation. Principles for developing 'communities of practice' (Wegner et al., 2002) may help in this endeavor. Developing an awareness of connections amongst practitioners is encouraged by bringing together people from different backgrounds and encouraging them to learn from each other. This will be encouraged through developing incentives for such learning and support mechanism to encourage it, for instance through mentoring relationships, and the development of networks of learners who are able to support each other in developing new skills and areas of knowledge.

3. Self-similarity and Links Across Levels of Scale

Over the last three decades there has been an increased awareness that local actions have regional and global effects, and in turn local environmental issues can be affected by regional and global environmental change. Many environmental problems have only become apparent over time, due to delays between cause and discernible effect. This lag is further complicated by the fact that global climate change, pollutants and ecological problems cross boundaries of scale, such that effects from a source of pollution or a human activity may be manifested at a different level of scale than its cause (Gibson et al., 2000). Such awareness points to the need to develop capacity in practitioners to link analysis and action across levels of scale.

An attempt to find principles applicable at multiple scales has been central to the development of systems thinking. This endeavor aims to reduce the duplication of effort and to promote improved communication between people working in different fields (e.g. Checkland, 1991; Maiteny and Ison, 2000).

Capacity building processes that actively seek opportunities to bring together actors working at different levels of scale would promote the skills of linking planning across scales. This would be enhanced by developing communication and training materials that show similarities of principles and ideas across levels of scale, and which enable participants to think of differences and similarities between the levels. In this endeavor, exploring global principles of sustainability can offer a means of linking an embodied awareness of understanding and global similarities of geo-biological resource flows, which can foster understanding, as the Earth is a common factor between all participants in a planning process. Governance structures could encourage communication between actors working at different levels of scale.

4. Process and Pattern

Physical forms are like ripples created from dynamic change, chimeras which may be relatively stable, but which are derived from the maintenance of self-organization in a state far from equilibrium. Patterns are configurations of relationships, which are expressed as repetition and similarities in space (form) and time (development). An understanding of patterns provides an essential link between insights into the interconnected nature of the world and design (Tippett, 1996, 2000). A pattern language, or set of organizing principles, can act as a tool for thinking about design (Alexander et al., 1977).

The concept of enacted cognition (Maturana and Varela, 1987) with its emphasis on learning through moving and physical engagement with the world "demonstrates how the way we experience the world is very much an active construction involving the whole body" (Mingers and Brocklesby, 1997, pg. 500). Capacity building processes should include stages which encourage observation, and direct experience, of natural systems in the local landscapes, to help develop naturalistic intelligence and awareness of the relationship between process and patterns. Such active learning can be enhanced through using the local landscape in the areas of training as a learning resource (Hough, 2002)

In addition, participants in learning can be encouraged to consider the nature of flows of energy and materials in the areas in which they work, and how these relate to the patterns of infrastructure and landscapes they are working with, to develop their own awareness of these flows. They will thus be better able to work with others to encourage an awareness of sustainability issues.

The concept of process and pattern also implies that careful attention to the form of the training and communication tools used to encourage capacity building can have an effect on its effectiveness. For example, graphic, interactive toolkits which encourage participants to explore and make visible connections between ideas, in a process of learning that allows patterns to emerge and be made visible, can help deepen learning of principles.

5. Self-organization and Emergence

A major concept of second order systems thinking is that of self-organization, in which the interaction of different elements can create emergent properties, which cannot be predicted from the sum of the parts of the system. As the concept of self-organization has been explored with more sophisticated mathematical modeling, new understandings of "the creation of novel structures and modes of behaviour in the process of development, learning, and evolution" have been developed (Capra, 1996, pg. 85).

The trend of applying systems thinking to organisational management was seen in early work of Beer (1980; 1995) and de Geus (2002) and popularized in books such as *The Fifth Discipline* (Senge, 1990) and the work of Wegner (2002). The concept of self-organization plays an important role in this work, and management is seen as an arrangement so that people can self-manage, and create learning organizations through their dynamic interactions.

In terms of capacity building, trainers and program managers need to recognize that the way that different people will learn will be inherently different, and that learning will emerge from the interactions of actors in a dynamic situation. This implies a need to allow learners to tailor a program of training to their own needs, to allow for flexibility as different opportunities arise in the process. It implies allowing trainees opportunities to manage their own learning process, and to integrate this with their developing awareness of their skills and roles as practitioners (e.g. Banathy, 2003a).

6. Unpredictability and Triggers of Change

Systems which are open to a flow of energy, information and materials self organize in unpredictable ways, dependent on the interaction of the parts, and on the context in which this interaction takes place (Kay et al., 1999). In terms of increasing knowledge about causality and possibilities for technology, 'reductionist thinking' has had tremendous success. Its intellectual process has been characterized by fragmenting the world into its smallest indivisible pieces, and attempting to describe and understand the forces interacting on these parts. This has led to an increased ability to predict events in many circumstances. The role of many of the institutions of science has been to provide sufficient information and predictive ability to enable humans to control and manipulate nature.

Recent discoveries of the interconnected and complex dynamic nature of the world have suggested, however, that there is a fundamental limit to knowledge derived in this way. Ecological systems cannot be fully described and understood from a description of the interaction of simple particles in a Newtonian field of forces. This was brought to attention by the meteorologist Edward Lorenz in the 1960s, through his attempts to model the weather. In his words, "I realized that any physical system that behaved non-periodically would be unpredictable" (quoted in Capra, 1996, pg. 134). Systems thinking has arisen in part in response to three problems in science: "complexity in general, the extension of science to cover social phenomena, and the application of science in real world situations" (Checkland, 1991, pg. 74).

Ackoff (2003) stresses the need to be able to make mistakes, or to admit that unexpected consequences have arisen from actions, and to learn from them. Changes in planning process will require practitioners to be willing to admit to mistakes and to discuss potential learning in new areas, which is not always a comfortable process. Change needs to be supported from directors and key people in the higher ranks of organizations, helping to create a culture in which admission of mistakes is seen as not only acceptable, but a necessary part of learning. An attitude of 'zero tolerance of failure' needs to be replaced with zero tolerance of rigid attitudes and lack of learning. It is an encouraging sign that *The Egan Review* suggests job applicants for the proposed National Centre for Sustainable Community Skills must have at least one failure from which they have learned.

7. History and Context

In addition to a recognition that the interactions in complex systems can give rise to new and emergent properties in a process of self-organization, studies into evolving systems have shown the importance of the starting points and context of the system on the overall evolution of the system. The metaphor of the machine has influenced planning for some time. The underlying metaphor of design in a process of planning for sustainability can be that of a living ecosystem. This metaphorical understanding is based in patterns and similarities in the processes of evolution and development of complex organisms. Each ecosystem develops in relationship to the context of the place, and is both affected by, and affects, its surroundings. Life is not simply an accident on inert rock. Living organisms are engaged in a dynamic interplay of matter and energy, a sun-driven dance that connects rock, water and atmosphere. There is a tendency towards a self-organizing state, embodying resilience, but one which is adapted to the particular circumstances of the place.

Any process of capacity building will involve working with people who have their own history and context of knowledge and worldview. These diverse starting points needs to taken into account in capacity building, respecting the experiences of the learners, whilst encouraging reflection on how people's experiences and prior learning affect their ability to develop new skills and capacities. Starting with processes to elicit people's understandings, and allowing opportunities for participants to discuss their own experiences and stories, is important in providing a learning environment in which people are able to connect new learning to their own context. Through sharing stories of their own learning process and development, trainers can help ground abstract principles in real examples. Trainers are thus demonstrating in their own behaviour the processes of change and reflection that are essential for developing new skills.

In this endeavor, Kolb's (1973; 1984) insight into the value of learning cycles is important. In any capacity building program, it is important to allow for hands on experience, reflection, conceptualization and further active experimentation in a cycle of learning.

In addition to skill, effective deployment of participatory planning requires careful consideration of how to tailor the planning process to the particular context. This implies both attention to the needs and interest of the participants, and an understanding of the reasoning behind the process, so that it can be adapted without losing its essential essence. This may need to be done 'on the fly' during workshops, requiring a degree of flexibility on behalf of the facilitator. Training should encourage an awareness of the underlying principles behind participatory tools, preferably in a context of practice, so that facilitators are offered support as they learn to use it in different contexts, and learn when and how it is appropriate to adapt the tools and approaches to meet the different contexts they are experiencing, and the emerging interactions of stakeholders.

8. Cognition Characterizes Living Systems

If the aim is to design in a way more consistent with living systems, it is worth asking, *'What is life?'*, as did the Chilean biologists Maturana and Varela (1992). They found that the answer was inextricably interwoven with the question *'What is cognition?'*. The process of knowing and self-reproducing in the world is inherent in the act of living (Maturana and Varela, 1987). This insight led to the development of the theory of autopoiesis, which explores the relationship between the process of interacting with the environment and the development of living organisms. The idea of 'enacted cognition' in autopoiesis:

"was the result of suspecting that biological cognition in general was not to be understood as a representation of the world out there, but rather as an ongoing bringing-forth of a world, through the very process of living itself".

The theory has led to an exploration of emerging properties of living systems at different levels of scale. This includes a debate about whether or not the interactions of the earth's geo-chemical cycles and living organisms in a state of dynamic homeostasis can be considered as constituting the Earth itself as a living entity (e.g. Lovelock, 1991; Sagan, 1990).

In his search for *'the pattern which connects'* Bateson (1972; 1979) looked at concepts of cognition and life, attempting to understand how systems self-organize and adapt in a constantly fluctuating environment. The importance of patterns in a holistic view of the world is emphasized in the following quote from Holism and Evolution, written in 1926 by the Prime Minister of South Africa:

"If you take patterns as the ultimate structure of the world, if it is arrangements and not stuff that make up the world, the new concept leads you to the concept of wholes. Wholes have no stuff, they are arrangements. Science has come round to the view that the world consists of patterns, and I construe that to be that the world consists of wholes" (Smuts, 1926).

Advances in the science of dynamic systems, including complexity and chaos theories provide an opportunity to *"learn from the principles involved as they apply to various circumstances"* (O'Riordan, Timothy, 2000, pg. 16). Patterns that embody ecological processes and mediate flows of material and energy can act as models for interweaving social, economic, biological and geological processes in a way that makes ecological knowledge applicable to design.

Learning from living systems can be related to the process of rethinking the nature of development discussed above. Living systems are organizationally closed. Changes in the environment can trigger changes in the organism, but cannot determine the changes. The organism cannot be separated from the environment with which it interacts, it is in a real sense embedded in a *"circular pattern of interaction through which it is defined"* (Morgan, 1997, pg. 254). It is not possible to 'regenerate' an area through applying a formula or imposing a development plan. It is only possible to create the conditions in which regeneration might flourish. Equally, it is not possible to teach practitioners the skills necessary to encourage such regeneration, it is only possible to create the conditions in which they may experience and learn them for themselves.

Conclusion

In planning theory there has been an emerging discussion of the need for practitioners involved in shaping communities and spaces to explicitly explore their value systems, and develop their awareness of their role as ethical actors. The erosion of certainty and a sense of confidence in universally accepted values heralded by post-modern theory has highlighted the fact that there is no such thing as value-free action. Instead there is a need to consciously explore values and to be aware of the underlying assumptions that color our perception of the world and decisions we make, based on those perceptions.

A possible new role for spatial planning is emerging, one that includes actively developing a vision for a desirable future, which is commonly understood and shared, with broad and ambitious goals. This is a significant shift from seeing the planner as a neutral technician, who applies technical skills to solving practical problems. The value of developing such future visions has been emphasized in two of the key policy messages in Planning Policy Statement 1, the documents setting out the philosophy of the recent revision of the British planning system, recognizing:

"the need for positive planning to achieve sustainable development objectives and proactive management of development, rather than simply regulation and control; and the need for plans to set clear visions for communities and help to integrate the wide range of activities relating to development and regeneration" (Office of the Deputy Prime Minister, 2004).

Cultivating an ethical awareness, and tying it to the skills of sustainable planning, in which conditions are created for meaningful dialogue and possible long-term implications of our actions are explored and debated, requires a new set of skills and capacities in practitioners. This paper has developed a conceptual framework for exploring possible ways of developing these capacities, using living systems thinking principles as a starting point for developing new approaches. This conceptual framework will be refined and tested in action research, training facilitators in a participatory approach to ecological planning in the North West of England.

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