Second intermezzo A transdisciplinary perspective on industrial ecology research

Cynthia Mitchell

INTRODUCTION

In this 'dialogue' chapter, my intention is to contribute to the exchange of ideas between social science perspectives and SET (science, engineering, technology) perspectives in industrial ecology research. My brief from the editors is to reflect on the chapters exploring regional approaches. Specifically, I am tasked with reflecting on the elements of the work that resonate with my experience, that are different, and that raise questions, and to do so by connecting my responses to my experiences. This I found an intriguing brief, not least because it leaves me feeling somewhat exposed – this intermezzo is a public and enduring account of something akin to the process of review as well as an exploration of the development of my own epistemological stance.

Having a dialogue between disciplines who share an interest in exploring and implementing industrial ecology concepts is essential for it to reach its potential. And the mode we have chosen for doing so here is something of a compromise, since it is just one iteration, rather than an ongoing dialogue. That said, I think it is a worthwhile step in a useful direction, so here goes . . .

To respond, I firstly give a brief account of my perspective, such as it is now – that of an engineering- and science-trained transdisciplinary researcher engaged with making a difference. I have synthesized the reflections into three sections: resonant concepts, differences, and clarifying questions.

MY PERSPECTIVE

In the spirit of this being a narrative, I'll begin by telling my story. My qualifications are in engineering and science. My passions are around

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learning and change for sustainability for all. My experience is based in the higher education sector, in conventional engineering faculties for eight years, and for a further eight years, in the rather less conventional Institute for Sustainable Futures (ISF) at the University of Technology Sydney, where I've directed our inter- and transdisciplinary postgraduate programme, whilst supervising graduate students, and leading contract research projects on urban infrastructure in which we develop, adapt and/or apply theoretical frameworks, methodologies, and analytical approaches drawn from the disciplines of engineering, systems, economics, business, learning and social sciences.

ISF occupies an intriguing space: the gap between university and industry. More than 80 per cent of our funds come from our research contracts. Our potential academic collaborators wonder if we might be too industry-focused, doing consulting rather than research,[1] whilst our potential clients wonder if we might be too academic. Surviving and thriving in such a challenging space is a wonderful driver for reflection and construction of conceptual frameworks to characterize what it is that we do. I'll explain the core of these here because they are the backdrop for the role I've been asked to take in this intermezzo. They have been developed collaboratively with my colleagues and students at the Institute, so I'll switch to 'we' for this description.

We conceive of our inter- and transdisciplinary research in line with ISF's mission, which is to create change towards sustainable futures. We've come to the view that life is far too messy to throw up 'problems' that can be 'solved'. So rather than seeking problem solutions, we wonder if we might be seeking 'problem re-solutions'? Certainly, we seek to make a recognizable improvement in some perceived real world situation. We have one foot firmly planted in 'the situation' (for example, drafting a plan for government to meet Sydney's water demand at the lowest societal and environmental cost), with the other foot firmly planted in the academy (for example, ensuring our doctoral students graduate). That leads us to specify three distinct outcome spaces:

1. The situation: there should be some recognizable improvement in the situation as a result of our work – a change in vision (for example from local best practice in new urban design to an integrated urban metabolic system), a change in strategy (for example revised company objectives that embed a shift from harm minimization to a restorative intent), or the uptake of a new tool (for example a model that treats water demand and supply options equally);
2. The stock of knowledge: because we begin with what is already known, we have a responsibility to contribute to the stock of knowledge of

theory and practice in our disciplines and sectors, through scholarly, industry, community and other outlets;

3. The practitioners involved: first, because we want to maximize the change we contribute to, we want our collaborators to do things differently as a result of working with us, and second, because we inhabit the cutting edge, the way we work should contribute to and/ or facilitate a transformational learning experience (Taylor 1998) for ourselves and for those we engage with in our projects.

This leads us to operate in something of a composite fashion with respect to the types of cross-disciplinary research noted in the literature (for example, Boix Mansilla 2006). Our epistemic value propositions are concerned with finding the balance between contextual specificity and generalizability, and between the rigour of quantitative modelling and the richness of qualitative processes, and between finding out and acting, whilst ensuring validity by finding a balance between the trandisciplinary intent of our work and retaining the integrity of its disciplinary origins.

RESONANT CONCEPTS

The concept from the preceding chapters that resonates most is the over-arching interest in seeing change on the ground, and wanting to explore that change in order to work out where and how to intervene to enable its growth and development (that is, in Meadows et al. (1993) terms, improve-ments in both quantity and quality). Linked to this is the explicit connec-tion to and exploration of other fields. Paquin and Howard-Grenville (Chapter 5) are deeply embedded in network analysis, and do a wonder-ful job of situating their work in that field, as does Gibbs for the field of socio-technical transitions.

In Chapter 5, recognizing and working with the political and cultural embeddedness of key actors resonates strongly with AtKisson's (1999) change agent and transformer roles, which are core to our praxis. For example, one water authority we have worked with over the life span of ISF has continually strengthened its commitment to sustainability as a core value for its operations. For the last three years, we have been col-laborating on implementing environmental costing within their business operations as a means of tracking their expenditure on and movement towards their goals. That involves working across the organization, getting buy-in from the senior executives so they can argue for it at their board, and to the government pricing regulator, collaborating with local managers to extract relevant data, setting up the analysis in a way that can

be readily handed over to staff in the future, interpreting and presenting the results in ways that can be communicated publicly in an annual report, and so on. This year, they did it themselves.

In the chapter by Chertow and Ashton, the resonant concept is in understanding the world in terms of two interacting spheres – the biophysical sphere and the socio-institutional sphere – the what and the how, for want of more sophisticated descriptors. Over the course of two years, I co-led a group of experienced and early career academics from design, history, economics, learning, ecology, engineering, futures and systems to develop a transdisciplinary framework to guide catchment management interventions. The framework has three dimensions: the what and how, perspectives (role-based, personal and specialized experience), and ways of finding out and acting. In co-developing the framework, we discovered together that the 'ah-hah' moments only arise after sitting with the discomfort and deep frustrations that come when attempting to communicate across epistemic, value and disciplinary divides. And that arriving at the ah-hahs requires commitment and trust, and trust takes time to develop across these divides, especially where no previous relationships exist (Palmer et al. 2007).

In the chapter by Gibbs, the notion of paradigmatic change being driven by tension in the explanatory system as it stands resonates with Kuhn's (1970) structure of scientific revolutions. Because our interest is in enabling both evolutionary and revolutionary change, we use Kuhn's insight explicitly and implicitly. For example, we have found it a powerful explanatory tool for arguing the need to move to new models for sanitation in developing and developed countries.

Also in Gibbs' chapter, I find resonance with the experience of the power of rating tools to shift behaviour. We have been working in the Australian building sector for a decade, and the advent of rating tools in the last few years has been a major factor in the transformation that has taken place. However, I wonder whether rating tools' role should be viewed as transitory? They are essential in creating awareness of what is preferable, and they lead to a focus on 'counting' green, rather than 'thinking' green. That is, finding the right balance between prescriptive and performance based approaches is difficult, and sadly it seems easy to get prescriptive tools wrong, and end up being inconsistent with preferred long term outcomes.

DIFFERENCES

The standout difference between my experience and the work reported in the chapters is in the approach to and analysis of interviews as a source of empirical data.

Each chapter includes interviews as part of their data. All three provide a short general description of their method. However, in none, were the details of the qualitative methodology, method and analysis revealed – there is no information about how interviews were conducted, how interviewees were recruited, what prompts were used, how the ethical implications were managed for either 'formal' or 'informal' interviews, what the stance of the interviewer was, for example, on the participant/ observer spectrum, what collection methods were used for example, notes, recorded, transcribed, what analysis was undertaken for example, coding, interpretation, or about what assumptions the researchers held about the validity of their interpretations. Interestingly, none make reference to qualitative methods texts.

I found I had a strong response to this omission. I think this response stems from the particular 'strawberry runner'[2] path I have taken to arrive at transdisciplinary work, and the values I have developed along the way. Let me explore this a little.

For about a dozen years, I have been working with qualitative methods with my postgraduate students and in contract research. I learned qualitative methodologies through having a go at applying them and reflecting on what went right and wrong and why, through reading about them, and through some formal training – short courses, seminars, and the like. And still, I see myself as something of a neophyte[3] in qualitative methodologies.

The experience of doing qualitative work fundamentally challenged the ideas of 'repeatability' and 'representativeness' so deeply ingrained from my engineering training. I came to know it wasn't physically possible to do, transcribe and exhaustively analyse huge numbers of in-depth interviews. And yet I had a hunch there was at least utility (and hopefully, validity) in reporting on the wonderful diversity arising from this kind of work.

My first attempt to publish this kind of research was salutary. Our paper describing what engineering academics mean by environmental, economic, and social sustainability was discarded out of hand by the editor of an international engineering education journal, and warmly praised by the editor of a high-profile international education journal. I came to describe the work as 'indicative, rather than exhaustive or comprehensive'.

But still, I found qualitative work confusing. In quantitative work, I knew the rules – significant figures, rough statistics, model variables that matter, and so on. But in the qualitative work I read, both research outcomes and methodological texts, the variability vexed me. Then I went to an intensive qualitative methods course, where the facilitator talked us through examples of readings across a spectrum of epistemological values, and the scales fell off. For years, I had felt like I had all the pieces

of a giant jigsaw, but not the box with the picture on the front. I could put a few pieces together here and there, but not the whole picture. All of a sudden, with the epistemological spectrum, I had the picture on the front of my jigsaw box! I had a means for structuring and positioning the contributions and perspectives relative to each other. Now, I draw this spectrum in various ways, for example with something like positivism on one end, and something like post-modernism on the other, with empiricist, constructivist and critical approaches in between. The spectrum allows me to articulate what it is that is valued and gives meaning within each epistemological domain. I find this device adds a significant dimension to the discussion about working across disciplines, since some span many epistemological domains.

My take accords with Nicolescu (2002): there are always rules and norms, and they are essential for ordering the world and our interactions, and they have both disciplinary and epistemological foundations. If anything, I find as I move away from my epistemological roots, I feel a stronger need to be explicit about these rules, norms and epistemological foundations. I am aware that this felt need may be precisely because I am on less familiar ground. It may also be in part a response to the lack of anything vaguely epistemological in my engineering and science training. I think it is also because I feel a certain responsibility to be able to be explicit about what constitutes quality in our inter- and transdisciplinary research efforts. I see this question of quality as far from resolved, either in the literature or in practice, and it is an active area of research for me[4] – a kind of meta-reflection on the goals of our Institute's work and how we might know their calibre. I frequently have cause to wonder about where is a good place for us to publish our work, and what practices would help our staff ensure good quality outcomes, and who could examine a transdisciplinary PhD thesis, and how would we know if our collaborators experienced transformational learning through our projects, etc.

Certainly, in our graduate students' programme, we emphasize the need for them to be aware of and explicit about their epistemological stance and to reflect on how that influences their choice of theoretical framework, methodology, method, data capture, analysis, and its interpretation and positioning in both the academic and practice worlds. Part of my motivation in doing this is my belief that it is easy for those of us from a positivist background to do poor quality qualitative research, albeit unintentionally, and I have seen too much evidence of this. Explicit consideration of positionality and its implications reduces the likelihood of that happening. Whether implicit or explicit, there should be enough in any paper for me to be able to discern the nature of those foundations, and judge the work according to the appropriate rules. I suspect this is the basis for my jarred

response to a lack of description of qualitative approaches in all three chapters.

There is a second standout difference between the three chapters I've been asked to reflect on and our practice, and that is about how the interviews are reported in the papers. In the final version of their chapter, Paquin and Howard-Grenville do a wonderful job of enriching their quantitative network analysis with quotes from wide-ranging interviews – it is these stories that answer the question: what led to changes in network structure? In the other two chapters, they are absent. The text lacks the richness associated with quotes, stories, vignettes . . . the intent seems to be to seek generality, and to do so whilst inadvertently obscuring some potentially significant data and its analysis.

I see myself as epistemologically plural. In any particular project, I endeavour to make space for a range of perspectives and exhort my collaborators to do the same. Where there are numbers, those numbers should be meaningful in the local context – accurate, reliable, repeatable, and so on. And for qualitative data, my exposure to social scientists, and my experience of using social science theories, methodologies, methods, and approaches, has given me the opportunity to develop beyond epistemological naivety (Ison 2008). My preference now is to give voice to those who have contributed to the research in this way, and to do so explicitly by including significant quotes and narratives, and providing research participants the opportunity to comment on and exercise control over my interpretation of their story. An example is a recent scoping paper on creating successful management entities in the decentralized wastewater industry in the USA, where every page has at least one quote or narrative story (Willetts et al. 2008).

This approach accords strongly with a recent paper (Morgan 2007) advocating a pragmatic approach to qualitative research, foregrounding the need to acknowledge personal history and its influence on our decisions and actions. Morgan advocates abduction (moving back and forth between induction/data and deduction/theory), intersubjectivity (for example, simultaneously holding the views that there is a single 'real world' and that each individual has a unique perspective on what constitutes that world), and transferability (a focus on the factors that enable or disable the transfer of knowledge gained in one context to a different context).

So, I see the absence of quotes and narratives as not so much wrong, but more as such an opportunity missed – somewhere, there is a wonderfully rich data source that could deepen our understanding of what is happening, and give us more effective insights into where else and how else we might intervene to broaden the uptake of industrial ecology regionally, and we are denying ourselves the chance to engage with it and learn from it.

CLARIFYING QUESTIONS

In the penultimate draft of Paquin and Howard-Grenville's chapter, I sought clarification of the modelling process as someone unfamiliar with the model, its outputs, and their meaning, and I wondered about the opportunity to enrich and enliven their interpretation of its outputs through the inclusion of qualitative data and analysis. Their final draft deals elegantly with those questions, so here, all that is left for me to wonder about is how the changes in the network uncovered by this analysis connect to changes in actual impacts (environmental, social and economic) associated with the operations of the network members.

In the chapter by Chertow and Ashton, I wonder about how the analysis might be enriched by perspectives from other fields within social science, and in particular, studies that are interested in values, motivation and behaviour change. The investigations seemed to show that personal relationships, especially those that either formed or were validated outside the work sphere, were critical enablers of industrial symbiosis outcomes. This resonates with our own work and the work of others around espoused values versus values in action – the idea that there is for most of us, a gap between what we say and what we do.

In the chapter by Gibbs, I wonder about the opportunity to strengthen the focus on the socio-technical paradigm shift, and deepen the analysis against this theoretical frame, especially since in the set of EIPs chosen, half were not yet operational at the time of the data collection in 2002–2004. In other work, I have found Rip and Kemp's (1998) frame quite compelling, perhaps because of its interdisciplinary foundations, and eschewing of the presumption that we can precisely plan or control the paths of either artefacts or societies. A deeper analysis of a handful of successful and unsuccessful EIPs could be quite enlightening.

CONCLUDING REMARKS

Any field that seeks to create real change must engage across the spectrum of ways of knowing, acting and being: that is, across disciplines and epistemologies, as well as across personal and professional roles. These are the characteristics of transdisciplinary research. These characteristics, alongside the idea of explicit planning for and evaluating outcomes in the three spaces of the situations, the stock of knowledge, and the practitioners involved, may offer some useful insights for industrial ecology. Doing good work across these domains is predicated on establishing effective collaborative partnerships. It is essential to avoid the trap of technically

trained specialists doing well-intentioned but poor quality qualitative work. The richest and most effective insights and outcomes will be associated with work that makes space for a real breadth of conversations, and encourages the reflective development of the epistemological stances of all involved, that is, an awareness of the impact of one's history and beliefs on one's interpretations and decisions.

The opportunity in industrial ecology and many other fields seeking to create change towards sustainable futures is to fearlessly engage with questions of what quality means in qualitative work, and to treat qualitative work as an equal to quantitative work.

The concept behind this book is a wonderful initiative in this direction, so I offer my congratulations to the editors, and humble thanks for the opportunity to participate in this most unusual of chapters. May the initiative do much to make room for social science perspectives in industrial ecology.

ACKNOWLEDGEMENTS

NOTES

1. I am rather enamoured of Lawrence Stenhouse's definition of research: systematic inquiry made public.
2. When strawberry runners grow, they branch in what appear to be haphazard ways.
3. I note with some irony two meanings for neophyte: 1. beginner: a beginner or novice at something, and 2. recent convert: a recent convert to a religion. http://encarta.msn.com/dictionary_/neophyte.html accessed 22 March 2008.
4. I am currently completing a fellowship from the Australian Learning and Teaching Council for a project entitled: Zen and the Art of Transdisciplinary Postgraduate Research.

REFERENCES

AtKisson, A. (1999), *Believing Cassandra: An Optimist Looks at a Pessimist's World*, White River Junction, VT: Chelsea Green.
Boix Mansilla, V. (2006), 'Interdisciplinary work at the frontier: an empirical

examination of expert interdisciplinary epistemologies', *Issues in Integrative Studies*, **24**:1–31.

Ison, R.L. (2008), 'Methodological challenges of trans-disciplinary research: some systemic reflections', *Nature, Sciences, Societies*, **16**: 241–51.

Kuhn, T.S. (1970), *The Structure of Scientific Revolutions*, 2nd edn, Chicago, IL: University of Chicago Press.

Meadows, D.H., D.L. Meadows and J. Randers (1993), *Beyond the Limits*, White River Junction, VT: Chelsea Green Publishing Company.

Morgan, D. (2007), 'Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods', *Journal of Mixed Methods Research*, **1**(1):48–76.

Nicolescu, B. (2002), *Manifesto of Transdisciplinarity*, Albany, NY: State University of New York Press.

Palmer, C., J. Gothe, C. Mitchell, C. Riedy, K. Sweetapple, S. McLaughlin, G. Hose, M. Lowe, H. Goodall, T. Green, D. Sharma, S. Fane, K. Brew and P. Jones (2007), 'Finding integration pathways: developing a transdisciplinary (TD) approach for the Upper Nepean Catchment', *5th Australian Stream Management Conference*, May 2007, Albury, NSW, Australia.

Rip, A. and R. Kemp (1998), 'Technological change', Chapter 6 in S. Rayner and E.L. Malone (eds), *Human Choice and Climate Change*, vol. 2, Colombus, OH: Batelle Press, pp. 327–99.

Taylor E.W. (1998), *The Theory and Practice of Transformative Learning: A Critical Review*, in ERIC Clearinghouse on Adult Career and Vocational Education (ed.), Information series no. 374, vol. 2006, 27 September, Center on Education and Training for Employment, Columbus, Ohio, viewed 27 September, 2006 http://www.cete.org/acve/mp_taylor_01.asp.

Willetts, J., N. Carrard, K. Abeysuriya, C. Mitchell, A. Macrellis, S. Johnstone and R. Pinkham (2008), *Guidance for Establishing Successful RMEs: Scoping Paper*, available at www.werf.org.