Complexity reduction in outdoor and environmental education: by whom, for whom, and in whose interests?

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Abstract

Complexity invites us to understand our worlds and selves as open, recursive, organic, nonlinear and emergent, and to be suspicious of understandings that assume mechanistic predictability and control. Nevertheless, many educators seek predictability and control through various practices of complexity reduction. In this paper I will first provide a brief history of complexity theorising and then examine some manifestations of complexity reduction in education, with particular (but not exclusive) reference to environmental education and related fields, including outdoor environmental education.

Complexity theorising in education: a brief (and partial) history

Sociobiologist Edward Wilson (1998) characterises the different dispositions that have enabled humans in times past to understand and represent complexity in these terms: ‘The love of complexity without reductionism makes art. The love of complexity with reductionism makes science’ (pp. 58-9). I admit that I have mobilised both of these dispositions to various extents in the constitution of my own subjectivity, and realise that the audiences for this paper are likely to include many different manifestations of the interplay between them. Within the limited scope of this paper, my brief (and partial) history of complexity theorising in education will speak chiefly to those whose ‘love of complexity… makes science’, not least because much science itself now ‘makes complexity’ without reductionism.

Between the mid-16th and late-19th centuries most Western scientists studied the material structures of simple systems. Since then, much mainstream scientific inquiry – in fields as diverse as molecular biology, neuroscience, nonlinear thermodynamics, atmospheric physics, psychology and cybernetics – has examined the informational structures of complex systems (see, e.g., Casti, 1997), with the terms ‘complexity’ and ‘science’ beginning to be linked explicitly in the 1940s (see, e.g., Warren Weaver, 1948), especially in areas such as systems biology and cybernetics. Yet there is no mention of complexity as a key scientific concept in Australia’s recently released National Science Curriculum Framing Paper, and the word ‘complex’ appears only in passages that reinforce reductionism, such as, ‘[t]he natural world is complex but can be understood by focusing on its smaller components’ – a guaranteed way of misunderstanding many ‘natural’ phenomena.

1 Quote at the risk of knowing that I change my mind frequently.
2 Weaver (1948) writes: ‘physical science before 1900 was largely concerned with two-variable problems of simplicity; whereas the life sciences, in which these problems of simplicity are not so often significant, had not yet become highly quantitative or analytical in character… Subsequent to 1900 and actually earlier, if one includes heroic pioneers such as [19th century US thermodynamicist] Josiah Gibbs, the physical sciences developed an attack [sic] on nature of an essentially and dramatically new kind. Rather than study problems which involved two variables or at most three or four, some imaginative minds went to the other extreme, and said: “Let us develop analytical methods which can deal with two billion variables.” That is to say, the physical scientists, with the mathematicians often in the vanguard, developed powerful techniques of probability theory and of statistical mechanics to deal with what may he called problems of disorganized complexity’. See also Brian Castellani’s (2009) Map of Complexity Science at www.art-sciencefactory.com/complexity-map_feb09.html (accessed 21 March 2009)
Complexity theorising in education has provided a counteraction to the residual effects of simplistic attempts to model education on industrial systems, that is, the so-called ‘factory’ model of schooling derived from Frederick Taylor’s (1947/1911) paradigm of ‘scientific management’. Taylor’s concept of mechanistic control (imposed, overt, top-down, centralised) was an explicit force in educational administration until at least the late 1960s. For example, George Beauchamp (1968) devoted a whole chapter of both editions of *Curriculum Theory* to the concept of ‘curriculum engineering’, which he used to represent both ‘the curriculum system’ and ‘its internal dynamics’:

The chief engineers in the curriculum system are the superintendent of schools, principals, and curriculum directors… They… organize and direct the manipulation of the various tasks and operations that must go on in order for a curriculum to be planned, implemented in classrooms through the instructional program, evaluated, and revised in light of the data accumulated through evaluation. (pp. 108-9)

Although many educational theorists subsequently opposed this crude mechanism, others refined Taylor’s principles of scientific management by appropriating the language of the relatively new field of cybernetics – the study of systems in which both humans and machines are understood in terms of information processing. For example, Francis Hunkins (1980) asserted that ‘the cybernetic principle’ was ‘essential to the monitoring aspect of program maintenance’:

Cybernation permits rationalization of the total managerial activities related to maintaining the program. It supplies data requisite for decision-making. Cybernation frees curriculum managers from petty distractions and enables these leaders to make decisions based on substantial data. With cybernation, curriculum decision-makers have much greater latitude in locating their facilities’ efficiency, their curriculum elements’ effectiveness in relation to initial intentions and current supply of resources. (p. 324)

Hunkins (1980) acknowledged that ‘some might argue that cybernation is fine when working with machines, but inappropriate when dealing with individuals in schools’, but nevertheless argued that ‘the components of a cybernetic system are present in most schools’:

effective curriculum development creates inputs, devises systems of transforming these inputs into programs, develops procedures for introducing these programs, identifies means for evaluation, and develops avenues for feeding information back into the curriculum system. (pp. 324-5)

Given the proliferation of cyberwords during the past few decades – cyborgs, cyberspace, cyberpunks, cybercafes – Hunkins’s invocation of ‘cybernation’ might seem to be unexceptional. Since the term ‘cybernetics’ was coined in the 1940s, the field has developed as an interdisciplinary science that interprets the interrelationships of organisms and machines in terms of feedback loops, signal transmission, and goal-oriented behaviour. But cybernetics is contested conceptual territory and there is more than one ‘cybernetic principle’. The question of which cybernetic principles appeal to educational administrators who are still disposed to working with a ‘scientific management’ model is raised by David Pratt’s (1980) application of ‘a cybernetic perspective’ to the problem of ‘managing aptitude differences’:

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4 Hunkins’s use of the definite article suggests that he sees *the* cybernetic principle as a singular object of inquiry.

5 Pratt’s reference to ‘a cybernetic perspective’ suggests that he recognises more than one – but he does not identify which ‘cybernetic perspective’ he privileges.
The problem of maintaining consistently high achievement from a group of learners who differ in aptitude and other characteristics can be seen as an instance of the general question of how a system with variable input can be designed to produce stable output. Phrased in this way, the question lies squarely within the field of cybernetics, the study of self-regulation in systems. (p. 335)

Pratt uses the regulation of temperature in a building as an example of a simple cybernetic system, and then uses temperature regulation in the human body to illustrate his assertion that ‘the most elegant and complex cybernetic systems are found in nature’. The unexamined assumption in Pratt’s argument is that curriculum systems and cybernetic systems should be ‘designed to produce stable output’. By his choice of examples, Pratt seems to assume that some sense of ‘natural’ order – in this case ‘stable output’ – should inform curriculum work and that cybernetics can help us to achieve it.

However, homeostasis – the ability of an organism to maintain itself in a stable state – is just one of several key concepts that informed the science of cybernetics. Katherine Hayles (1994) points out that during the period from (roughly) 1945 to 1960, homeostasis provided cybernetics with meanings that were deeply conservative, ‘privileging constancy over change, predictability over complexity, equilibrium over evolution’ (p. 446). But even in these early years, homeostasis competed with reflexivity (‘turning a system’s rules back on itself so as to cause it to engage in more complex behavior’), which led ‘away from the closed circle of corrective feedback, privileging change over constancy, evolution over equilibrium, complexity over predictability’. Hayles (1994) argues that, in broad social terms, ‘homeostasis reflected the desire for a “return to normalcy” after the maelstrom of World War II. By contrast, reflexivity pointed toward the open horizon of an unpredictable and increasingly complex postmodern world’ (p. 446).

In Hayles’s (1994) brief history of three waves of cybernetics since WWII, reflexivity displaced homeostasis as a key concept in the period from 1960 to about 1972, after which the emphasis shifted to emergence, with interest focused ‘not on how systems maintain their organization intact, but rather on how they evolve in unpredictable and often highly complex ways through emergent processes’ (p. 463). Hayles emphasises that concepts such as homeostasis and reflexivity do not disappear altogether but linger on in various ways and may exert an inertial weight that limits the ways in which newer concepts may be deployed.

In the case of Hunkins’s and Pratt’s selective appropriations of cybernetic principles, we might well ask why educational theorists in 1980 continued to privilege homeostatic self-regulation two decades after it had ceased to be generative in the field of cybernetics. I suspect that, unlike cyberneticists, educators faced few compelling challenges to the deeply sedimented conceptions of ‘natural’ order to which Pratt alludes – order as stability, predictability, and equilibrium. Such conceptions of ‘natural’ order are pervasive in many different disciplines, including the science of ecology which informs the practice of many outdoor and environmental educators.

During the post-World War II period, under the leadership of Eugene Odum, the US version of systems ecology privileged the concept of the ecosystem as a stable and enduring emblem of ‘natural’ order. But as Andrew Jamison (1993) points out, systems ecology contributed very little to the solution of environmental problems:

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6 Pratt’s uses of the terms ‘simple’ and ‘complex’ do not convince me that he distinguishes usefully between ‘complex’ and ‘complicated’. 
By the late 1970s, systems ecology had lost much of its public appeal, although it continued to develop as a research program. Within ecology, however, new evolutionary approaches had become increasingly popular, so that systems ecology today is only one (and not even the most significant one at that) of a number of competing ecological paradigms. (p. 202)

Donald Worster (1995) argues that the several editions of Odum’s (1971) textbook, *Fundamentals of Ecology*, ‘laid so much stress on natural order that it came close to dehistoricizing nature altogether’ (p. 70). Elsewhere, Worster (1993) describes how ecologists subsequently repudiated Odum’s portrayal of orderly and predictable processes of ecological succession culminating in stable ecosystems. For example, the essays collected by Steward Pickett and P.S. White (1985) deliver the consistent message that the very concept of the ecosystem has receded in usefulness and, to the extent that the word ‘ecosystem’ remains in use, that it has lost its former implications of order and equilibrium. This is particularly evident in the work of the theoretical ecologist and philosopher Robert Ulanowicz (1986, 1997, 2009) who emphasises that chance, disarray and randomness are necessary conditions for creative advance, emergence and autonomy in the natural world.

Most educational bureaucracies are still governed by a systematic rationality that privileges orderly and predictable processes culminating (as Pratt would have it) in ‘stable output’. In these systems, educational policies and curriculum documents (like Australia’s National Curriculum Framing Papers) function as homeostatic devices, regulating the diverse inputs of students and teachers by bringing them within closed circuits of corrective feedback in order to maintain stability and equilibrium. This presents those of us who see stability and equilibrium as evolutionary dead ends in any arena of human activity with difficult questions about possibilities for strategic action. How can we act to reflexively disturb the equilibrium of the systems in which we work, to provide opportunities for unpredictable, complex, and unstable ‘outputs’ to emerge? This is the type of question that has led a number of curriculum scholars – myself included – to explore the implications of complexity theorising for our work. William Doll (1986, 1993, 1989) was one of the first curriculum scholars to explore some of the theoretic and practical consequences of reconceptualising curriculum, teaching and learning in terms of reflexivity, emergence and other metaphors generated by chaos and complexity theorising, drawing particular attention to the evolutionary potential of disequilibrium. This work is being continued by Doll and others, many of whom are associated with the Chaos and Complexity Special Interest Group of the American Educational Research Association7 (see, for example, Biesta & Osberg, 2007; Davis & Sumara, 2007, 2008; Davis et al., 2008; Doll et al., 2005; Doll & Gough, 2002; Osberg & Biesta, 2007; Osberg et al., 2008).

Although I have very few quarrels with these theorists, I do not share Osberg and Biesta’s (2007) enthusiasm for the work of Belgian thermodynamicist (and Nobel Prize laureate) Ilya Prigogine (Prigogine, 1980; Prigogine & Stengers, 1984) from whom they derive many of their understandings of emergence. For example, their explorations of the epistemological and pedagogical implications of what they call ‘strong’ emergence rely heavily on Prigogine’s theorising of irreversible thermodynamic processes in open and far-from-equilibrium systems that give rise to increasingly higher levels of organisational complexity. Osberg and Biesta seem to go beyond suggesting that complexity science provides generative metaphors for educational inquiry and action. That is, they seem not only to assert that the dynamics of education are like those of complex self-organising systems but, rather, that education is a

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7 See http://jan.ucc.nau.edu/~chaplx-p/news.php
system with these properties. But does this distinction really matter if the juxtaposition of complexity theorising with educational inquiry encourages new forms of social imagination? As already noted, the dominant discourses of curriculum inquiry are characterised by metaphors that suggest closed systems and linear dynamics. Complexity theorising invites us to consider the possibilities and practicalities of working in open, far-from-equilibrium systems, the dynamics of which are non-linear, reflexive, irreversible, and self-organising. However, we also need to resist the temptation to ‘elementarise’ these characteristics – to reduce them to the elements of yet another foundational model in which education is (again) over-simplified and distorted (see Green & Bigum, 1993).

Debates about the applicability of complexity theorising to educational inquiry often return to questions about the relationship between ‘natural’ order and human affairs. I can see no categorical reason for excluding the invocation of nature as a ground for judgement, but when propositions from the natural sciences are invoked to support social and cultural policies and practices, we must ask: why should descriptions of the physical world be prescriptions for social life? I agree with Andrew Ross (1994) that ‘ideas that draw upon the authority of nature nearly always have their origin in ideas about society’ (p. 15). Thus, although I am disposed to resist the impulse to see complexity theorising as a ‘new paradigm’ for education, I am more than happy to continue exploring the generative possibilities of the new metaphors it provides.

At the very least, the language of complexity theorising encourages us to see education as work that anticipates – and even welcomes – unpredictable change and evolution. Rather than seeing disturbances to business-as-usual as ‘problems’ to be ‘solved,’ we can look for the new evolutionary (and perhaps revolutionary) opportunities that states of disequilibrium present to us. A homeostatic view of education suggests that there is something intrinsically desirable about working in a state of stability and equilibrium, in much the same way that a means-ends (or process-product) model of curriculum development gives us a false sense of security when we achieve our ends. We do not ‘solve’ practical educational problems in the hope that we will eventually have fewer such problems to solve, any more than crossword puzzle addicts hope that, by completing each crossword, they are reducing the number of puzzles remaining to be solved. Certainly, as an educator, I do not place much value on the ‘stable outputs’ that we expect from homeostatic systems; I prefer to be pleasantly surprised by what learners achieve. To produce such pleasant surprises, we might sometimes need to deliberately introduce perturbations into our systems.

Complexity reduction in education

Complexity theorising requires no elaborate ‘proof’, justification or validation to be useful to educators. It is enough that it invites us to understand our physical and social worlds as open, recursive, organic, nonlinear and emergent, and to be suspicious of mechanistic models that assume linear thinking, control and predictability. If we accept (assume) that there are limits

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8 I also see tensions between the educational implications of complexity theorising and understandings of curriculum as a deconstructed text (see Gough, 1994; Pinar & Reynolds, 1992). Complexity theorising raises expectations of it being the basis for a new foundational synthesis (i.e., a metanarrative) whereas deconstruction subverts universalising systems and discourses. Poststructuralism challenges the impulse to write a metanarrative of complexity that is immanent in its (re)presentation as the harbinger of a new scientific/cultural paradigm. I do not deny the complementary of the destabilising methods made available both by deconstruction and complexity theorising but I suggest a need for some caution in ‘emplotting’ complexity theorising in curriculum as text.

9 I also suggest that we should not fear being accused of advocating change for the sake of change; this cliché obscures its own emptiness. If we ‘read’ change in this way, I would suggest that we are not being active enough as readers.
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To predictability and control then we can understand that educational processes are necessarily characterised by gaps between ‘inputs’ (policy, curriculum, pedagogy) and ‘outputs’ (learning) (see Biesta, 2004). These are not gaps to be ‘filled’ but sites of emergence. The concept of emergence allows us to recognise that knowledge, understanding and reality emerge through educational processes (rather than being simply represented in and through education), and that individuals emerge in and through educational processes in unique and unpredictable ways. As Biesta (2006) argues, education is not only about qualification (the transmission of knowledge and skills) and socialisation (the insertion of individuals into existing social, cultural and political orders), but should also be characterised by a concern for the ‘coming into presence’ of unique, individual beings. In this sense, complexity provides a useful vocabulary for understanding education, in an educational way (see also Osberg & Biesta, 2007; Osberg et al., 2008).

The current Australian policy initiatives around national curriculum and school accountability and transparency seem to me to exemplify complexity reduction in education. For example, I get no sense from the recently released framing papers for English, History, Mathematics and Science (National Curriculum Board, 2008)10 that the knowledges, understandings and realities on which these disciplines focus emerge through educational processes. On the contrary, the framing papers seem more like cargo manifests – lists that prescribe the contents of shipping containers that will be unpacked by schools across the nation. Nor do these documents invite any consideration of how they might constrain or enable the unpredictable emergence of unique, individual young people who are not merely ‘qualified’ and socialised to take their predetermined place in an existing socioeconomic order.

Complexity offers a different perspective on what is or appears to be not complex, and can therefore help us to understand order, structure, regularity, causality and permanence differently. This partly has to do with important distinctions within complexity itself, such as between closed and open systems (i.e., systems that do not interact or exchange information with their environment and systems that, for their existence, depend on such interchange and through this both change themselves and their environment) and between weak and strong emergence (see Osberg & Biesta 2007). But the important question complexity helps us to ask is how complexity reduction is achieved, and more particularly to ask who is reducing complexity for whom and in whose interest.

One of Biesta’s (2008) five theses on the politics of complexity reduction in education concerns the effects of retrospective complexity reduction:

Complexity reduction in education not only happens prospectively (through the reduction of initial variables) but also retrospectively (through backwards selection of particular trajectories). One of the most explicit examples of retrospective complexity reduction in education is assessment, because assessment validates some learning trajectories and invalidates others but always does so ‘after the event.’ Because education is a recursive system, the anticipation of assessment also reduces complexity. In this way assessment also functions prospectively in the reduction of complexity.

In much the same way, the anticipation of school league tables will prospectively reduce complexity in school systems. The question we must ask is: who benefits from this form of complexity reduction? Who benefits from ‘naming and shaming’ poorly performing schools where socioeconomic background and inadequate funding produces predictable outcomes? Under the inequitable system set up by the former conservative government of John Howard,

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government schools’ share of funding declined from 43% to 35% and is forecast to fall to 34% by 2011. As Ken Davidson (2008) writes, the great political virtue of the current Labor government’s plan to publish a rating system for schools is that:

it allows governments without any real commitment to raising the standard of poorer schools to appear to be doing something.

This is bad enough in Britain and the US where the overwhelming proportion of students go to public schools and the middle class cannot escape its responsibilities to the system. It is toxic when it is applied to the Australian system of education apartheid that allows the middle class to avoid its responsibilities to public education and provides a financial incentive to do so.

Complexity reduction in environmental education research

In previously published work I have drawn attention to the some of the ways in which environmental education researchers have deliberately reduced the complexity of the objects of their inquiries in ways that produce simplistic – and thus almost meaningless – conclusions (see, for example, Gough, 1999a, 1999b). One example that is pertinent to my brief history of complexity theorising in education concerns efforts by environmental education researchers to adapt constructivist science education research to their own purposes.

For example, Bruce Munson (1994) draws on the literature of conceptual change in science education to explore ways of dealing with students’ ‘ecological misconceptions’. Munson equates ‘misconceptions’ with ‘scientifically incorrect interpretations and responses to problems’ (p. 30) – a rather more dogmatic formulation of ‘misconceptions’ than those offered by constructivist science education researchers, who tend to see them as ideas that are incompatible with currently accepted scientific knowledge. Munson argues that because ‘ecology forms the foundation for environmental education’, research on students’ ‘ecological misconceptions’ should ‘provide useful insights for environmental educators’ (p. 30). Thus, Munson ignores any contestation over what knowledge might be ‘foundational’ for environmental education and also neglects contestation within the field of ecology itself. Rather tellingly, Munson begins by quoting Odum’s view – as expressed in a 1977 essay – that ‘we are abysmally ignorant of the ecosystems of which we are dependent parts’ (p. 30). Despite paying lip-service to the proposition that ‘the field of ecology has improved considerably over the last 16 years’, Munson alleges that ‘environmental educators could still use Odum’s quote to express our concerns and beliefs about the public’s understanding of basic ecological concepts’ (p. 30), an assertion which may reveal that Munson himself is ‘abysmally ignorant’ of post-Odum ecology. Munson’s phrasing suggests that ‘basic ecological concepts’ – among which he cites ‘the ecosystem’ as being pre-eminent – are somehow stable and enduring (even ‘natural’) rather than being constantly changed and reformulated by the ecologists who construct them.

Munson’s foundationalist assumptions about the existence of ‘basic ecological concepts’ match Odum’s foundationalist view of stability in nature, and his apparent ignorance of post-Odum ecology suggests that many of the ‘basic ecological concepts’ to which he refers are themselves ‘misconceptions’ – insofar as they are ideas that are incompatible with currently accepted scientific knowledge – and his appropriation of the conceptual change discourse of constructivist science education research is thus little more than an elaborate rationale for replacing students’ ‘misconceptions’ with his own.

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11 New Commonwealth funding arrangements announced at a COAG meeting on 28 November 2008 provide some additional funding for all schools but do not appear to address these inequities.
Also, in Munson’s schema, subjectivities are as stable as ecosystems: ‘misconceptions are stable elements of an individual’s conceptual framework and highly resistant to change’ (p. 33), a proposition that is indeed supported by a great deal of the conceptual change research in science education (although it is also possible that much ‘evidence’ of conceptual stability is an artefact of the researcher’s assumptions of a stable subject). This kind of assumption leads Munson to interpret the literature of conceptual change in science education in a way that seems to take reductionism to new extremes of absurdity:

If educators view misconceptions as completely individualistic, they will find the task of teaching for conceptual change overwhelming. However… some studies have found that the vast majority of individuals hold a limited number of misconceptions (Driver et al 1985). This suggests that a finite number of ecological misconceptions exist. Such a conclusion should be encouraging to environmental educators and environmental curriculum developers. (p. 34, my emphasis)

Munson’s suggestion ‘that a finite number of ecological misconceptions exist’ is logically absurd (a finite sample does not prove the existence of a finite population) and somewhat perverse – I cannot understand why any human being would accept finite limits to human imagination as an a priori principle (and history would seem to demonstrate that humans have a limitless capacity to generate concepts that might in retrospect be judged to be erroneous in some way). But Munson’s conclusion can also be understood as an illustration of the constructivist principle that knowledge is actively constructed rather than passively received – in this case, Munson appears to be assimilating Rosalind Driver et al’s (1985) report of interpretivist research to his preexisting constructs of objectivist, instrumentalist, and behaviourist research. I would argue that this aspect of constructivism – the insistence that all knowledge (personal and social) is made rather than found – certainly needs to be foregrounded in environmental education research, but that ‘misconceptions’ research might have very limited uses. My reservations about ‘misconceptions’ research in environmental education are of two kinds. On the one hand, as contestation about the ecosystem concept illustrates, there might simply be too few (if any) uncontested conceptions in environmental education that can function as reference points for ‘desirable’ conceptual change. On the other hand, I question the ways in which researchers identify some conceptions as ‘misconceptions’ and the assumptions they make about the relationship of privileged conceptions (such as ‘scientific’ knowledge) to action (or dispositions to act).

My misgivings about the wisdom of environmental education researchers emulating science education researchers’ concern with identifying learners’ ‘misconceptions’ were reinforced by Joy Palmer’s (1995) report of results from the early stages of her investigation into the ‘development of environmental knowledge and concern’ (p. 36) in children from pre-school years onwards. Palmer’s project is in part grounded explicitly in misconceptions research in science education – the widely cited work of Driver et al (1985) again being an exemplary reference – and one aspect of the research is described as a ‘longitudinal study, monitoring the development of knowledge into active concern’ (p. 36). In other words, the researcher is so confident that ‘knowledge’ does ‘develop’ in the direction of ‘active concern’ (rather than vice versa or in a mutually reinforcing way) that all she needs to do is ‘monitor’ this orderly process. As those who have revisited Odum’s work on ecological succession can testify, it is not difficult to produce data that fit prior assumptions. In Palmer’s report, what counts as ‘environmental subject knowledge’ is uncontested, as is the researcher’s ability to classify children’s knowledge, from an analysis of interview tapes, into such categories as ‘accurate knowledge’, ‘misconceptions’, ‘misunderstandings’, and ‘biased, stereotypical thinking’. Palmer analysed the data ‘to reveal elements of accurate subject knowledge’ by constructing a concept map ‘for each subject recording the network of related scientific concepts referred to,
explained, and apparently understood’ (p. 37). Apart from the unquestioned privileging of ‘scientific’ concepts, the maps were made up of ‘key concepts “understood” in the sense that subjects could provide an explanation which satisfied the interviewer’ (p. 37). My reading of Palmer’s report suggests that the research might actually ‘reveal’ more about the interviewer/researcher’s personal constructs than the children’s.

I find it particularly worrying that many aspects of children’s imaginative lives that are sources of great pleasure to them (and to many adults who enjoy children’s company) are dismissed as ‘misconceptions and confusions’. For example, Palmer’s report focuses particularly on ‘children’s knowledge and understanding of… management of waste materials’ (p. 37). Several pages of the report catalogue the ‘substantial confusions’ of 4- and 6-year-olds about recycling, among which Palmer includes several children’s references ‘to recycling waste for the making of such items as robots, waste monsters, hats and boats’ (p. 43); we are also told that for some children ‘television… was the source of confusion over recycling into boats, monsters and robots’ (p. 43). To refer to television programs as a ‘source of confusion over recycling into boats, monsters and robots’ (p. 43). To refer to television programs as a ‘source of confusion’ seems a little at odds with ostensibly constructivist research, yet Palmer explicitly seeks ‘insights into the origins and sources of knowledge and misconceptions’ (p. 37). But if knowledge is actively constructed rather than passively received, is it useful to think about ‘origins and sources’? To claim that something seen on television can be a ‘source of confusion’ suggests the passive reception of a ‘misconception’ rather than its active construction. More significantly, I cannot accept that a child who brings a waste monster into a conversation about recycling is necessarily demonstrating a ‘misunderstanding’ or a ‘misconception’ of environmental knowledge – indeed, I would think it more likely that many are recalling their own experiences of box construction work in preschools in which they actually did make ‘robots,…monsters, hats and boats’ from waste materials (see figure 1). An article and cover illustration in Green Teacher (Hodges, 1990, p. 9; see figure 2), titled ‘What is a garbage monster?’, suggests that teachers too might actively encourage children to deploy the concept of a waste monster. Should we conclude that such teachers are also demonstrating a ‘misconception’ in their knowledge and understanding of the management of waste materials?

Reporting on a different aspect of this research, Palmer, Suggate and Matthews (1996) claim that children who suggest that ‘imaginary creatures (monsters, dinosaurs)’ might live in tropical rainforests are similarly demonstrating misconceptions and confusions (p. 304). In an earlier discussion of this same research, Palmer and Matthews (1995) write:

One sort of monster that many children cite when asked what sort of animals live in the tropical rain forest is the Dinosaur. Many 4 year olds appear to believe that dinosaurs still roam the earth. This is certainly a testament to the (mis)educative power of the popular media. Dinosaurs regularly appear in children’s television and motion picture entertainment (p. 8).

To suggest that popular media produced to satisfy children’s fascination with dinosaurs is ‘(mis)educative’ borders on the ludicrous and certainly calls into question the researchers’ appreciation of, and empathy with, children’s imaginative lives. It seems equally plausible that children are simply mobilising a different discourse and different storylines from the interviewer – a fantasy discourse in which the prospect of meeting a dinosaur in a rainforest (or the metamorphosis of bottles, cans, plastics and paper into waste monsters) is just another ‘good story’. We adults cannot and should not expect children always to participate in our
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FIG 1. ‘MONSTERS’ MADE BY PRIMARY SCHOOL CHILDREN FROM RECYCLED PACKAGING MATERIALS AT THE GOULD LEAGUE OF VICTORIA’S RECYCLING CENTRE (PHOTOGRAPH BY ANNETTE GOUGH)
"enlightened" discourses – of science and technology, consumerism and conservation – for they, rather more than many adults, are often only too happy to mobilise the language of myths, fables and fantasies. Nor should we assume that children’s fantasy discourses are in any way inferior to ‘accurate knowledge’ in supporting the practical goals of environmental education: some children might believe that the protection of a dinosaur’s habitat is a more compelling reason to preserve a tropical rainforest than any of the more conventional reasons offered by conservationists. But what makes the response of Palmer and her colleagues to children’s fantasies so egregious is not that they overlook their positive potential but that they
actually want to suppress them. That is, having clearly identified ‘imaginary creatures (monsters, dinosaurs)’ living in tropical rainforests as a ‘misconception’, Palmer, Suggate and Matthews (1996) then argue that one of the ‘clear implications’ of their research is that ‘the teacher’s task… obviously includes the correction of misconceptions’ (p. 328). The prospect of teachers using Palmer et al’s research to police children’s imaginative lives would be alarming were I not convinced that most attempts to do so are likely to be doomed to failure. In this respect, children’s popular media that show dinosaurs still roaming the earth are not so much ‘miseducative’ as a welcome corrective to the tendency in western education to privilege ‘accurate knowledge’, analysis and logic and to diminish imagination and fantasy.

**Afterword**

This paper draws on work-in-process towards a briefing paper invited by the Australian Association for Research in Education (AARE) and the Australian Council of Deans of Education (ACDE) as input to a national invitational Research Futures Summit to be held in October 2009. The paper builds on ideas introduced in my AARE 2008 Presidential Address and as such addresses a wide spectrum of education researchers. Although the sections dealing with ecology and environmental education have clear implications for outdoor environmental educators, I have yet to apply the critical frames provided by complexity to theorising to specific examples of outdoor education research.

**References**


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For PowerPoint show with full text go to: [http://www.latrobe.edu.au/oent/Staff/gough_papers/noelg_AARE08_Prez_ppt(with%20notes).pdf](http://www.latrobe.edu.au/oent/Staff/gough_papers/noelg_AARE08_Prez_ppt(with%20notes).pdf)


