INTRODUCTION

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It has long been recognised that the social and physical worlds we inhabit are in a state of rapid change, and within the turmoil, the only place that we can find continuity is in the certainty of change itself. The twentieth century saw astounding changes in population, in technology, in urbanisation, in industrialisation, in globalisation – facilitated mainly by the availability of cheap and abundant fossil fuels, and the commercial drive to produce and consume more food and more material goods. Over the course of the twentieth century, world population increased 3.5 times to reach six billion; the number of cars in the UK rose from 8000 to 21 million; and in 1999 more people were living in cities than the entire world population of 1950.

The premise of this book is that the twenty-first century will be a time of change no less dramatic than that of the twentieth century, but that the changes will be of an entirely different nature. The reason for this is a convergence of trends - individually subject to uncertainty, but collectively giving an overall indication of the trajectory of society. The world population is continuing to expand, consumption in large developing countries is increasing rapidly, and the consequential demands for fuel, energy, water and biological resources are rising. At the same time, we will no longer be able to depend on the input of energy from cheap fossil fuels, partly because of restrictions imposed by climate change legislation, but also because oil production is set to peak and start its inevitable decline, threatening everything that depends on it, from transportation and plastics to agriculture and food distribution. These trends, combined with the now inevitable impact of climate change, ecosystem degradation, and exhaustion of a wide range of resources, mean that the trajectory of the twenty-first century is toward a planet which is a less hospitable place for human life, and the lives of countless other species.

There is, therefore, an increasingly urgent facet to the already multifaceted concept of sustainability. In 1987, the Bruntland report wrote of the need for meeting the needs of the present without compromising the ability of future generations to meet their own needs. Since then, efforts to build more sustainable societies have failed dramatically. Those born in 1987 are now in their twenties, are members of the future generations Bruntland was referring to, and their ability to meet their needs in the future has been compromised. Increasingly, sustainability becomes a struggle not only to ensure that future generations have the means to survive, but also to meet the needs of the present in the deteriorating conditions of the world.

As the Transition Movement (Hopkins 2007) has shown so well, combining the more abstract ideal of enabling future generations to meet their needs with the far more immediate and practical dimension of preparing for difficult times ahead in the near future can galvanise people and communities into practical action which has immediate and multiple benefits. If carefully planned, the transition toward a society which relies far less on fossil fuel and physical materials has the potential to meet higher human needs more effectively than one based on consumerism and unlimited growth. Steps taken towards creating a smooth transition to a low energy future may, of themselves, help people escape from the addiction and isolation of consumerism, gain a sense of belonging to a community, improve mental and physical health through time spent working in and with nature, reduce obesity and the many illnesses associated with a sedentary lifestyle, enjoy a

cleaner, greener environment, and find meaningful employment – while still benefiting from advances in medicine, public transport and communications. The benefits may, of course, be short lived and overtaken by external changes that are simply too large to adapt to. But even if short lived, the benefits are nonetheless real for those enjoying them, and the self/ community/ business/ society in transition provides a model of sustainability for those 'in power' who are well-placed for influencing the trajectory of society.

The ability to take steps towards building a more sustainable self, community, society and world requires far more than knowledge *about* sustainability – it requires *sustainability literacy*. This book uses the term *sustainability literacy* to indicate the skills, attitudes, competencies, dispositions and values that are necessary for surviving and thriving in the declining conditions of the world in ways which mitigate that decline as far as possible. Gaining practical skills requires a form of learning which goes beyond memorising and repeating facts. It requires *active learning,* a broad term used to refer to self-reflection, self-directed enquiry, learning by doing, engagement with real life problems and issues, and learning within communities.

The metaphoric use of the term 'literacy' in *sustainability literacy* stretches it from its literal use within the area of reading and writing. However, in literacy theory, *literacy* refers to far more than a binary category 'can/cannot read and write'. Instead, it refers to a wide range of *practices* people are empowered to participate in, through having skills in using language in particular ways. For example, being influential and successful in the commercial world requires the ability to read and write business cases, reports and formal letters. Literacy, then, is a collection of skills that allow for effective participation and influence in diverse areas of social life. As people gain *sustainability* literacy skills, they become empowered to read self and society critically, to discover insights into the trajectory of society and to envisage where it is heading. They gain skills in re-writing self and society both in an effort to meet needs under increasingly difficult conditions and also to work towards new paths that lead to a more sustainable world.

Ray Anderson provides a case in point, an example of a business leader who knew had very little in the way of sustainability literacy, but experienced a sudden epiphany when reading Paul Hawken's (1994) *The Ecology of Commerce*. He came across the term 'the death of birth' and, in his own words:

> It was E.O. Wilson's expression for species extinction, the death of birth, and it was the point of a spear into my chest, and I read on and the spear became deeper, and it was an epiphanous experience, a total change of mindset for myself, and a change of paradigm. (Anderson 2005).

He realised the company he was leading, Interface Carpets, was acting in an entirely unsustainable way:

> ...it dawned on me that the way I was running Interface was the way of the plunderer. Plundering something that's not mine. Something that belongs to every creature on earth. [I realised that] someday people like me will end up in jail... (Anderson 2005)

At this point we could say that Anderson had gained, at a deep reflective level, *knowledge about sustainability*. Sustainability literacy, however, is more than that – it is the ability to act on that knowledge. Anderson managed to transform his company from one selling carpets to be ultimately disposed of, to one which provided a carpet covering *service.* His company started renting out carpet tiles, reusing them when no longer required, replacing only those that had worn out, and even then recycling the discards using energy generated from wind and the sun. Transforming

corporations in this way requires skills in *ecological intelligence*, to understand the impact of actions on the ecosystems which support life, *systems thinking*, to gain a holistic picture of inputs, outputs and waste to maximise reuse and recycling, *appropriate technology* and *appropriate design* to minimise the adverse impacts of the technologies employed, *cultural literacy* to adapt solutions to the prevailing culture, and a wide range of other sustainability literacy skills described in this book.

Anderson had to gain knowledge about sustainability, and develop sustainability literacy for himself. The conventional education system he went through prepared him for the role of industrial leader in an unsustainable society, but it did not give him the skills to lead his company in ways that were sensitive to the systems that human life depends on. The starting point for the exploration of sustainability literacy in this book is the realisation that educational policy tends, even now, to revolve around twentieth-century skills – skills for commercial innovation, further industrialisation of society, economic growth, international competitiveness, and financial prosperity. The further we enter the twenty-first century, the more short term these goals seem – a temporary bubble of financial prosperity existing on paper only, already partially burst by the 'credit crunch', and about to be burst on a much larger scale by the 'ecological crunch', the 'peak oil crunch', and the 'climate change crunch'.

To explore the skills demanded of people in the twenty-first century, this book brings leading sustainability educators together with specialists from a wide range of areas, including engineering, art, permaculture, outdoor education, anthropology, literature, mathematics, business studies, climatology, ecology, and linguistics. Interaction amongst authors was encouraged through a series of workshops, including the national event *Soundings in Sustainability Literacy*, and through a peer review process. In the first part of the book each author explores a particular skill, attribute or disposition such as *Social Conscience*, *Permaculture Design*, or *Futures Thinking*, showing why it is an important skill for life in a changing world, and giving example active learning exercises for development of the skill. The chapters close with a list of resources for gaining a deeper insight into the skills described. In the second part of the book, four chapters explore the question of how education systems and institutions will need to adapt if they are to help learners gain the sustainability literacy skills described in the first part.

The book is intended as a *handbook* in the sense of containing practical ideas that may be adapted and applied by a wide range of educators, from parents to professors, but not as a rigid guide to the 'one right way'. There is no simple, empirical way of determining whether a particular skill will help learners survive and thrive in ways which contribute to sustainability. Instead, the book aims to bring together multiple, carefully thought out perspectives which can shift the debate away from the narrow focus of the dominant discourse on 'skill sets' for employability. These skill sets often fail to take into consideration environmental limits, social justice, or adaptation to the deteriorating ability of the Earth to support human life and, therefore, are unlikely to serve the long term interests of learners, businesses, societies or the human species. Alternative possibilities more grounded in the realities of the changing world need to be articulated, but without reproducing the same 'tick-box' approach to skills associated with both dominant discourses and with some efforts to define sustainability literacy in the past.

The book is therefore intended to engage the reader in the multi-perspectival reflection, discussion and debate from which it springs, and open up a range of previously un-thought of paths, many of which will no doubt be rejected, but some considered worthy of further exploration. There may well be parts that are contentious or refutable, but given the conditions of the world this was considered preferable to something that was so blandly abstract that it was beyond debate. To borrow words

from Rachel Carson (1962:16), 'I would ask those who find parts of this book not to their taste or consider that they can refute some of the arguments to see the picture as a whole. We are dealing with dangerous things and it may be too late to wait for positive evidence of danger'.

The help convey the picture as a whole, the layout of the book is designed to facilitate reading from cover to cover, with chapters exploring similar themes in proximity, and chapters which build on each other placed in sequence. There are no rigid demarcations, however, since the aim is to convey a holistic picture rather than separating and categorising it into disciplines. The remainder of this introduction provides a brief overview of the book, mentioning all the chapters in the order they appear (the titles of the chapters are in italics).

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The starting point of the book is not the environmental problems which are undermining the ability of the Earth to support human life, but instead the social, cultural and economic systems that gave rise to those problems. Without considering this deeper level we will be 'fighting against circumstances', an expression that Allen (1951:19) uses to mean 'that a man is continuously revolting against an *effect* without, while all the time he is nourishing and preserving its *cause* in his heart'. Of particular concern in the opening chapters are the economic and social forces which encourage unnecessary consumption, debt and environmental destruction, and the ability of learners to critique and resist these forces (chapters: *Ecocriticism, Optimisation, Grounded Economic Awareness,* and *Advertising Awareness*). Critique by itself is not enough, however, and sustainability literacy also requires practical skills for engaging in the transition away from consumerist societies to strong, resilient communities capable of fulfilling human needs with minimal use of energy and resources (chapters: *Transition Skills*, and *Commons Thinking*). One way (perhaps the only sustainable way) to move beyond fossil fuels is to develop skills for working with nature to make the best possible use of 'ecosystem services' - the services which fulfilled human needs long before the discovery of fossil fuel (chapters: *Effortless Action, Permaculture Design,* and *Community Gardening*).

Clearly, sustainability literacy requires skills in thinking in fundamentally different ways from those which set society on a trajectory towards collapse in the first place. New ways of thinking (which are often revivals of older ways that have become marginalised) include the ability to think of the world relationally, as consisting of interconnected systems, and as having animate qualities itself (chapters: *Ecological Intelligence, Systems Thinking,* and *Gaia Awareness*). Unless underpinned by ethics and values, however, new ways of thinking can be appropriated by political and commercial forces to serve narrow goals. The ability to think in new ways, therefore, needs to be complemented by the ability to reflect on goals, on what kind of society may be desirable, on what is important and worth protecting, and what, deep down, there is an ethical obligation to do (chapters: *Futures Thinking, Values Reflection and the Earth Charter,* and *Social Conscience*).

The vision that emerges requires expression, not because reflection necessarily results in a 'better' vision, but because there are too many visions expressed by dominant forces in society that have not yet been updated to respond to the changed and changing context of the twenty-first century. Effectively and persuasively expressing a vision for the future requires skills in oral presentation, writing, and skilful use of new media, as well as the ability to communicate in ways which are culturally appropriate and sensitive to different perspectives (chapters: *New Media Literacy* and *Cultural Literacy*).

Sustainability goes far beyond environmental concerns, including aspects such as social justice;

intergenerational justice; mental and physical wellbeing; social, economic and cultural transformation; and the flourishing of the diversity of life. However, none of these is possible within a degraded and unliveable environment, so skills in reducing environmental footprints are an essential part of sustainability literacy (chapters: *Carbon Capability, Greening Business,* and *Materials Awareness*).

Technological issues are also highly relevant, primarily because it is technology which enables fossil fuel energy and environmental resources to be converted, on an immense and unsustainable scale, into material goods and then waste. As energy use becomes increasingly constrained and environmental resources depleted, it will be necessary to develop skills in rethinking and redesigning the role that technology plays in society (chapters: *Appropriate Technology and Appropriate Design* and *Technology Appraisal*). Technology, however, is only one aspect of the highly complex task of building a society along sustainable lines, and technological solutions have to be considered within the web of other factors that influence sustainability (Chapters: *Complexity, Systems Thinking and Practice* and *Coping with Complexity*).

The deepest level of sustainability literacy is the psychological level, since problems which manifest themselves outwardly in injustice or destruction of the environment, arise from social and cultural systems which are, in turn, located in individual psychology and social cognition. One important psychological aspect is awareness of what, deep down, gives people a sense of wellbeing. Only with this awareness can we find ways to gain life satisfaction without the over-consumption of resources (chapters: *Emotional Wellbeing* and *Experiencing Meaning without Consuming*). One psychological issue that is frequently blamed for both a lack of emotional wellbeing, and for the kind of self-centred behaviour which leads to ecological destruction, is alienation – the feeling that human beings exist independently and separately from the environment, or from other organisms in the web of interconnection that is life. The ability to reconnect and feel a part of the world rather than apart from it may well be a central foundation of sustainability literacy (chapters: *Being-in-the-World, Beauty as a Way of Knowing*).

The final four chapters form a separate part entitled *Educational Transformation for Sustainability Literacy* and move on from questions of the skills themselves to the next logical question: how can the education system be transformed to enable learners to gain those skills? The suggestions are radical and thought-provoking, including rethinking, not only the physical campus and curriculum, but also who the learners are and whose interests educational institutions serve (chapters: *Citizen Engagement, Re-educating the Person, Institutional Transformation,* and *A Learning Society*).

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From the many perspectives expressed in the chapters, a complex picture emerges of the skills, attributes and dispositions that the authors feel are necessary for life in the twenty-first century. It is, however, a picture which is far from complete and one which needs continuous updating and expanding on as the conditions of the world change. The project, therefore, continues with a multimedia version of the *Handbook of Sustainability Literacy* accessible at www.sustainability-literacy.org, which includes additional chapters, video interviews with authors, discussion groups and further resources.

One final point is that, given the trajectory of society and the seeming lack of political will to make changes significant enough to change that trajectory, it is easy to lose hope or cling to unlikely 'solutions', such as electric cars for solving the energy crisis, genetic engineering to solve the food crisis, or planetary engineering to solve climate change. Finding well-grounded hope lies instead in

taking a stark and honest look at the changing conditions of the world, developing the skills necessary for responding to those conditions, and building a better future in whatever ways remain realistic and possible.

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Acknowledgements

OPTIMISATION

the art of personal sufficiency

John Naish, author of *Enough: breaking free from the world of excess*

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In the modern developed world, the vast majority of us can be supplied with the things we need as a basis for living contented and fulfilled lives, such as food, heating, healthcare, safe transport and security. But our society tells us that we should always pursue 'more' – whether it be more money, possessions, choices, work or growth… and ultimately more of a commodity called 'happiness'.

But this approach is increasingly backfiring, with the Western world now suffering growing epidemics of depression, stress and anxiety – along with a range of stress-related physical diseases such as cardiovascular disease. This population-wide pursuit of 'always more' has also set consumer culture on a collision course with ecological collapse. Thus, our constant striving appears to makes us increasingly miserable as well as physically endangered (see de Graaf 2005).

The constant, all-consuming pursuit of 'more' is only a recent phenomenon. From the dawn of civilisation until shortly after the Second World War, it was considered admirable in Western culture to know when you had enough of any particular thing, and to understand where having more would actually prompt less satisfaction, because your pursuit had taken you into the world of diminishing returns where you have to put more effort into attaining something, but the rewards get increasingly smaller. The rewards can also rapidly turn into negatives: too much work robs us of time we might spend enjoying the fruits of that labour; and consuming excess food lies behind the West's 'obesity epidemic'. The old art of knowing when you had enjoyed the optimum amount of anything is encapsulated in the Edwardian table saying: 'Thank you, I have had an elegant sufficiency, and any more would be superfluous.'

This Western philosophy stretches back to Aristotle, who devised the idea of the Golden Mean, where the path to contentment lies between the 'twin evils' of having too much or too little. This idea is also in the Chinese Tao Te Ching written in 260BC by Lao Tsu, which declares, 'He who knows he has enough is rich' (see Maurer 1982). In 18th-century Europe, frugal living was considered the cool lifestyle choice: outside royal courts, luxury goods were often spurned, thanks to the practice of 'worldly asceticism', a Calvinist idea that offered hope of salvation through diligent use of God's gifts (i.e., planet Earth). Puritans and Quakers promoted the 'Christianity writ plain' ideal, where it was considered good to produce, but bad to consume more than necessity required. Those who lived luxuriously were criticised for squandering resources that might support others.

It might seem odd that humans have had to develop social conventions for knowing when they have had enough, rather than being able to perceive this instinctively. But the basic difficulty lies in our ancient instincts: through millions of years of early evolution, humankind's great success as a species lay in its ravenous, dissatisfied striving for 'always

more'. The humans who made it through the frequent famines, plagues and natural disasters of the Pleistocene era were the ones who always stockpiled, always grabbed the most land and possessions, always gorged when food was available. They never had to develop an instinct that said, 'enough'. They never had to learn how to deal with abundance. And they survived to pass us their genes.

When humans began to organise themselves into civilisations capable of creating regular material abundances as well as surviving shortages, it became necessary to develop a philosophy of enoughness, of personal sufficiency, so that resources could be shared and enjoyed, optimised rather than squandered. This approach, pioneered by the likes of Aristotle and Lao Tsu, remained broadly accepted until the aftermath of the Second World War, when the vastly expanded wartime industrial power of America faced shrinkage and depression unless consumers could be persuaded to want ever more and more new things, and to take out credit to buy them.

The American marketing guru Victor Lebow, a former director of Fabergé, described this trend in the *Journal of Retailing* in 1950: 'We need things consumed, burned up, worn out, replaced, and discarded at an ever-increasing rate,' he wrote. 'Our enormously productive economy demands that we make consumption a way of life, that we convert the buying and use of goods into rituals, that we seek our spiritual satisfaction, our ego satisfaction, in consumption.'

Lebow's clarion call was amply answered. The rapidly expanding power of postwar marketing, sales and advertising helped to ensure that personal consumption grew at an exponential rate across the developed world. Vast industrial growth also precipitated revolutions in technology that brought leaps in the realms of communications, healthcare, transport and construction – sufficient to make our lives comfortable and potentially sustainable… so long as we learn to live within the planet's capacity to support our activity.

For while the post-war period of rapidly spiralling consumption was great for manufacturers, it became apparent that it wasn't so beneficial for the planet. By the 1970s a welter of ideas had emerged about the need to say, 'enough growth'. The most famous examples are two books: E.F. Schumacher's *Small Is Beautiful: Economics As If People Mattered*, and the high-powered Club of Rome think-tank's *Limits to Growth*.

Since the 1970s we have lived with the growing awareness that our ecosystem is fragile, that perpetual economic growth is impossible and that every time we earn or consume, we may make the world potentially worse for our children. By the late 1980s, even the Sun newspaper had appointed its own green correspondent. Today the most bullish Western consumers' consciences are regularly punctured by shards of eco-understanding. But our culture and economy remain centred on the idea that there is no alternative to continuing to produce and consume ever more, even when we know that it may prove calamitous. So why hasn't our behaviour changed?

One reason is that our marketing culture has become extremely effective at targeting our subconscious brains. We may consciously know that chasing and consuming more and more is bad for us and bad for the planet, but subconsciously, we still feel driven to do so. We are

like the 60-a-day man who knows that smoking will kill him, but still he can't stop (see Marshall 2007).

One of the most effective tools used by advertisers is the cult of celebrity (see Evans and Hesmondhalgh 2005). All the new 'even better' products that advertisers dangle in front of us seem to be owned by beautiful people. There's Liz Hurley in perfumed ecstasies over a new cosmetics range; Daniel Craig manfully tapping on a product-placed laptop while pretending to be James Bond. Our subconscious minds tend to over-identify with celebrities because we evolved in small tribal groups. In Neolithic times, if you knew someone, then they knew you, too. If you didn't attack each other, you were probably friends. Our minds still work this way – and give us the false idea that the celebrities we see so much are somehow our acquaintances.

Humans are also born imitators: this talent underlies much of our species' success, as it enabled us to adapt to changing environments far quicker than our competitors could via biological evolution alone. What gets us far ahead of other primates is our attention to detail. A chimp can watch another chimp poking a stick into an ant-hill and then mimic the basic idea, but only humans can replicate a clever technique exactly. As a result, we need to choose with great care who we copy. We have evolved to emulate the habits of the most successful people we see, in the hope that imitation will elevate us to their rank. This helps to explain why many of us feel compelled to keep up materially with celebrities, the mythical alpha-people in our global village.

There's a dark side to the celebrity effect, too. We so want to be part of our tribe's top clique that we're perpetually anxious about being snubbed by it. Feeling left out makes us so mad that our ability to act intelligently plummets. This was shown by a series of tests that involved making students feel sorely excluded. Roy Baumeister, a psychologist at Case Western Reserve University, invited undergrads to meet a group of impressive strangers and then asked them to name two of the group that they would like to work with on a project.

But next the students were told that, sorry, the strangers did not rate them. The rebuffed students' IQs plunged by about a quarter for several hours. Their aggressiveness rose. Baumeister says his tests reveal that tribal rejection interferes with our self-control: 'It strikes a blow that seems to interfere with our ability for complex reasoning,' he says. 'You may do stupid things' (Baumeister et al 2002). Thus our perpetual exclusion from the celebrity clique makes us more likely to dumbly, impulsively buy stuff – just because it is endorsed by people we desperately want to love us.

Celebrities are only one weapon in the marketers' broad battery of highly sophisticated subconscious persuaders which constantly make us feel compelled to pursue more new things and to feel bad about the things that we already possess. But although this constant pursuit of 'more' is having increasingly toxic social and environmental effects, no one in power would dare to suggest that we curb the advertisers' activities – unless they are advertising products that actively cause immediate harm to health, such as tobacco and alcohol.

In fact, the very idea of creating a culture that encourages us to live sustainably balanced lives by rediscovering the lost art of sufficiency is currently taboo. There is a distinct lack of high-level discussions on alternative ways to organise our society. For the sake of personal and

planetary balance, we urgently need to develop an economic system that is effectively zero-growth, to stop putting any more strain on our systems. But this is not up for discussion in the corridors of power, says Tim Jackson, a green economist who sits on the Sustainable Development Commission, a UK government watchdog.

I asked him what would happen if we were to wave a magic wand, so that one morning we woke to find that suddenly everyone in Britain was living a personally and planetarily sustainable existence, he said: 'This is the hardest question of all. I've just raised this at our commission and was told by a Treasury official that switching to true sustainable development might mean that we have to go back to living in caves. The government has a split personality on this. It keeps telling people to get out of their cars and consume less. But we would be up the creek without a paddle if everyone did. As it currently exists, our economy relies strictly on increases in consumption.'

The credit crunch has clearly shown that our postwar culture of more-more-more cannot be sustained, but the lack of government action means that we have to achieve change from the grass roots, by learning as individuals the lost art of sufficiency – the art of being highly wary of marketing tricks and knowing when to say, 'that's enough for me, I have the optimum amount of this, and I want to leave space and time for other bounties in my life'. It is a challenge for all of us.

Example discussion questions to stimulate reflection on optimisation

➢ Discuss what 'enough' means to you. When is excess permissible? When is it enjoyable? How do you put limits on your own actions?

➢ Can Governments pass effective laws to make people consume only enough of certain things? Which items can be limited and how? Which items can never be limited, and have to be left to individuals' own discretion?

➢ Can you ever have too much of the following: friendship, gratitude, social connection, rewarding leisure time, contentment? Discuss ways in which consumer society can prevent us from enjoying these qualities to the full.

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TRANSITION SKILLS

skills for transition to a post fossil-fuel age

Stephen Quilley, Keele University

> Production of cheap, abundant fossil fuels is peaking and will soon be withering
> away… Around the world, numerous sovereign governments are close to
> becoming dysfunctional – likely with very bad consequences. We are pumping so
> much of the wrong kinds of gases into the atmosphere that the poles are melting,
> the seas are rising, the land is drying out and some day soon this planet is going to
> be very tough to live on. (Whipple 2009)

The twenty first century is going to be different – perhaps more so than most of us had
realized. Official commentaries habitually focus on progress – the challenge of matching our
increasing scientific understanding of the natural world and the continuing flow of new
technologies, with corresponding improvements in our social and political arrangements. But
what if change involves systemic failures and geopolitical conflict? What if the techno-
economic escalator of development runs into the sand? What if change involves a *decrease* in
the complexity of societies and economies? What if globalization falters and is replaced by a
more visceral relocalization of human activity? What if the sum of human knowledge,
represented by the institutions of modern science, actually begins to shrink? This is the
scenario underpinning the peak oil movement and which James Kunstler, in *The Long
Emergency* and his recent novel *World Made By Hand*, has elaborated most cogently.

In this chapter I explore this vista of serious rupture and discontinuity and its implications for
sustainability education. I provide an overview of the kind of 'transition skills' that may
become relevant to the survival and well being of our children and their communities over the
coming decades. I conclude by suggesting ways in which such skills might be taught along
side traditional academic disciplines in a variety of learning contexts.

Transition implies radical discontinuity and upheaval

There have always been tensions at the heart of the concept of sustainability: between the
ecological limits to growth and the irrefutable demands for social development in the global
south; between optimistic Cornucopians trumpeting the possibilities of ecological
modernization and pessimistic Malthusians warning of overshoot. Teachers and lecturers
attempting to green their institutions and push the issue of sustainability into both curricula
and institutional practice, constantly brush up against these ambiguities and the diverging
scenarios that they engender.

Advocates of 'weak' sustainability and most non-ecological economists tend to assume that
the sustainable re-adjustment of the relationship between human economics and global
ecology can take place over a relatively long time-period. They share an optimistic faith in
technology and assume that, with the appropriate regulatory reforms and institutional
innovations, the sustainable re-orientation of national and global economies can be achieved

with a minimum of disruption. The assumption is that 'ecological modernization' is *continuous* with the trajectory of twentieth century industrialism and consumerism.

In contrast, the Transition (see Hopkins 2008) movement is predicated on abrupt discontinuity arising from two factors:

1. The reality of rapid and potentially catastrophic **climate change**.
2. The reality of **peak oil** – an imminent, permanent short fall in oil supply, increasing year on year with massive geo-political, economic and social consequences.

From a 'peak oil' perspective, the coming energy crunch will send globalization spiralling into reverse, resulting in a massive reduction in global and national flows of people, goods and information (see Kunstler 2005, 2008). In the long term the effect of this will be to re-create much more localized, 'bio-regional' patterns of economic production and consumption. Anticipating global systemic failures, and taking profound socio-economic upheaval, state-failure and (implicitly) conflict as likely, the movement focuses on enhancing the **resilience** of local communities (see Barry & Quilley 2008). Although clearly supportive of mainstream efforts to reduce emissions and to develop more eco-cyclical business models, Transition eschews party politics. Although avoiding the survivalist discourse of many peak oil forums, *The Transition Handbook* does refer to 'burn out', 'collapse' and 'overshoot' as scenarios that are likely to play out in the absence of a 'planned and urgent energy descent' (Hopkins 2008: 49). And whether the end of the current global order takes the form of a planned energy descent or a chaotic implosion, 'the time for seeing globalisation as an invincible and unassailable behemoth, or localisation as some kind of lifestyle choice, is over (p.15)... Small is inevitable' (p. 68). But at the same time Transition transforms the survivalist discourse of the North American peak oil movement, arguing that positive, up-lifting visions of a more convivial post-oil future are more likely to induce active participation and behavioural change: 'the Transition approach [demonstrates that] the future with less oil could be preferable to the present' (p. 53); 'Our best chance of a successful collective transition will not come from presenting people with the possibility of [collapse/disintegration] scenarios' (p. 49).

So Transition is less about politics per se than enabling community self-reliance through relocalization – initiatives which 'pre-figure' or anticipate what is seen to be an inevitable reversal of globalization. Awareness of peak oil, climate change and now the global economic crisis is driving 'solutions-oriented' experiments in sustainable community. Focusing as it does on very practical issues such as skills/re-skilling, food, energy, transport, land use, cultivation and above all community building, Transition is a form of D.I.Y. geared towards the bottom-up transformation of local communities, preparing them for 'the long emergency.'

Education for Upheaval

For those who are happy to take the continuity in economic and political life as an article of faith, the agenda of sustainable education is relatively unproblematic. Advances are being made, year on year, with dozens of new sustainability-related courses, impressive green buildings and sustainable campus management systems. However, after the roller coaster year of 2008, the spectre of *discontinuity* – geo-political conflict, social upheaval and systemic failure – seems suddenly plausible and for seasoned peak oil pundits, more than likely.

Transition educators, working within mainstream institutions find themselves in an odd and sometimes awkward position. We find ourselves wearing two hats, and operating with two partially incompatible discourses – one of continuity and development and the other of rupture, discontinuity and survival.

So if we do need to hedge our bets, then what kind of skills should we be thinking about for the long emergency? How do we educate for upheaval? Moreover, how do we combine Transition skills with mainstream sustainability education?

Two central and related features of the post-petroleum age will be the reversal of twentieth century mechanization and automation and the collapse of energy intensive farming and food provisioning systems. The brave new world of localized production and consumption will be, as Kunstler puts it, a 'world made by hand' – craft operations dependent on skilled artisans using hand tools combined with a resurgence of animal power (draught horses, oxen etc) and the intensive use of unskilled human labour. Losing our fossil fuel slaves will certainly make life harder in many ways. But Kunstler, Heinberg and Hopkins are not alone in discerning the possibility of a new era of human dignity and self-worth rooted in vibrant, participative and self-sufficient local communities.

Taken seriously, this scenario suggests that we need to develop a completely different kind of education. The system that we have developed over the last one hundred years is designed to develop abstract, cognitive skills and forms of theoretical understanding which equip students to take up ever more specialized functional niches in the economy. Developments in education have run parallel to the steadily advancing complexity of economy and society – what sociologists refer to as the 'division of labour'. Workers in all areas of the economy have become ever smaller and more dedicated cogs in an increasingly complex economic machine. Underlying these changes in classical engineering and manufacturing employment as well as the proliferating service economy, has been the rapid and totally pervasive tendency towards automation and mechanization. And driving the entire process has been access to unlimited, cheap fossil fuel energy.

The downside of this economic-educational regime has been the systematic downgrading of artisanal and craft skills in manufacturing, in agriculture and even in the service, leisure and domestic sectors. With the reliance on black box technologies and expert systems there has been a corresponding erosion of folk knowledge and expertise. Individuals and communities have lost the power to repair and maintain the material artifacts upon which they depend, they have forgotten horticultural and domestic skills and 'know how' built up and passed down between generations over decades, centuries and millennia. And in adapting to the complexity and hyper mobility of the modern world, individuals have become cut adrift from extended family and community, depending to an ever greater extent on the complex systems of state and society to guarantee health and well being.

So what kind of skills and aptitudes should we try to incorporate into a Transitional education system? New Zealand Transitioner Michael O'Brien (2009) came up with a list of two hundred artisan skills that were required to make a Victorian town function effectively. The few that I list here give some indication of the range.

Woodland Crafts. Coppicers, hurdle makers, rake makers, fork makers, besom makers, handle makers, hoop makers, ladder makers, crib makers, broaches and peg makers, clog sole cutters, bodgers, charcoal burners, oak basket makers, trug makers, stick and staff makers, field gate makers, willow basket makers, net makers.

Building crafts. Stone masons, joiners, roofers, floor layers, wallers, thatchers, slaters, lime burners, paint makers, glass blowers, glaziers, stained glass artists, mud brick makers, tile makers, chimney sweeps, plumbers, decorators, bridge builders, French polishers, sign writers.

Field crafts. Hedge layers, dry stone wallers, stile makers, well diggers, peat cutters, gardeners, horticulturists, vintners, arborists, tree surgeons, foresters, farmers, shepherds, shearers, bee keepers, millers, fishermen, orchardists, veterinarians.

Workshop crafts. Chair makers, iron founders, blacksmiths, wheelwrights, coopers, coppersmiths, tinsmiths, wood turners, coach builders, boat builders, sail makers, rope makers, wainwrights, block makers, leather tanners, harness makers, saddlers, horse collar makers, boot and shoe makers, cobblers, clog makers, knife makers, cutters, millstone dressers, potters, printers, typographers, calligraphers, bookbinders, paper makers, furniture makers, jewellers, mechanics, boiler makers, boiler men, soap makers, gunsmith, sword smith, brush maker, candle maker, artist, sculptor, firework maker, cycle builder, bone carver, musical instrument maker, clay pipe maker, tool maker.

Textile crafts. Spinner, weaver, dyer, silk grower, tailor, seamstress, milliner, hatter, lace maker, button maker, mat and rug maker, crochet worker, tatting and macramé worker, knitter, quilter, smock worker, embroiderer, leather worker, felt maker.

Domestic crafts. Fish smoker, bacon curer, butter maker, cheese maker, brewer, cider maker, wine maker, distiller, herbalist, ice cream maker, butcher, fishmonger, pie maker, pickle maker, baker, barrister and coffee roaster, homeopath, reflexologist, osteopath, naturopath, storyteller, teacher naturalist, historian, jester, actor, administrator, philosopher, labourer, poet, writer, midwife, publican, bookseller, librarian.

To these we might add a new sector – *Repair, Maintenance and Salvage* – that we might expect to feature in any imploding post-carbon economy. During the 1970s radical educationalists such as Ivan Illich often remarked on the fact that in developing countries one could always find untutored, practical and effective know-how – people who could repair radios, keep an old engine running, make, mend and salvage. As the expert systems upon which we have relied break down, we will need to rediscover this confident, practical, experimental attitude to machinery and technology – not least because for many decades we may be dependent on salvaging and reconditioning the technological detritus of the petroleum age.

Hedging our Bets

My wife and I have two young boys who are just coming up to school age. Clearly we want them to have the same educational opportunities as we have had. And I am certainly not going to deny them the chance of a university education just because Jim Kunstler has speculated that industrial civilization might crash and burn. On the other hand I am worried. I worry about whether they will be able to avoid being conscripted into someone else's army or militia, about whether they will be tough enough to survive in a chaotic and possibly violent world, about whether they will have the skills and independence of mind to enable them to thrive in a simpler and more self-sufficient world.

Our own strategy will, I think, be to find somewhere where we can home educate the boys and so, hopefully, combine the pursuit of academic qualifications with the development of an ambitious array of craft and artisanal skills and aptitudes. But this is a personal solution. As a professional educator, I am also aware of the opportunities and benefits that might arise – in schools, universities, colleges, hospitals, prisons – from combining traditional forms of learning, with a resurgence of craft and artisanal skills, from wainwrighting and cooperage to home brewing and saddlery. As a university lecturer it occurs to me that we need to re-invent the notion of apprenticeship – and find a way of making educational bifocal, such that academic degrees and secondary school diplomas are consistently combined with the learning of practical craft skills.

With regard to institutions, one obvious point of entry is the food provisioning system. In the UK, Jamie Oliver and Hugh Fearnley-Whittingstall have paved the way. Schools, universities and colleges are now ripe for experiments in permaculture and self-provisioning. Many campus universities and some schools have sufficient land and student labour to move in the direction of food self-sufficiency, with the growing and processing of food at the core of the student experience.

Finally, we might think of more ambitious educational experiments, specifically designed to promote an array of Transition-related self-sufficiency skills. I am developing my own ideas for a post-graduate *One Planet Institute* in this mould (see below). However, outside of formal education we might think in terms of developing short courses, perhaps building on what people are already doing in areas such as bushcraft and appropriate technology. What matters is not so much what we learn individually, but the range of skills and experience available within communities – the social stock of knowledge. In the context of Transition, we must all become apprentices – to each other and to master craftsmen and women – as well as reflexive observers of the ecological and material patterns of our lives

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PERMACULTURE DESIGN

designing our lives with nature as the model

Patrick Whitefield, author of *The Earth Care Manual: a permaculture handbook for Britain and other temperate climates*

The essence of permaculture is that it takes natural ecosystems as the model for our own farms, gardens, buildings and settlements. In most parts of the world where agriculture is possible the natural ecosystem is woodland or forest. The annual production of biomass in a woodland is greater than in a typical agricultural system, such as a wheat field, because more niches are filled. In plain terms the woodland is three-dimensional where the wheat field is two-dimensional. To produce this biomass it needs none of the energy and other inputs which agriculture needs. Present day agriculture is so energy-intensive that on average, by the time food reaches our plates, ten calories of fossil fuel have been expended for every one contained in the food. Nor does the natural ecosystem produce any of the negative ecological impacts of agriculture, such as enhanced soil erosion. The catch is that only a very small proportion of the natural ecosystem's annual production is edible for humans. So the aim of permaculture is to produce systems which have the high yield, low level of inputs, and benign ecological impact of natural ecosystems but which also have a high proportion of edible or otherwise useful yield. In short, the aim is to create edible ecosystems. Permaculture approaches this end in two different ways.

In its early days permaculture focused on imitating natural ecosystems in a fairly direct way. Its key characteristics included, amongst others: a high level of plant and animal diversity, growing perennial food crops rather than annuals, and not disturbing the soil by digging or ploughing. These are typical characteristics of natural ecosystems which can be observed and reproduced empirically in food-growing systems. An example of this approach is the forest garden, which mimics the structure of a natural woodland but replaces native plants with edible equivalents: fruit and nut trees, fruit bushes and perennial vegetables (Whitefield and Cassel 1996). I call this approach original permaculture.

But before long permaculturists began to look beyond the visible characteristics of ecosystems and ask what the basic principle is which enables them to be so high-yielding and self-reliant. The answer lies in diversity, but not so much in the diversity of the component species themselves as in the diversity of beneficial relationships between them. One example of this kind of relationship is that between the flowering plants and the pollinating insects, in which one gets its food need met and the other its reproductive needs. An ecosystem consists of a whole network of relationships of this kind, both between living organisms and between them and the non-living components of the ecosystem such as soil, water and climate.

An example of how beneficial relationships can be created in a human system can be seen in a productive conservatory. The conservatory collects solar energy and passes some of it on to the house in the form of space heating. Energy is also stored in the wall of the house and re-radiated at night, keeping the conservatory frost-free and warmer than a free-standing

greenhouse. Thus each helps to warm the other. The conservatory is relatively narrow from front to back and goes all the way along the most southerly-facing wall of the house. This ensures maximum gain of heat and minimum loss. The conservatory is also used for raising vegetable plants in the spring, and the ease of visiting what is in effect another room of your house, compared to going to an outside greenhouse in inclement weather, means that the seedlings get more attention. This means they get off to a better start in life, which is a very important factor in the final performance of the crop.

A house with conservatory attached does not look like an ecosystem but it shares its most important characteristic: a network of beneficial relationships. This kind of permaculture is not dependent on direct imitations of nature; it depends on placing things in relation to each other so that beneficial relationships can be formed between them. In short, it is a matter of functional design. I call this approach design permaculture. It can be practised with or without the characteristics of original permaculture, though in practice most permaculture contains elements of both.

A central method used in permaculture design is what we call the key planning tools. These comprise the concepts of: zone, sector, network and elevation. By *zone*, we mean the amount of human attention which a piece of land receives. Crops and activities which need the most attention are placed where they will receive it with the least effort. For example, when confronted with the choice between a very small back garden or an allotment which is half an hour away by bicycle, the wise gardener may forgo the allotment and grow their fruit and vegetables in the garden. The constant presence of the gardener means that production can be many times more intensive and the garden may out-yield an allotment several times its size. In addition, more frequent harvesting means that a greater proportion of what is grown actually gets eaten. Although simple, this is a wonderfully powerful design tool, not only for households but for farms and whole settlements.

While the concept of zone deals with the human energy centred on the site, *sector* is about off-site factors which affect it. These include wind, light and shade, water, views, neighbours, and pollution. Many of these are climatic factors and the concept of microclimate - the characteristic climate of a small area - is important in permaculture design. Whilst creating a totally new microclimate, such as a conservatory, can be worthwhile, it is not the first priority. The first step is to observe the site carefully through all the seasons and then match the planting to the various microclimates the site contains. For example, a tough fruiting tree such as a damson will yield as well in a windy or shady spot as it will in a south-facing sun trap. Not so a peach. Matching the plants to the microclimates available means that a wider range of plants can be grown, including more demanding ones, and the overall yield of the system will be higher than if they were placed at random.

Network is similar to zone but it comes to bear when there is more than one centre of human activity. This means it is more often relevant on larger sites such as farms and whole settlements than in domestic gardens. It is concerned with access and links between different nodes of activity. An example in settlement design is to ensure that all frequently used services, from shops to allotments, are within easy walking distance of people's homes.

Elevation is concerned with altitude, both relative and absolute, and degree of slope. It is particularly relevant when dealing with water, both in domestic and broad-scale situations.

For example, the conventional approach to siting a pond for farmland irrigation is to place it on flat ground at the bottom of the slope and use fuel to pump the water to wherever it is needed. The permaculture approach is to find a spot which combines three characteristics: low enough in the landscape to be able to collect water; high enough so that it is above the area to be irrigated; and on a relatively flat piece of land for economy of construction – you need a taller dam to make a pond of given size on a steep slope than on a more gradual one. A pond in such a position may have to be a little smaller or may be a little more difficult to construct than one sited on the flat land at the bottom. But throughout the fuel-hungry ages which stretch before us it will irrigate the land entirely by gravity.

When they are used together as a set, the synergistic effect of these planning tools is powerful. They are far from being the only design method used by permaculturists but they are perhaps the most effective. A frequent theme which runs through them is the reduction of energy expenditure, both human and fossil fuel. In the examples I have chosen here: excessive travelling is cut out and more food is produced per unit of energy invested; tender fruit can be grown without the need for glasshouses or imports; journeys can be made by foot instead of powered transport; and water is available where it is needed without any pumping. In the past, human needs were met largely by muscle power, which meant unremitting drudgery for the majority of the population. In the present our needs are met by throwing unlimited quantities of under-priced fossil fuel at any problem. People often assume that these are the only two options but permaculture seeks to provide a third, one which is based on design.

Most of the elements of permaculture design, from conservatories to irrigation ponds, are not unique to it. Even the less familiar elements which are associated with original permaculture, such as the forest garden, have their equivalents in other parts of the world or in other times. The contribution which permaculture brings to the practice of sustainability is less to do with the elements it contains than the connections between them. The network of beneficial relationships which characterises a permaculture system is an alternative to the excessive use of energy which is characteristic of present-day systems. Although I am focusing here on energy use, permaculture is about much more than energy, just as the challenges which face us in the 21st century are not confined to climate change and peak oil. But these are certainly the biggest and most urgent of those challenges and permaculture has an important role to play in confronting them.

Whatever design methods are used, they are used within a clearly defined design sequence. The stages of the sequence are: making a map of the existing situation; conducting a site survey; asking the people who inhabit or use the site what they want from it and what work and skills they can provide; evaluation of the information gathered; formulating design proposals and drawing these on a map; and finally re-evaluation. A great emphasis is placed on the early stages, those of observing and listening. The temptation to rush into making design decisions early on is always there but a good, workable design is unlikely to result if the receptive part of the process is rushed. Listening rather than speaking, valuing the passive above the active, is the antithesis of our contemporary culture. We find it very hard to do. Yet it is a cultural change we need to make if we are to learn to live with nature rather than in spite of her.

Ideally the designers should be the inhabitants themselves. The time they are able to give to the design, compared to a consultant designer who will complete the job in a few days, is

important. It allows for observation during all the seasons so that microclimates can reveal themselves. It allows time for all the people involved to have their say and be well listened to. It also allows initial ideas to be mulled over in the light of experience. There is a place for permaculture consultants but most people who want to practice permaculture prefer to learn how to do it themselves and only bring in professional help to check that their design is on the right track.

At present, permaculture tends to be taught outside formal education in short courses in a two-week block, a series of weekends or evening classes. These courses provide a good model for how permaculture design could be introduced in formal education in dedicated modules, although permaculture principles could also be woven in right across the curriculum. Active learning is essential for gaining permaculture skills. The core of the standard permaculture course consists a series of design exercises, usually one for each of the stages in the design sequence listed above. This is carried out on an actual piece of land but with a fictitious inhabitant. The land gives the exercises the element of reality and the tutor who plays the part of the 'client' can choose a scenario which will give the best learning experience. Having learnt how to do permaculture design in this practical way, the students can go home and do it on their own place.

That place need not be the idyllic smallholding or large garden which may spring to mind as the sort of place you need in order to practice permaculture. One of the strengths of permaculture is that it can be used to make the most of unpromising situations. Balconies, shady back yards, odd scraps of unused land, even flat roofs have their potential, and the permaculture design process can seek out these potentials and maximise them. It is also well adapted to community situations, where many voices need to be heard, and often the human aspect is more of a challenge than the physical. In the twenty first century, the long, vulnerable, energy-intensive supply lines which presently keep us fed are unlikely to perform as smoothly as we have become used to. It is likely that we will need to cultivate every scrap of land available to us, especially in cities, and to learn how to work together as we do it. Permaculture design skills therefore have an important role to play if we are to survive and thrive in the difficult times ahead.

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COMMONS THINKING

the ability to envisage and enable a viable future through connected action

Justin Kenrick, University of Glasgow, and PEDAL – Portobello Transition Town

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What is Commons Thinking?

The further we move into this century, the more urgently we realise that we need to relearn the political and personal skills of envisaging and enabling a viable future. This skill is not new: it is at the heart of commons regimes the world over. Commons regimes manage socio-environmental relations in ways that attend to the finite nature of human and natural systems in a way which – paradoxically – ensures their infinite abundance continues. Vandana Shiva notes that in Commons or Sustenance Regimes 'People work directly to provide the conditions necessary to maintain their lives . . . Sustenance economies exist even where capital markets do not. Yet capital's market cannot exist without the sustenance economy because externalising the social burden is the very basis of profits and capital accumulation' (2005: 17).

The Commons are life-sustaining or life-enhancing resources and services that have not been divided up and assigned a monetary value in the global economy but instead are shared - according to evolving arrangements and agreements - among members of a community or group. They range from the air we breath, pollination provided by bees, land that provides food for gathering, sharing, cultivating and dwelling rather than selling, to libraries, public parks, pavements we walk along, and on to childcare, care for the elderly and words of comfort given freely and willingly rather than at an hourly rate. Pitted against the Commons, however, are the forces of Enclosure, which attempt to appropriate, own and sell resources that were once accessible not through the power of money but through the rights and responsibilities gained by being a member of a community. The processes of Enclosure spread from England to the rest of the British Isles: dispossessing people of their land, displacing them, and using these same people to colonise and appropriate the land of peoples in Commons regimes the world over. However Commons regimes continue all over the world. These range from place-based communities agreeing how to use and share resources for the well-being of all their members (whether in the rainforests of Central Africa or through community buyouts on the west coast of Scotland) to emerging communities of practice - such as educators passionate about sustainability and empowerment. Wherever and whenever people find ways to ensure that our well-being ensures the well-being of others - and to refuse the logic that asserts that our well-being depends on exploiting (human and ecological) others - then the we are re-asserting Commons processes and resisting processes of Enclosure which now threaten us with extinction.

This chapter aims to describe one important skill for rebuilding political, community and personal resilience: the ability to think in a Commons way. This way of thinking is crucial to tackling the root causes of economic and ecological meltdown, to restoring the local, national and global Commons, and so recovering a future that can often – to say the least – seem

precarious. Commons regimes persist and re-emerge wherever people retain the political space to concern themselves with maintaining social and ecological resilience. They persist in the face of pressure from more powerful outside forces which seek to exploit, in a short-sighted way, the social and ecological resources upon which the community depends.

Commons thinking involves identifying the way one is complicit in the Enclosure or destruction of the Commons, in order to extricate oneself from such processes and instead identify with and strengthen the processes that maintain abundance for all. In essence, Commons approaches assume a world of abundant relations from which individual entities emerge and are sustained, whereas the Western dominance perspective assumes a world of scarcity where discreet entities are brought into relationship through processes of control and competition.

Putting it bluntly, these contrasting problem solving approaches can be thought of in terms of:

A **Commons approach** which assumes that:

> ➢ we live in a common life-world upon which we all depend,
> ➢ any problems stem from a breakdown in relationships, and
> ➢ solutions are primarily about restoring these relationships

and a **dominance approach** which assumes that:

> ➢ one's well-being ultimately depends on controlling the devalued other (whether other life forms, other humans, or other aspects of oneself),
> ➢ problems are about the lack of such control, and
> ➢ the solution involves the dominant realm (the mind, the 'developed' world, the adult, the expert, or humans in general) imposing control on the supposedly inferior realm.

How dominance thinking misrepresents the Commons

When the 'Commons' is referred to at all in dominant thinking, it is usually in terms of the so-called 'Tragedy of the Commons', and this term is used to argue that left to ourselves (without the market and government to control our behaviour) we would each choose to exploit our ecological context for our own individual benefit even though this would inevitably lead to the destruction of the ecosystems (the Commons) on which we all depend. In fact, the opposite is the case. Even Garrett Hardin, the inventor of the term, later admitted that the phrase describes, not a Tragedy of 'Commons regimes', but a Tragedy of 'Open Access regimes' (Kirby at al 1995).

The irony here is that an excellent example of an 'Open Access regime' is that of capitalism, where the only understanding of being 'rational' is of acting in one's own immediate, narrow self-interest. 'Open access regimes' describe situations where people are persuaded to act in a way that has no consideration for the longer term of themselves, their children or others. Commons regimes, in sharp contrast, always have unwritten or written rules about who can use what resource when and for how long, in order to ensure everyone's well-being over the longer term (Kirby at al 1995, Kenrick 2005). Some may be wealthier than others, and there is

always negotiation, argument or conflict as the rules are changed, kept, or broken; but the basic principle is that you don't get a free lunch (getting a free lunch is exactly what advertisers, political parties and any other open access regime pundit tries to persuade us we can get). Commons regimes are how humans have effectively self-organised for millennia; and it is somehow typical (in an Orwellian 1984 kind of way) that the term is then used to denote a 'tragedy' in order to assert that our only hope is a market system regulated by government, when it would be blindingly obvious to a Martian anthropologist that such a system has brought us to the brink of extinction, and that we need to change it fast.

Commons systems have recently re-emerged in the UK – both through the land reform movement and community buy-outs that have swept through rural Scotland since the mid 90s, and through the proliferation of Transition initiatives (see Quilley, this volume) in Ireland, Scotland, England and Wales since the mid 2000s. These are recent examples of Commons regimes re-emerging because people realise that it is more rational to base their well-being on collectively caring about those around them, than to believe they can – over the long term - improve their own lives at the expense of their neighbours. The Transition approach embodies Commons thinking and is a creative, empowering, and immediately gratifying proof that – if we come at problems from a Commons perspective – our solutions will improve life for us all, rather than deal with symptoms in ways that exacerbate the original problem.

Naming the problem: Ecological Collapse, or why it is Rational to be *Scared*

The first step in bringing Commons thinking to bear is to recognise the problem, and the way in which all aspects of it are related. In today's Sunday Herald newspaper (2009.03.29) under the headline: 'Two Months to Save the World', Professor Jacqueline McGlade, the European Environment Agency's executive director, states that:

> Even if all the current promises to cut greenhouse gas emissions are honoured, the world will still see global temperatures rise by an average of four degrees centigrade by the end of the century. . . This is hot enough to make most of the world uninhabitable.

Climate change demonstrates that it is short-sighted in the extreme to base our well-being on destroying the life support system upon which we depend, and hoping that imposing technological or political solutions can protect us from the consequences. Climate change is a consequence of a system in which: companies are legally obliged to maximise profits for shareholders, profits are made by externalising the social and environmental costs, and if companies aren't willing to externalise these costs to make these profits, then they are simply swallowed up by those who will. Ongoing destruction of the earth's life support system ensues. From a Commons perspective, climate change is as much a reason to be hopeful as a reason to be fearful, since it is an urgent wake up call to stop this socio-ecological devastation which would destroy us sooner rather than later if we don't act now.

To take a brief snapshot of the current ecological situation, we can see accelerating climate change feedback loops are evident in the Arctic, which – as recently as 2007 - was predicted by the UN's IPCC to be ice free in summer by 2100, but is now predicted to be ice free by 2011-2015. Accelerating climate change feedback loops are also evident in the Amazon, Southern Europe and Australia, where drying out forests and bush are vulnerable to

devastating fires; and in the weakening of the planet's carbon sinks – especially the Southern Ocean – to absorb our carbon pollution (Climate Safety 2008). Meanwhile we are persuaded that only economic growth can meet our needs. The responses to climate change by corporate compliant governments focus on carbon trading, which does not directly reduce the CO2 going into the atmosphere, but turns it into a tradable commodity. The focus is also on maintaining the so-called 'carbon sink' forests of the Global South so that economic growth can continue unchecked, while justifying Global players appropriation of local peoples' forests and livelihoods (Griffiths 2007).

Recovering a Commons way of thinking, or why it is Rational to be *hopeful*

Moving towards a society based on Commons sufficiency requires recovering a *Commons way of thinking* and relinquishing dominance thinking, the dualistic problem solving approach underpinning non-egalitarian and unsustainable social systems. Several questions follow from this:

➤ How do we make the transition from a system in which problems are made worse by the way solutions are imposed – imposed by a supposedly superior realm on a supposedly inferior realm - to a system that no longer divides the world into superior and inferior realms?

➤ How do we move towards a recognition that – in the current system - development workers, police, doctors, social workers and teachers are entirely dependent on others' poverty, criminal acts, ill-health, social problems and supposed lack of education? For example, how do we recognise that ending poverty in Africa does not require the supposedly 'superior' wealthy and educated 'West' to intervene with charity, but requires the 'West' to stop building its wealth on forces of extraction and domination that impoverish Africa?

➤ How do we move to a Commons society in which sufficiency and security are grounded in the ability to respond to fear and lack by continually rebuilding relationships of trust? How do we create a society in which the other's problem is recognised as arising from a mutual world, and in which solutions are sought through dialogue and engagement?

Commons thinking recognises the rich resources available to us by starting from ensuring the well-being of locality, and the well-being of others in their localities, rather than from a system of competition over resources made scarce by that very competition. Resources are assumed to be abundant, and are made abundant by ensuring that all people and other species (all ecosystems) have sufficient to meet their needs and to ensure their flourishing. This is predicated on the notion that my well-being depends on your well-being, and on the assumption that solving problems involves working to restore relationships of trust rather than seeking to impose solutions on others.

As Lohmann (2005:20) points out 'Communal use adapts land, water and work to local needs rather than transforming them for trade and accumulation'. In the sustenance economy 'satisfying basic needs and ensuring long-term sustainability are the organizing principles for natural resource use' (Shiva 2005: 18). Such Commons approaches can perhaps best be understood as Life Projects:

> Life Projects are about living a purposeful and meaningful life. In this sense, their political horizons cannot be located in the future, just as living in the present cannot be put on hold in pursuit of a future goal. . . Life Projects have no political horizon; they *are* the political horizon. They are not points of arrival, utopian places, narratives of salvation or returns to paradise. They are the very act of maintaining open-endedness as a politics of resilience. (Blaser 2004: 48)

Life Projects are coming into focus not only through standing out as a force to be reckoned with in the Global South and North, but also through their ability to build alliances through which to wrest political space from corporation controlled governments. This is evident in the way indigenous people have moved to take control of national governments in places like Bolivia, to secure degrees of autonomy through legal means in places like Canada, or through creative modes of resistance in places like Mexico. In the UK, it is evident in crofting communities' successful campaigns to take back collective control of their communities, which led to the Scottish Land Reform Act securing that right for a whole range of rural communities. It is also evident in the emerging movement of Transition Initiatives in villages, towns and cities where local people are seeking to enable their communities to make the transition from an oil based economy, to a local economy where local decision-making can ensure sufficiency for all.

Activity

In small groups, in pairs or by yourself try bringing a Commons way of thinking to problem solving. As you attempt the exercise, notice if your response persistently seeks to revert to habitual dominant, dualistic problem solving approach:

> Think of a political problem that is bothering you (an example given above is that of Poverty in Africa, others could be: the role of air travel in generating carbon emissions, population growth and poverty, ways of ensuring well-being while reducing carbon emissions to zero, supporting an ageing population, the lack of affordable childcare, or 'ghost-town' high streets due to out-of-town supermarkets).

> Instead of thinking about how this problem can be solved by the wealthy/ powerful/ intelligent/ experts imposing a solution on those deemed poor/ powerless/ stupid/ non-experts, *imagine* that the problem does not lie in the devalued lacking something but in the powerful imposing something; imagine that the solution lies in supporting connections rather than controlling others; imagine that it lies in discovering, respecting and responding to people's real needs.

> How can we identify the processes that trap us in relations of domination, and how can we challenge such processes in a way which builds (rather than undermines) common cause between all concerned?

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COMMUNITY GARDENING

skills for building community and working within environmental limits

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The challenges of a changing climate and a peaking oil supply are an opportunity for educators to rethink the kind of community and world we would like to live in. As oil peaks, intensive farming becomes less economical, since it depends on oil and natural gas for pesticides, fertilizers and farm machinery. At the same time, climate change, ecosystem degradation, the demand for biofuels, an increasing population and increasing demand for milk and meat in developing countries, is putting further pressure on food supplies. For many communities, particularly those hardest hit by economic turbulence and extreme weather events, high food prices will present a challenge for survival, and even in rich countries it will become increasingly difficult for many to afford a varied and healthy diet. The ability to work with communities and design and implement gardens that can provide organic produce from minimal resources is therefore an important sustainability literacy skill, for both sustainability in the sense of surviving in the face of the challenging conditions of the twenty first century, and the efficient use of resources so as not to contribute to making those conditions even worse. Developing skills in designing and implementing community gardens requires active engagement in real projects. This chapter describes how the form of active learning involved in community gardening helps learners gain skills not only in garden design but also a wide range of other sustainability literacy skills that are useful in other contexts.

Community gardens are urban plots of land which provide opportunities for learners and educators to work together with the local community to design spaces according to goals, such as creating an attractive space, demonstrating permaculture principles, building resilient communities, providing food, health, and environmental education. Community gardens can be sited on derelict urban brownfield sites, on allotments, or on the grounds of educational institutions themselves. Within community gardens, learning is a social process: learners, educators and members of the local community all learn from each other and from interaction with the built and natural environment (see *A Learning Society,* this volume). Working with nature and a local community in establishing and maintaining a community garden can enable learners to gain sustainability literacy skills in ways which would not be possible in a regulated classroom environment. This is a form of 'experiential learning' (Orr, 1992), providing a direct participatory learning experience through active engagement.

The activities involved in designing, implementing and maintaining a community garden contribute to both environmental sustainability and the health and wellbeing of the learners. A wellbeing approach encourages the learner to think positively about sustainability since they have something to gain directly for themselves, while at the

same time they can learn how environmental impacts are related to everyday choices and values. The approach demonstrates that the health of the environment and the wellbeing of the learner are interlinked - our natural environment generates the conditions for organic life, of which human life is one form, existing only in interdependence with other forms of life.

The sites are ecologically designed contained spaces. Energy and waste inputs and outputs are minimised by natural and designed-in cyclical processes, of organic food growing, natural seasonal growth, composting, rainwater harvesting, use of solar energy and reusing and recycling of waste materials generated on site. In this way, activities within the sites enable the learner to become aware of environmental limits and ways of living within those limits. The sites also facilitate connection with the knowledge and skills for sustainable living that are imbedded in local communities.

Table 1 summarizes just some of the sustainability literacy skills that can be gained directly through the activities involved in designing, implementing and maintaining a community garden.

Table 1 – skills and activities in community garden projects

Skills	Activities
Community building	➢Designing, planning and implementing a project collectively brings people from different ages and walks of life together ➢Social events such as cooking with food grown in the garden, eating and working together help to develop social skills for bonding with others.
Ecological design and observation	➢Participating in maintaining a non-rigid design and natural evolution of site. ➢Learning about the natural history of the site; ➢Working within the existing natural features of site: soil testing, aspect, shading, seasons, microclimates etc. ➢Seeing the consequences of one's actions within the site; ➢Caring for plants; growing food organically; recycling; reusing; encouraging wildlife
Appropriate technology	➢Designing, building and using rainwater harvesting systems, compost toilets, cold frames, wormeries etc.
Holistic health	➢Working physically outdoors, being able to choose activities to match body limits. Eating organic, locally grown vegetables and fruit, becoming aware of interrelationships between a healthy body and healthy environment
Communication skills and stakeholder engagement	➢Talking with others within and about the local natural environment, solving problems together, consulting people when making decisions, overcoming disagreements and working with people who have different agendas.

Because sites tend to be compact in size, learners can readily see the negative consequences of wasted resources, or the positive impacts of recycling and reusing

the site's resources. Ecological design principles can be employed within the site in order to integrate natural processes with learning activities. Examples of this include using coppice willow in building structures, composting with organic waste from the site, using harvested rainwater to water crops during the summer months, eating food produced on the site and using a compost toilet. Such activities demonstrate how individual choices made within the site can enable or undermine conditions for other choices to be made in the future.

Since each learner is actively involved in the evolving design process, they can develop the important quality of *mindfulness*, becoming aware of how their actions affect and are constrained by the natural processes around them across the changing seasons (see *Permaculture Design,* this volume). This can lead to the emergence of what E. O Wilson (1984) calls 'biophilia', as learners begin to love the site and the unfolding structures, plants and wildlife within it. Since learners have a stake in the success of site activities such as growing food, participating in community events, building structures such as teaching rooms, digging ponds and making compost bins from natural and recycled materials, the activities are purposeful and meaningful.

The sites are embedded in place and community, and solutions to design problems are worked out within the site. Learning is through experiencing the success or failure of food crops, different composting techniques, methods of mulching and natural pest control. Diverse groups work together, learn from each other, eat food produced on site together, and gain observation skills through learning about the natural history, soil type, aspect and shading within the space. The informal and sometimes contested nature of reclaiming a public space for group activity gives those involved a sense of ownership, empowerment and community. The design evolves as the site evolves with the seasons, food grown, with changing types and numbers of people and groups involved. In this way participants learn to deal with uncertainty, design for the future where appropriate and 'let what happens happen' where appropriate.

Because of the informal structure of community gardens, the learner has a choice in what activities/tasks to participate in. If they are not interested in being involved in a high level of physical activity such as digging or building on a particular day, they are free to choose a less strenuous activity such as weeding or harvesting. In this way, they can test and realise their own bodily limits, gaining intuitive knowledge of themselves as embodied beings acting within an environment. Since taking on tasks is voluntary and there are no deadlines, learners can focus on achieving tasks slowly using simple technology such as hand tools to allow mindful attention to the task at hand. Such choices and experiences are in contrast to a usually hi-tech and regulated urban educational setting. Activities such as planting and harvesting in natural surroundings while chatting with others absorbed in the same activities, provides sensory stimulation and can lead to a highly enjoyable learning experience.

By thinking holistically, learners realise their role as active *agents* of change both within the site and in their daily lives. Agency is the ability to exercise choice and live according to deeply held values and is enabled or constrained by physical health, social structure and environmental limits. Through being an active participant within a community garden, learners can become free from the artificial and often rigid constraints of disciplinary-based education and instead, exercise their agency within the very different constraints of community and environment.

In everyday activities, the concept of sustainability may be perceived as restricting choices. People may be "locked-in" to unsustainable behaviors; for example, recycling opportunities may be limited, local organic food too expensive, or greywater systems impractical given constraints on building alteration. There may, therefore, be many instances where actions which contribute to sustainability are desirable but cannot proceed because there are no enabling structures. Community gardens provide learners with such enabling structures by allowing access to skills, knowledge and support to grow food organically and be creative in the reuse of waste materials. They provide a space for active sociable participation in a natural environment which can fulfill human needs for belonging, community, physical exercise, healthy food and entertainment in ways which do not demand high consumption of resources. Because taking part provides so many enjoyable experiences, community garden projects can bridge the gap between valuing a sustainable life and having the enabling skills to act on such values.

The environment provides the resources we require for human life, and the activities and experiences within the site help learners understand the natural processes that make life possible for all life-forms. Goodin (1992) describes how these larger ecological cycles and processes provide a continuity and context in which humans understand their own individual plans and projects, and hence shape their own well-being. However, in a built up urban environment, learners may not be aware of such cycles of activity. Community gardens enable such a realisation by creating a self-contained, ecologically designed space, within which the learner plays an integral part. In this way, they are transformative spaces in which the learner realizes both human and environmental limits, and the intrinsic value of the natural environment.

Summary

The ability to design and create community gardens is a skill of considerable importance for surviving and thriving in the twenty first century. It is not a skill that could be learned merely in the classroom, but one which requires learners to become actively engaged with educators and the local community in creating working community gardens for themselves. The sustainability literacy skills involved in participation in community garden projects reach far beyond gardening, and include a wide range of skills, from community-building to ecological design, which may be transferred to other spheres of life.

Within a community garden project there is a positive focus on both the health of the environment and the well-being of the learner. Education for sustainability within the sites is based on the premise that simply accumulating knowledge about problems such as climate change, pollution or threats of a peaking oil supply, is ineffective and may be disempowering. Including community gardens into learning programmes provides a resource hub for learning about the processes of nature and gaining a range of sustainability literacy skills. It is a transformative environment which enables a holistic way of thinking and of making choices about resources in everyday environments. Gaining skills in community gardening can help learners shift from thinking about sustainability literacy as being about self-restraint, to conceptualising it as a route to personal well-being, community resilience and the health of the systems that support life.

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APPROPRIATE TECHNOLOGY AND APPROPRIATE DESIGN

the ability to design systems, technologies and equipment in an appropriate way

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Engineers and product designers have often been guilty of feeding on consumer wants rather than working to satisfy the basic needs of the global population. It is nothing short of scandalous that in the twenty first century, one-third of the world's population – two billion people – do not have access to safe drinking water, whilst expensive projects such as the Large Hadron Collider (estimated final cost £5.5 billion) occupy the attention of engineers. Large projects with no obvious benefits are easy targets, but on the individual scale, a survey carried out by insurer Cornhill Direct, found that the average UK teenager leaves the house with clothes, jewellery, watches and gadgets such as mobile phones worth £529.54; a value roughly equivalent to the Gross National Income per capita of sub-Saharan Africa (estimated by the World Bank as £590 in 2006).

Up to the mid twentieth century, engineering was usually a response to a physical need. For example, steam engines were developed by Newcomen, Watt, Trevithick and others, to pump water from mineshafts; Abraham Darby's efforts to refine iron production were motivated by the need for cheaper cooking pots; and the chlorination of water by John Snow was in response to the 1854 Cholera epidemic.

Maslow ranked human needs in a pyramid, with basic physiological needs such as the need to eat, to breathe, to sleep at the bottom of the pyramid. The next layer includes the need for safety and security. Next comes the need to belong, to love and be loved, which are topped by esteem and other higher 'self-actualisation needs'. With basic needs having been largely met in over-developed countries, engineers have been aimlessly 'innovating' and relying on a massive advertising industry to convince consumers that the resultant products will satisfy their higher needs. Buy these trainers and you will be accepted. Use this deodorant and you will be attractive to the opposite sex. Subscribe to our mobile phone network and your talk will be unlimited (see *Advertising Awareness*, this volume). In the twenty first century, consumerism, not necessity is the mother of invention.

The influence that technology can have on culture is discussed by Postman, who classified cultures into three types: tool-using cultures, technocracies, and technopolies. Until the seventeenth century, all cultures fitted into the first type. Tools were invented to do two things – firstly to solve urgent basic physical problems such as grinding corn, ploughing land, transporting water and so on, and secondly to serve the symbolic world of art and religion. The integrity and dignity of the culture was not threatened by the use of such tools. However, in a technocracy, tools play a central role in the thought-world of the culture. The very instruments created to meet the needs of society threaten to transform and indeed overthrow it. In Huxley's Brave New World, the revolution is complete – Technopoly eliminates alternatives to itself by creating a culture that seeks its purpose and finds its satisfaction in technology. The means to an end has become an end in itself.

The Indian theologian M. M. Thomas (1993) expressed these concerns in an address to the Christian Medical College at Vellore:

> There is no doubt that the scientific and technological revolution of the modem period has been a tremendous expression of human creativity, it has eliminated distances and created the global community materially. It has given us the knowledge necessary to produce goods and services in abundance. It has given us power for social, psychic and genetic engineering, to control disease and death as well as birth. But as we survey the world situation today, the general feeling is that along with many benefits, many of the promises of technology stand betrayed and there is evidence of a lot of technology having become instruments of exploitation of peoples, destruction of cultures and dehumanization of persons and pose a threat of destruction not only to the whole humanity through nuclear war but also to the whole community of life on the Earth through the destruction of its ecological basis.

As powerful marketing departments encourage consumers to switch their focus from one flashy technology to another, designers provide products to meet the latest fad, even though they know that the market for whatever it is they are producing will last perhaps a few years at the most. The rate at which technology becomes obsolete is increasing. For instance, it is estimated that mobile phones are replaced by users after eighteen months, whereas it takes approximately 1000 years for a mobile phone to decompose naturally (see *Materials Awareness*, this volume).

Too often, engineers have ignored sustainability and designed equipment, processes and technologies without taking into account local factors such as culture, environment, gender, local availability of materials and local production methods. Market economics has pushed engineers into coming up with mass-produced 'one size fits all' solutions, which may be inappropriate for some. This is particularly evident when designing for remote communities both in economically well-off countries and, acutely, for those with fewer physical resources.

Cook stoves make a good case study. Half the world cooks using wood as a fuel. With population pressures and climate change, it is becoming increasingly difficult in the twenty first century for populations around the world to find sustainable sources of wood for cooking, leading to widespread deforestation. In addition, with some designs of wood burning stove there are issues of indoor pollution. The developed world's response to these problems has largely been to come up with new technologies which are designed and tested at considerable distance from the communities they intend to serve. Often research is carried out in academic institutions away from where stoves are used and although the resulting stoves can be fuel efficient, the neglect of social factors is a major barrier to successfully introducing improved stoves into the homes of those living in remote communities.

In Ethiopia and neighbouring Eritrea, the staple food *injera*: a spongy sour flatbread, is cooked on a large griddle on a *mogogo* stove. These inefficient, smoky stoves are made by individuals from a mixture of mud and clay, whilst the mogogo plates are supplied by the local ceramics industry. Two recently proposed "improved" stoves are not suitable for cooking injera. The CleanCook alcohol stove, made in Sweden from aluminium, has two small burners which are insufficient to heat a mogogo plate. The change of fuel and stove also

has adverse economic effects on local mogogo plate manufacturers and firewood sellers. A stove from Aprovecho with a more traditional appearance but made from concrete failed to take into account the even temperature distribution required, so although testing in the USA by boiling pots of water appeared to show improved efficiency, when it came to cooking injira, the results were inedible. Although these attempts have some merit, their use requires Ethiopians to change their eating habits, threatens local economies and could thus be regarded as intrusive and colonialist. There is also a design of mogogo plate promoted by the Eritrean government – the ETRC (Energy Research and Training Centre) mogogo, but the cost of £28 places it out of reach of many Eritreans.

Alternative approaches involving local stakeholders have tended to be successful on a small scale, but are much more labour intensive. For example, on a recent trip with Engineers Without Borders UK to install wood stoves in a remote village in the Imbabura region of Ecuador, Nottingham University undergraduate Rob Quail found that although initially the villagers were rather shy, by involving them in the design and material selection process, they overcame scepticism. Returning to the village two weeks later, Rob found that the villagers had built two stoves from his design and had begun to experiment with modifying the stoves according to their own ideas.

It may be impractical to involve end-users at every stage of the process in the design of improved cook stoves, but it is vital that users' requirements are assessed carefully before solutions are proposed. For instance, stove users in rural locations are more concerned about the cost of a stove than fuel efficiency, since firewood is often collected free, whereas urban dwellers may have to purchase fuel and consequently are concerned with both initial cost and fuel efficiency.

An alternative approach is to tackle the problems of poor fuel economy and harmful emissions by modifying stoves which are currently in use rather than starting with a blank sheet of paper. Indigenous stoves will have undergone a natural process of evolution, with good stoves being imitated and bad ones replaced. Indigenous technologies can inspire us to find solutions to engineering problems of the twenty first century because they are addressed at solving real needs with limited resources. We must therefore exercise caution in defining the characteristics of good stoves. A project to replace smoky stoves in Nepal was successful in eliminating harmful indoor air pollution, but after six months, several dwellings collapsed due to termite damage; the previously used smoky stoves had been effective at killing pests whereas the new improved stoves did not fulfil this secondary (but essential) function.

Whilst the evolutionary approach to stove design is commendable for the way in which it builds up local communities, supports the local economy and fosters a sense of ownership, the process is frustratingly slow and costly in terms of the number of new stoves that have to be built and tested, many of which will not show any improvement on the previous generation. A novel approach is to make use of genetic algorithms and computer modelling. Traditional stoves are allowed to "mate" with stoves with good fuel efficiency, such as the rocket stove. The offspring stoves are modelled using Computational Fluid Dynamics (CFD) and assessed in terms of fitness. Fitness can be defined to include factors such as: fuel efficiency, temperature distribution, volume of material used to construct the stove (indicative of cost) and so on, although other cultural and environmental concerns, such as local availability of materials, may be harder to factor into the algorithms.

An excellent way to engender appropriate design is through project based learning. Learners have tackled the following problems: designing a wheelchair suitable for use in Kenya, producing a small-scale cardboard briquetting machine for use on the Isle of Lewis (to avoid cardboard ending up in landfill), designing medical equipment such as laryngoscopes and otoscopes which work without the need for replacement batteries in remote regions of Uganda, removing excess fluoride from drinking water using locally available materials in Ethiopia, designing a mechanical solar tracker for the Democratic Republic of Congo, and so on.

Working on projects designed with specific communities in mind encourages learners to develop communication skills, increases their awareness and understanding of the importance of cultural and social factors to engineers and promotes people-centred design. Involving users of technologies in the design and manufacturing process breaks down the barriers between learners and educators, and facilitates the discovery of solutions through mutual investigation and knowledge sharing.

Understanding the principles of appropriate design and technology is important not just for engineers but for everyone, since everyone makes choices about what kind of technology to employ in particular circumstances. As fossil fuels become scarcer and their use increasingly constrained, appropriate design and use of technology will become increasingly important, not only in remote locations which lack physical resources, but everywhere. Skills in appropriate design and appropriate technology will be essential in order to confront real problems of survival rather than the artificial problems of satisfying fleeting whims created by marketers.

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