Part 4
Conditions and visions for change and sense-making in a rapidly changing world

World Social Science Report 2013
Changing Global Environments

41. Possibilities and prospects of social change in response to the environmental crisis

Introduction to Part 4

by
Susanne Moser

Part 4 focuses on visions of change, particularly the role of technology and shifts in economic policies in shaping the future; conditions of change: that is, the drivers and barriers to changes in human behaviour; and interpretation and subjective sense-making, exploring how individuals and societies perceive and understand the changes occurring around them.

Humans are living a paradox. The global environment and its constituent parts are changing at an accelerating rate, all because of the collective impact of more than 7 billion people consuming the planet's bounty – albeit at different rates – with seemingly little regard for its long-term sustainability. At the same time, society's progress in reducing that impact is "glacially" slow – a metaphor the English language must soon let go of.

Part 4 focuses on understanding the processes of social change that drive, are impacted by, and respond to these environmental changes, and on how we make sense of change in the world around us. The very diverse contributions to this part are grouped under three headings. The first – visions of change – addresses the first component of Cornerstone 3. Contributions here imagine the role of technology and shifts in economic policies in shaping a better future. The second heading – conditions for change – integrates perspectives on personal and local change to global and systemic shifts in human behaviour, drawing largely on psychology, sociology, and integrative studies for human behaviour and social practices. The third heading – making sense of change – includes a number of articles on interpretation and subjective sense-making (Cornerstone 4) that provide a sketch of how individuals and societies perceive and understand the changes occurring around them.

Part 4 – while unable to be comprehensive – brings together a number of contributions that point to important progress being made by the social sciences. But it also points to the challenges that remain in understanding social change and in making this knowledge useful and actionable to decision-makers.

Visions of change

The first set of contributions speaks to visions of change, the images of a future we may want to strive for and that may inspire and guide us. Turok and Borel-Saladin, in their critical assessment of three major documents on the "green economy", speak to the need for an inspiring, positive vision of the future that is inclusive of North and South. Vision and implementation tools and measures are needed, they argue, to show that it is possible to benefit economically from transitioning to a low-carbon, highly efficient economy without degrading environmental and social conditions. Yet how incremental or radical a socially emancipatory "green economy" really is will depend on nations' interests, willingness, and commitment to making the necessary tough choices.

The contribution from Muchie and Demissie focuses on the promise of nanotechnology, while Maguire and colleagues take an optimistic but critical look at green chemistry. They explore the potential of advancing green chemistry as a design philosophy in which the production, use and disposal of chemical substances no longer results in toxic hazards. The authors call on the social sciences to help chemists become more reflexive about their enterprise, and produce more socially robust knowledge, superior product design, more effective communication between industry and citizens, and greater policy support among stakeholders.

Many other technologies (such as information communication technology, biotechnology, robotics, new sources of energy) and social interventions, besides economic policies and measures (such as democratisation, education, empowerment or political strategy) could be subject to social analysis. Many social scientists in fact have done just that (e.g. Dryzek, 2011; Giddens, 2009; Jasanoff, 1995). Thus, the contributions included here are limited and selective. Moreover, perhaps by accident, the visions of change presented are all positive, maybe even utopian. They do not break with past paradigms and dominant beliefs, but represent continuations and evolutionary enhancements. Such cultural narratives are seductive, socially reinforced and powerful, especially at a time when many trends are not encouraging. But as O'Brien (2012) urged, the social sciences, not questioning these paradigms and beliefs or envisioning possible alternatives, can create blind spots which can give rise to unanticipated negative consequences, social dispute and stalemate. Historically the social sciences have played this much-needed role: for example, questioning the technocratic implementation of new and risky technologies (Jasanoff, 1986), over-confidence in grand techno-economic experiments such as the Green Revolution (Shiva, 1991; Glaeser, 2011), or the inherent contradictions in modernity's promise of a controllable future (Beck, 1992) and "sustainable growth" (Mol, Sonnenfeld and Spaargaren, 2009). Much could be gained from bringing this traditional capacity to bear on possible interventions to mitigate global environmental change.

Conditions for change

The largest set of contributions to Part 4 addresses the questions of what motivates behaviour and social change, what the barriers are, and how change unfolds. Perspectives offered here range from the individual, household and local levels to the national, international and global or systemic levels. Collectively, they suggest that the social sciences actually do understand much about how complex and embedded human behaviours and practices are (e.g. Shove, 2003) and why and how they can be changed (e.g. Gifford, Kormos and McIntyre, 2011; Whitmarsh, O'Neill and Lorenzoni, 2011; APA, 2009).

Weber reviews major psychological theories on individual behaviour change. She lays out a set of coherent and mutually reinforcing insights into the innermost drivers of change, information processing and decision-making in individuals, as well as the range of inner and outer barriers to realising a particular behaviour. Recent work in evolutionary psychology (van Vugt and Griskevicius) looks at the deepest causes of human behaviour, adding considerable explanatory power to our understanding of why humans think and act the way they do, and how behaviour change interventions can be made more effective. Head and colleagues then place individuals in the social and structural contexts in which they exist. They unpack the household unit to better understand household dynamics, everyday practices, and linkages between individuals and wider influences, and uncover possibilities for more effective behaviour change interventions. Similarly, Feola examines the behaviour of individual smallholders in their socially and environmentally embedded structures, in the context of the use of agricultural pesticides. Using process-based modelling, Feola brings social-ecological systems approaches to life with insights into decision-making, capturing the feedbacks from peers, the environment and macro-scale influences that affect an individual's choices (see also O'Brien, Part 1).

Gutberlet and Song both take behaviour change to the neighbourhood and community levels. Song examines a neighbourhood-based effort in Shanghai, China, to increase participation in recycling, and highlights individual, structural and cultural obstacles to behaviour change as well as social influences that help overcome them. Gutberlet describes a community-based co-operative engaged in waste recovery in Brazil, emphasising the social and economic co-benefits that can motivate behaviour change and support more fundamental empowerment and social change.

Urry takes a systems perspective on the carbon-intensive socio-technical systems that underlie the "Western lifestyle", and the potential to halt and reverse their environmentally destructive momentum. He shows how the path-dependencies in these systems constrain the options and effectiveness of individual behavioural choices, and argues that the way out of such system lock-in is to develop a vision of feasible, attractive and visible low-carbon lifestyles and systems to replace current outdated models.

Together, the contributions to this thread show that there is no one all-determining independent driver or scale from which to initiate social change. Nor is there any monolithic constraint on change. Instead, change is always the result of complex interactions and is affected by multidirectional and multifaceted influences, motivations and barriers, as well as direct and indirect feedbacks from the social and natural environment (see Part 2). No single intervention, and certainly not the provision of scientific information alone, will suffice to bring it about.

Making sense of change

The contributions on sense-making give a bird's-eye view of how individuals perceive, understand and interpret what is happening in their environment, and provide interesting comparative insights across the world. As such, they touch on the personal and collective values, beliefs and worldviews that underlie people's experiences of, and responses – or lack of response – to, processes of global environmental change. However, they do not fully reflect the existing and emerging social science research on the psychological and social

processes that shape and change cultural values and worldviews on the environment (e.g. Dietz, Fitzgerald and Schwom, 2005; Leiserowitz, Kates and Parris, 2006; Crompton, 2011).

Smith, and Johnstone and colleagues, begin with cross-national surveys investigating concerns and attitudes toward environmental issues in general, and climate change in particular. Smith finds limited concern for environmental issues in general, though climate change has risen to the top of concerns in many countries. Johnstone, Serret-Itzicsohn and Brown's findings illustrate variable, but in general positive, attitudes towards pro-environmental behaviour changes. Many studies have shown that such positive attitudes and concerns are essential but insufficient to guarantee political or behavioural engagement, given the barriers that exist and the common observation that individuals tend to pass on responsibility for tackling climate change to policymakers.

Abbas and colleagues report on two international surveys of youth to understand young people's concerns, interests, aspirations, fears and hopes for the future, and the barriers they face to living more sustainable lives. UNESCO's educational efforts and those in French schools (Arnould) hint at the possibilities of affecting young people's abilities and aspirations. Many of their findings mirror those emerging from Rogers' report on the Field Hearings project, conducted in 34 communities in Asia, Africa and Europe, which aims at having poor people's voices included in high-level policy processes. Findings reflect important improvements in poor people's lives (see also Sachs, Part 1), but also a long list of worsening trends in the environment, governance, and economic and social conditions. Finally Buckland, in summarising the creative work of the innovative project Cape Farewell, describes the crucial role artists can play in articulating and visualising scientific findings and how people vision and make sense of the future.

Together, these contributions suggest that sense-making takes place as each of us is embedded and steeped in certain social and cultural environments (media, education, upbringing, organisations, neighbourhoods, peers and so on) that reinforce some values and worldviews, and contest or reject others. Much remains to be learned about how rapid environmental and socio-technical change will affect our ways of sense-making, and how these social processes interact with personalised experiences and psychologies. The contributions here also hint at indications of "useful" social discontent, particularly among youth. They point to the role of education in shaping the values of future generations from an early age, which can help redirect preferences and inclinations while instilling empowering skills to enact them.

Conclusion: Call on the social sciences

Taken together, the contributions to Part 4 reveal rich insights into the visions and conditions of change, but also show that no single discipline or level of investigation can capture the complexity of how change occurs. In this synthesis, a coherent story of individuals richly and dynamically embedded in households, communities, socio-technical systems, economies and cultures begins to emerge. This story goes a long way toward explaining the paradox of how the social drivers of global environmental change persist, or at least change only slowly, while the environmental crisis continues to unfold rapidly. Yet so much empirically rich social science research is still small-scale or single-scale and monodisciplinary. More research is needed on the power and embeddedness of individuals and the cross-scale connections in processes of change.

Similarly, there is a need to better understand how both deliberate and unintended changes unfold. For example, we see the power of participation, social capital and community engagement at small scales, but why is there not more investment in proven ways of empowerment and social capital building? How can they be scaled up? Is there a social tipping point beyond which big transformational change can occur?

The contributions collected here also suggest the question of whether there may be an implicit call for a "theory of change in everything" here. Is an overarching theoretical framework for social change (driven by hierarchy theory, systems thinking and the like) required at all levels, whereby change processes at different levels of social organisation are somehow linked together?

Particularly in the area of sense-making, there are important knowledge gaps to close through closer collaboration and integration of the "mainstream" social sciences with subdisciplines which are currently considered marginal to the core (eco-psychology, depth psychology, political ecology, political psychology and many more). Such integration could bring to the surface deeper drivers of change and sense-making, as well as the inadequately considered power dynamics of everyday life and big-stage politics. Finally, there is significant opportunity for the social sciences to work more closely with the humanities, for example to better understand historical social change processes and cultural narratives.

Bibliography

APA (2009), *Psychology and Global Climate Change: Addressing a Multifaceted Phenomenon and Set of Challenges*, report by the Task Force on the Interface Between Psychology and Global Climate Change, American Psychological Association, Washington DC, *www.citeulike.org/user/jdgrahame/article/10249327*.

Beck, U. (1992), *Risk Society: Towards a New Modernity*, Sage, London.

Crompton, T. (2011), "Values matter", *Nature Climate Change*, No. 1, pp. 276-277, *www.nature.com/nclimate/journal/v1/n6/full/nclimate1196.html*.

Dietz, T., A. Fitzgerald and R. Shwom (2005), "Environmental values", *Annual Review of Environment and Resources*, Vol. 30/1, pp. 335-372, *www.atmosp.physics.utoronto.ca/people/lev/ESSgc2/18920673.pdf*.

Dryzek, J. S. (2011), *Democracy in Capitalist Times: Ideals, Limits, and Struggles*, Oxford University Press, Oxford.

Giddens, A. (2009), *The Politics of Climate Change*, Polity, Cambridge.

Gifford, R., C. Kormos and A. McIntyre (2011), "Behavioral dimensions of climate change: Drivers, responses, barriers, and interventions", *WIREs Climate Change*, Vol. 2/6, pp. 801-827, *http://pics.uvic.ca/sites/default/files/uploads/publications/kormos_wires_2011.pdf*.

Glaeser, B. (ed.) (2011 [1987]), *The Green Revolution Revisited: Critique and Alternatives*, Routledge, New York.

Jasanoff, S. (1995), "Product, process, or programme: Three cultures and the regulation of biotechnology", in Bauer, M. (ed.), *Resistance to New Technology*, Cambridge University Press, Cambridge.

Jasanoff, S. (1986), *Risk Management and Political Culture: A Comparative Study of Science in the Policy Context*, Russell Sage Foundation, New York.

Leiserowitz, A. A., R. Kates and T. M. Parris (2006), "Sustainability values, attitudes, and behaviors: A review of multinational and global trends", *Annual Review of Environment and Resources,* Vol. 31, pp. 413-44, *www.isciences.com/assets/pdfs/-annurev.energy.31.102505.133552.pdf*.

Mol, A. P. J., D. A. Sonnenfeld and G. Spaargaren (eds.) (2009), *The Ecological Modernisation Reader: Environmental Reform in Theory and Practice*, Routledge, London and New York.

O'Brien, K. (2012), "Global environmental change II: From adaptation to deliberate transformation", *Progress in Human Geography*, Vol. 36/5, pp. 667-676, *http://phg.sagepub.com/content/36/5.toc*.

Shiva, V. (1991), *The Violence of the Green Revolution: Third World Agriculture, Ecology and Politics,* Zed Books, London.

Shove, E. (2003), *Comfort, Cleanliness and Convenience*, Berg, Oxford.

Whitmarsh, L., S. O'Neill and I. Lorenzoni (eds.) (2011), *Engaging the Public with Climate Change and Energy Demand Reduction*, Earthscan, London.

Susanne Moser is the director of Susanne Moser Research and Consulting in Santa Cruz, California, and a social science research fellow at the Woods Institute for the Environment at Stanford University. An expert on climate change adaptation, communication, and science-policy interactions, she has contributed to the IPCC and United States national and regional assessments and serves on the Scientific Committee of Future Earth. Moser is also a senior editorial adviser to the *World Social Science Report 2013*.

World Social Science Report 2013
Changing Global Environments

42. Promises and pitfalls of the green economy

by
Ivan Turok and Jacqueline Borel-Saladin

The green economy is an important feature of policy discussions around the world. It is portrayed as part of the solution to the global economic crisis, and as an innovative, efficient means of advancing the climate change agenda. It promises a targeted economic stimulus to launch the transition to a low carbon economy and spur long-term prosperity based on radical new technologies and improvements in resource efficiency. Clearly, this is a seductive idea worthy of careful scrutiny by social scientists.

Introduction

The green economy encompasses the development potential of interlinked natural and human systems. Natural systems are fundamental to regional economies based on agriculture, forestry, fisheries and tourism. Manufacturing and advanced service economies also depend on natural resource inputs in the form of energy, raw materials, clean water and fresh air. The green economy focuses on improving rather than undermining the material conditions upon which human systems depend.

This article explores the arguments of three major intellectual contributions by leading global institutions aimed at setting the agenda for environmental and economic policy in the years ahead: The United Nations Environment Programme's (UNEP) *Towards a Green Economy* (2011), the Organisation for Economic Co-operation and Development's (OECD) *Towards Green Growth* (2011), and the World Bank's *Inclusive Green Growth* (2012).

A bold vision

The green economy offers a positive vision of the future (Hallegatte et al., 2011; Pollin et al., 2008), in contrast to the apocalyptic perspective common in the environmental literature (Jackson, 2009; Meadows, Randers and Meadows, 2004; WCED, 1987). By identifying opportunities for progress, it is likely to have more potential for inspiring change in citizens and decision-makers than the paralysis that often stems from fear and negativity. The basic point is that something can be done to reduce the degradation of natural resources and ecosystems, while simultaneously improving human well-being. The emphasis is on pursuing the combined benefits of interactions between the economy and the environment, rather than accepting trade-offs and compromises.

The notion also includes ideas about how progressive change may be brought about: that is, the policies and instruments that will achieve green growth, including taxes, subsidies, direct investment, regulations and capacity building, which may be aimed at producers or consumers. A fundamental principle is that attaching a more appropriate monetary value to natural capital should help reduce its exploitation and degradation (UNEP, 2011; World Bank, 2012). The use of pricing instruments is apparent in carbon taxes, tradable carbon permits and the removal of fossil-fuel subsidies. Pricing strategies may encourage firms or households to substitute green products for brown. Green products are less harmful to the environment, less resource-intensive to produce, and generate lower levels of waste, pollution and greenhouse gas emissions. Better information, awareness raising and the enforcement of tougher standards and regulations may also be required to influence perceptions and reduce behavioural resistance to greening measures. Where markets are weak or nonexistent, as in impoverished rural communities, investment in building new institutions may be required to launch more sustainable forms of development.

Another feature of the green economy is that its basic principles are applicable to developed and developing economies alike. Both share an interest in harnessing the potential of improved environmental outcomes to enhance human welfare and raise living standards, and so to reap the synergies of economic and environmental action. The green economy is a kind of umbrella concept that could draw together diverse sectoral, economic and territorial interests around a common agenda.

The staunchest supporters suggest that greening the economy could launch the next wave of global growth (Moody and Nogrady, 2010; von Weizsäcker et al., 2009), or even the next industrial revolution (Rifkin, 2011). They argue that the rising prices of energy and mineral resources will lead to dramatic improvements in efficiency and productivity through better designs and new operating systems. A simple example is the Internet-enabled 3-D printing process that allows cost-effective manufacturing in small batches anywhere in the world. Other examples may emerge from new disciplines such as green nanotechnology, industrial ecology, green chemistry and biomimicry. A co-ordinated international green growth strategy involving investment in research and development and support for practical applications could in principle generate a profusion of disruptive new products and processes with transformative economic and environmental effects.

The OECD is more restrained, but endorses the idea that "the core of transforming an economy is innovation" (OECD, 2011: 51). It gives examples of solar power, microhydro power and biofuels that have resulted in important increases in energy supply and self-sufficiency in developing countries. The World Bank (2012) supports green industrial policies to develop new technologies that help to decarbonise the economy. Both organisations recognise the need for complementary financial instruments, such as long-term loans and equity funds, which can take a patient and broad view of the returns from such investments.

Because of the need for early and far-reaching action to mitigate climate change (OECD, 2011), the speed and scope of technology diffusion and adoption are just as important as the development of new products and systems. In the past, environmental technologies tended to be exchanged between developed countries in the North, which limited their impact. Green technology transfers between countries in the South will become increasingly important, given the greater similarities in their circumstances and

their need for more appropriate and affordable solutions. Various forms of international financial support and collaborative pacts between governments could facilitate such arrangements.

Creative thinking also extends to the protection and restoration of natural ecosystems. New systems of planning and management are needed that respect and value the services they offer, such as clean water and fresh air (OECD, 2011). Ingenuity is also essential in large-scale, long-lasting physical infrastructure, because it may lock in unsustainable patterns of material flows and consumer behaviour for decades (World Bank, 2012). This is vital in the rapidly urbanising countries of Asia and Africa, where the biggest environmental effects can be expected in the next few decades. Innovation is required in constructing energy-efficient buildings, retrofitting existing structures and introducing mass transportation systems. Greening the construction sector, waste recycling, and low-tech renewable energy generation could all generate substantial numbers of jobs because they are labour intensive (UNEP, 2011). The necessary tools for change include setting new norms and standards, creating financial incentives for producers and consumers, and raising awareness through demonstration projects and promotional campaigns.

Questions about the green economy

A fundamental question is whether greening the economy will achieve enough to alter the current unsustainable trajectory of the global economy and enable it to stay within the "safe operating boundaries" of the planet (Rockström et al., 2009; Bina and Camera, 2011; Victor and Jackson, 2012). In other words, will the scale of change from "business as usual" be sufficient to prevent excessive global warming and other environmental catastrophes, bearing in mind continuing population growth and pressures to increase consumption? Can a new sustainable development path be engineered by manipulating resource prices and stimulating new technologies? Or does the underlying market-based, short-term, growth-oriented paradigm of the global economy need to be replaced?

This is a hugely important but complicated set of questions. One answer is that there are different versions of the green economy, each implying different levels of intervention and different outcomes. They range from minor incremental reforms to major restructuring and transformation of the system. The three reports discussed here do not address the questions explicitly. They provide a range of policy approaches and tools from which governments can choose, depending on their economic conditions and political ambitions. The simple answer to the questions, therefore, depends on what aspect of the green economy is pursued, and how vigorously. The concept is not inherently conservative or radical, but is open to different forms and degrees of action, depending on local, national and international support and commitment.

A second question concerns the social pillar of sustainability. Can greening the economy have a substantial impact on poverty and inequality? The three reports maintain that the green economy can address all three dimensions of sustainable development, although the social aspects are least developed conceptually. All three advocate pro-poor policies in particular situations. One response involves the better management of natural ecosystems, such as soils, forestry and fisheries, on which the welfare of many subsistence communities depends. Another is to improve access to basic services, such as drinking

water and sanitation, in order to improve the quality of life. These actions are discussed mainly in terms of poverty relief rather than sustainable routes out of poverty through decent jobs and livelihoods.

The issue of equity between social groups and territories is a related concern. The continuing importance of competition and market forces in most versions of the green economy means that inherited strengths and assets offer sizeable advantages to individual firms, households, communities and nations; some economic agents and interests are bound to benefit, while others will lose out in the transition to a green economy.

These reports tend to minimise the impact of job losses in industries and localities dependent on fossil fuels, arguing that they would be balanced out by growth and the creation of new jobs in new green industries. This assumption ignores the likelihood that the new industries would emerge in places better suited to their specific needs, and may call for different occupations and skill-sets. There are few reasons why industries based on renewable energy (solar, wind and hydropower) would be sited alongside those based on coal, oil and other minerals. There would also be sizeable adjustment costs for those affected by the restructuring and for future generations within their local communities.

Without a substantial transfer of resources to developing nations, most will struggle to raise the funds required to invest in the transition to a green economy. Many of the new technologies have high upfront capital costs. Mature brown production techniques (those with more damaging consequences for ecosystems) tend to be more cost effective in the short term because they externalise their environmental costs. Considerable effort will be required to develop new collaborative solutions, such as voluntary patent pools to leverage intellectual property (OECD, 2011). Multilateral action may also be necessary to give poorer countries access to other green technologies, such as new medicines to fight infectious diseases. Experience suggests that measures that threaten powerful commercial interests encounter fierce resistance.

There is a technocratic slant to these reports which verges on assuming that if natural resources are priced correctly, the economy will green itself. There should be operating-cost savings from some green technologies and more efficient systems of production and distribution, but these do not mean that the green economy will emerge automatically. In the face of considerable inertia, vested interests and investments already made, it is likely that co-ordinated political action will be required to achieve the systemic changes envisaged. Dedicated efforts will also be needed to restore and regenerate natural environments that are already degraded. The green economy discourse is rather disconnected from the realities of climate change, the disruption caused to communities, and the considerable costs involved in preventing disasters, recovering from extreme events and adapting to shifting weather conditions.

The reports recognise that governments have important roles to play in establishing the conditions for the green economy to emerge. However, there is little discussion of the need for leadership across all sectors of society. Leadership will be necessary to avoid self-interest, advocate higher business costs in some instances, and encourage consumer sacrifices and lifestyle changes for those with large ecological footprints if society is to achieve the collective good of a low-carbon economy. There is also little consideration of the strategic capabilities needed to negotiate the transition, by means of social contracts

and other binding agreements between key economic stakeholders within and between nations.

Conclusion

The green economy offers an intriguing vision of change, with potential practical solutions to some of the major challenges of our time. The concept has probably raised the profile of environmental concerns in mainstream economic and development policy more than the idea of sustainability ever did. In other words, it appears to be an idea whose time has come. Yet it also needs further development, including conceptual clarification and a stronger evidence base grounded in our already degraded environment (MEA, 2005; IPCC, 2007). The extent to which there are genuine synergies rather than trade-offs between economic and environmental objectives is a particular gap in knowledge. Greening the economy in ways that are inclusive and equitable are further challenges. Understanding the diverse possibilities of the green economy in different local and national circumstances is also crucial. Integrating different elements of the green economy to create a new vision of sustainable cities would be particularly worthwhile. Finding the means to scale up effective action to achieve systemic global change is, of course, the biggest challenge of all.

Bibliography

Bina, O. and F. L. Camera (2011), "Promise and shortcomings of a green turn in recent policy responses to the 'double crisis'", *Ecological Economics,* Vol. 70, pp. 2308-2316, *http://academia.edu/651189/Bina_O_and_La_Camera_F._2011_Promise_and_shortcomings_of_a_green_turn_in_recent_policy_responses_to_the_double_crisis_Ecological_Economics_doi_10.1016_j.ecolecon.2011.1006.1021*.

Hallegatte, S. et al. (2011), *From Growth to Green Growth,* World Bank Policy Research Working Paper No. 5872, Office of the Chief Economist, Sustainable Development Network, *www.iadb.org/intal/intalcdi/PE/2011/09303.pdf*.

IPCC (2007), *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* Geneva, *www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf*.

Jackson, T. (2009), *Prosperity Without Growth? The Transition to a Sustainable Economy,* Sustainable Development Commission, London, *www.sd-commission.org.uk/publications.php?id=914*.

MEA (2005), *Ecosystems and Human Well-being: Synthesis. Millennium Ecosystem Assessment,* Island Press, Washington DC, *www.millenniumassessment.org/documents/document.356.aspx.pdf*.

Meadows, D. H., J. Randers and D. Meadows (2004), *Limits to Growth: The 30-Year Update,* Chelsea Green Publishing, White River Junction, Vt.

Moody, J. B. and B. Nogrady (2010), *The Sixth Wave: How to Succeed in a Resource-Limited World,* Random House, Sydney.

OECD (2011), *Towards Green Growth,* Organisation for Economic Co-operation and Development, Paris, *www.oecd.org/greengrowth/48224539.pdf*.

Pollin, R. et al. (2008), *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy,* Political Economy Research Institute (PERI) University of Amherst, Amherst, Mass., *www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf*.

Rifkin, J. (2011), *The Third Industrial Revolution: How Lateral Power is Transforming Energy, the Economy and the World,* Palgrave Macmillan, New York.

Rockström, J. et al. (2009), "A safe operating space for humanity", *Nature*, Vol. 461, pp. 472-475, *www.nature.com/nature/journal/v461/n7263/full/461472a.html*.

UNEP (2011), *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*, United Nations Environment Programme, Geneva, *www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/Green%20EconomyReport_Final_Dec2011.pdf*.

Victor, P. A. and T. Jackson (2012), "Commentary: A commentary on UNEP's green economy scenarios", *Ecological Economics,* Vol. 77, pp. 11-15, *www.sciencedirect.com/science/journal/09218009/77*.

Von Weizsäcker, E. et al. (2009), *Factor Five: Transforming the Global Economy through 80% Increase in Resource Productivity*, Earthscan, London.

WCED (1987), *Our Common Future,* United Nations World Commission on Environment and Development, Oxford University Press, Oxford.

World Bank (2012), *Inclusive Green Growth: The Pathway to Sustainable Development,* World Bank, Washington DC, *http://siteresources.worldbank.org/EXTSDNET/Resources/Inclusive_Green_Growth_May_2012.pdf*.

Ivan Turok is deputy executive director of the Economic Performance and Development Unit at the Human Sciences Research Council in South Africa and honorary professor at the Universities of Cape Town and Glasgow. He is editor-in-chief of the journal *Regional Studies*.

Jacqueline Borel-Saladin is a researcher at the Economic Performance and Development unit at the Human Sciences Research Council in South Africa, with expertise in local labour markets, spatial data analysis and urban geography.

World Social Science Report 2013
Changing Global Environments

Viewpoint

43. Making sense of techno-optimism? The social science of nanotechnology and sustainability

by
Mammo Muchie and Hailemichael T. Demissie

Using nanotechnology, scientists can change the atomic configuration of matter. New materials have seemingly magical applications, with promise that ranges from harnessing energy from the sun to eternally recycling materials by breaking them down into their atomic building blocks and reassembling them. It is vital, as UNESCO has urged, that social scientists engage fully in debates on nanoethics, and contribute to policy and decision-making processes concerning the use of nanotechnology in achieving sustainability.

Introduction

Our geological calendar is changing fast. The end of the Holocene period and the beginning of the Anthropocene, as the current geological time is known, should have long been official. Paul Crutzen, the Nobel Prize winner who coined the term Anthropocene, is convinced of the power humanity is wielding over nature: "It is no longer us against nature; instead, it's we who decide what nature is and what it will be" (Walsh, 2012).

In nanotechnology, Crutzen's words appear even more literal. Nanotechnology gives humanity unprecedented control of matter at the level of atoms and molecules. It gives us the capability to change the atomic configuration of matter; the new substances and materials it produces have seemingly magic applications. Nanotechnology products – ranging from stain-proof outfits to scratch-proof paints, from smart water filters to space elevators, from self-cleaning glasses to printable, self-healing body tissues – are already available on the market, or soon will be. As another Nobel Prize winner and nanotechnology pioneer, Richard Smalley, said, "[t]he list of things you could do with such a technology reads like much of the Christmas Wish List of our civilization" (Schummer, 2006).

At the top of this wish list for humanity are solutions to achieve sustainability. Attempts to use sustainable development to resolve the tensions between economic growth and environmental protection, between profit- and market-led development, and between intragenerational and intergenerational equity, have yielded little or no result.

Nanotechnology offers the potential to reconcile the three sustainability issues: economic prosperity, environmental quality and social equity. Promises range from harnessing energy from the sun via super-efficient solar energy harvesters installed in offices, houses or even painted on roads, to removing carbon from the atmosphere, or eternally recycling materials by breaking them down to their building blocks and rebuilding them again, and to constructing materials that will never deteriorate in quality or functionality.

The list is inexhaustible, with new applications appearing on a regular basis. However, trying to generalise about specific applications of nanotechnology will only give an incomplete picture of its potential. Nanotechnology promises greater control of matter, and solutions to many of our problems (Fogelberg and Glimmel, 2003).

As noted by the UN Millennium Project Task Force (2005), the relevance of nanotechnology for sustainability is based not on any one application, but on the nanotechnology method and its general features:

> [Nanotechnology] involves little labor, land, or maintenance; it is highly productive and inexpensive; and it requires only modest amounts of materials and energy. Nanotechnology products will be extremely productive, as energy producers, as materials collectors, and as manufacturing equipment.

These features validate the claim that nanotechnology, if properly handled, will lead the next industrial revolution, ushering in a new, ecologically sound logic for industrialisation and manufacturing.

Definitions

Nanotechnology has been defined in various ways, and with varying degrees of stress on the elements of the definition. The elements that feature most prominently are the scale at which the technology operates and the unique properties of matter at this scale. Nanotechnology is broadly defined as science and technology operating at the nanoscale – mostly confined to 1-100 nanometres. A nanometre is one-billionth of a metre, and the diameter of a human hair is said to be about 80 000 nanometres. It is widely held that it is at the range of 1-100 nanometres that matter exhibits strange properties that do not exist at larger scales. However, this not always true, as some new attributes emerge at a larger scale. No clear definition of nanotechnology has yet been agreed; even the need for such a definition is questioned (Maynards, 2011). Because of this, a UNESCO report warned that "nanotechnology will be defined by the corporations and nations that pursue their own interests most vigorously" (UNESCO, 2006).

Despite the lack of a precise definition, nanotechnology is on the verge of attaining the status of a broad "protodiscipline", with several disciplines taking the "nano" prefix: nanomedicine, nanobiotechnology, nano-electronics and so on. While nanotechnology itself is a science and engineering field, its focus extends to other disciplines, the social sciences included. Given the lack of agreed nomenclature, the social science aspects employ an awkward terminology simplified by the use of acronyms, including NELSI (nano, ethical, legal, social implications), ELSA (ethical, legal, social aspects), SEIN (social, ethical implications or interactions of nanotechnology) and even NE^{3}LSI (nanoethical, environmental, economic and legal and social issues).

However, nanoethics is the more widely used term for the social science of nanotechnology, and refers to nanotechnology issues in general. Allhoff and Lin (2007)

describe nanoethics simply as "something like the ethical, social, environmental, medical, political, economic, legal issues and so on, arising from nanotechnology". The scope of nanoethics is broad, and would profit from refocusing on sustainability. It is rightly argued that nanoethics should be treated as "another angle on the question of sustainable development" (Hunt, 2006).

Weighing up the risks

As nanotechnology continues to deliver on its promises, sceptical views of the claims made on its behalf are giving way to other issues such as the ownership of the technology and distribution of the risks and benefits of it the technology. The role of the social sciences as a means of analysis and articulation of uncertain situations is especially pronounced with respect to nanotechnology. The expectations are high that the social sciences will provide the knowledge base and critical analysis for attitudes towards nanotechnology, that they will nurture and raise public understanding of emerging technologies, and promote and facilitate the sustainability solutions that nanotechnology promises. The social sciences will need to challenge sceptical attitudes towards nanotechnology. The blanket labelling of new technology as "risky" is a conventional precautionary measure taken when we face uncertainty, but this assumption, and the regulation based on it, have caused undue delays in the use of beneficial technologies. The cost of delaying nanotechnology needs to be balanced against the cost of maintaining the status quo as a precautionary measure.

The chances of achieving environmental sustainability without new technologies are disappearing fast. The many international environmental laws dealing with issues ranging from biodiversity to climate change, from ozone protection to stopping desertification, reiterate the significance of technological solutions. Indeed, it may be asked whether environmental conventions are anything more than the embodiment of techno-optimism?

The social science of nanotechnology needs to take advantage of this optimism. It should avoid the usual debates on risk regulation by elevating concern about the distribution of benefits to the level at which risk issues are treated. These new technologies have so much potential that the previous risk-based regulation of technology is now asked to explore ways to manage the benefits. Indeed, the social sciences will need to ensure the equitable distribution of the benefits of nanotechnology. The answer to the question "Who benefits from the technology?" is critical when deciding the course the technology should take. The bad publicity that greeted genetic modification (GM) technology was not so much about risk as it was about the question of who benefits from its use. The GM story demonstrates that it was essentially politics and public attitude – the issues belonging to the social sciences – that were in dispute rather than the physical science behind the technology. The recent shift in attitudes towards GM technology is largely due to the role the social sciences have played in fuelling the debate.

The lessons from the GM experience have been learned. The risk-wary European Union (EU), for example, has a far more positive attitude towards nanotechnology than it did towards GM technology. EU regulation is clear that there will be none of the blanket risk-management decision that campaigners are demanding (European Commission, 2012). It has rejected the oversimplification that the smaller materials get, the more reactive and

toxic they are. The EU approach avoids the assumption that all nanotechnology products may not be safe, opting instead to carry out risk assessments on a case-by-case basis.

This is not the first time that risk management concerns have been used as an excuse to resist new technology. This approach highlights important tensions between using the technology for societal benefits, and the desire of shareholders to maximise profits. Through public policies, laws and regulations, the state will need to provide guidance on using emerging technologies, and negotiate a pathway between such tensions.

The social sciences have a key role to play here. They will need to analyse the convergence between the goals of global social movements, of which the sustainability movement is the most important, and the promises of nanotechnology and related public policy, and then communicate this analysis widely. Key issues to resolve include setting the right priorities, identifying the goals the technology is pursuing, and addressing key questions such as why we need nanotechnology and how best it might be used. Social science research should explore, examine and theorise on its role in catalysing the development of useful nanotechnology and in protecting it as a global social asset from narrow interests determined to control it as a means of power.

Conclusions

Social science scholarship accepts the need to move from "research as usual" towards research that is more involved and has greater impact and relevance (O'Brien, 2010). Science and technology provide solutions for societal challenges and help set values. They are often ahead of the social sciences, which are sometimes said to suffer a "cultural lag". According to Habermasian critique, social sciences have not developed as quickly as natural sciences (McCarthy, 1996: 5), and scientists have a tendency to exploit this. The social sciences respond by reasserting their key role in guiding the public's interpretation of technology and in setting the values that need to be pursued (Lee, 2009: 245, 251). Indeed, UNESCO has urged social scientists to take the initiative and become more engaged in nanoethics, without waiting to be asked or being forced to do so in response to the public or to new technological developments (ten Have, 2007).

A more compelling reason for the social sciences to become involved is to open up technological trajectories and influence policy decisions in achieving sustainability. While humanity made do without sufficient ethical, legal and regulatory tools for new technologies in the past, it may not be so lucky in the future with respect to nanotechnology. Nanotechnology, which is converging with other technologies, marks the transition from the "age of discovery" to the "age of mastery", leading to profound and comprehensive impacts (Kaku, 1998). The exponential changes happening now are so radical that they "put the future quite literally beyond our capacity to foresee it" (Broderick, 2001). Besides, the notion of finality – a trend towards a "final theory of everything" – keeps recurring in analyses of the nanotechnology pathway.

Bibliography

Allhoff, F. and P. Lin (2007), "What's so special about nanotechnology and nanoethics", *International Journal of Applied Philosophy*, Vol. 20/2, pp.179-190, *http://ethics.calpoly.edu/nanoethics/paper010807.html*.

Broderick, D. (2001), *The Spike: How our Lives are being Transformed by Rapidly Advancing Technologies*, Macmillan, New York.

Drumbl, M. (2002), "Poverty, wealth and obligation in international environmental law", *Tulane Law Review,* Vol. 76/4, p. 843, *http://papers.ssrn.com/sol3/papers.cfm?abstract_id=283204*.

European Commission (2012), *Second Regulatory Review on Nanomaterials*, Communication from the Commission 572 Final, *http://ec.europa.eu/nanotechnology/pdf/second_regulatory_review_on_nanomaterials_-_com(2012)_572.pdf*.

Fogelberg, H. and H. Glimmel (2003), *Bringing Visibility to the Invisible: Toward a Social Understanding of Nanotechnology*, Göteborg University, *www.sts.gu.se/publications/STS_report_6.pdf*.

Hunt, G. (2006), "The global ethics of nanotechnology", in Hunt, G. and M. Mehta (eds.), *Nanotechnology: Risk, Ethics and Law*, Earthscan, London.

Kaku, M. (1998), *Visions: How Science Will Revolutionise the 21st Century and Beyond,* Oxford University Press, Oxford.

Lee, M. (2009), "Beyond safety? The broadening scope of risk regulation", in O'Cinneide, C. (ed.), *Current Legal Problems,* Oxford University Press, Oxford.

McCarthy, T. (1996), *The Critical Theory of Jürgen Habermas*, MIT Press, Cambridge, Mass.

O'Brien, K. (2010), "Responding to the global environmental change: Social sciences of the world unite!", in ISSC and UNESCO (2010), *World Social Science Report 2010: Knowledge Divides*, UNESCO Publishing, Paris, *www.unesco.org/new/en/social-and-human-sciences/resources/reports/world-social-science-report/*.

Ridley, M. (2003), "We've never had it so good – and it's all thanks to science", *Guardian*, 3 April.

Schummer, J. (2006), "Societal and ethical implications of nanotechnology", in Schummer, J. and D. Baird (eds.), *Nanotechnology Challenges: Implications for Philosophy, Ethics and Society,* World Scientific Publishing, Singapore, pp. 413-449.

Ten Have, H. (2007), "Introduction: UNESCO, ethics and emerging technologies", in ten Have, H. (ed.), *Nanotechnologies, Ethics and Politics*, UNESCO Publishing, Paris.

UNESCO (2006), *The Ethics and Politics of Nanotechnology*, United Nations Educational, Scientific and Cultural Organization, Paris, *http://unesdoc.unesco.org/images/0014/001459/145951e.pdf*.

UN Millennium Project Task Force (2005), *Innovation: Applying Knowledge in Development*, Earthscan, London, *www.unmillenniumproject.org/reports/tf_science.htm*.

Verhoosel, G. (1998), "Beyond the unsustainable rhetoric of sustainable development: Transferring environmentally sound technologies", *Georgetown International Environmental Law Review,* Vol. 49, *http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/gintenlr11&div=8&id=&page=*.

Walsh, B. (2012), "Nature is over", *Time*, 12 March, *www.time.com/time/magazine/article/0,9171,2108014-1,00.html*.

Mammo Muchie is research professor of science, technology, innovation and development, Tshwane University of Technology, South Africa; professor at Aalborg University, Denmark; and senior research associate, Department of International Development, Oxford University.

Hailemichael T. Demissie is a postdoctoral research fellow at Tshwane University of Technology, South Africa.

World Social Science Report 2013
Changing Global Environments

44. Bringing new meanings to molecules by integrating green chemistry and the social sciences

by
Steve Maguire, Alastair Iles, Kira Matus, Martin Mulvihill,
Megan R. Schwarzman and Michael P. Wilson

The chemical industry, perhaps more than any other, needs to change if it is to be acceptable and viable in a greener, more sustainable world. Chemists and chemical engineers are taking up this challenge through "green chemistry," and social scientists with backgrounds in economics, politics and law, along with environmental health scholars, are increasingly collaborating with them to produce socially robust knowledge through interdisciplinary scholarship.

Green or sustainable chemistry[1] is "the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances" (Anastas and Warner, 1998: 1). It is a "design philosophy" (Mulvihill et al., 2011) that focuses on preventing – at the molecular level – the health and environmental problems associated with industrial chemicals. Green chemistry is the science of developing chemicals and materials that not only require less energy, water and raw materials in their production but also are *inherently* safe for biological and ecological systems. It marks a sharp departure from the current industrially embedded approach to risk assessment and management, which seeks to control risks through controlling exposures rather than eliminating inherent hazards.

Green chemistry is mainly associated with the fields of chemistry and chemical engineering. However, we argue that it will require the efforts of a much broader community, including environmental health scientists, policy and legal scholars, political scientists, economists and others in the social sciences to fully realise its transformative potential. We therefore advocate new research practices that bring social scientists, chemists and environmental health scientists together in interdisciplinary scholarship.

Introducing green chemistry

The origins of green chemistry can be traced back to chemists' critiques of the definition of "success" in chemical processes. Traditionally, success was based on percentage yields and satisfactory costs, with remediation of waste left as an (often costly) afterthought.

Beginning in the 1970s, increasingly stringent environmental regulation led to greater prominence for new voluntary industry criteria, such as input efficiency and zero-waste processes. Following the United States Pollution Prevention Act of 1990, these ideas were codified in *Green Chemistry: Theory and Practice* (Anastas and Warner, 1998). This defined the field and outlined 12 non-regulatory design principles that address the lifecycle of industrial chemicals, focusing primarily on the perspectives of working chemists.

Guided by these principles, green chemistry has found a home in many academic and industrial settings. Because chemistry is central to most economic sectors, green chemistry technologies have potential applications far beyond the chemical industry itself, for example in pharmaceuticals, food processing, energy, electronics, packaging, and consumer products for cleaning and personal care. Examples of green chemistry applications in industry include replacing organic solvents with condensed carbon dioxide in semiconductor manufacturing, doing dry cleaning without the use of perchloroethylene, and developing processes to manufacture plastics from biomass instead of oil as a feedstock (Manley, Anastas and Cue, 2008).

In contrast to the exposure reduction approach which dominates the risk assessment and management paradigm of present-day regulators and business, green chemistry aims to reduce or eliminate any chemical that poses a hazard. Further, within green chemistry the notion of hazard is interpreted broadly. Along with traditional toxicological concerns such as carcinogenicity and mutagenicity, and new ones such as endocrine disruption, it also includes damage to public goods, such as a substance's ozone-depleting and global-warming potential. The principles of green chemistry therefore also aim to maximise efficiency by reducing the consumption of energy, water and non-renewable feedstock materials. As a result, green chemistry is a fundamental component of sustainable development (NRC, 2006; Mulvihill et al., 2011). It provides conceptual integration for a wide range of seemingly disparate global issues, such as occupational and environmental health, energy and resource efficiency, and climate change.

Recognising green chemistry's transformative potential

If every chemical technology that relies on a hazardous substance is a target for a green chemistry solution, how should priorities be established, and how should the success of new green chemistry technologies be defined? Who should make these value-laden decisions? The approach taken in the United States to developing green chemistry has reinforced the autonomy of chemists, chemical engineers and industry actors, while explicitly endorsing market forces and eschewing regulation (Woodhouse and Breyman, 2005; Iles, 2011). "Unlike regulatory requirements for pollution prevention, Green Chemistry is an innovative, non-regulatory, economically driven approach toward sustainability" (Manley et al., 2008: 743).

This approach may have seemed apolitical to chemists, who on average may be less comfortable than social scientists with issues that are regarded as political. However, as social scientists have long noted, choices that deliberately avoid apparently political activities are themselves inherently political because they arise from socially and culturally embedded value judgements.

In this case, green chemists' preferred approach, via voluntary measures decided by industry, is an implicit endorsement of the status quo. It also positions chemists, chemical

engineers and industry actors, inappropriately we argue, as the main arbiters of the direction and pace of change in the mix and distribution of chemical risks.

In contrast, many social scientists and environmental health scientists, who recognise green chemistry's potential to transform, may be sceptical of relying solely on a market-driven approach. They recognise that markets are structured by regulatory frameworks which, in the case of chemicals, are deeply flawed. Some have argued that "Existing policies have produced a United States chemicals market in which the safety of chemicals for human health and the environment is undervalued relative to chemical function, price, and performance" and that this has led to:

> A chemical *data gap*, because producers are not required to investigate and disclose sufficient information on chemicals' hazard traits to government, businesses that use chemicals, or the public; a *safety gap*, because government lacks the legal tools it needs to efficiently identify, prioritize, and take action to mitigate the potential health and environmental effects of hazardous chemicals; and a *technology gap*, because industry and government have invested only marginally in green chemistry research, development, and education.
>
> (Wilson and Schwarzman, 2009: 1202)

As a result, social scientists from a range of disciplines – such as science and technology studies, law, policy studies, and management – along with environmental health scientists, citizens, non-governmental organisations (NGOs) and policymakers, have joined forces "to propose credible tax incentives, regulations, and mandates; foster public debate; and begin to use the state's legitimate coercive role to reshape innovation in line with public purposes" (Woodhouse and Breyman, 2005: 219). States such as California, Washington and Oregon are passing new, if imperfect, regulations to shift the investment and innovation priorities of chemical producers away from known toxic substances and toward greener chemistries. The debate in California, for example, has focused on industrial innovation in green chemistry as a forward-looking strategy to achieve health and environmental protection as well as increased economic competitiveness (Matus, 2010). As a result, "[g]reen chemistry is beginning to emerge as a key battleground for shifting technologies toward greater sustainability," and has become a site for "epistemic politics" (Iles, 2011: 17).

In some ways, these tensions are unsurprising. They are foreshadowed by green chemists' own definition of their field, which emphasises hazard and risk, concepts that are frequently contested and which have a rich social science literature. We do not take a position on the merits of establishing regulatory regimes that would motivate investment in green chemistry. We do, however, believe it is important to recognise the way in which social scientists and environmental health scientists have engaged with green chemistry to investigate the levers available beyond the chemistry laboratory that might speed the adoption of green chemistry technologies.

Engaging social scientists as important stakeholders for advancing green chemistry

Green chemistry can benefit from collaboration between chemists and experts from other sciences and from the social science disciplines, because "sustainability demands the *integration* of multiple forms of knowledge, including natural scientific, health, social scientific, commercial, and policy, across the entire life cycle of chemicals" (Iles and

Mulvihill, 2012: 5644). An awareness of green chemistry's multi-stakeholder community (Iles and Mulvihill, 2012) enables chemists, chemical engineers and industry actors to engage with social scientists, environmental health scientists, workers, NGOs and policymakers to shape the direction of economic activity in a more acceptable and viable form. This type of collaboration has the potential to provide enormous benefits beyond what might be achieved in the laboratory alone.

Knowledge from the social sciences, and from other scientists engaged in advancing sustainability, can inform choices about what kind of research and development to undertake within a chemical enterprise. It can also shape the social parameters within which green chemistry will either flourish or remain on the margins of industrial activity. At the same time, interdisciplinary work of this nature presents inherent challenges which stem from the cultural and epistemological differences that characterise different academic disciplines.

Fruitful initiatives are emerging, however. The Berkeley Center for Green Chemistry at the University of California, in the United States, facilitates interactions among scholars from chemistry, business, engineering, natural resources, public health policy and the environmental health sciences. It continues to work on overcoming historical differences, but has collaborated successfully on joint research grants, academic and public seminars, conferences, and on building a curriculum of interdisciplinary courses. Similarly, the Green Product Design Network at the University of Oregon in the United States brings together academics and practitioners with expertise in green chemistry, business, product design and communication to catalyse innovation and commercialisation of sustainable products. At McGill University in Canada, the Centre for Green Chemistry and Catalysis includes social scientists along with chemists, and the faculties of Management and Chemistry collaborate on a sustainable innovation workshop that brings together students from the two disciplines to evaluate the environmental performance and commercial viability of actual green chemistry technologies. Linking these and similar initiatives, the Interdisciplinary Network for Green Chemistry provides a forum for dialogue among social scientists, public health scholars and chemists who seek to catalyse the implementation of green chemistry principles throughout the global chemical enterprise through innovative research and education (IN4GC, 2012).

Integrating social sciences with green chemistry

These experiences suggest that the emergence of green chemistry in the context of a multi-stakeholder community has a number of potential benefits. The first is that by working more closely with social scientists, green chemists are likely to develop a greater awareness of their own discipline and of its role in shaping the chemical enterprise – one that recognises science as a socially embedded activity permeated with value judgements. Because any technology is a mixture of benefits and risks, none of which is evenly distributed across time, space or social groups (Maguire and Ellis, 2003), chemists must take their design decisions and responsibilities seriously by exposing and questioning the trade-offs and value judgements they make. These judgments can be masked by "taken-for-granted" assumptions, heuristics and routines. Chemists and engineers, working with social scientists, can reveal and critique these assumptions using social scientific knowledge. Such a reflexive stance is especially important given the significant uncertainties and controversies that surround many chemical risks, a situation that increases the scepticism that citizens feel towards experts' claims (Iles, 2011).

Second, significant policy and industrial advances can be attained. A multi-stakeholder community brought together around green chemistry is more likely to produce "socially robust knowledge" (Nowotny, Scott and Gibbons, 2001) that can withstand both scientific *and* societal testing, because it has emerged from a transparent and participatory process (Iles, 2011). Despite its difficulties, we believe that interdisciplinary collaboration which examines problems using multiple perspectives is more likely to enable academics, industry and policymakers to produce successful interventions in sustainable technologies that support a life-affirming economy.

Experience at the University of California suggests that new ties between previously disparate actors can enable the building of new, broad coalitions to support public policies that alter the nature of economic incentives in the chemical industry by addressing demand-side issues – i.e. the data and safety gaps that are so prominent in today's chemicals markets. Such policies would increase the requirements for companies to generate and disclose information about hazards and to take greater responsibility for their products across their full lifecycle. This in turn would encourage action on supply-side issues through increased investment in green chemistry education, research and innovation, thereby eventually closing the technology gap (Wilson and Schwarzman, 2009).

Finally, the inclusion of social scientists in interdisciplinary teams engaged in the design of new chemical technologies can produce superior designs. During the design phase of a new chemical technology, "the scope of possible innovation ranges from incremental or superficial design improvements to completely redesigning the system of production – a much deeper form of innovation" (Mulvihill et al., 2011: 275). Social scientific knowledge can, for example, contribute to a more realistic understanding of how businesses and members of the public use and dispose of products. This can improve lifecycle analyses and ensure more effective priority setting in chemical policy and in green chemistry research and development. Because social scientists are sensitive to the meanings attached to molecules by different social groups, and to the distributive and ethical implications of the trade-offs between various types of hazards, they can make significant contributions to design deliberations.

Final words

Encouraging the emergence and success of green chemistry in the context of a multi-stakeholder community will present challenges and tensions, such as those associated with the debate on the merits of regulatory versus voluntary approaches to greening the chemical enterprise. Debate is healthy, and given the stakes involved in achieving sustainability, appropriate. There is evidence that the challenges of communicating and sharing information across disciplines can be overcome (Iles and Mulvihill, 2012). Green chemistry can realise its potential to transform the global chemical enterprise towards sustainability.

Note

1. Some social actors and scholars distinguish between *green chemistry* and *sustainable chemistry*, while recognising that they overlap significantly: "The term green chemistry is used commonly by academics because of the historical development of the field. The term sustainable chemistry is often preferred by industry as a way to distinguish technological innovation from the potential political overtones of the word green" (Mulvihill et al., 2011: 272). Here, we use "green" as including both.

Bibliography

Anastas, P. T. and J. C. Warner (1998), *Green Chemistry: Theory and Practice,* Oxford University Press, New York.

Iles, A. (2011), "Greening chemistry: Emerging epistemic political tensions in California and the United States", *Public Understanding of Science*, 13 July, pp. 1-19, *http://pus.sagepub.com/content/early/2011/06/28/0963662511404306.abstract?rss=1*.

Iles, A. and M. J. Mulvihill (2012), "Collaboration across disciplines for sustainability: Green chemistry as an emerging multistakeholder community", *Environmental Science and Technology,* Vol. 46, pp. 5643-5649, *www.ncbi.nlm.nih.gov/pubmed/22574828*.

IN4GC (2012), *Interdisciplinary Network for Green Chemistry*, *www.mcgill.ca/desautels/beyond-business/integrated-management/mdiim-initiatives/in4gc*.

Maguire, S. and J. Ellis (2003), "The precautionary principle and global chemical risk management: Some insights from the case of persistent organic pollutants", *Greener Management International,* Vol. 41, pp. 33-46, *www.greenleaf-publishing.com/default.asp?ContentID=8*.

Manley, J. B., P. T. Anastas and B. W. Cue (2008), "Frontiers in green chemistry: Meeting the grand challenges for sustainability in R&D and manufacturing", *Journal of Cleaner Production*, Vol. 16, pp. 743-750, *www.sciencedirect.com/science/journal/09596526/16/15*.

Matus, K. (2010), "Policy incentives for a cleaner supply chain: The case of green chemistry", *Journal of International Affairs,* Vol. 64/1, pp. 121-136, *www.tandfonline.com/toc/caji20/64/1#.UdrVIawUxL4*.

Mulvihill, M. J. et al. (2011), "Green chemistry and green engineering: A framework for sustainable technology development", *Annual Review of Environment and Resources,* Vol. 36, pp. 271-293, *www.annualreviews.org/toc/energy/36/1*.

Nowotny, H., P. Scott and M. Gibbons (2001), *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*, Polity, Cambridge, UK.

NRC (2006), *Sustainability in the Chemical Industry: Grand Challenges and Research Needs,* US National Research Council, National Academies Press, Washington DC.

Wilson, M. P. and M. R. Schwarzman (2009), "Toward a new U.S. chemicals policy: Rebuilding the foundation to advance new science, green chemistry, and environmental health", *Environmental Health Perspectives*, Vol. 117/8, pp. 1202-1209, *www.ncbi.nlm.nih.gov/pmc/journals/253/*.

Woodhouse, E. J. and S. Breyman (2005), "Green chemistry as social movement?", *Science, Technology, and Human Values*, Vol. 30/2, pp. 199-222, *www.nisd.cass.cn/upload/2012/12/d20121221231814475.pdf*.

Steve Maguire is director of the Marcel Desautels Institute for Integrated Management at McGill University, Canada.

Alastair Iles is an associate professor in the Department of Environmental Science, Management and Policy at the University of California, Berkeley, United States.

Kira Matus is a lecturer at the London School of Economics and Political Science, United Kingdom.

Martin Mulvihill is executive director of the Berkeley Center for Green Chemistry at the University of California, Berkeley, United States.

Megan R. Schwarzman is a research scientist at the Center for Occupational and Environmental Health at the University of California, Berkeley, United States.

Michael P. Wilson is director of the Labor Occupational Health Program at the University of California, Berkeley, United States.

World Social Science Report 2013
Changing Global Environments

45. Individual and collective behaviour change

by
Elke U. Weber

Negative consequences normally lead people to change their behaviour, but the timelag between behavioural cause and many environmental impacts makes it hard for people to see the connection. Other barriers to change include lack of a fear response and habits. To promote change, new behavioural routines need to be established using default options and social imitation. Existing goal conflicts need to be minimised by better communication of the co-benefits of environmental goals. Since many people in developing countries aspire to a western lifestyle that adversely affects the global environment, different models of human happiness need to be explored.

Successful responses to global environmental challenges such as climate change will require enormous individual and collective behaviour change, on a timescale far more rapid than evolutionary change. Reluctance to change has been documented as status quo bias (Samuelson and Zeckhauser, 1988). The familiar has been tested over time, whereas change involves uncertainty and risk. Routine behaviours, including those that impact environmental resources, are automatic and require no attention, whereas change requires effort. This means that behaviour change needs to be motivated by providing positive incentives for the change, a credible threat to business as usual, and information about both the need and the means to align current reality with a desired target state.

Learning to change

Reinforcement learning (Sutton and Barto, 1998) – a form of learning from personal experience through the consequences of one's actions – is an effective way to shape behaviour, and is commonly used by parents and animal trainers alike. In the environmental domain, personal experience with the adverse consequences of climate change appears to increase people's willingness to change their behaviour (Mozumder, Flugman and Randhir, 2011), especially for those without strong prior beliefs about climate change (Weber, 2013a). People prefer, and find it easier, to make decisions when they receive information about the consequences of their potential options through personal experience rather than statistical description (Hertwig et al., 2004; Marx et al., 2007). Unfortunately for many environmental challenges, the lag times between behaviour and its consequences are long and the process is non-linear, making the relationship difficult to detect (Weber, 2013).

In addition, adaptation to slowly changing environments itself reduces the perceived need for behaviour change; this is referred to as shifting baseline syndrome (Pauly, 1995). Reinforcement learning may also be too slow in this domain, as widespread personal experience of negative consequences will only come at a time when behaviour change may no longer be able to prevent serious impacts.

Rational economic models of choice assume an ideal decision-maker. Yet human decisions are constrained by finite attention and processing capacity, making them at best boundedly rational (Simon, 1982). Cognitive and emotional limitations make humans myopic as decision-makers, with short time horizons or present bias (Hardisty et al., 2009; Laibson, 1997) and with a narrow focus on the self rather than collective well-being. Benefits of changing behaviour so that it becomes environmentally more sustainable tend to accrue over longer periods of time, but not primarily to the decision-makers themselves, and thus are not very effective motivators.

Barriers to change

Different types of barriers to behaviour change have been identified. Kollmuss and Agyeman (2002) contrast external (such as structural) and internal (such as psychological) obstacles. Lorenzoni, Nicholson-Cole and Whitmarsh (2007) distinguish between individual- level (such as uncertainty and lack of knowledge) and social-level barriers (such as social norms and expectations). Gifford (2011) lists limited cognition, ideologies, social comparisons, miscredence (distrust, reactance and denial) and perceived risks.

Weber (2013) classifies barriers by three qualitatively different processing modes that decision-makers use to arrive at an environmentally relevant decision, namely calculation-, affect-, and rule-based decisions. Risk and loss aversion (Kahneman and Tversky, 1979) as well as present bias (Laibson, 1997) discourage behaviour change when people calculate the costs and benefits of different actions, whether formally or by means of heuristic shortcuts. Affect-based processing fails to change people's behaviour, when people do not naturally worry about a hazard, for example the gradual and future risks of climate change (Slovic, 1987; Weber, 2006). Other feelings, including the impression that personal behaviour change is ineffective in the face of collective challenges that require coordinated change, also play important roles (Böhm, 2003).

Even when it is effective, behaviour change motivated by a negative affect can result in single-action bias (Weber, 1997), the propensity for a single action in response to a threat, even in situations where a broader set of remedies is called for. This is because the first action seems to remove the worry and with it the motivation for further actions. Response patterns consistent with the single action bias have been identified. In the context of changes in energy behaviour, these are often called psychological rebound effects (Ehrhardt-Martinez and Laitner, 2010). Moral balance theory (Merritt, Effron and Monin, 2010) also explains such rebound effects, where one behaviour change (such as switching from carbon to renewable electricity) provides a moral licence to decrease other energy-saving behaviour (Monin and Miller, 2001).

Instilling behavioural routines or rules that are consistent with people's personal values, and that get triggered when the decision-maker's social role or self-identity is activated, may offer the most promising route towards behaviour change (Whitmarsh and O'Neill, 2010). Role-consistent behaviour can be demonstrated and encouraged in the first

instance by prominent trusted and admired sources that will be imitated until repetition turns the behaviour into a habit that no longer requires conscious attention (Weber, 2013).

Widespread social observation of new behaviours or the communication of descriptive norms by other means can lead to tipping points (Griskevicius, Cialdini and Goldstein, 2008). See Article 46 in this Report.

Barriers to behaviour change are responsible for the widely documented gap between attitudes and observed behaviour (Gifford, Kormos and McIntyre, 2011). Other predictors of behaviour, as well as attitudes in models, such as Ajzen's (1991) theory of planned behaviour, point to barriers to change and also to solutions that promote behaviour change. This includes behavioural intentions, which translate the goals provided by a decision-maker's attitudes into the means of achieving those goals. Construal-level theory (Trope and Liberman, 2010) predicts the attitude–behaviour gap, in the sense that plans for behaviour change (such as more environmentally sustainable food consumption) are initially construed on an abstract goal level that emphasises their benefits. As the time for implementation approaches, however, the construal becomes more concrete and moves to a means level, where structural and psychological barriers to change are encountered. Gollwitzer (1999) shows that it helps to anticipate and circumvent at least the structural barriers, so as to have decision-makers consider and articulate the implementation of their intentions – the specific "when", "where" and "how" of achieving their goals – at an early stage.

In the context of the global environment, attentional, cognitive and motivational limitations and material constraints are more important barriers to behaviour change than knowledge deficits about environmental challenges and their relation to human behaviour (Weber and Stern, 2011). An important exception is the lack of sufficient information about what is most effective in modifying behaviours to achieve sustainability goals (Attari et al., 2010; Gardner and Stern, 2008). This lack of knowledge is not restricted to the general public. Most social science studies of how to reduce barriers to behaviour change in the environmental domain examine high-frequency but low-impact behaviour (such as recycling or refusing plastic bags in shops) rather than high-frequency, high-impact behaviours (such as food choices or travel behaviour) and low-frequency, high-impact behaviour (like buying a car or insulating one's home) (Gifford et al., 2011).

Goal conflicts

Individuals and collectives have a wide range of often conflicting goals (Krantz and Kunreuther, 2007). The cultural context and decision-specific physical and social environment influence decisions through selective goal activation (Weber and Johnson, 2006). However, goal conflict is a barrier to change. Most individuals would endorse fighting climate change or species depletion as a goal, even when their collective action has large negative global environmental consequences, because existing behaviour patterns originate in other, widely endorsed, goals such as comfort or physical security at the individual level, or economic development at the collective level. Change designed to achieve environmental sustainability goals is seen as detracting from these more immediate and personal goals. Better communication of the associated benefits of actions that achieve environmental goals (for instance, health benefits at the individual level, or energy security and job creation at the collective level) contributes to a more accurate benefit–cost analysis of environmental policies. It is also a way of allowing

people to align multiple goals, reducing the perception of losing certain, immediate and personal benefits in return for uncertain, distant and collective ones.

Tools to change behaviour

Most studies of behaviour change focus on the actions of citizens or consumers: for example, purchase or consumption decisions that affect water use or carbon emissions. While this is an important target group by virtue of its prevalence, behaviour change in other segments of the population (such as politicians, or designers of building and transportation infrastructure) may have larger impacts. Their decisions shape the regulatory, economic and physical infrastructure, which in turn influences the decisions of the general public. A better understanding of the fact that preferences are often constructed at the time a decision is made, and therefore behaviour is malleable (Lichtenstein and Slovic, 2006), has provided additional tools to achieve behaviour change. Previous tools were restricted to regulation, a paternalistic intervention that prohibits choice options that reduce individual or public welfare; policies that materially incentivise desirable behaviour by offering material rewards, thus changing the cost–benefit calculation; and information and persuasion campaigns designed to shape active decisions through facts and arguments.

Recent advances based on understanding how choices are made have suggested ways to change decisions and behaviour without conscious awareness by shaping people's choice environment (Thaler and Sunstein, 2008; Johnson et al., 2012). This includes the priming or activation of important but possibly under-attended goals, for example legacy concerns or moral imperatives (Weber, 2013). It also includes tools that guide people's attention and choices towards actions that typical processing (and myopia) would ignore, but that have greater long-term individual and social utility (Johnson and Goldstein, 2003).

Behaviour change and happiness

Research on affective forecasting shows systematic biases in people's predictions of what will make them happy (Wilson and Gilbert, 2003). Adaptation to new increases in material welfare at the individual level and in economic development at the collective level put people on a hedonic treadmill. However, positive psychology and other social sciences have been working on reconceptualising human happiness and its drivers in a more sustainable way (Seligman, 2004). As Western consumption behaviour and lifestyles serve as aspirations to the large proportion of the human population living in developing economies, widespread significant and observable behaviour change by citizens in developed countries on dimensions that impact environmental outcomes may be a very important first step towards global sustainability.

Bibliography

Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50, pp.179-211, *www.sciencedirect.com/science/journal/07495978/50/1*.

Attari, S. Z., DeKay, M. L., Davidson, C. I., & Bruine de Bruin, W. (2010), "Perceptions of energy consumption and savings", *Proceedings of the National Academy of Sciences*, Vol. 107, pp. 16054-16059.

Böhm, G. (2003), "Emotional reactions to environmental risks: Consequentialist versus ethical evaluation", *Journal of Environmental Psychology*, Vol. 23, pp. 199-212, *www.sciencedirect.com/science/article/pii/S0272494402001147*.

Ehrhardt-Martinez, K. and J. A. Laitner (2010), "Rebound, technology and people: Mitigating the rebound effect with energy-resource management and people-centered initiatives", in American Council for an Energy-Efficient Economy, *Summer Study Proceedings*, pp. 76-91. *www.garrisoninstitute.org/.../613-breaking-out-of-the-economic-box-ehr.*

Gardner, G. T. and P. C. Stern (2008), "The short list: The most effective actions U.S. households can take to curb climate change", *Environment,* Vol. 50, pp. 13-24, *www.environmentmagazine.org/Archives/Back%20Issues/September-October%202008/gardner-stern-full.html*.

Gifford, R. (2011), "The dragons of inaction: Psychological barriers that limit climate change mitigation", *American Psychologist,* Vol. 66, pp. 290-302, *www.ncbi.nlm.nih.gov/pubmed/21553954*.

Gifford, R., C. Kormos and A. McIntyre (2011), "Behavioral dimensions of climate change: Drivers, responses, barriers, and interventions", *WIREs Climate Change,* Vol. 2, pp. 801-827, *http://pics.uvic.ca/sites/default/files/uploads/publications/kormos_wires_2011.pdf*.

Gollwitzer, P. M. (1999), "Implementation intentions: Strong effects of simple plans", *American Psychologist,* Vol. 54, pp. 493-503, *www.psych.nyu.edu/gollwitzer/99Goll_ImpInt.pdf*.

Griskevicius, V., R. B. Cialdini and N. J. Goldstein (2008), "Peer influence: An underestimated and underemployed lever for change", *Sloan Management Review*, Vol. 49, pp. 84-88.

Hardisty, D. J. et al. (2009), "About time: An integrative approach to effective environmental policy", *Global Environmental Change: Human and Policy Dimensions,* Vol. 22, pp. 684-694, *www.journals.elsevier.com/ global-environmental-change/*.

Hertwig, R. et al. (2004), "Decisions from experience and the effect of rare events", *Psychological Science,* Vol. 15, pp. 534-539, *http://library.mpib-berlin.mpg.de/ft/rh/RH_Decisions_2004.pdf*.

Johnson, E. J. and D. Goldstein (2003), "Do defaults save lives?", *Science,* Vol. 302, pp. 1338-1339, *www.sciencemag.org/content/302/5649/1338.short*.

Johnson, E. J. et al. (2012), "Beyond nudges: Tools of a choice architecture", *Marketing Letters*, Vol. 23, pp. 487-504, *http://link.springer.com/article/10.1007%2Fs11002-012-9186-1#page-1*.

Kahneman, D. and A. Tversky (1979), "Prospect theory: An analysis of decision under risk", *Econometrica,* Vol. 47, pp. 263-292, *www.hss.caltech.edu/~camerer/Ec101/ProspectTheory.pdf*.

Kollmuss, A. and J. Agyeman (2002), "Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior?" *Environmental Education Research*, Vol. 8, pp. 239-260, *www.tandfonline.com/doi/abs/10.1080/13504620220145401#.Udrgn6wUxL4*.

Krantz, D. H. and H. C. Kunreuther (2007), "Goals and plans in decision making", *Judgment and Decision Making,* Vol. 2, pp. 137-168, *http://journal.sjdm.org/jdm7303b.pdf*.

Laibson, D. (1997), "Golden eggs and hyperbolic discounting", *Quarterly Journal of Economics*, Vol.112/2, pp. 443-477, *http://qje.oxfordjournals.org/content/112/2/443.abstract*.

Lichtenstein, S. and P. Slovic (2006) (eds.), *The Construction of Preference*, Cambridge University Press, New York.

Lorenzoni, I., S. Nicholson-Cole and L. Whitmarsh (2007), "Barriers perceived to engaging with climate change among the UK public and their policy implications", *Global Environmental Change,* Vol. 17, pp. 445-59, *www.sciencedirect.com/science/article/pii/S0959378007000209*.

Marx, S. M. et al. (2007), "Communication and mental processes: Experiential and analytic processing of uncertain climate information", *Global Environmental Change*, Vol. 17, pp. 47-58, *http://socialscience.focusonfloods.org/2013/*.

Merritt, A. C., D. A. Effron and B. Monin (2010), "Moral self-licensing: When being good frees us to be bad", *Social and Personality Psychology Compass,* Vol. 4/5, pp. 344-357, *http://wat1224.ucr.edu/Morality/Monin%202010%20Compass%20on%20Moral%20Licensing.pdf*.

Monin, B. and D. T. Miller (2001), "Moral credentials and the expression of prejudice", *Journal of Personality and Social Psychology,* Vol. 81, pp. 33-43, *www.ncbi.nlm.nih.gov/pubmed/11474723*.

Mozumder P., E. Flugman, and T. Randhir (2011), "Adaptation behavior in the face of global climate change: Survey responses from experts and decision makers serving the Florida Keys", *Ocean and Coastal Management,* Vol. 54, pp. 37-44, *http://academia.edu/856848/Facilitating_Adaptation_to_Global_Climate_Change_Perspectives_From_Experts_and_Decision_Makers_Serving_the_Florida_Keys*.

Pauly, D. (1995), "Anecdotes and the shifting baseline syndrome of fisheries", *Trends in Ecology and Evolution,* Vol. 10, p. 430, *www.seaaroundus.org/researcher/dpauly/PDF/1995/JournalArticles/Anecdotes%26ShiftingBaselineSyndromeFisheries.pdf*.

Samuelson, W. and R. Zeckhauser (1988), "Status quo bias in decision making", *Journal of Risk and Uncertainty,* Vol. 1, pp. 7-59. *http://dtserv2.compsy.uni-jena.de/__C125757B00364C53.nsf/0/F0CC3CAE039C8B42C125757B00473C77/$FILE/samuelson_zeckhauser_1988.pdf/*.

Seligman, M. E. P. (2004), "Can happiness be taught?", *Daedalus,* Vol. 133, pp. 80-87. *www.gobookee.net/can-happiness-be-taught-seligman*.

Simon, H. A. (1982), *Models of Bounded Rationality, Vol. 1–2,* MIT Press, Cambridge, Mass.

Slovic P. (1987), "Perception of risk", *Science,* Vol. 236, pp. 280-285, *http://heatherlench.com/wp-content/uploads/2008/07/slovic.pdf*.

Sutton, R. S. and A.G. Barto (1998), *Reinforcement Learning: An Introduction*, MIT Press, Cambridge, Mass.

Thaler, R. H. and C. R. Sunstein (2008), *Nudge: Improving Decisions about Health, Wealth, and Happiness*, Yale University Press, New haven, Conn.

Trope, Y. and N. Liberman (2010), "Construal-level theory of psychological distance", *Psychological Review,* Vol. 117, pp. 440-463, *www.ncbi.nlm.nih.gov/pmc/articles/PMC3152826/*.

Weber, E. U. (1997), "Perception and expectation of climate change: Precondition for economic and technological adaptation", in Bazerman, M. et al. (eds.), *Psychological Perspectives to Environmental and Ethical Issues in Management*, Jossey-Bass, San Francisco, Calif., pp. 314-341.

Weber, E. U. (2006), "Experience-based and description-based perceptions of long-term risk: Why global warming does not scare us (yet)", *Climatic Change,* Vol. 70, pp. 103-120, *www.rsmas.miami.edu/users/agriculture/pubs/papers/Full_versions/Weber_2006.pdf*.

Weber, E.U. (2013a), Seeing is believing. *Nature Climate Change*, Vol. 3, pp. 312-313.

Weber, E. U. (2013b), "Doing the right thing willingly: Behavioral decision theory and environmental policy", in Shafir, E. (ed.), *The Behavioral Foundations of Policy,* Princeton University Press, Princeton, N.J., pp. 380-397.

Weber, E. U. and E. J. Johnson (2006), "Constructing preferences from memory", in Lichtenstein, S. and P. Slovic (eds.), *The Construction of Preference*, Cambridge University Press, New York, pp. 397-410.

Weber, E. U. and P. Stern (2011), "The American public's understanding of climate change", *American Psychologist,* Vol. 66, pp. 315-328, *http://sciencepolicy.colorado.edu/students/envs_4800/weber_2011.pdf*.

Whitmarsh, L. and S. O'Neill (2010), "Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours", *Journal of Environmental Psychology*, Vol. 30/3, pp.305-314, *http://psych.cf.ac.uk/home2/whitmarsh/Whitmarsh%20O%27Neill%20J%20Env%20Psych%202010.pdf*.

Wilson, T. D. and D. T. Gilbert (2003), "Affective forecasting", *Advances in Experimental Social Psychology,* Vol. 35, pp. 345-411, *http://homepages.abdn.ac.uk/c.n.macrae/pages/dept/HomePage/Level_3_Social_Psych_ files/Wilson%26Gilbert%282003%29.pdf*.

Elke U. Weber is the Jerome A. Chazen professor of international business at Columbia Business School, and professor of psychology and Earth Institute professor at Columbia University in the United States. She is an expert on behavioural models of decision-making under risk and uncertainty.

World Social Science Report 2013
Changing Global Environments

46. Going green? Using evolutionary psychology to foster sustainable lifestyles

by
Mark van Vugt and Vladas Griskevicius

Polls show that very few people purchase green products or curb their consumption to become more green. Owing to natural selection, most humans tend to prioritise their self-interest, disregard the future, desire status, imitate others, and ignore evolutionary threats such as global climate change. All of these obstacles can, however, be overcome, or be used to promote sustainability.

Environmental polls show that while an overwhelming majority of individuals are very keen to be green, only a small minority actually purchase environmentally friendly products or curb their household consumption (Home Depot, 2010). Clearly, changing people's environmentally significant behavioural patterns is a huge challenge. Evolutionary psychologists look deep into humans' evolutionary roots for possible answers and solutions.

Natural selection has endowed humans with a psychology best suited for a hunter-gatherer lifestyle (Dunbar and Barrett, 2007). This means that a large portion of human-inflicted ecological damage may well be caused, or exacerbated, by innate psychological tendencies to prioritise self-interest, discount the future, prefer relative over absolute status, imitate others, and ignore novel evolutionary threats such as global climate change (Penn, 2003). Yet research suggests that these evolved preferences can be harnessed to help develop sustainability policies and behaviour change campaigns that can foster environmentally sustainable action (Griskevicius, Cantu and van Vugt, 2012).

Take the all-too-human concern with self-interest. Evolutionary theory sees self-interest not as being equal simply to the interest of an individual person, but as extending to kin who share our genes. Research shows that a message urging people to conserve is more effective if it emphasises that there may not be enough left for our children or grandchildren (Neufeld et al., 2011). Kin appeals will always win over non-kin appeals. Even fake labels or slogans such as "Mother Nature" or "We are family" may produce pro-environmental change.

Then there is the human tendency to discount the future. Research shows that people prefer immediate smaller rewards over future larger rewards (Penn, 2003). But evolutionary life history theory suggests that people vary in how much they discount the future. Their behaviour here depends on how certain they believe that future to be. People discount the future less if they see their environments as safe and predictable (Griskevicius et al., 2012b). This implies, for example, that interventions to encourage individuals to develop a more sustainable lifestyle should focus on making neighbourhoods safer and crime-free, and keeping families and communities together (Van Vugt, 2009). Findings also suggest that local gender ratios influence the discount rates (Griskevicius et al., 2012). When women are perceived to be scarce, and men are less certain they can find a mate, our research has shown that men become more impulsive and engage more in conspicuous consumption. Conveying to men that women prefer mates with a sustainable lifestyle could help encourage them to take the future more seriously.

A third evolved tendency is the desire for status, which fuels the excessive purchase of luxury goods with significant costs to the environment (Frank, 1985). Psychological and econometric studies show that an increase in status does not necessarily make people happier. The average United States income has increased by 140% since 1946, but the average happiness has not changed (Diener and Suh, 2000). A more effective strategy would take relative status into account in one or more ways. For example, a desire for relative status can promote environmentalism through the use of competition. "Competitive environmentalism" has been shown to work when lists of the greenest companies are published (Griskevicius et al., 2012). After all, no company wants to be the last on the list. Our research also shows that naming and shaming campaigns are great ways to get companies, cities and private individuals to act in more sustainable ways (Hardy and Van Vugt, 2006).

A fourth contributor to environmental problems is the human tendency to imitate what others around us do. Research shows that even when people say that the behaviour of their neighbours has little effect on their own environmental behaviours, it is actually one of the strongest predictors of their energy and water use (Van Vugt, 2001). Because of this copying tendency, asking households to consume less energy or water will fail if they are not convinced many others will do the same (Van Vugt, 2009). This also mean that depicting bad environmental practices as occurring frequently is counterproductive. Research in hotels shows that when guests are told that most guests re-use their towels at least once during their stay, re-usage increases (Goldstein, Cialdini and Griskevicius, 2008). OPOWER, a United States utility company, already uses this social imitation strategy by providing householders with information on how their electricity usage compares with that of their neighbours (Cuddy and Doherty, 2010). A "smiley" emoticon appears on their bill if usage is lower than average and a "frowney" if it is higher. Governments and councils could oblige utility companies to provide this kind of feedback.

The fifth evolved psychological trait undermining effective behaviour change is the tendency to ignore evolutionary novel threats. Humans are poor at taking on board the severity of environmental risks unless we can detect them with our senses (Slovic, 1987). We tend to respond more readily to environmental threats that we can see, hear, feel or smell (Griskevicius, Cantu and Van Vugt, 2012). If there is no tangible link between our behaviours and environmental outcomes, few of us change our habits. At the same time, we should recognise that humans evolved in natural environments, and this may have

instilled an innate love of nature, of life and living systems (what is known as biophilia) (Penn, 2003; Van Vugt, 2009). Our research shows that when city-dwellers are exposed to nature, they discount the future less (Steentjes and Van Vugt, 2011).

Evolutionary psychology has important insights for the way we approach environmental behaviour change campaigns. Working against evolved human nature guarantees low effectiveness, while working with it increases the likelihood of intervention success.

Acknowledgement

A longer version of this article was published in 2012 as V. Griskevicius, S. M. Cantu and M. van Vugt, "The evolutionary bases for sustainable behaviors: Implications for marketing, policy and social entrepreneurship", *Journal of Public Policy and Marketing*, Vol. 31, pp. 115-128.

Bibliography

Cuddy, A. J. C. and K. T. Doherty (2010), "OPOWER: increasing energy efficiency through normative influence", *Harvard Business School Case* N9-911-16.

Diener, E. and E. M. Suh (2000), *Culture and Subjective Well-Being,* MIT Press, Boston, Mass.

Dunbar, R. I. M. and L. Barrett (2007), *Oxford Handbook of Evolutionary Psychology,* Oxford University Press, Oxford.

Frank, R. H. (1985), *Choosing the Right Pond: Human Behaviour and the Quest for Status,* Oxford University Press, New York.

Goldstein, N. J., R. B. Cialdini and V. Griskevicius (2008), "A room with a viewpoint: using social norms to motivate environmental conservation in hotels", *Journal of Consumer Research*, Vol. 35/3, pp. 472-482, *www.jstor.org/stable/10.1086/586910*.

Griskevicius, V., S. M. Cantu and M. Van Vugt (2012), "The evolutionary bases for sustainable behaviors: Implications for marketing, policy and social entrepreneurship", *Journal of Public Policy and Marketing,* Vol. 31, pp. 115-128, *www.professormarkvanvugt.com/files/Sustainability_JPPM_2012(1).pdf*.

Griskevicius, V. et al. (2012b), "The financial consequences of too many men: Sex ratio effects on saving, borrowing, and spending", *Journal of Personality and Social Psychology*, Vol. 102/1, pp. 69-80,*www.ncbi.nlm.nih.gov/pubmed/21767031*.

Hardy, C. L. and M. van Vugt (2006), "Nice guys finish first: The competitive altruism hypothesis", *Personality and Social Psychology Bulletin*, Vol. 32/10, pp. 1402-1413, *http://psp.sagepub.com/content/32/10/1402.abstract*.

Home Depot (2010), "Second annual Canadian green home index reveals reduced environmental efforts at home," 7 April, *www.homedepot.ca/wcsstore/HomeDepotCanada/pdf/canadian_press/green_home_index.pdf*.

Neufeld, S. L. et al. (2011), "Going green to help your genes: The use of kin-based appeals in conservation messaging", Working paper, Global Institute for Sustainability, Arizona State University, *www.stanford.edu/group/peec/cgi-bin/docs/events/2011/becc/presentations/*.

Penn, D. J. (2003), "The evolutionary roots of our environmental problems: Toward a Darwinian ecology", *Quarterly Review of Biology*, Vol. 78/3, pp. 275-301, *www.ncbi.nlm.nih.gov/pubmed/14528621*.

Slovic, P. (1987), "Perception of risk", *Science*, Vol. 236/4799, pp. 280-285, *http://heatherlench.com/wp-content/uploads/2008/07/slovic.pdf*.

Steentjes, K. and M. van Vugt (2011), "Exposure to nature promotes cooperation in social dilemmas", Working paper, Department of Social and Organisational Psychology, VU Amsterdam.

Van Vugt, M. (2001), "Community identification moderating the impact of financial incentives in a natural social dilemma: water conservation", *Personality and Social Psychology Bulletin*, Vol. 27/11, pp. 731-745, *http://psp.sagepub.com/content/27/11/1440.abstract*.

Van Vugt, M. (2009), "Averting the tragedy of the commons: Using social psychological science to protect the environment", *Current Directions in Psychological Science*, Vol.18/3, pp.169-173, *www.professormarkvanvugt.com/files/CDIRmvv2010.pdf*.

Mark van Vugt is professor of psychology at the VU University, the Netherlands. He is particularly interested in using evolutionary psychology to help understand group dynamics, leadership, status and power relations, altruism and co-operation, and relations between groups.

Vladas Griskevicius is the McKnight associate professor of marketing and psychology at the University of Minnesota, United States. He studies the evolutionary roots of modern consumer behaviour and decision-making.

World Social Science Report 2013
Changing Global Environments

47. Environmental issues and household sustainability in Australia

by
Lesley Head, Carol Farbotko, Chris Gibson, Nick Gill and Gordon Waitt

The complex and variable structure of households makes it difficult to design policies to help them behave in a greener way. Cultural research methods, particularly ethnography, provide survey research with the necessary extra depth. These perspectives illustrate pathways towards sustainable results and the problems of achieving more sustainable outcomes.

Households in affluent societies are crucial for environmental outcomes

Households make sense to the people who live in them, and to government policymakers, as foundational social units. They are also regarded as sites through which it is logical to understand the consumption of energy, water, and other materials that have implications for sustainability issues such as climate change. In wealthy urban societies, with a high per head ecological footprint, government policy is increasingly focusing on households regarding sustainability issues. A growing research literature considers the household an important social organisation for pro-environmental behaviour (Reid, Sutton and Hunter, 2009). Global change science is starting to recognise that solutions to planetary problems must be sought on a variety of smaller levels, including the household (DeFries et al., 2012).

However, environmental policies directed at households in the affluent world do not always have the intended outcomes. Households' attitudes and practices often do not match (Lorenzoni, Nicholson-Cole and Whitmarsh, 2007) and their daily routines are influential (Gram-Hansen, 2008). Electricity smart meters do not challenge practices that householders consider non-negotiable (Hargreaves, Nye and Burgess, 2010; Strengers, 2011). Water tanks do not save as much water as predicted (Moy, 2012).

In this article, we contend that the conceptualisation of the household in environmental policy needs to be more sophisticated. Many policy approaches treat households as black boxes, freestanding social units operating at the domestic level, and involve little conceptualisation of their internal politics and practices, or their connections to the wider world. We argue instead for a conceptualisation of connected households, which we illustrate with an overview of our collaborative research in a series of projects in urban Australia.

The importance of cultural environmental research

We draw on collaborative research in the Illawarra region of eastern Australia (Waitt et al., 2012; Gibson et al., 2013). Our work combines ethnographic and practice-based methods with quantitative surveys. This cultural environmental research makes four potential contributions to sustainability research.

Identification and understanding of norms

Cultural research helps explain that promoting public awareness of climate change cannot change behaviour, because cultural norms determine household consumption in complex and uneven ways. Norms of cleanliness, for human bodies and their clothes, mean increasing levels of water consumption in the bathroom and laundry. Take teenagers who may change their clothes several times and take more than one shower a day, because they exercise, attend university, have part-time jobs and go out at night (Sofoulis, 2005).

The importance of everyday practice

Most incentive and education programmes pay little attention to the ways household energy, water and other resource consumption practices form part of the rituals, rhythms, habits and routines of everyday life (Shove, 2003; Gregson, Metcalfe and Crewe, 2007). Programmes emphasising that "it's easy being green" understate the amount of domestic labour involved, and sidestep the question of who does the work (Organo, Head and Waitt, 2012).

Households are not similar, socially or geographically. They may be nuclear families within which parents argue with teenagers about leaving lights or heaters on; they may be baby boomers approaching retirement who argue over what to keep and what to throw out; they may be single-person households, couple households in old age, families struggling to survive, blended families, or same-sex couples with children or without them. Nowhere do households consume things or approach environmental issues in identical or predictable ways. In Gibson et al. (2013), however, trends are summarised that may have relevance for policy, with examples shown in Table 47.1.

Contradictions between attitude and practice

Research on extended family households shows that younger generations identify with sustainability by recycling and affirming their belief in the importance of tackling climate change. They therefore claim to have stronger green credentials than their parents and grandparents. Yet it is their grandparents, who grew up with frugality and thrift, who are least likely to consume large amounts of clothing and appliances. Instead, they keep and store old "stuff", maximizing its use value (Klocker, Gibson and Borger, 2012). Baby boomers are the least likely to doubt climate change, but the most likely to fly five times or more annually. The poorest households are most likely to say that they are "uninterested" in climate change as an issue, but they are also the least likely to own liquid-crystal display (LCD) or plasma screen televisions or clothes dryers (Waitt et al., 2012).

Capturing knowledge and capacity

In households where frugality is a necessity rather than a choice, creativity and adaptability are needed to make ends meet. Families find ways to achieve quality of life without storing material things, without air-conditioners or sports utility vehicles. There

are still people who grew their own food or mended clothes during wartime – a reminder that there are effective systems of provision besides the industrial capitalist system, and stocks of knowledge that have not yet been lost (Gibson et al., 2013).

Connected households: traction and friction

Connections refer to processes within the household, and between the household and wider society. The breadth of these connections means that in-depth ethnographic analysis should not examine only the local and domestic levels. There are wider economic spaces in which people access, use, exchange and value financial and material resources. Energy and materials flow through households. Some systems of provision are very fixed, and some are fluid. Where they are fixed, any changes that a household makes may be limited unless these changes are connected to larger-scale change in infrastructure and technology. Where they are fluid, households may be able to contest wider patterns of consumer capitalism through bargaining networks and informal sharing with friends, relatives and neighbours.

We draw on Shove's (2003) use of the ratchet to discuss the role of tools and technologies in making and remaking everyday household practices. She illustrates how changing social norms, for example in terms of cleanliness and washing clothes, may counteract efficiency improvements in provision systems. In many ways, what we call zones of traction and zones of friction are two sides of the same coin, but we use them here to trace less and more sustainable pathways (Table 47.1). The framework of the connected household helps pick out a constructive path between two negative extremes: giving up on the household as a powerless unit and ascribing all power to wider economic and political forces, or making households totally responsible for sustainability, without expecting any from industry and business.

Table 47.1. **Examples of traction towards sustainability and friction against sustainability in the household context**

Zones of traction
Substantial changes in consumption often occur around lifecycle changes: having babies, getting married (or divorced), retiring. Transitions between these stages suggest productive times for policy intervention.
A high level of acceptance of stringent water restrictions during recent drought, and water savings equal to domestic water tank installation.
Experience of water scarcity in early life creates lifelong practices of not wasting water.
Non-energy-using heating and cooling practices, especially in the home, where sweat is tolerated.
Combined – although gendered – contributions to household sustainability transitions in families with young children (where fathers tend to contribute project investment, mothers embed habits in household life).
Zones of friction
Cultural norms of cleanliness in which sweat is anathema – particularly in the contexts of business and of young adults' socialising.
Need for automobility – people love their cars, and current lifestyles demand seamless use of time.
Desire for privacy in extended family households contributes to multiple television ownership.
Subsidised water tanks can be used to maintain high levels of mains water consumption.

Sources: C. Moy (2012), "Rainwater tank households: Water savers or water users?", *Geographical Research,* Vol. 50, pp. 204-216; V. Organo, L. Head and G. Waitt (2012), "Who does the work in sustainable households? A time and gender analysis in New South Wales, Australia", *Gender, Place and Culture;* G. Waitt et al. (2012), "Sustainable household capability: Which households are doing the work of environmental sustainability?", *Australian Geographer,* Vol. 43, pp. 51-74; C. Gibson et al. (2013), *Household Sustainability: Challenges and Dilemmas in Everyday Life,* Edward Elgar, Cheltenham, UK.

Conclusion

These qualitative approaches place a new emphasis on research, and in our experience they are yet to have a significant policy impact. However, our collaborations with engineers working on sustainable buildings indicate considerable potential; the engineers understand the necessity for a nuanced and contextual understanding of human experience. We suggest that friction and traction will help decision-makers think through the possibilities and constraints of working at the household scale – why some policy approaches do not work and others do. Identifying friction does not mean that education campaigns or the provision of information can simply overcome it. Wider cultural and economic change may be necessary. This can be in the form of changed relations between home and work, changed regulation, changed cultural norms of cleanliness or changed expectations of seamless mobility.

Where traction is identified, there is considerable policy value in letting people know they are already making a difference. Campaigns could usefully sustain or encourage existing practices rather than attempting to change behaviour.

Bibliography

DeFries, R. S. et al. (2012), "Planetary opportunities: A social contract for global change science to contribute to a sustainable future", *BioScience,* Vol. 62/6, pp. 603-606, *http://wanderinggaia.files.wordpress.com/2012/03/defries_2012_in_press.pdf*.

Gibson, C. et al. (2013), *Household Sustainability: Challenges and Dilemmas in Everyday Life*, Edward Elgar, Cheltenham, UK.

Gram-Hansen, K. (2008), "Consuming technologies – developing routines", *Journal of Cleaner Production*, Vol. 16, pp. 1181-1189, *www.sciencedirect.com/science/article/pii/S0959652607001850*.

Gregson, N., A. Metcalfe and L. Crewe (2007), "Moving things along: the conduits and practices of divestment in consumption", *Transactions of the Institute of British Geographers*, Vol. 32/2, pp. 187-200, *http://onlinelibrary.wiley.com/doi/10.1111/j.1475-5661.2007.00253.x/full*.

Hargreaves, T., M. Nye and J. Burgess (2010), "Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors", *Energy Policy*, Vol. 38, pp. 6111-6119, *https://blog.itu.dk/hest/files/2012/10/hargreaves_energy-impacts-of-the-smart-home-e28093-conflicting-visions.pdf*.

Klocker, N., C. Gibson and E. Borger (2012), "Living together, but apart: Material geographies of everyday sustainability in extended family households", *Environment and Planning A*, Vol. 44, pp. 2240-2259, *www.envplan.com/abstract.cgi?id=a44594*.

Lorenzoni, I, S. Nicholson-Cole and L. Whitmarsh (2007), "Barriers perceived to engaging with climate change among the UK public and their policy implications", *Global Environmental Change,* Vol. 17, pp. 445-459, *http://glennumc.org/clientimages/41359/etf_barriers.pdf*.

Moy, C. (2012), "Rainwater tank households: Water savers or water users?", *Geographical Research,* Vol. 50, pp. 204-216, *http://onlinelibrary.wiley.com/doi/10.1111/j.1745-5871.2011.00720.x/abstract*.

Organo, V., L. Head and G. Waitt (2012), "Who does the work in sustainable households? A time and gender analysis in New South Wales, Australia", *Gender, Place and Culture 20:559-577, http://libra.msra.cn/Publication/57601509/who-does-the-work-in-sustainable-households-a-time-and-gender-analysis-in-new-south-wales*.

Reid, L., P. Sutton and C. Hunter (2009), "Theorizing the meso level: the household as a crucible of pro-environmental behaviour", *Progress in Human Geography*, Vol. 34, pp. 309-327, *http://phg.sagepub.com/content/34/3/309.abstract*.

Shove, E. (2003), *Comfort, Cleanliness and Convenience*, Berg, Oxford.

Sofoulis, Z. (2005), "Big water, everyday water: A sociotechnical perspective", *Continuum,* Vol. 19, pp. 445-463, *www.homepages.ucl.ac.uk/~ucessjb/S3%20Reading/sofoulis%2005.pdf*.

Strengers, Y. (2011), "Negotiating everyday life: The role of energy and water consumption feedback", *Journal of Consumer Culture*, Vol. 311, pp. 319-338, *http://joc.sagepub.com/content/11/3/319.abstract*.

Waitt, G. et al. (2012), "Sustainable household capability: Which households are doing the work of environmental sustainability?", *Australian Geographer,* Vol. 43, pp. 51-74. *http://dx.doi.org/10.1080/00049182.2012.649519*.

Lesley Head is a geographer and director of the Australian Centre for Cultural Environmental Research at the University of Wollongong, Australia.

Carol Farbotko, Chris Gibson, Nick Gill and **Gordon Waitt** are researchers at the Australian Centre for Cultural Environmental Research at the University of Wollongong, Australia.

World Social Science Report 2013
Changing Global Environments

48. Models of human behaviour in social-ecological systems

by
Giuseppe Feola

Environmental change research often relies on simplistic, static models of human behaviour in social-ecological systems. This limits understanding of how social-ecological change occurs. Integrative, process-based behavioural models, which include feedbacks between action, and social and ecological system structures and dynamics, can inform dynamic policy assessment in which decision making is internalised in the model. These models focus on dynamics rather than states. They stimulate new questions and foster interdisciplinarity between and within the natural and social sciences.

Human behaviour in social-ecological systems

The intensity and pace of environmental change mean that social scientists need to identify existing weak spots and new approaches to providing knowledge for action (e.g. O'Brien, 2012). Too often, global environmental change policy relies on a limited understanding of the social world (Shove, 2010) and tends to be based on oversimplified and unrealistic models of social systems and their interactions with biophysical systems (Feola and Binder, 2010).

New social theoretical approaches can contribute to environmental change research with regard to human behaviour. Decision-making determines behaviour, which can be regarded as an action or a series of actions that mediate the interactions between the social and biophysical components of social-ecological systems (Liu et al., 2007; Feola and Binder, 2010; An, 2012).

Human actions drive anthropogenic environmental change and convey the responses, such as adaptation and mitigation, to its effects. These actions interact dynamically at different spatial and temporal scales with social structures (such as values, social norms) and biophysical ones (such as infrastructure, technology and ecosystems). This is a process of reflexive self-regulation during which actions influence structures and vice versa. The social-ecological change that policymakers and scientists invoke to deal with environmental change involves deep-rooted structures (O'Brien, 2012). Understanding how actions drive the dynamic interactions in socio-ecological systems is thus critical to support adaptive change.

Conceptual issues

While significant theoretical and methodological progress has been made in understanding human action in social-ecological systems, three issues need to be addressed: the theoretical basis, interdisciplinarity, and the ability to represent the process-based nature of human behaviour (Feola and Binder, 2010).

First, simulation or econometric models that claim to represent human actions often lack a solid theoretical foundation or are inadequately based on reductionist theories (like that of "economic man", or *homo oeconomicus*) that tend to be prescriptive rather than descriptive. A solid theoretical model is necessary to avoid oversimplification and environmental determinism (O'Brien, 2012; Schlüter et al., 2012; Shove, 2010).

Second, while the added value of interdisciplinarity is increasingly recognised, theoretical decision-making models are often based on the insights of single disciplines that assume that one factor constantly causes change or persistence explanations and the inability to represent heterogeneity of actors (Feola and Binder, 2010; An, 2012). Interdisciplinarity allows multi-dimensional explanations through the systematic, but flexible, integration of a variety of factors and processes (Gifford, Kormos and McIntyre, 2011).

Third, while the contribution of individual actions to processes that occur at the macro level has received significant attention, the ways in which feedbacks from the macro to the individual level influence human behaviour are still not well understood. Most theoretical models of human behaviour conceptualise actions as a linear sequence of causes, decisions and consequences (Gifford et al., 2011; Shove, 2010). Only when the process nature of the adaptive interactions between individual decisions, social structures and biophysical structures is considered, is it possible to understand how system structures are reproduced or changed (Feola and Binder, 2010; Gifford et al., 2011; Schlüter et al., 2012).

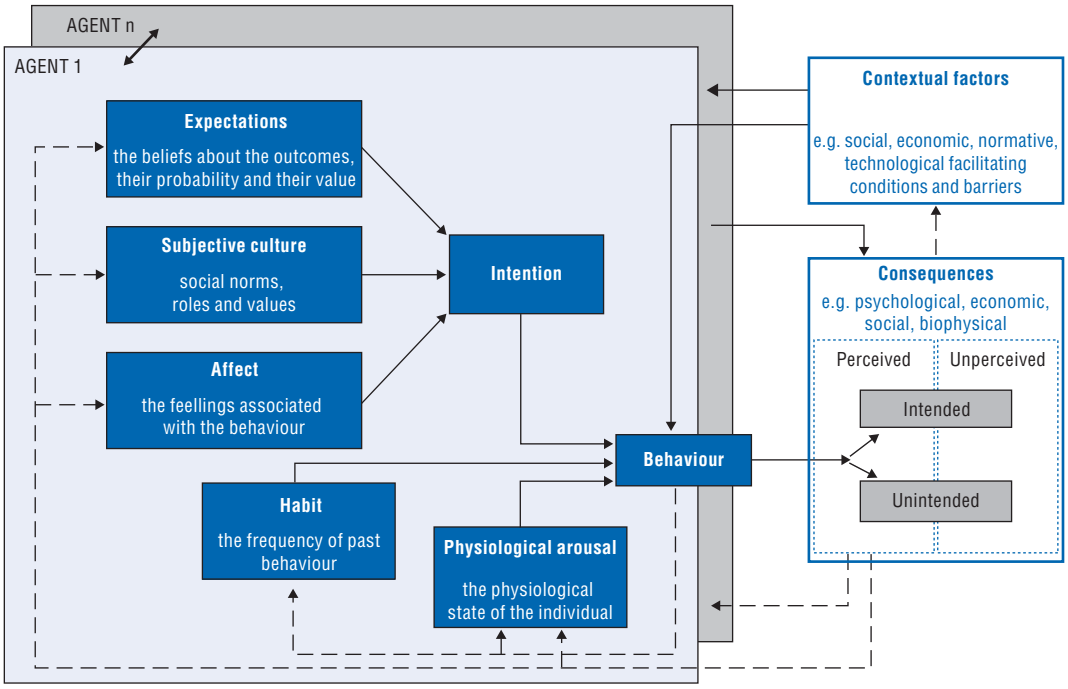
Integrative process-based models of human behaviour

It is important to embed human action in social-ecological systems models if we are to clarify the complex interactions between the social and biophysical components of such systems (Liu et al., 2007; An, 2012; Schlüter et al., 2012).

Integrative process-based models have recently been proposed and implemented, mostly through agent-based computational models. These differ radically from the linear thinking of mechanistic empirical models (An, 2012; Schlüter et al., 2012). They are grounded in social theory, and include feedbacks between individual behaviours, social dynamics and ecological system dynamics. They therefore help users to understand what drives individual and collective changes, and to explore alternative pathways. They are also integrative in terms of the social and ecological system components, the different social levels and the types of human agency considered. This allows representation of different dynamic responses to environmental change. These models can therefore reveal persistence or change, for example in the beliefs and values underpinning the responses to environmental change (Feola and Binder, 2010; An, 2012). They also bridge traditional disciplines. Researchers have been exploring this class of models in environmental change studies in various fields, including land use change, natural resource management and conservation (An, 2012; Schlüter et al., 2012). However, because these issues are not fully understood, very few general models have been developed from specific case studies.

The integrative agent-centred (IAC) framework is one such integrative, process-based theoretical model (Feola and Binder, 2010) (Figure 48.1). It combines Giddens' structuration theory (Giddens, 1984) and Triandis' theory of interpersonal behaviour (Triandis, 1980) to provide an understanding of human behaviour in social-ecological systems. This framework combines different behavioural drivers, and therefore depicts a potentially varied model of agency. In the framework, an agent's decision to enact a specific behaviour is influenced by external and internal drivers. The behaviour can have intended or unintended, and perceived or unperceived, social and biophysical consequences. These in turn can feed back to the agents through social, psychological or physical processes. The feedback processes can reinforce the current state or activate change, and can occur in the short or long term. Agents' interactions happen either directly or indirectly. Direct interactions depend on the agents' social network while indirect interaction happens through the aggregation of the consequences of behaviour that are perceived and reinterpreted by the actor.

Figure 48.1. **The integrative agent-centred framework**



Source: Modified from G. Feola and C. R. Binder (2010), "Towards an improved understanding of farmers' behaviour: The integrative agent-centred (IAC) framework", *Ecological Economics*, Vol. 69/12, pp. 2323-2333.

The IAC framework was applied empirically to Colombian smallholders' use of pesticides (Feola and Binder, 2010). It revealed the socially and environmentally adaptive value of farmers' behaviour in relation to static factors (the share of pesticide application) as well as the system dynamics in the social domain (such as conformity with social norms, the social definition of health) and the biophysical domain (such as response to pesticide-related health effects) of the local social and ecological system. It also informed a simulation model that was used as a learning platform for policymakers to discuss policy options for the safer use of pesticides (Feola, Gallati and Binder, 2012).

New mixed methods needed

In practice, integrative process-based models call for new mixed-method approaches whereby different methods (such as quantitative, qualitative and social experiments) can be adopted to collect data on the various components (such as social networks, social norms, cognition, biophysical barriers) and integrate this data. The IAC framework, for example, was applied in a mixed-methods approach that included survey research, secondary data and simulation modelling. (Feola et al., 2012.)

Integrative process-based models shift the research focus from states to dynamics – from explaining one-off decisions to understanding how and why social and biophysical structures and patterns of social actions persist or change over time. Adaptation behaviours, for example, are usually modelled in a linear way, as a sequence of causes (such as risk perception, climate information, or resource availability), decisions, and consequences (Shove, 2010). However, adaptation to climate change mostly entails decisions that are cyclically repeated over time. In addition, they are made at least partly in response to changes and pressures that are the result of previous behaviours and their consequences in the social and ecological system. For instance, in agriculture, adaptive crop management strategies are cyclical and depend on climatic and social pressures (such as market pressure and peer pressure) as well as on long-standing social structures, previous experience, habit, and potential technological lock-in.

This means that integrative process-based models are policy-relevant because they explain the process-based nature of human behaviour in social and ecological systems. They can help explain variation in behavioural patterns and responses, such as why some farmers adapt and others do not, and help understand how and why behaviour patterns such as crop management adaptation persist over time or are dropped. They can also show how behaviours influence, and are influenced by, change or persistence in social and ecological systems and in social and biophysical structures. Policies informed by such understanding advise and can speed up change by identifying the best places to intervene in a system, which might involve biophysical, economic or normative barriers or belief systems, and by facilitating the creation of conditions for change in specific social and ecological systems.

Conclusions

Integrative process-based theoretical models such as the IAC framework help overcome the limits of models that have weak theoretical foundations, are monodisciplinary and do not represent the process-based nature of human behaviour. They help in selecting the relevant factors and social and ecological processes that need analysing, and in identifying the relationships between them. These relationships will be tested in specific cases, in order to support flexible, context-specific understanding of the complexity of social-ecological systems.

Integrative process-based models are policy relevant because they can support the analysis of the dynamics of change, including change activated by interventions or policies. They can also inform dynamic vulnerability and sustainability assessment by internalising the human component of social and ecological system models. Understanding how human actions mediate and drive dynamic interactions in social and ecological systems and explore different pathways for change is critical to support adaptive change.

These models of human behaviour also require new ways of "doing" science. First, by shifting the focus from statics to dynamics, they stimulate new types of question that are

relevant for transforming social and ecological systems. They support a shift from explaining one-off decisions to understanding persistence or change in social and biophysical structures and patterns of social actions over time. They also support a shift from a focus on the individual decision-maker to the feedbacks between actions and their social and biophysical bases and constraints, in spatially and temporally defined social and ecological systems.

Second, while these models tend to be comprehensive and therefore difficult to test, they can serve as conceptual frameworks to integrate knowledge on decision-making and social action that is traditionally kept separate in subdisciplines. They facilitate integrative approaches and collaborative research to bridge the natural and social sciences, but also the more subtle differences within the social sciences.

Acknowledgement

I am grateful to Christof Knoeri and Emily Boyd for their useful feedback on an earlier version of this article.

Bibliography

An, L. (2012), "Modeling human decisions in coupled human and natural systems: Review of agent-based models", *Ecological Modelling*, Vol. 229/24, pp. 25-36, *www-rohan.sdsu.edu/~lian/Pdf/An_2012.pdf*.

Feola, G. and C. R. Binder (2010), "Towards an improved understanding of farmers' behaviour: The integrative agent-centred (IAC) framework", *Ecological Economics*, Vol. 69/12, pp. 2323-2333, *www.deepdyve.com/lp/elsevier/towards-an-improved-understanding-of-farmers-behaviour-the-integrative-Iv5YJNQEjp/1*.

Feola, G., J. A. Gallati and C. R. Binder (2012), "Exploring behavioural change through an agent-oriented system dynamics model: The use of personal protective equipment among pesticide applicators in Colombia", *System Dynamics Review,* Vol. 28/1, pp. 69-93, *http://onlinelibrary.wiley.com/doi/10.1002/sdr.469/abstract*.

Giddens, A. (1984), *The Constitution of Society*, Polity Press, Cambridge.

Gifford, R., C. Kormos and A. McIntyre (2011), "Behavioural dimensions of climate change: drivers, responses, barriers, and interventions", *WIREs Climate Change*, Vol. 2, pp. 801-827, *http://pics.uvic.ca/sites/default/files/uploads/publications/kormos_wires_2011.pdf*.

Liu, J. et al. (2007), "Complexity of coupled human and natural systems", *Science,* Vol. 317/5844, pp. 1513-1516, *www.ncbi.nlm.nih.gov/pubmed/17872436*.

O'Brien, K. (2012), "Global environmental change II: From adaptation to deliberate transformation", *Progress in Human Geography*, Vol. 36/5, pp.667-676, *http://phg.sagepub.com/content/36/5/667*.

Schlüter, M. et al. (2012), "New horizons for managing the environment: A review of coupled social ecological systems modeling", *Natural Resource Modeling,* Vol. 25, pp. 219-272, *http://onlinelibrary.wiley.com/doi/10.1111/j.1939-7445.2011.00108.x/abstract*.

Shove, E. (2010), "Social theory and climate change questions often, sometimes and not yet asked", *Theory, Culture and Society*, Vol. 27/2-3, pp. 277-288, *http://tcs.sagepub.com/content/27/2-3/277.full.pdf+html*.

Triandis, H. C. (1980), "Values, attitudes, and interpersonal behavior", in Howe, H. E. and M. M. Page (eds.), *Nebraska Symposium on Motivation 1979*, University of Nebraska Press, Lincoln, Neb./London, pp. 195-259.

Giuseppe Feola lectures on environment and development at the Department of Geography and Environmental Science at the University of Reading, United Kingdom. His current research examines individual adaptation, and the evolution of Colombian peasants' social institutions under environmental change.

World Social Science Report 2013
Changing Global Environments

49. Social aspects of solid waste in the global South

by
Jutta Gutberlet

Municipal solid waste is seen either as a nuisance or as a commodity and social dimensions are less important. Waste problems require an integrated, multifaceted, interdisciplinary approach. Informal but organised recycling in Brazil is an example of an innovative, inclusive resource recovery and environmental awareness strategy that has many benefits for the environment and for the waste collectors. Policies need to safeguard the social dimension and the ecological and economic aspects of waste management.

Introduction

Definitions of waste range from "all material unwanted by the generator" (Statistics Canada, 2005), to "any substance or object … which the holder discards or is required to discard" (European Union, 2006: 5), and to waste as a resource recovered through reuse and recycling or as a culturally determined material perception (Pongracz and Pohjola, 2004). According to Gregson and Crang, "waste is seen as historically mutable, geographically contingent, and both expressive of social values and sustaining to them" (2010: 1027). The waste we generate has increased in volume, has a complex material composition and brings associated health risks.

Humans generate more waste than ever because of population growth and as a consequence of increased consumption and discard levels. In particular, discarded plastics are a global problem. Waste is a nuisance when proper treatment or waste prevention strategies are lacking, which results in serious challenges for municipal governments. All waste treatment techniques have some environmental impact, for example by releasing toxins, air pollutants or toxic ash as final residues from incineration, or through contaminated leachate from landfilling (Allsopp, Costner and Johnston, 2001). Although recycling and reuse also create environmental impacts, when energy and water are needed, they spare virgin resources. All other modes of waste management require continuous extraction of new raw materials to maintain the production/consumption cycle.

Waste management following linear techno-economic, end-of-pipe approaches usually falls within the remit of engineering. The social sciences are more often concerned with related environmental policies, environmental education or urban planning, and

with ensuring that the social aspects of waste are visible. For example, Daly (1996), Layard (2005), Victor (2008) and others realised that unlimited economic growth would generate the current environmental and natural resource crisis. According to Schor (2010), humans are already consuming more than the Earth can supply, and generating more waste than it is able to absorb. A one-sided technocratic perspective does not explain the other social aspects of waste, nor does it provide a sustainable solution.

Social theory of solid waste management

It is therefore critical to reduce the amount of waste generated, and to recover all possible re-usable resources from discarded materials. This article focuses on municipal solid waste. This forms only a small part of the problem, since most waste is generated by industrial, agricultural and construction activities. However, waste avoidance and more responsible consumption will tackle these other forms of waste generation indirectly as well.

Not generating waste in the first place, as suggested in *On The Road to Zero Waste* (GAIA, 2012), and focusing on recycling, seem like natural ways forward, and yet they appear to be the most difficult adaptation activities for society to carry out. Reliable information, and creative forms of knowledge mobilisation and environmental education, should require people to voluntarily alter their consumption habits and participate in resource recovery programmes. However, lifestyle changes and waste reduction activities need to be integrated into government strategy and policy.

Importantly, resource recovery creates jobs in waste collection and sorting, and in education and recycling; indeed reuse and recycling create more employment than landfilling and incineration. According to Tangri (2003), recycling 10 000 tonnes of materials per year employs 296 people in the computer sector, 85 in textiles, 18 in paper recycling, 26 in glass recycling and 93 in plastics recycling. Incineration and landfill create only one job per 10 000 tons of material incinerated or landfilled per year.

It is crucial to include different stakeholders from civil society (non-governmental organisations, universities, community groups) and the recycling business itself when designing waste recovery and consumption strategies or policies for a new perception. Examples from the global South reveal the contribution that organised, co-operative recycling has made and how important these stakeholders' participation in waste management programmes and policies is. Inclusive waste management has developed in Brazil as a concept based on principles of solidarity economy and ecological economy (Gutberlet, 2009, 2012). The purpose is to value and empower the workers involved and ultimately reduce, reuse and recycle, thus addressing responsible lifestyles and refusing to waste resources in general (Barr and Gilg, 2006).

The benefits of co-operative recycling

Informal, selective waste collection is common in poorer countries of the South. It is partly done in organised co-operatives or associations, with or without municipal support. Sometimes they add value by creating new products from the materials collected and separated, for example, recycled paper products, washing lines from PET (polyethylene terephthalate) bottles, and roof tiles and furniture from TetraPak packaging (Gutberlet, 2012). In Brazil, approximately 800 000 people are involved in

informal, often co-operative, recycling. Most of these individuals live in poverty and work under hazardous conditions.

Although the activity of selective waste collectors, or *catadores*, in Brazil, is a recognised profession, most of this work is still informal. Not all co-operatives or associations are formalised and not all collectors have access to workers' rights. Regional co-operative networks have emerged that promote collective commercialisation and engage in other collective actions to improve working and remuneration conditions (Singer, 2003).

The resource recovery rate per recycler and per co-operative depends on different factors including the quality of the material separated at the source; the mode of transport; the equipment used at the processing centre where waste is separated, baled and stored; the topography; the distances in the serviced neighbourhood; and the level of training. On average, a recycler carries up to 200 kg of recyclable material a day or approximately 4 tonnes a month (Conceição, 2005). They often work 12-hour days and, on average, push their carts 20 km per day. Informal and organised recyclers recover an estimated 60% of the paper and cardboard that is recycled in Brazil and up to 90% of all materials used in the recycling industry. Conceição (2005) estimates that informal and organised recyclers recover up to 20% of the municipal solid waste generated in urban Brazil, although the official recycling rate in most Brazilian cities remains very low. Only 1.3% of the total 15 000 tons of solid waste generated daily in the megacity of São Paulo is officially collected for recycling (Arini, 2012).

Recyclers who belong to a co-operative or association supported by the local government often experience previously unknown opportunities for development, training and education. These experiences have contributed to building leadership and empowering the recyclers, thereby playing an important role in the restoration of their full citizenship (Tremblay and Gutberlet, 2011). The participants have a say in decision-making processes within their co-op and in stakeholder meetings to negotiate with government and business. Co-op leaders participate in public events, conferences and exhibitions. These practices further empower the recyclers, and open new avenues for social development (Couto, 2012).

Most importantly, co-operative-run selective waste collection schemes generate social capital by providing these individuals with meaningful work. They contribute to improving the neighbourhood, cleaning up waste materials and demonstrating resource recovery behaviour, thus creating opportunities for greater community cohesion. This effect has been widely observed in cities in Brazil and in other countries, for example, Nicaragua (Zapata Campos and Zapata, 2013) and Argentina (Carenzo, 2011; Carenzo and Fernández Alvarez, 2011). Recyclers are often invited to speak at schools, community centres and universities to educate the public about waste and their resource recovery practices.

The new federal solid waste legislation[1] (Politica Nacional de Resíduos Sólidos) provides opportunities for municipalities to collaborate with recycling groups (Brazil, 2010). The law requires municipalities to adopt selective waste collection and composting. It supports the involvement of *catadores* in shared responsibility for product lifecycles,[2] and prioritises recycling co-operatives in formal recycling programmes. Nevertheless, the same legislation also allows for waste incineration with energy recovery (waste-to-energy). The law does not set out the waste hierarchy clearly, or give precedence to waste prevention, re-use and recycling over waste-to-energy and disposal, as for example the EU Framework Directive[3] on waste does. A recent proposal to build new incineration plants has generated conflicts in many

Brazilian cities and in other countries in the poor Southern part of the world (GAIA, 2012). The national and local recyclers' movement is aware of the risk of a "vacuum cleaner effect" in favour of waste-to-energy – a danger that has also been outlined by the European Commission. Consequently the movement has called for action to promote selective waste collection and recycling rather than incineration.

Incineration might be an effective way to reduce the volume and weight of waste, but it destroys materials that could generate new products, create employment and save natural resources. Furthermore, waste-to-energy technology is very expensive, it pollutes and produces by-products, is energy inefficient and, above all, does not provide incentives for zero-waste behaviours, because the more waste is incinerated, the higher the cost–benefit ratio.[4]

Despite the increased level of organisation and the international extent of the recyclers' movement, there are many hurdles still to overcome. Probably the biggest challenge is related to the extreme poverty and socio-economic vulnerability of most recyclers, as demonstrated by the *catadores*. Furthermore the lack of political will from most local governments to include the recyclers in their waste management programmes, the threat from corporate waste management, including waste-to-energy schemes, the low prices for recyclable resources and the low remuneration for selective waste collection and organised groups' lack of financial resources, remain as persistent threats to recyclers.

Conclusion

This article highlights the benefits of engaging recycling co-operatives in resource recovery in the global South. Including *catadores* and their equivalents elsewhere in collecting, separating and transforming recyclable material and in re-educating consumers is an opportunity that can help ensure their livelihoods are sustainable. As environmental stewards they can make ground-breaking contributions by spreading information and using knowledge about waste reduction, resource recovery and the many social benefits of organised, selective waste collection. Incineration is not a viable option, given the environmental, social and economic impacts it has. In countries such as Brazil, household waste is high in organic matter, and thus low in heating value for energy recovery through incineration. Shekdar (2009) also highlights the difficulties of maintaining the necessary operating conditions in Asian countries. Organised and informal selective waste recovery and recycling activities are widespread and need to be expanded to recover most of the recyclable resources from the waste. Increasing awareness of what is recyclable at the household level is also important to enhance waste treatment efficiency. These issues, combined with higher costs relative to other municipal solid waste management options (Dijkgraaf and Vollebergh, 2004) mean that incineration is an unsustainable and inefficient method for household waste treatment.

The benefits from recycling are greenhouse gas reduction and, ultimately, climate change mitigation through the recovery of materials that would otherwise end up in landfills, generating detrimental gases and leachate (Sunil et al., 2004; King and Gutberlet, 2013). As highlighted in the European Commission's Green Paper (2013), plastics recycling and the consequent material savings alone contribute most to preventing climate change impacts, resource depletion and freshwater aquatic ecotoxicity. Reuse and recycling reduce the pressure on natural resources, diminishing environmental damage and contamination in developing countries (Troschinetz and Mihelcic, 2009).

The author suggests a bottom-up approach to achieving sustainable communities where citizens become responsible consumers, concerned with avoiding and reducing waste and providing an appropriate final destination for materials that need discarding. Inclusive resource recovery generates income and addresses poverty mitigation (one of the United Nations Millennium Development Goals). Moreover, inclusive waste management targets a reduction in public spending on conventional waste management practices and generates carbon credits.

Appropriate practices and efficiency in logistics and scale are fundamental to reducing the ecological footprint of resource recovery practices. Organised selective waste collectors such as those in Brazil contribute to these benefits. Capacity building for effective and efficient resource recovery, adaptive policy design, and public awareness building for efficient stakeholder collaboration in source separation are all critical and should be addressed with research. Community engagement, environmental stewardship and social economy can take endless creative and different forms. The organised activity of the *catadores* is important for waste reduction, zero waste and the creation of a more balanced and responsible society.

Notes

1. Law No. 9 12.305, 2 August 2010.
2. Chapter II, Art. 6, XII.
3. 2008/98/EC.
4. For discussion of the contested nature of waste incineration, see, for example Allsopp, Costner and Johnston (2001), Corvellec, Zapata Campos and Zapata (2012), Gutberlet (2011), Ngoc and Schnitzer (2009), Rocher (2008), Shekdar (2009), Themelis and Millrath (2004) and Weaver (2005).

Bibliography

Allsopp, M., P. Costner and P. Johnston (2001), *Incineration and Human Health: State of Knowledge of the Impacts of Waste Incinerators on Human Health,* Greenpeace Research Laboratories, University of Exeter, UK, March, *www.ncbi.nlm.nih.gov/pubmed/11400640*.

Arini, J. (2012), "Reciclagem ainda engatinha em São Paulo e Rio", *Veja – Ambiente*, 21 June, *http://veja.abril.com.br/noticia/ciencia/reciclagem-ainda-engatinha-em-sao-paulo-e-rio*.

Barr, S. and A. Gilg (2006), "Sustainable lifestyles: framing environmental action in and around the home", *Geoforum*, Vol. 37/6, pp. 906-920, *www.lifestylesandlifecourses.org/Staff/_private/Barr*.

Brazil (2010), Law no. 12.305, 2 October, *http://legislacao.planalto.gov.br/legisla/legislacao.nsf/Viw_Identificacao/lei%2012.305-2010?OpenDocument*.

Carenzo, S. (2011), Desfetichizar para producir valor, refetichizar para producir el colectivo: Cultura material en una cooperativa de "cartoneros" del Gran Buenos Aires. *Horizontes Antropológicos*, Vol. 17/36, pp. 15-42.

Carenzo S. and Fernández Alvarez, M.I. (2011), La promoción de cooperativas como ejercicio e gubernamentalidad: reflexiones a partir de una experiencia de cartoneros/as en la metrópolis de Buenos Aires. *Argumentos, Estudios Críticos de la Sociedad*, Vol. 65, pp. 171-193.

Conceição, M. M. (2005), *Os empresários do lixo: um paradoxo da modernidade,* 2. Ed. Átomo, Campinas.

Corvellec, H., M. J. Zapata Campos and P. Zapata (2012), "Infrastructures, lock-in, and sustainable urban development: The case of waste incineration in the Göteborg Metropolitan Area", *Journal of Cleaner Production*, Vol. 50, pp. 32-39, *http://dx.doi.org/10.1016/j.jclepro.2012.12.009*.

Couto, G. A. (2012), *Aprendizagem social e formação humana no trabalho cooperativo de catadores(as) em São Paulo*, MA thesis, Faculty of Education, University of São Paulo, Brazil.

Daly, H. E. (1996), *Beyond Growth: The Economics of Sustainable Development*, Beacon Press, Boston, Mass.

Dijkgraaf, E. and H. R. J. Vollebergh (2004), "Burn or bury? A social cost comparison of final waste disposal methods", *Ecological Economics*, Vol. 50, pp. 233-247, *www.bvsde.paho.org/bvsacd/cd43/burn.pdf*.

European Commission (2011), *Plastic Waste: Ecological and Human Health Impacts*, In-depth report. Science for Environment Policy News Service, Directorate-General of Environment Policy, *http://morerecycling.no/wp-content/uploads/2012/06/Plastics-waste-Ecological-and-human-health-impacts-DG-E-EU.pdf*.

European Commission (2013), *European Strategy on Plastic Waste in the Environment,* Green Paper, Brussels, 13 March, COM (2013), *http://ec.europa.eu/environment/waste/pdf/green_paper/green_paper_en.pdf*.

European Union (2006), Directive on Waste, *www.wastexchange.co.uk/documenti/europeanorm/st03652-re01.en05.pdf*.

GAIA (2012), *On The Road to Zero Waste: Successes and Lessons from around the World*, Global Anti-Incinerator Alliance, *www.no-burn.org/downloads/On%20the%20Road%20to%20Zero%20Waste.pdf*.

Gregson, N. and M. Crang (2010), "Materiality and waste: Inorganic vitality in a networked world", *Environment and Planning A*, Vol. 42, pp. 1026-1032, *www.envplan.com/epa/editorials/a43176.pdf*.

Gutberlet, J. (2009), "The solidarity economy of recycling co-ops: Micro-credit to alleviate poverty", *Development in Practice,* Vol. 19/6, pp. 737-751, *www.developmentinpractice.org/journals/solidarity-economy-and-recycling-coops-s%C3%A3o-paulo-micro-credit-alleviate-poverty*.

Gutberlet, J. (2011), "O custo social da incineração de resíduos sólidos: Recuperação de energia em detrimento da sustentabilidade", *Revista Geográfica de América Central, Número Especial* XIII EGAL, Costa Rica, Vol. 2/47E, pp. 1-16.

Gutberlet, J. (2012), "Informal and cooperative recycling as a poverty eradication strategy", *Geography Compass,* Vol. 6/1, pp. 19-34, *http://onlinelibrary.wiley.com/doi/10.1111/j.1749-8198.2011.00468.x/abstract*.

King, M. and Gutberlet, J. (2013), Contribution of cooperative sector recycling to greenhouse gas emissions reduction: a case study of Ribeirão Pires, Brazil. *Waste Management*. *http://dx.doi.org/10.1016/j.wasman.2013.07.031*.

Layard, R. (2005), *Happiness: Lessons from a New Science*, Allen Lane, London.

Medina, M. (2010), "Solid wastes, poverty and the environment in developing country cities", *UNU-WIDER Working Paper Series*, Vol. 23, pp. 1-15, *www.wider.unu.edu/stc/repec/pdfs/wp2010/wp2010-23.pdf*.

Ngoc, U. N. and H. Schnitzer (2009), "Sustainable solutions for solid waste management in Southeast Asian countries", *Waste Management,* Vol. 29, pp. 1982-1995, *www.ncbi.nlm.nih.gov/pubmed/19285384*.

Pongracz, E. and V. Pohjola (2004), "Re-defining waste, the concept of ownership and the role of waste management", *Resources, Conservation and Recycling*, Vol. 40/2, pp. 141-153, *www.deepdyve.com/lp/elsevier/re-defining-waste-the-concept-of-ownership-and-the-role-of-waste-GkoDGuy5hh*.

Rocher, L. (2008), "Les contradictions de la gestion intégrée des déchêts urbains: l'incinération entre valorisation énergétique et refus social", *Flux,* Vol. 74/4, pp. 22-29, *http://olegk.free.fr/flux/homefl1.html*.

Schor, J. B. (2010), *Plenitude: The New Economics of True Wealth*, Penguin, New York.

Shekdar, A. V. (2009), "Sustainable solid waste management: An integrated approach for Asian countries", *Waste Management*, Vol. 29, pp. 1438-1448, *www.sciencedirect.com/science/journal/0956053X/29/4*.

Singer, P. (2003), "As grandes questões do trabalho no Brasil e a economia solidária", *Proposta,* Vol. 30/97, pp. 12-16, *www.fase.org.br/projetos/vitrine/admin/Upload/1/File/Proposta97/paulsinger97.pdf*.

Statistics Canada (2005), *Solid Waste in Canada: Annual Statistics 2005*, *www.statcan.gc.ca/pub/16-201-x/16-201-x2005000-eng.pdf*.

Sunil, K. et al. (2004), "Estimation method for national methane emission from solid waste landfill", *Atmospheric Environment*, Vol. 38/21, pp. 3481-3487, *www.cabdirect.org/abstracts/20053123936.html;jsessionid=9F80FFA44D1AD259B808B62436312199*.

Tangri, N. (2003), *Waste Incineration: A Dying Technology*, Global Anti-Incinerator Alliance, Berkeley, Calif.

Themelis, N. J. and K. Millrath (2004), "The case for WTE as a renewable source of energy", 12th North American Waste to Energy conference (NAWTEC 12), *www.seas.columbia.edu/earth/wtert/sofos/themelis-millrath_nawtec12_2004.pdf*.

Tremblay, C. and J. Gutberlet (2011), "Empowerment through participation: Assessing the voices of leaders from recycling cooperatives in São Paulo, Brazil", *Community Development Journal,* Vol. 46/3, pp. 1-21, *http://cdj.oxfordjournals.org/content/47/2/282.full?sid=9de0bed0-5a65-4df7-8199-72c7c65192a9*.

Troschinetz, A. M. and J. R. Mihelcic (2009), "Sustainable recycling of municipal solid waste in developing countries", *Waste Management*, Vol. 29, pp. 915-923, *www.scopus.com/record/display.url?eid=2-s2.0-56349134803&origin=inward&txGid=5949C94FC44877BA88535633B212172E.mw4ft95QGjz1tIFG9A1uw%3a2*.

Victor, P. A. (2008), *Managing Without Growth: Slower by Design, not Disaster,* Edward Elgar, Northampton, UK.

Weaver, P. M. (2005), "Innovation in municipal solid waste management in England: Policy, practice and sustainability", *International Journal of Innovation and Sustainable Development*, Vol. 1/1-2, pp. 21-45, *www.ingentaconnect.com/content/ind/ijisd/2005/00000001/f0020001/art00002*.

Zapata Campos, M. J. and P. Zapata (2013), "Switching Managua on! Connecting informal settlements to the formal city through household waste collection", *Environment and Urbanization,* Vol. 25/1, pp. 1-18, *http://eau.sagepub.com/content/early/2013/02/22/0956247812468404.abstract*.

Jutta Gutberlet is an associate professor of geography at the University of Victoria, Canada, and visiting professor at the University of São Paulo, Brazil. Her research and community outreach over the past fifteen years has focused on integrated waste management in Latin America.

World Social Science Report 2013
Changing Global Environments

50. Incentives for low-carbon communities in Shanghai, China

by
Lei Song

It is essential for China's fast-growing cities to reduce their environmental impact. Vanke, a major housing development in Shanghai, has been a test case of what is possible in the area of waste reuse and recycling. It shows that considerable issues remain unsolved in terms of altering the behaviour of Chinese householders.

Around half of all people in China live and work in cities (Wenyuan, 2012). Their involvement in global solutions for climate change mitigation is essential. It could have an enormous impact on policies at many levels, including the city level (Abrahamse et al., 2005). Low-carbon community development could empower local people by supporting them to become increasingly self-reliant (Heiskanen et al., 2010). However, community-based approaches lack resources and effective decision-making processes (Kollmuss and Agyeman, 2002). Local actors and institutions do not have legislative or regulatory powers. The central government still leads most low-carbon community projects in terms of providing funds, new technologies and mandatory policies. If the local level is not allowed to provide these, sustainable collective action is impossible (Jackson, 2005).

In Shanghai it is the Vanke Corporation, the largest residential real estate developer in China, rather than the government or non-government organisations, that is piloting a low-carbon community: the Vanke Green Community Project. There are several reasons for the lack of refuse sorting in China, including the fact that residents are not used to sorting their refuse for recycling, institutional failures such as the lack of a garbage classification processing system, and the lack of quality control. Where residents do sort their refuse, it can get mixed again later. Even in communities where a refuse-sorting service is provided, the residents are still not willing to sort their refuse themselves.

The Vanke Green Community Project set out to establish the following process:

- Residents sort their own refuse in their homes.
- Vanke then sorts and compresses the refuse.
- Food waste is disposed of by biochemical treatment equipment.

According to social learning theory, behaviour change can be reinforced through social interaction, especially in groups with strong social networks (Jones et al., 2012). Besides providing free refuse bins, educational lectures and other resources, Vanke employs administrators in every building who are responsible for helping the residents understand the sorting process, helping them sort their refuse, and helping with the second sorting. The administrators' bonuses are linked to positive results.

Initially, the residents were not interested in taking part. But gradually, as the administrators built up a rapport with residents and as a social network developed between the residents within a building, they felt more inclined to become involved. They may have felt too embarrassed if they did not take part, or if they did not comply with the first stage of sorting, as this would create extra work at the second stage. In addition, the administrators monitored the results and accuracy rates. Over time, the residents' behaviour gradually changed, to the extent that a culture emerged in which anyone not conforming with the rules would lose their neighbours' trust. The residents supporting the project were given cash obtained from selling recycled goods and materials to recycling centres, or prizes from refuse-sorting community activities.

The activities of the Vanke Green Community Project have reduced refuse disposal by 46% from 2006 to 2012. The annual reduction in 2012 was over 0.7 million tonnes, compared with 0.5 million tonnes in 2008; the average annual reduction since 2008 is 25%. Participation has also increased; survey results from 2006-10 indicate that in 2006 the participation rate was below 30%, but that this had risen to 70% by 2010, with a more than 80% sorting rate accuracy.

The development of green industries and low-carbon technologies is slow. This slow progress is hindering market-based refuse disposal, making it prohibitively expensive. It is uncertain how long the project can keep going or if it can be replicated elsewhere. These problems need to be investigated and resolved.

Bibliography

Abrahamse, W. et al. (2005), "A review of intervention studies aimed at household energy conservation", *Journal of Environmental Psychology*, Vol. 25/3, pp. 273-291, *www.rug.nl/staff/e.m.steg/abrahamsestegvlekrothengatterreview.pdf*.

Heiskanen, E. et al. (2010), "Low-carbon communities as a context for individual behavioural change", *Energy Policy*, Vol. 38/12, pp. 7586-7595, *www.energychange.info/.../184-submitted-paper-low-carbon*.

Jackson, T. (2005), "Motivating sustainable consumption: A review of evidence on consumer behavior and behavioral change", *Energy Environment*, Vol.15/1, pp 217-223, *http://hiveideas.com/attachments/044_motivatingscfinal_000.pdf*.

Jones, N., J. Clark and G. Tripidaki (2012), "Social risk assessment and social capital: A significant parameter for the formation of climate change policies", *Social Science Journal*, Vol. 49/1, pp. 33-41, *www.sciencedirect.com/science/article/pii/S0362331911000966*.

Kollmuss, A. and J. Agyeman (2002), "Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior?", *Environmental Education Research*, Vol.8/3, pp. 239-260, *www.ingentaconnect.com/content/routledg/ceer/2002/.../art00002*.

Wenyuan, N. (2012), *The Report of China Urbanization,* Beijing: Science Press.

Lei Song is associate professor of urban sustainable development at the China Executive Leadership Academy, Pudong, China. She is also a postdoctoral researcher at the Chinese Academy of Social Sciences.

World Social Science Report 2013
Changing Global Environments

51. Climate change education and Education for Sustainable Development

by
UNESCO

Under the auspices of the UN Decade of Education for Sustainable Development (2005-2014), UNESCO is leading efforts to integrate educational responses to climate change, mitigation and adaptation. Education for Sustainable Development (ESD), which is growing in schools around the world, encourages pupils to think broadly about pressing scientific, technological and human issues. It also recognises that a sustainable environment is essential if children are to live a secure and rewarding life.

Introduction

Education is widely conceived as a catalyst for sustainable development. Yet our education systems are not always prepared for or responsive to challenges such as climate change. Accelerating geopolitical, demographic and environmental changes, and their associated uncertainty, risks and disasters, mean that there is an urgent need to reorient education systems to empower everyone to make informed decisions for environmental integrity, economic viability and a just society, and to respond to current and future challenges.

Climate change education

UNESCO promotes climate change education as part of Education for Sustainable Development (UNESCO, n.d.). Sustainable development cannot be achieved through political agreements, financial incentives or technological solutions alone. It requires changes in how we think and act. This is where Education for Sustainable Development is a critical lever for the global transition to sustainability. Its importance was reaffirmed in the Rio+20 outcome document, "The future we want", in which governments agreed to "promote Education for Sustainable Development and to integrate sustainable development more actively into education beyond the UN Decade of Education for Sustainable Development" (paragraph 233) (Rio+20, 2012).

Integrating educational responses to climate change

As the lead agency of the UN Decade of Education for Sustainable Development (2005-14), UNESCO is leading the effort to integrate the various educational responses to climate change, including educational strategies for mitigation and adaptation.[1]

Promoting children's rights

Climate change education now goes beyond its original focus on climate science. Most climate change education aims to increase understanding of the causes and consequences of climate change, and encourages people to take action to reduce greenhouse gas emissions. Climate change disproportionately affects developing countries, and vulnerable citizens in those countries. So it is important to use education as a means of safeguarding and promoting children's rights to survival, development and protection, as well as their right to participate in decision-making processes that affect their lives. Several international children-focused organisations are already doing this.

Enhancing climate responses through education

UNESCO is developing policy guidelines on climate change education, which have two strands, mitigation and adaptation. The idea is to help establish a common framework to enhance climate responses through education, and to advocate education as a largely untapped strategic resource for building resilient and sustainable societies.

Enhancing climate responses through education will involve specific dedicated measures as well as the integration of Education for Sustainable Development into existing education and development processes. The immediate tasks are to promote education for sustainable consumption in developed countries, and to ensure safe learning environments in countries which are most vulnerable to climate change impacts, integrating disaster risk reduction into their education systems. The longer-term task – common to all countries – is to improve and reorient education systems to foster the knowledge, skills and dispositions needed to deal with current and future challenges. This may not appear entirely new. Indeed, it has always been at the heart of a quality education agenda. It nevertheless emphasises that climate change education in the context of Education for Sustainable Development has to go far beyond inserting new thematic content into overcrowded curricula. Instead it stresses the importance of participatory and solution-oriented learning that encourages systems and critical thinking, engages with uncertainty and complexity, and draws on learners' cognitive, affective and practical potential both in and out of the classroom.

Note

1. In 2012, the Conference of the Parties to the United Nations Framework Convention on Climate Change, "recognizing that a goal of education is to promote changes in lifestyles, attitudes and behaviour needed to foster sustainable development and to prepare children, youth, women, persons with disabilities and grass-root communities to adapt to the impacts of climate change", adopted the eight-year Doha work programme on UN Framework Article 6, which focuses on education, training and public awareness (UNFCCC, 2012).

Bibliography

Rio+20 (2012), "The future we want", statement of heads of state and government and high level representatives, *www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf*.

UNESCO (n.d.), "Education for Sustainable Development", United Nations Educational, Scientific and Cultural Organization, Paris, *www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/*.

UNFCCC (2012), "Report of the Conference of the Parties on its eighteenth session, held in Doha from 26 November to 8 December 2012", UN Framework Convention on Climate Change, *http://unfccc.int/resource/docs/2012/cop18/eng/08a02.pdf*.

World Social Science Report 2013
Changing Global Environments

52. Education, science and climate change in French schools

by
Guillaume Arnould

Education for Sustainable Development in France is taught at all levels across all subjects in state schools. Climate change is not taught as a subject in its own right, until secondary level. Good teacher training is essential to enable teachers to teach this controversial issue in an interesting and scientific way.

Teaching climate change is a challenge for education for at least two reasons. First, what is the best way to help pupils understand complex research on climate change? Second, climate change is the subject of intense debate over ideologies and opinions in the mass media. Teachers are not necessarily well prepared or willing to teach such controversial issues (Latour, 2005).

In the United States, new science education guidelines were adopted in April 2013 which introduced climate change as a central aspect of science education for middle- and high-school students. Although the guidelines are not mandatory and are somewhat vague, they are meant to allow teachers to discuss climate change in the classroom. In England, recent discussions could mean that teachers start teaching climate change only when pupils are 14 years old and can understand the basic science.

This article focuses on teaching climate change in the French education system, and the challenges it poses for educators. Climate change is not taught explicitly in France until secondary school, or Grade 6, when pupils are about 11. But it is taught at all levels within the topic of Education for Sustainable Development. Here it is treated as a cross-cutting issue, whereby several disciplines integrate the consequences of human actions for sustainable development into their syllabuses. This approach gives teachers enormous freedom in how they might teach the subject in class.

A multidisciplinary issue

Education for Sustainable Development includes climate change, which is inherently multidisciplinary. Geography, the life sciences, Earth science, economics and technology all include aspects of climate change in their syllabuses. In disciplines such as philosophy or history, teachers can highlight the ethical aspects of climate change and put relevant issues into perspective.

However, the idea of bringing several disciplines together to work jointly on a common topic has not yet been realised. Institutional and disciplinary divides remain: each discipline has its own agenda and its own approach to the subject. Lange (2008) underlines the role of teachers and their perceptions; their concept of sustainable development as a school subject is highly dependent on each teacher's subject specialisation. In addition, it is difficult to teach a contested subject, such as climate change. Should the teacher begin with pupils' preconceptions – so-called common sense – or with the latest scientific knowledge? This would involve popularising complex issues while maintaining rigour.

One starting point could be the conflict between the scientific evidence that human action is causing climate change, and doubts about whether everyday individual action can change things. This approach could, for example, lead students to rethink their consumption patterns and production practices.

Teaching climate change and sustainable development ultimately requires an educational approach that fosters citizenship, guides young people towards appropriate environmental actions, and empowers them to deal with risk and uncertainty. It is necessary to teach climate change in all its dimensions: cognitive (the state of knowledge in the field), psychological (representations that lead to opinions being formed about the issue) and behavioural (what to do and what decisions to take). Qualified teachers are necessary if students are to deal with these questions: good teacher training is thus more relevant than ever (Urgelli, 2007).

The subject matter of climate change ranges from daily action, such as sorting waste in a school, to international negotiations on climate change. But the overall ambition of education to train pupils in citizenship is hampered by the lack of consensus on climate change science, which affects the way in which the subject can be treated in the classroom. However, the research suggests that the fear of teaching controversial subjects is largely unfounded, and that students are very interested in the political dimensions of an issue (Albe, 2010-11), as are people more generally (Pruneau et al., 2003).

Bibliography

Albe, V. (2010-11), "Changements climatiques à l'école: Pour une éducation sociopolitique aux sciences de l'environnement", *Education Relative à l'Environnement*, Vol. 9, *www.revue-ere.uqam.ca/PDF/volume_9/V.ALBE.pdf*.

Lange, J. M. (2008), "L'éducation au développement durable au regard des spécificités enseignantes, Aster recherches en didactique des sciences expérimentales", *www.stef.ens-cachan.fr/annur/lange/ASTER_08.pdf*.

Latour, B. (2005), *Re-assembling the Social: An Introduction to Actor-Network Theory*, Oxford University Press, Oxford.

Pruneau, D. et al. (2003), "Experimentation with a socioconstructivist process for climate change education", *Environmental Education Research*, Vol. 9/4, pp. 429-446, *www8.umoncton.ca/littoral-vie/articles/Jeunes%20visionnaires%20anglais2003.pdf*.

Urgelli, B. (2006-07), "La question du changement climatique dans le programme français d'éducation à l'environnement pour un développement durable – Nouvelle épistémologie des savoirs scolaires et implications pour la formation des enseignants", *Education Relative à l'Environnement*, Vol. 6, *www.revue-ere.uqam.ca/PDF/Volume6/05_Urgelli_B.pdf*.

Veyret, Y. (2007), *Dictionnaire de l'environnement*, Armand Colin, Paris.

Guillaume Arnould is regional academic inspector at the Académie de Strasbourg, France.

World Social Science Report 2013
Changing Global Environments

53. Are increasing greenhouse gas emissions inevitable?

by
John Urry

Western development over the past century involves the interdependent development of a cluster of high-carbon socio-technical systems and related social practices. Reversing these systems will be a massive challenge. Instead a set of low-carbon models or systems are needed, using new practices of low-carbon innovation. This article explores the likelihood of these developing as more than tiny niches, and ends by noting some green shoots of such alternatives.

This article uses systems thinking to examine how a high-carbon world was initiated, established, and globally diffused over the course of the 20th century, and to consider how to reverse those locked-in high-carbon processes.

Various systems were trialled and developed in the United States in the 20th century, and then spread and formed the "Western" way of life. These included electrical power, national grids, oil-based car and truck transportation, aeromobility, industrial food production, suburban homes and a general zoning of development, as well as distant places of shopping, leisure and pleasure (Urry, 2011). These systems were not just technological, but involved social values and practices, and were often characterised by long-term path-dependence as many elements were locked into the system and were very difficult to shift (on the automobility system, see Geels et al., 2012).

Such systems cluster together, thus reinforcing each other and engendering high-carbon practices and lives. Nye describes how in the United States, the "high-energy regime touched every aspect of daily life. It promised a future of miracle fabrics, inexpensive food, larger suburban houses, faster travel, cheaper fuels, climate control, and limitless growth" (1998: 215). Various social practices extended over various societies, including a daily shower, the school run, foreign holidays, climate control, dining out, global friendships, project work in a global team, the weekly shop and so on (see Shove, Panzar and Watson, 2012 on social practices).

This cluster of Western practices spread during the second half of the last century as the population, income, consumption and energy use grew exponentially. This led to the problem of the systemic, clustered and path-dependent nature of high-carbon systems and practices (see Urry, 2013 for more detail). From a systems perspective, merely slowing

down the rate of emissions will not be sufficient to reduce future temperature rises. Rather, what is needed is the rapid global growth of an alternative cluster of low-carbon systems. This is not just a question of different individual values, beliefs or behaviour. Nor is it just a question of the economy. The requirement is to reverse the apparently inexorable growth of high-carbon systems and related social practices, thus reducing, eliminating or replacing many high-carbon worlds with an interdependent cluster of low-carbon systems. This reversal has to be both social and economic.

This requires "reversing" most systems set in motion during the 20th century, finding the equivalent of a reverse gear while going forwards very fast. However, there are many reasons why finding a reverse gear is so troublesome.

First, there is the power of the carbon interests which generate rising greenhouse gas emissions and which are complicit in the over-use of energy (as documented in Oreskes and Conway, 2010). And yet these interests are also expected to solve these issues by systematically reducing emissions. This is a kind of wicked problem in which the interests generating system problems are also those that are seen as crucial to the development of solutions.

Further, low-carbon systems will reduce the short-term levels of measured income and consumption, which will make it difficult to persuade people to embrace low-carbon social practices. And yet research shows that beyond a level of income in a society, increasing personal incomes do not necessarily turn into more human well-being. Wilkinson and Pickett (2009) document how life expectancy, the well-being of children, literacy, social mobility and trust are all higher in societies that are more equal. Many extra goods and services are "wasted" in unnecessary products, extra car journeys, goods that become prematurely obsolescent or building temperatures kept too high (Shove, Chappells and Lutzenhiser, 2009; Offner, 2006). Societies need to be measured in terms of their quality of life, or "prosperity", and not through gross domestic product (GDP) measures of "growth" (Jackson, 2009).

Third, systems are often characterised by their momentum, which makes it more difficult to reverse those systems in which most people in a society are embedded. Societal change can be surprisingly slow. An example is seen with the enduring car system, which dates from the late 19th century and which has so far "driven out" potential competitors (see Dennis and Urry, 2009; Geels et al., 2012).

There is a lack of time to make the seismic shifts necessary, given that changes in the atmosphere and a decline in energy security are already locked into systems. To some degree these will happen whatever changes happen now or in the immediate future (Hansen, 2011). Some would say that we should prepare to adapt to such atmospheric changes, since climate transformations are more or less inevitable.

There are also difficulties in organising a global polity that can reset global agendas, especially as resources are in short supply and contested. Latouche (2009) suggests that the World Trade Organization should be replaced by the World Localization Organization in order to disrupt the momentum of increasing globalisation, which is partly the cause of rising greenhouse gas emissions.

In addition, even if there were global agreements, states are rarely able to enforce change from the top, because of people's understandable resistance to being instructed to move to low-carbon practices. The global media circulate stories and accounts of how corporate, political and media celebrities live ultra-high-carbon lives, which make

them especially inappropriate to lecture others on reducing their carbon footprint. One element of celebrity lives is tax evasion or avoidance, resulting from the "offshore world" of 70 or so tax havens or "secrecy jurisdictions" (Shaxson, 2011). This offshore world is disastrous for reducing carbon emissions and for moderating energy use. These havens limit the taxation available to the societies where income and wealth are mostly created. This is an especially pertinent issue in societies where many people's basic needs are not met and where people are especially vulnerable to climate change impacts. Low-carbon systems cannot develop if resources are not brought onshore, and made public and much more accountable.

Indeed a low-carbon world requires people around the globe to feel a strong mutual indebtedness, especially by current generations towards future generations, including those not yet born. This public or social indebtedness is expressed in the UNESCO Declaration of 12 November, 1997 on the responsibilities of present to future generations (UNESCO, 1997). However, this social indebtedness has been overlain by financial debt for people, states and corporations (Dienst, 2011). In the neoliberal decades since the 1980s, social indebtedness has been distorted by financial indebtedness and greater inequality through the large-scale offshoring of income and wealth, especially by major corporations, societal leaders and celebrities.

Global inequality has probably never been higher, which makes low carbonism even more difficult to implement. In China, India and the other "BRIC" countries, there are generally large increases in fossil-fuel dependency and a striking resurgence of "King Coal" as these countries become even more unequal (see Hansen, 2011). In societies in which many people do not have access to adequate resources to meet their basic human needs, there are strong aspirations to improve access to energy for power, heating or cooling, and transportation as elements of a development strategy. But there are also opportunities for development through new low-carbon systems, to bypass the fossil-fuel-intensive path of traditional development. This is partly why futurist Richard Buckminster Fuller once maintained, "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete."[1]

This points to the need for a cluster of new models that use less energy but which sustain many of the pleasures of contemporary wealthy societies. Societies could be as happy, with high life expectancy, but not as rich as measured by GDP. It is not so much a reverse gear that is needed, as a different set of gears altogether to make innovations in "developing societies" productive. There would be no smooth progression from the present to a lower-carbon future. If we consider where other big changes have occurred across large populations, it took something like 50 years for the rich North to bring about significant reductions in tobacco smoking, although the scientific evidence for its dire health consequences was clear-cut (Oreskes and Conway, 2010).

There are many models that explore the possibilities of low-carbon societies or "de-growth" (Latouche, 2009). The important question is how to get to such a powered-down future, and how to get there fast enough. It will require engineering "systems" of low carbon social practice, a matter of technical, economic and social development. It would involve innovation, with users of commodities and services modifying products, making fashionable alternatives and developing new, collective innovations. Various analysts, such as von Hippel (2006), increasingly emphasise the importance of "democratising innovation". He describes how many "users" of goods and services engage in and develop new products and services. The development of apps for mobile phones is a good illustration of widespread consumer

innovation, some of which is – most strikingly – found in the developing world where the costs of innovation are reducing quickly.

Similarly, sustainable innovation requires consumer communities that highlight, advocate and develop low-carbon actions and objects, and make them fashionable. Consumers would have to innovate low-carbon local goods and services on a vast scale, while states and corporations would have to provide the conditions for these to start and then be scaled up. *The Transition Companion* (Hopkins, 2011), based on the "transition towns" movement , describes many different aspects of how this can be engineered by starting out, deepening, connecting and building new products and services. Some of the innovation features of this transition movement are that it is viral, open source, self-organising, iterative, historic and enjoyable.

It is possible that some tiny green shoots of such a future are developing in the rich North. Analysis shows that travel has reached its peak, with various surveys reporting declining numbers of car journeys, distances travelled by car, and of young people acquiring driving licences (Millard-Ball and Schipper, 2011; Geels et al., 2012). It also seems that the amount of material goods that consumers in the rich North are now using is peaking. This quantity seemed to peak before the 2007-08 financial crisis, and so suggests increased material efficiency, which could mean that a low-carbon cluster is beginning to emerge. Perhaps at long last, at least in the rich North, there are some green shoots of a different set of practices and systems developing (as shown in Urry, 2013).

Note

1. *http://challenge.bfi.org/movie,* accessed 4 November 2011.

Bibliography

Dennis, K. and J. Urry (2009), *After the Car,* Polity, Cambridge.

Dienst, R. (2011), *The Bonds of Debt,* Verso, London.

Geels, F. et al. (eds.) (2012), *Automobility in Transition? A Socio-Technical Analysis of Sustainable Transport,* Routledge, New York.

Hansen, J. (2011), *Storms of My Grandchildren,* Bloomsbury, London.

Hopkins, R. (2011), *The Transition Companion,* Green Books, Totnes, UK.

Jackson, T. (2009), *Prosperity without Growth,* Earthscan, London.

Latouche, S. (2009), *Farewell to Growth,* Polity, Cambridge.

Millard-Ball, A. and L. Schipper (2011), "Are we reaching peak travel? Trends in passenger transport in eight industrialized countries", *Transport Reviews*, Vol. 31, pp. 357-78, *http://web.mit.edu/vig/Public/peaktravel.pdf*.

Nye, D. (1998), *Consuming Power,* MIT Press, Cambridge, Mass.

Offner, A. (2006), T*he Challenge of Affluence,* Oxford University Press, Oxford.

Oreskes, N. and E. Conway (2010), *Merchants of Doubt,* Bloomsbury, New York.

Shaxson, N. (2011), *Treasure Islands,* Bodley, London.

Shove, E., H. Chappells and L. Lutzenhiser (eds.) (2009), *Comfort in a Lower Carbon Society*, Routledge, London.

Shove, E., M. Panzar and M. Watson (2012), *The Dynamics of Social Practices*, Sage, London.

UNESCO (1997), "Declaration on the responsibilities of the present generations towards future generations", 12 November, *http://portal.unesco.org/en/ev.php-URL_ID=13178&URL_DO=DO_TOPIC&URL_SECTION=201.html*.

Urry, J. (2011), *Climate Change and Society,* Polity, Cambridge.

Urry, J. (2013), "A low carbon economy and society", *Philosophical Transactions of the Royal Society A*, *www.ncbi.nlm.nih.gov/pubmed/23359737*.

Von Hippel, E. (2006), *Democratizing Innovation,* MIT Press, Cambridge, Mass.

Wilkinson R. and K. Pickett (2009), *The Spirit Level: Why More Equal Societies Almost Always Do Better,* Allen Lane, London.

John Urry is distinguished professor in the Department of Sociology at Lancaster University in the United Kingdom. His main research in recent years has been in advocating and developing a new paradigm for the social sciences, the new mobilities paradigm. His latest book is *Societies beyond Oil,* published in 2013 by Zed Books.

World Social Science Report 2013
Changing Global Environments

54. The human dimensions of global environmental change

by
Tom W. Smith

Cross-national surveys indicate that environmental issues are not the main concern in any country or region, and from 1993-2010 there were, on average, no large or consistent trends in public concern with climate change. Climate change is the environmental issue mentioned as the most important in ten of the 33 countries and regions surveyed in 2010. There is no international consensus, although in general, richer nations are more concerned than poorer nations are. Younger generations mention global warming more often than older generations.

Introduction

Scientific consensus has emerged that global warming is occurring and that human activity is an important cause of climate change. It is increasingly recognised that the social sciences need to become more deeply involved in understanding the human dimensions of global environmental change and in crafting solutions (Nawrotzki, 2012). To do this, and given the global nature of climate change, cross-national data are essential. There are considerable cross-national and inter-regional differences in attitudes towards environmental issues in general, and climate change in particular. Trend data are also vital, since environmental conditions and the public's assessment of climate change are constantly changing.

The International Social Survey Programme (ISSP) provides valuable comparative and temporal data and has conducted three rounds of studies on global environmental issues. Nationally representative probability samples were carried out in 22 countries/regions in 1993 (n=28 301), in 37 in 2000 (n=31 042), and in 33 in 2010 (n=45 199). Different sampling frames were used, depending on the available sampling information such as population registers, electoral rolls and small-area census data.[1]

Ranking of environmental problems

In 2010, the ISSP rated the importance of eight issues: health care, education, crime, the environment, immigration, the economy, terrorism and poverty (see Box 54.1 on survey questions at the end of this article). The economy was ranked highest in 15 countries/regions, followed by health care in eight, education in six, poverty in two, and terrorism and crime in one each. Immigration and the environment were not ranked first in any country or region.

In terms of averages across nations, the overall order of concern was: the economy (25.0%); healthcare (22.2%); education (15.6%); poverty (11.6%); crime (10.3%); environment (4.7%); immigration (4.1%); and terrorism (2.6%). For earlier rankings in the United States, see Leiserowitz (2007).

As Table 54.1 shows, environmental concern is greatest in Scandinavia, Switzerland and Canada. They are followed by other West European countries/regions (France, Austria, Flanders, Finland, the former West Germany) and East Asia (Taiwan, Republic of Korea, Japan), and New Zealand. Towards the bottom of the table are ex-socialist states (the former East Germany,[2] Russia, Slovenia, Slovakia, Bulgaria, Croatia, Latvia and Lithuania) and developing countries[3] (Mexico, the Philippines, South Africa, Chile, Turkey and Argentina). The greater concern in wealthier nations is consistent with some past research (Franzen and Meyer, 2010; Gelissen, 2007), but other studies have found an inconsistent relationship between development and pro-environmentalism (Dunlap and York, 2008; Marquart-Pyatt, 2012).

Table 54.1. **Most important problems by country, 2010**

Country/region	% selecting "environment"	Ranking "environment" out of 8 problems
Norway	15.0	3
Switzerland	13.1	4
Canada	12.7	3
Denmark	10.3	4
Sweden	10.2	5
Taiwan, China	8.8	5
New Zealand	8.7	5
Republic of Korea	7.6	5
France	7.5	5
Austria	7.4	6
Flanders	7.4	4
Finland	6.9	4
Germany – West	6.8	5
Germany – East	4.8	5
Mexico	4.8	6
Russia	4.8	6
Czech Rep.	4.7	6
Japan	4.1	5
United States	3.6	6
Great Britain	3.4	6
Israel	3.0	7
Spain	3.0	8
Slovenia	2.9	5
Philippines	2.7	6
Slovakia	2.5	6
Bulgaria	2.3	6
South Africa	2.3	7
Croatia	2.0	6
Latvia	1.8	6.5
Chile	1.7	6
Turkey	1.1	7
Lithuania	1.0	7
Argentina	0.4	7.5

The ISSP also inquired about the importance of nine environmental problems facing the respondents' countries as a whole. Air pollution was ranked first in 13 countries/regions, climate change in ten, water pollution in three and water shortages in three. Chemicals and

pesticides, nuclear waste, domestic waste disposal and depleting natural resources were each first in one country. Genetically modified foods never appeared in the top position. The order of environmental concerns was air pollution (20.5%), climate change (14.6%), water pollution (11.5%), using up our natural resources (10.8%), chemicals and pesticides (9.4%), domestic waste disposal (8.2%), water shortages (7.0%), nuclear waste (6.9%) and genetically modified foods (5.2%). For another ranking of environmental concerns across countries, see GlobeScan (2013).

Table 54.2 indicates large cross-national differences in mentioning climate change as the most important environmental problem. It is ranked first, with 49.2%, in Japan, followed by West Germany, Norway, Denmark, the former East Germany, Canada, Finland, Sweden and Britain (18.6-25.8%). With the exception of the former East Germany, it is ranked much lower in ex-socialist states. It is also ranked lower in most developing countries. Israel rated it the lowest.

Table 54.2. **Most important environmental problems by country, 2010**

Country/region	% selecting "climate change"	Ranking of "climate change" out of 9 problems
Japan	49.2	1
Germany – West	25.8	1
Norway	25.4	1
Denmark	23.9	1
Spain	23.3	1
Germany – East	23.2	1
Austria	23.0	2
Canada	21.8	1
Finland	20.2	1
Sweden	20.2	1
Taiwan, China	18.9	2
Great Britain	18.6	1
Switzerland	16.8	3
Philippines	16.6	2
Flanders	12.9	2
Republic of Korea	12.9	5
New Zealand	12.5	2
Croatia	10.1	5
Mexico	9.9	4
United States	9.0	5
Czech Rep.	8.6	5
France	8.4	6
Slovenia	8.4	5
Slovakia	7.9	5
Russia	7.7	6.5
Latvia	7.6	7
South Africa	7.1	4
Bulgaria	6.7	6
Argentina	5.9	7
Chile	5.7	7.5
Turkey	5.6	7
Lithuania	5.0	7
Israel	2.4	9

One reason for the relatively low ranking of climate change is that people often believe it does not affect them directly (Leiserowitz, 2006; Lorenzoni et al., 2007). While, on average, 14.6% cited it as the most important environmental issue for their country, only 9% rated it first for themselves. It ranked lower as a personal problem than as a national problem in 20 of the 33 countries. The 12 largest differences were all declines from perception of a national to a personal problem (Table 54.3). Warmer and ex-socialist states tended to show more personal than national concern, while East Asia and cooler countries tended to have lower personal than national concern.

Table 54.3. **Most important environmental problems by country versus self and family; percentage selecting climate change, 2010**

Country/region	Climate change as a problem
Israel	+4.8
Philippines	+4.7
Argentina	+3.1
Russia	+2.6
Turkey	+2.6
Mexico	+1.8
Lithuania	+1.6
Chile	+1.5
France	+1.1
Czech Rep.	+0.9
Bulgaria	+0.8
Croatia	+0.7
South Africa	+0.6
Slovakia	-0.1
Slovenia	-0.9
Latvia	-1.6
Switzerland	-2.8
Republic of Korea	-3.0
United States	-3.1
New Zealand	-3.7
Flanders	-4.3
Austria	-5.0
Germany – East	-6.0
Germany – West	-7.5
Taiwan, China	-8.0
Denmark	-8.6
Finland	-8.7
Spain	-8.7
Great Britain	-9.1
Sweden	-9.1
Canada	-11.4
Norway	-12.4
Japan	-23.5

Note: The percentage of respondents saying climate change is the environmental problem that "affects you and your family the most" minus the percentage saying climate change is the biggest problem for their country. A positive score indicates climate change is seen more as a personal problem than a national problem. A negative score indicates that climate change is regarded as a national problem rather than a personal problem.

The ISSP also asked how respondents rated the level of dangerousness to the environment of "a rise in the world's temperature caused by climate change" and six other environmental problems. Nuclear power plants were rated as the most dangerous in 12 countries, industrial air pollution in 8.5, water pollution in 5.5, chemicals and pesticides in farming, as well as rising temperatures as a result of climate change, in 3, and genetically modified foods in 1. As Table 54.4 below shows, climate change was rated more dangerous than the average of the other 6 environmental problems in 17 countries, tied in one country, and was rated less dangerous in 15. It was ranked as the most dangerous environmental problem in Japan, the Republic of Korea and Great Britain. Taiwan, China also rated it well above average in dangerousness. In contrast to its higher than average ratings in East Asia, it was rated lower than average in dangerousness in all ex-socialist countries except the former East Germany. Developing countries and other parts of Europe showed a wide dispersion in their rating of the danger of climate change.

Table 54.4. **"Dangerousness" of climate change, 2010**

Countries/regions	Climate change is extremely dangerous – average of other 6 environmental problems[1]	Ranking of climate change among 7 environmental issues	% climate change extremely dangerous
Japan	+20.2	1	38.0
Taiwan, China	+14.3	2	33.9
Republic of Korea	+ 8.4	1	26.4
Germany – East	+ 6.9	3	27.8
Mexico	+ 6.9	2	42.1
Finland	+ 5.2	2	19.4
Great Britain	+ 4.7	1	16.3
Chile	+ 4.6	2	49.7
Philippines	+ 4.6	4	39.6
Germany – West	+ 4.1	3	28.4
Spain	+ 4.1	3	27.8
Canada	+ 2.7	3	27.8
Switzerland	+ 2.7	2	14.9
Sweden	+ 1.9	3	17.3
Denmark	+ 1.6	3	18.0
Norway	+ 0.8	2	11.8
South Africa	+ 0.6	5	33.8
United States	0.0	4	19.6
Croatia	- 0.7	5	35.1
Flanders	- 1.0	5	13.4
Slovakia	- 1.0	4.5	24.3
Bulgaria	- 1.1	5	28.5
New Zealand	- 1.4	3.5	20.6
Argentina	- 2.0	5	26.7
Austria	- 2.8	3	24.6
Czech Rep.	- 3.2	4	15.2
Turkey	- 3.2	5	43.8
Israel	- 4.2	4	23.6
Slovenia	- 4.2	6	18.7
Lithuania	- 5.8	6	18.3
Latvia	- 6.7	6	15.0
France	- 10.2	6	19.2
Russia	- 13.2	7	29.6

Note: The percentage of respondents saying climate change is "extremely dangerous" minus the average saying the following six environmental concerns are "extremely dangerous": air pollution caused by cars; air pollution caused by industry; pesticides and chemicals used in farming; pollution of their country's rivers, lakes and streams; modifying the genes in certain crops; nuclear power stations. A positive score indicates that climate change is seen as more dangerous than the average of the other six environmental concerns. A negative score indicates that the other concerns (average) are seen as more dangerous than climate change.

Trends in ratings of climate change

As Table 54.5 indicates, there has been no clear or substantial change in the public's assessment of the danger of climate change over time. Between 1993 and 2000, nine countries showed more concern and eight showed less, while in 2000-10 concern had risen in 13 and fallen in ten. From 1993 to 2010, it increased in eight countries and declined in seven (overall +30 and -25). The average number of respondents in the 15 countries surveyed between 1993 and 2010 who believed climate change was extremely dangerous increased by +1.8 percentage points. The greatest gains were in the Philippines (+21.6), Japan (+15.8), Spain (+15.1) and Russia (+10.7). The largest declines were in East and

Table 54.5. **Trends in saying global warming or climate change is extremely dangerous, 1993 to 2010**

Country/region	1993	2000	2010
Bulgaria	23.9	19.0	28.5
Canada	24.1	24.3	27.8
Czech Rep.	24.1	25.2	15.2
Germany – East	39.4	40.6	27.8
Germany – West	38.2	27.2	28.4
Great Britain	24.5	22.7	16.3
Israel	17.3	25.4	24.5
Japan	22.2	29.2	38.0
New Zealand	24.9	27.7	20.6
Norway	16.4	11.6	11.8
Philippines	18.0	43.9	39.6
Russia	18.9	17.5	29.6
Slovenia	26.2	24.4	18.7
Spain	12.7	24.1	27.8
United States	16.9	15.8	19.6
Ireland	25.0	17.4	----
Netherlands	8.3	8.6	----
Austria	----	26.7	24.6
Chile	----	34.3	49.7
Denmark	----	15.8	18.0
Finland	----	12.5	19.4
Latvia	----	20.1	15.0
Mexico	----	24.6	42.1
Sweden	----	13.6	17.3
Switzerland	----	32.4	14.9

West Germany (-11.6 and -9.8), the Czech Republic (-8.9) and Great Britain (-8.2). This mixed pattern is consistent with other recent trends regarding environmental issues and with cross-national research showing little, mixed or no increase in pro-environmental positions (Franzen and Meyer, 2010; GlobeScan, 2013; Hadler and Wohlkoenig, 2012; Humphrey and Scott, 2012; Leiserowitz, 2007; Sabio, 2012).

Age differences in climate change concerns

As Table 54.6 shows, younger adults are more likely to regard climate change as extremely dangerous than are older adults. In 26 of 33 countries/regions, respondents under 30 believed it was more dangerous than those aged over 70. Age differences ranged from +30.8 percentage points in Taiwan, China to -14.2 in the Philippines, and averaged +8.8. Previous research across countries has found that younger adults are more pro-environmental on most issues (Franzen and Meyer, 2010; Hadler and Wohlkoenig, 2012; Humphrey and Scott, 2012; Marquart-Pyatt, 2012).

The differences were larger in East Asia, with the notable exception of the Philippines, and Scandinavia. With the exception of the former East Germany, the differences were smaller than average, and often negative, in ex-socialist states. They were generally smaller than average, and usually negative, in developing nations.

Table 54.6. **Age or cohort difference on the "danger" of climate change, 2010**

Country/region	% aged under 30 –% aged over 70
Taiwan, China	+30.8
Republic of Korea	+24.8
Sweden	+19.2
Germany – East	+19.1
Finland	+17.5
Canada	+15.4
Austria	+14.9
Flanders	+14.6
Chile	+14.5
Denmark	+14.3
New Zealand	+14.3
Norway	+13.4
France	+13.0
Great Britain	+12.7
Spain	+12.6
Israel	+10.8
Czech Rep	+10.1
Slovakia	+9.8
United States	+9.6
Switzerland	+9.5
Lithuania	+9.3
Japan	+7.9
Germany – West	+7.4
Argentina	+5.7
Croatia	+2.1
Slovenia	+0.9
South Africa	-2.8
Russia	-2.9
Latvia	-2.9
Mexico	-3.9
Bulgaria	-8.1
Turkey	-9.0
Philippines	-14.2

If the age differences reflect cohort rather than ageing effects, this suggests that concern about climate change will increase as younger generations replace the older, less concerned generations. As others have noted, cohort effects are those that occur across generations due to historical developments and period effects that affect generations differently. Ageing effects are biological or physiological changes that come from ageing and lifecycle changes associated with ageing. It is impossible to separate ageing and cohort effects definitively at a single point in time. While the 2010 data cannot distinguish between cohort and ageing effects, it is plausible that cohort effects, due to the rising discussion of and growing scientific consensus about climate change, are the main determinants of the age differences, especially as there is no compelling reason to expect ageing effects.

Box 54.1. **Survey questions**

Which of these issues is the most important for [your country] today?

Health care	The economy
Terrorism	Poverty
Education	Crime
The environment	Immigration
None of these	Can't choose

Here is a list of some different environmental problems:

Air pollution	Chemicals and pesticides	Water shortage
Nuclear waste	Domestic waste disposal	Climate Change
Genetically modified foods	Using up natural resources	
None of these	Can't choose	

Which, if any, do you think is most important for [your country]?

Which, if any, affects you and your family the most?

In general, do you think that [a rise in the world's temperature caused by the greenhouse effect/ climate change**] is:*

- extremely dangerous
- very dangerous
- somewhat dangerous
- not very dangerous
- not at all dangerous ... for the environment?

Other issues rated on the same scale were: air pollution caused by cars; air pollution caused by industry; pesticides and chemicals used in farming; pollution of [your country's] rivers, lakes, and streams; modifying the genes in certain crops; nuclear power stations.

*used in 1993 and 2000 surveys; **used in 2010 survey

Conclusion

Environmental issues are not the top concern in any country/region, ranking only sixth of eight general problems. But among environmental issues, climate change ranks rather high – it is mentioned most in ten countries, and overall is only second to air pollution. However, climate change is seen as a country-level problem rather than as a pressing personal problem. This is because many people believe climate change will have impacts in the future rather than today, while others believe the effects are mostly happening elsewhere, in other places or in the polar regions. Neither is climate change regarded as the most dangerous environmental problem. It is ranked first in only three of 33 countries/regions. But it is seen as more dangerous than the average of six other environmental problems in half of the countries surveyed.

There is no international consensus on climate change; there is a rather large national and regional variation in attitudes. East Asia (Aoyagi-Usui, Vinken and Kuribayashi, 2003) and Scandinavia generally show the most concern, while ex-socialist and developing countries express the least concern. Both the former East and West Germany often have distinctive profiles, with the former East Germany often resembling other ex-socialist states. However, these patterns do not emerge regarding climate change and related environmental issues. People in wealthier countries/regions generally indicate greater concern than those in poorer ones.

On average, there were no large or consistent trends in public concern over climate change from 1993-2010, although large shifts in both directions occurred in particular countries/regions. The respondents under 30 years of age mention global warming due to climate change more often than those over 70, which probably reflects cohort effects and, if so, should increase the levels of concern in the future.

Notes

1. For more methodological detail see *www.issp.org*.
2. The ISSP finds that the former East Germany and West Germany still differ in many respects, although the differences are declining over time.
3. Based on per capita gross national product (GNP)/gross domestic product (GDP).

Bibliography

Aoyagi-Usui, M., H. Vinken and A. Kuribayashi (2003), "Pro-environmental attitudes and behaviors: An international comparison", *Research in Human Ecology*, Vol. 10, pp. 23-31, *www.humanecologyreview.org/pastissues/her101/101aoyagietal.pdf*.

Dunlap, R. E. and R. York (2008), "The globalization of environmental concern and the limits of the postmaterialist values explanation: Evidence from four multinational surveys", *Sociological Quarterly*, Vol. 49, pp. 529-563, *http://onlinelibrary.wiley.com/doi/10.1111/j.1533-8525.2008.00127.x/abstract*.

Franzen, A. and R. Meyer (2010), "Environmental attitudes in cross-national perspective: A multilevel analysis of the ISSP 1993 and 2000", *European Sociological Review*, Vol. 26, pp. 219-234, *www.soz.unibe.ch/unibe/wiso/soz/content/.../Franzen_Meyer_2010.pdf*.

Gelissen, J. (2007), "Explaining popular support for environmental protection: A multilevel analysis of 50 nations", *Environment and Behavior*, Vol. 39, pp. 392-415, *http://eab.sagepub.com/content/39/3/392.short*.

GlobeScan (2013), "Environmental concerns 'at record lows': Global poll. GlobeScan Radar report", *www.globescan.com/commentary-and-analysis/press-releases/press-releases-2013/261-environmental-concerns-at-record-lows-global-poll.html*.

Hadler, M. and P. Wohlkoenig (2012), "Environmental behaviours in the Czech Republic, Austria, and Germany between 1993 and 2010: Macro-level trends and individual-level determinant compared", *Czech Sociological Review*, Vol. 48, pp. 667-692.

Humphrey, A. and A. Scott (2012), "How far will people go to tackle climate change?" in Park, A. et al. (eds.), *British Social Attitudes: The 29th Report*, National Centre for Social Research, London, *www.bsa-29.natcen.ac.uk/*.

Leiserowitz, A. (2006), "Climate change risk perception and policy preferences: The role of affect, imagery, and values", *Climate Change*, Vol. 77, pp. 45-72, *environment.yale.edu/climate.../files/LeiserowitzClimaticChange.pdf*.

Leiserowitz, A. (2007), "Fighting climate change: Human solidarity in a divided world", *Human Development Report Occasional Paper 2007/31*, United Nations Development Programme, New York, *hdr.undp.org/en/reports/global/hdr2007-8/.../leiserowitz_anthony6.pdf*.

Lorenzoni, I. et al. (2007), "Cross-national comparisons of image associations with 'global warming' and 'climate change' among laypeople in the United States of America and Great Britain", *Journal of Risk Research,* Vol. 9, pp. 265-281, *www.tandfonline.com/doi/abs/10.1080/13669870600613658#.Ud5jdTw1jcs*.

Marquart-Pyatt, S. T. (2012), "Contextual influences on environmental concerns cross-nationally: A multilevel investigation", *Social Science Research*, Vol. 41, pp. 1085-1099, */www.ncbi.nlm.nih.gov/pubmed/23017919*.

Nawrotzki, R. J. (2012), "The politics of environmental concern: A cross-national analysis", *Organization and Environment*, Vol. 25/8, pp. 286-307, *http://oae.sagepub.com/content/25/3/286*.

Sabio, G. S. S. (2012), "Are we a greener nation now? Trends in pro-environmental behaviors of Filipinos (1993-2010)", paper presented to the World Association for Public Opinion Research, Hong Kong, China, June, *http://wapor2012.hkpop.hk/doc/papers/ConcurrentSessionsV/VC/VC-3.pdf*.

Tom W. Smith is principal investigator of the General Social Survey and director of the Center for the Study of Politics and Society of NORC at the University of Chicago. He is co-founder and former secretary general of the International Social Survey Programme.

World Social Science Report 2013
Changing Global Environments

55. Environmental attitudes and demographics

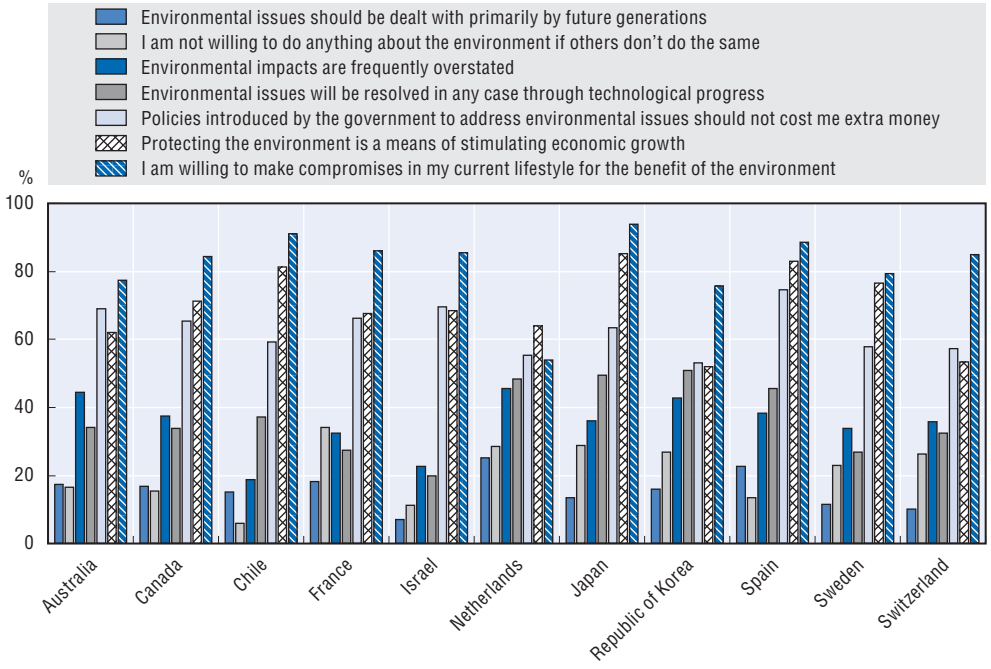
by
Nick Johnstone, Ysé Serret-Itzicsohn and Zachary Brown

An OECD survey, carried out every three years, assesses the effects of environmental policy on people's attitudes and behaviour concerning the environment.

The Organisation for Economic Co-operation and Development (OECD) Survey on Environmental Policy for Individual Behaviour Change is carried out every three years to assess the effects of environmental policy on environmental attitudes and behaviour. The most recent round was implemented in 2011 (OECD, 2013). This survey included responses from over 12 000 respondents in 11 OECD countries: Australia, Canada, Chile, France, Israel, Japan, Republic of Korea, the Netherlands, Spain, Sweden and Switzerland. In order to be included in the sample, the respondents had to have partial or full responsibility for important environment-related decisions in the household. The countries included are representative of conditions in the OECD as a whole. The in-country samples were stratified by age, gender, region and socio-economic status.

Environmental attitudes formed an important part of the survey questionnaire, since they can determine habitual behaviour and investment decisions. Respondents were asked whether they agreed with seven statements addressing different aspects of the environment which are thought to have an important effect on behaviour (see Figure 55.1). In 10 of the 11 countries, the statement with which respondents agreed the most was "I am willing to make compromises in my current lifestyle for the benefit of the environment." Agreement with this statement was highest in the Republic of Korea, where nearly 95% of respondents expressed a willingness to make such sacrifices. The exception was Japan, where the statement garnering the most agreement was "Protecting the environment is a means of stimulating economic growth." In all countries, most respondents agreed with this statement, and that "Policies introduced by the government to address environmental issues should not cost me extra money".

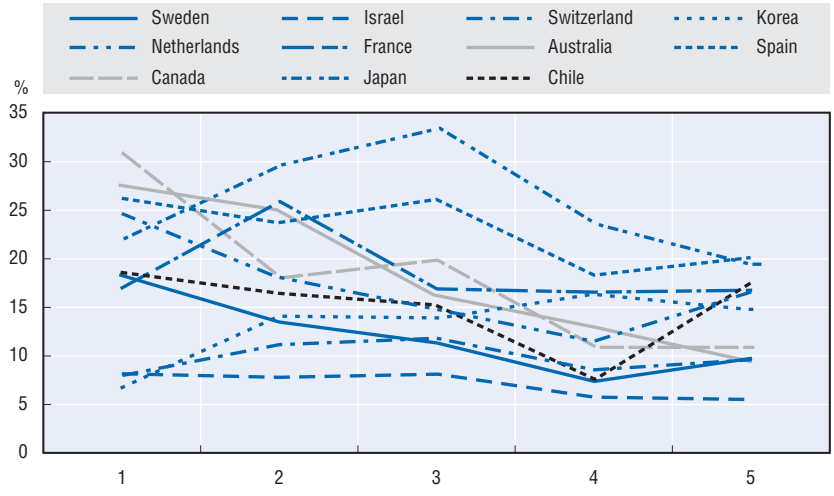
Figure 55.1. **Levels of agreement with seven statements about environmental policy**



Source: OECD (2013), *Greening Household Behaviour: Results of the 2011 Survey,* Organisation for Economic Co-operation and Development, Paris.

The statements with the least agreement also exhibit the most international variation. In seven countries, the respondents most often disagreed with the proposition that "Environmental issues should be dealt with primarily by future generations." In the other four countries – Australia, Canada, Chile and Spain – the respondents disagreed most with the notion that "I am not willing to do anything about the environment if others don't do the same" for them to help improve the environment.

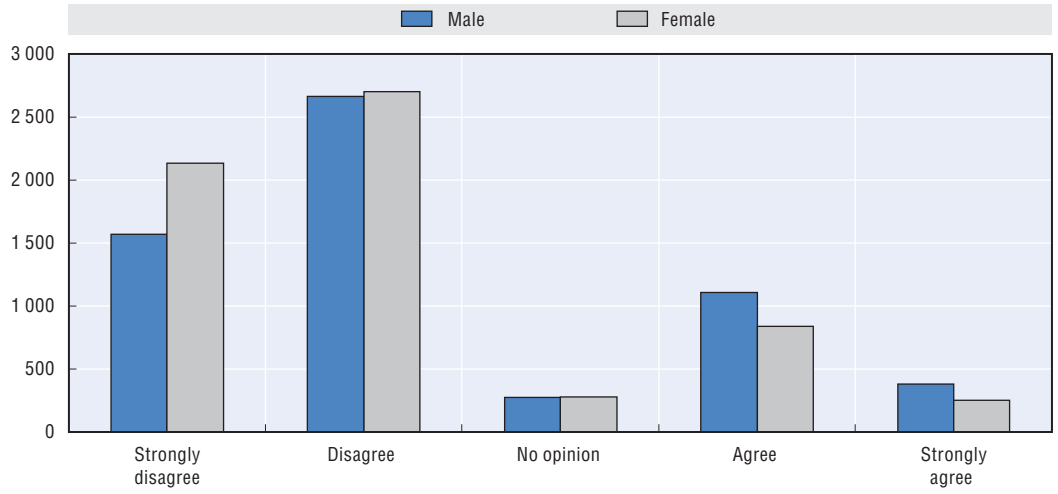
Figure 55.2. **Views on intergenerational equity across ages**



Note: Australia, Canada, Israel, the Netherlands and Sweden have a statistically significant relationship between age and attitude.
Source: OECD (2013), *Greening Household Behaviour: Results of the 2011 Survey,* Organisation for Economic Co-operation and Development, Paris.

In 6 of the 11 countries, concerns about intergenerational equity appear to be greater among older respondents (see Figure 55.2). That is, older respondents more frequently expressed the belief that such problems should not simply be left for future generations. This finding may reflect a degree of regret about their putative responsibility for the current state of the environment.

Figure 55.3. **Views on need for reciprocity across genders**



Source: OECD (2013), *Greening Household Behaviour: Results of the 2011 Survey,* Organisation for Economic Co-operation and Development, Paris.

Bibliography

OECD (2013), *Greening Household Behaviour: Results of the 2011 Survey*, Organisation for Economic Co-operation and Development, Paris, *www.oecd.org/env/consumption-innovation/households.htm*.

Nick Johnstone is senior economist at the OECD Environment Directorate in Paris. He focuses on analysis of environmental policy instrument choice.

Ysé Serret-Itzicsohn developed the OECD Environment Directorate's project on Greening Household Behaviour. Her research has focused on the economics of policy instrument choice and improving policy design.

Zachary Brown is a research economist at the OECD Environment Directorate. He focuses on how environmental policies impact behaviours of individuals and households.

World Social Science Report 2013
Changing Global Environments

56. Sustainable consumption and lifestyles? Children and youth in cities

by
Khairoon Abbas, Ian Christie, Fanny Demassieux, Bronwyn Hayward,
Tim Jackson and Fabienne Pierre

This article focuses on one of the world's first online qualitative global surveys of young consumers and their lifestyles. The discussion highlights how the survey has informed subsequent planning for a new mixed-method global study of urban youth, CYCLES for sustainability. This research aims to equip young people, local and national governments to support flourishing young lives and sustainable consumption more effectively.

Understanding young urban consumers and their visions of sustainability

Consumption by urban youth is not well understood. Nor are their diverse aspirations and attitudes to sustainable living. The environmental impacts and consumption behaviour of young people have only recently been scrutinised (e.g. Belk, Ger and Askegaard, 2003; Cohen, 2010; Fondapol, 2011; Mead et al., 2012; Schor, 2011; UNEP, 2011). There is still much to learn about the complex motivations and drivers of youth consumption, including the way consumption is influenced by youth identities, aspirations, relationships, habits and norms as well as by social practices. Further lessons include the opportunities and constraints that the producers of urban environments impose and that the urban environments in which young people live provide (CERG/IRG, 2011; Euromonitor International, 2012). In addition, the richer North has undertaken much of the existing research, which only examines affluent youth. The complex issues confronting nine out of ten young people living in developing countries have been overlooked (UNICEF, 2012).

Many young city residents can exercise significant "agency" (or the ability to imagine and effect desired change), in this case for sustainable outcomes. However, cities are also the sites of some of the most serious experiences of growing inequality. Some youth experience unemployment and severe material deprivation, including food, fuel and financial insecurity, which erodes their agency (Hart, 1997; Hayward, 2012; Jackson, 2009; Nussbaum, 2011; UN Habitat, 2011).

In this light, this article has two functions. First, it briefly summarises the results and insights from one of the first global qualitative surveys of sustainable lifestyles to focus on youth – the United Nations Environment Programme's (UNEP) Global Survey on Sustainable Lifestyles (GSSL) (UNEP, 2011). It explains why the authors of this survey call for the social sciences to rethink the conditions of youth consumption, and to examine young people's experiences in their own words and images more effectively. Then it introduces the research aims and approach of a new CYCLES for Sustainability, a mixed-method, repeated cross-sectional global survey focused on children and youth (aged 12 to 24) that builds on the GSSL.

Insights from the Global Survey on Sustainable Lifestyles

In 2011, UNEP and the International Marrakech Task Force on Sustainable Lifestyles, led by Sweden under the Marrakech Process on Sustainable Consumption and Production, published a report called *Visions for Change: Recommendations for Effective Policies on Sustainable Lifestyles* (UNEP, 2011). This publication reported on the results of the GSSL, an online survey based on qualitative research principles, involving 8 000 young urban adults aged 18 to 35 years from 20 countries. The survey, conducted in co-operation with research partners in each country, examined how young people talk about the sustainability of their everyday lifestyles, their expectations, socio-cultural identities and visions for their future. A special partnership was formed with the International Association of Universities and 13 of its members participated in the GSSL.

The GSSL had four secondary aims:

- to investigate how young adults (predominantly tertiary educated, mid- to high-income consumers) evaluated their life satisfaction and the sustainability of their daily mobility, food and home life
- to interrogate young people's reactions to alternative, animated scenarios of sustainable mobility, food and housekeeping
- to determine young respondents' self-reported knowledge of the implications of climate change on their lives
- to understand the opportunities, actors and responsibilities for a sustainable future identified by the respondents.

Against the background of the 2008 financial crisis and significant media debate about youth consumption and personal debt, the respondents were questioned about their hopes, fears and dreams. The results of the GSSL revealed surprisingly modest aspirations for material security, closer personal relationships and fulfilling employment. Well-being, agency and meaning-making, often referred to as "making a difference", were frequently cited as the cornerstones of the respondents' ideal futures (UNEP, 2011).

Most respondents agreed that poverty and environmental degradation were the world's "most important global challenges", but many had difficulties linking these to their local conditions. Self-reported life satisfaction ranged from a median of 6 out of 10 (Ethiopia) to 9 out of 10 (Colombia). The sample median score was 8. However, a significant minority of respondents in industrialised economies also noted stress as a result of exam pressure, long working or commuting hours and concerns about finding a life purpose, a significant relationship or financial security. In developing economies, physical insecurity as a result of drug wars, conflict and poverty were important concerns.

Despite their comparatively high income and education, a significant minority also felt their lives were more stressful than those of their grandparents (although many young

women in particular reported having more education and employment options). When asked to describe the worst way of living they could imagine, many expressed concern about loss of freedom, summed up as a loss of their human rights or personal agency.

The GSSL also tested young people's responses to scenarios for more sustainable living. The results revealed significant gaps between the reactions of respondents to some policies and activities that might be conducive to sustainable living, and the expectations of policymakers and other actors such as businesses and urban planners. The negative reactions in some communities to suggested policy scenarios underscores why we need more research into the complex ways in which young people engage in consumption to achieve their life aspirations in their local communities.

Why CYCLES, why cities?

The GSSL experience has prompted the development of a major mixed-method study of changing consumption and well-being: CYCLES for Sustainability. This is a new global survey developed by UNEP and the Sustainable Lifestyles Research Group (SLRG) at the University of Surrey in the United Kingdom in collaboration with important partner organisations.[1] Youth unemployment is approaching record levels in Europe, Africa and the Middle East, threatening to blight the prospects of young adults (ILO, 2012). Widespread concern has been expressed about a "lost generation" and a broken social contract between the generations and between communities and governments.

As nearly half of the world's population are under the age of 25 and an estimated seven in every ten young people are expected to be living in urban communities by 2050 (UNICEF, 2012), CYCLES will concentrate on young people living in cities. While cities occupy only 2% of the Earth's surface, they consume 75% of its natural resources.

The objective of CYCLES is to understand the consumption experiences and life aspirations of children and young people aged 12 to 24 using cross-sectional, repeated cohort sampling (Bryman, 2012). The first cohort survey will be ready in 2014. The research methodology aims to identify the drivers of sustainable lifestyles, sociocultural identities and habits over time and in local communities. It will also examine the ways in which built infrastructure and policy initiatives help or hinder young citizens to effect lifestyle change.

The GSSL focused on the energy-intensive aspects of mobility, food and housekeeping. The CYCLES survey will examine these areas as well as leisure and communication, which are closely related to fundamental rights, basic needs and social interactions, and which also influence pollution, waste production, greenhouse gas emissions, health and well-being. Analysis of the survey's results, in consultation with an international advisory panel including urban policymakers, youth advocates and social researchers, will help ensure that targeted policy recommendations support more sustainable outcomes for urban youth.

CYCLES for Sustainability will be implemented in 21 cities in 21 countries at five-year intervals to capture public imagination at a grassroots community level. This survey will highlight the significance of Agenda 21, a blueprint for sustainable development, development that promotes economic growth, improved quality of life and environmental protection – adopted by countries at the 1992 UN Conference on Environment and Development. The study will be conducted in two parts. First will be discussions with city focus groups, including youth photo diaries about consumer behaviour and perceptions. These will feed into the second part, a global online survey (Barry and Proops, 1999) to

probe attitudes regarding consumption habits, self-reported well-being, material quality of life and people's aspirations and experiences in urban environments.

Rethinking youth consumption in cities

The initial GSSL research indicated that contrary to widely reported media expectations of "selfish me" consumers, many young people approach their aspirations and future prospects with an attitude that could be well aligned with a more sustainable future. This includes modest material hopes and desires, a strongly internalised sense of agency expressed as a desire to "make a difference", and fear of loss of freedoms such as human rights. Yet younger generations now face ecological and economic challenges that threaten to limit their ability to exercise agency and freedom. And at present, their values and attitudes are not always translated into concrete sustainable behaviours.

In order to live well within the boundaries of the planetary and local ecosystems, we need to understand the youthful visions of more sustainable lives, and the challenges that confront this rising urban generation. We argue that social science research can and must support young people in dealing with the threats and dilemmas of 21st-century urban living, and should identify opportunities for greater co-operation and sustainable and social innovation.

Acknowledgement

The authors acknowledge the research assistance of Sylvia Nissen, Sustainable Lifestyles Research Group and University of Canterbury, New Zealand.

Note

1. United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Children's Fund (UNICEF), the Partnership for Education and Research about Responsible Living (PERL), the International Social Science Council (ISSC), Consumers International and the SEEDS Youth Research Group, University of Canterbury, New Zealand.

Bibliography

Barry, J. and J. Proops (1999), "Seeking sustainability discourses with Q methodology", *Ecological Economics,* Vol. 28/3, pp. 337–345, *www.sciencedirect.com/science/article/pii/S0921800998000536*.

Belk, R., G. Ger and S. Askegaard (2003), "The fire of desire: A multi-sited inquiry into consumer passion", *Journal of Consumer Research,* Vol. 30, pp. 325-351, *http://papers.ssrn.com/sol3/papers.cfm?abstract_id=354640*.

Bryman, A. (2012), *Social Research Methods,* Oxford University Press, New York.

CERG/IRG (2011), *Child Friendly Cities Tool Kit,* Children's Environments Research Group, City University of New York and United Nations Children's Fund International Research Group, New York, *http://childfriendlycities.org/en/research/final-toolkit*.

Cohen, M. (2010), "The international political economy of (un)sustainable consumption and the global financial collapse", *Environmental Politics*, Vol. 19/1, pp. 107-126, *www.tandfonline.com/doi/abs/10.1080/09644010903396135#.UdvqmKwUxL4*.

Euromonitor International (2012), *Global Youth Survey,* Euromonitor: London.

Fondapol (2011), *2011 World Youths: A Worldwide Survey,* Fondation pour l'innovation politique, Paris, *www.fondapol.org/en/etudes-en/2011-world-youths/*.

Hart, R. (1997), *Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care,* Earthscan, London.

Hayward, B. (2012), *Children, Citizenship and Environment: Nurturing a Democratic Imagination in a Changing World,* Earthscan/Routledge, London.

ILO (2012), *Global Employment Trends for Youth,* International Labour Organization, Geneva, *www.ilo.org/global/research/global-reports/global-employment-trends/youth/2012/WCMS_180976/lang--en/index.htm*.

Jackson, T. (2009), *Prosperity without Growth Economics for a Finite Planet,* Earthscan, London.

Mead, E. et al. (2012), "Information seeking about global climate change among parents and their adolescents: The role of risk perceptions and efficacy beliefs", *Atlantic Journal of Communication*. Vol. 20/1, pp. 31-52, *www.ncbi.nlm.nih.gov/pmc/articles/PMC3411115/*.

Nussbaum, M. (2011), *Creating Capabilities: The Human Development Approach,* Belknap/Harvard, Cambridge, Mass.

OECD (2012), *Redefining Urban: A New Way to Measure Metropolitan Areas,* Organisation for Economic Co-operation and Development, Paris, *www.oecd.org/regional/redefiningurbananewwaytomeasure metropolitanareas.htm*.

Schor, J. (2011), "The Viacom Generation", in Garey, A. I. and K. V. Lansen (eds.), *At the Heart of Work and Family: Engaging the Ideas of Arlie Hochschild,* Rutgers University Press, Piscataway, N.J., pp. 206-216.

UNEP (2011), *Visions for Change: Recommendations for Effective Policies on Sustainable Lifestyles,* United Nations Environment Programme, Paris, in collaboration with the Marrakech Task Force on Sustainable Lifestyles, led by the Ministry of the Environment, Sweden, *www.unep.org/pdf/DTIx1321xPA-VisionsForChange%20report.pdf*.

UN Habitat (2011), *The State of the World's Cities: Bridging the Urban Divide,* United Nations Human Settlements Programme, Nairobi, *www.unhabitat.org/content.asp?cid=8051&catid=7&typeid=46*.

UNICEF (2012), *The State of the World's Children,* United Nations Children's Fund, New York, *www.unicef.org/sowc2012*.

Khairoon Abbas is a consultant for UNEP's Division of Technology, Industry and Economics. Her work focuses on education for sustainable consumption, lifestyles and youth, including the UNEP/UNESCO YouthXchange Initiative.

Ian Christie is a research fellow and coordinator of the Sustainable Lifestyles Research Group, University of Surrey, United Kingdom. His research interests include sustainable consumption, sustainable development and policymaking, climate policy and governance.

Fanny Demassieux coordinates the resource efficiency subprogramme, one of UNEP's six priority work areas. She also leads the Responsible Consumption Unit at UNEP's Division of Technology, Industry and Economics in Paris.

Bronwyn Hayward is a visiting fellow at the University of Surrey with the Sustainable Lifestyles Research Group, and senior lecturer at the School of Social and Political Sciences, University of Canterbury, New Zealand. Her research focuses on understanding young people's political aspirations, participation in and experience of the physical and socio-economic environment.

Tim Jackson is professor of sustainable development and director of the Sustainable Lifestyles Research Group at the University of Surrey, United Kingdom. His recent research interests include the relationship between lifestyle, well-being and the environment.

Fabienne Pierre is a programme officer in the Division of Technology, Industry and Economics at the Untied Nations Environment Programme. She is in charge of the Partnerships and Knowledge Platform of the Secretariat of the 10-Year Framework of Programmes on Sustainable Consumption and Production.

World Social Science Report 2013
Changing Global Environments

57. Bringing poor people's voices into policy discussions

by
Deborah S. Rogers

The Equity and Sustainability Field Hearings project set out to ensure that poor communities have the opportunity to share their views on sustainable development and poverty issues. Coordinated by the Initiative for Equality, civil society and research groups are working to find out what poor and disadvantaged communities think about their future. Their responses will be compiled and included in the Sustainable Development Goals dialogue and decision-making processes.

How do poor people experience inequality? How do they envisage moving towards sustainability? Marginalised communities and poor people are rarely asked their opinion about their lives or aspirations for the future (Chambers, 1997; Narayan et al., 2000). The Equity and Sustainability Field Hearings project (Initiative for Equality, 2012) set out to do this by asking people living in impoverished and disempowered communities around the world what they think about poverty, sustainability, and the future for their families and communities. A global collaboration between social scientists and non-governmental organisations (NGOs), the Field Hearings project aims to ensure that poor people's voices are included in discussions on environmental and social sustainability such as Rio+20 and the Post-2015 Sustainable Development Goals processes. It is important to find out what people in disempowered communities think, and then to ensure that strategies address these issues in ways that are relevant, effective and collaborative.

In early 2012, following a broad call for partners around the world, the NGO Initiative for Equality embarked on this global project with 18 academic and civil society organizations. The aim is to conduct "Field Hearings" in 34 communities in Asia, Africa and Europe: Bangladesh, China, India, Kyrgyzstan, Mauritius, the Philippines, Malawi, Nigeria, South Africa, Uganda, Hungary and Scotland.

The questionnaire

The project developed a questionnaire in English, which partners then translated and modified to be culturally appropriate for their own communities. Using public meetings, focus groups, and individual interviews, respondents were asked to:

- assess trends in their community in health, education, the economy, politics, conflict, families, happiness, circumstances for women, and other areas (are things getting better, worse, or staying the same?)
- speculate about the causes of these trends
- propose changes needed for their community to become sustainable (what is needed for a good life for family and community that would last into the future?)
- describe your perceptions of privilege and deprivation (how are privilege and deprivation experienced in your community? Where do you see yourself?)
- articulate their wishes for the future of their family and community.

The preliminary results of these interviews are published in *Waiting to Be Heard: Preliminary Results of the 2012 Equity and Sustainability Field Hearings* (Initiative for Equality, 2012), with 60 co-authors and based on interviews with over 2 700 individuals. The results were presented at Rio+20 events in Brazil, and will be brought into the Sustainable Development Goals (SDG) dialogue through contributions on various official online platforms, presentations at United Nations SDG policy meetings, and national media releases in the surveyed countries.

Trends

Several communities reported improvements over the past five years in health care, education, access to technology and the position of women, although many problems remain for women. The list of worsening trends was long, but surprisingly strong common themes emerged, including environmental degradation, corruption, inequality, economic insecurity, social problems and conflict.

Causes

Respondents offered many explanations for the problems they face in their communities, including:

- Corruption and a lack of accountability and transparency on the part of government officials mean that lower-income people are deprived of economic opportunities. This is a major way in which inequality is perpetuated and increased.
- Social, economic and gender inequality, as well as prejudice and discrimination, and selfishness on the part of those with money and power, lead to a dearth of economic opportunities for poor people and for women.
- Environmental degradation, competition for scarce resources, growing populations and changing weather make life much more difficult, especially for the poor.
- Lack of appropriate planning, training, education and access to knowledge constitute barriers to problem solving in communities.
- Lack of trust and unity among community members blocks the dialogue and collaboration necessary for effective problem resolution and new approaches to development and sustainability (Wilkinson and Pickett, 2009; World Economic Forum, 2011).

Most Field Hearing participants see the gap between the wealthy and the poor as increasing. Wealth and poverty are viewed as being directly associated with access to political decision-making and economic opportunities, or a lack of them. Several groups cited racial or ethnic discrimination as a root cause of these problems, while others

blamed the selfishness of the rich, or the entanglement of political power and business opportunities.

Aspirations

The wishes articulated by most respondents were simple, basic, and compatible with sustainability. They would like:

- stable incomes and a secure future
- food, health care and education for their children
- more responsive and accountable governments that work to create opportunities for all, regardless of ethnicity or economic class
- access to opportunities and to decision-making.

The Field Hearings project is important for several reasons. First, it provides human-centred and policy-relevant results that contribute new perspectives in the search for pathways towards sustainability. Second, in working with local partners to gather the voices of poor people, it represents an inclusive approach to knowledge, and broadens the constituencies given an effective voice in discussions on sustainability. Third, it takes an interdisciplinary approach to answering these urgent policy questions, rather than a narrow disciplinary one. In so doing, the project reveals the connection between environmental problems and the underlying disparities in social, economic and political empowerment. These disparities prevent local communities from protecting themselves from resource exploitation and environmental degradation, and mean that they cannot develop and implement their vision of a decent life in which human needs are met over the long term.

The project is currently expanding its global coverage, with over 250 partners in 67 countries, for a second round of Field Hearings designed to better understand the similarities and differences in the experiences and perspectives of the poor.

Bibliography

Chambers, R. (1997), *Whose Reality Counts? Putting The First Last,* Intermediate Technology, London.

Holland, J. with J. Blackburn (1998), *Whose Voice? Participatory Research and Policy Change,* Intermediate Technology, London.

Initiative for Equality (2012), *Waiting to be Heard: Preliminary Results of the 2012 Equity and Sustainability Field Hearings*, Initiative for Equality, Rapid City, S.D., *www.initiativeforequality.org/images/wtbh_link_page.pdf*.

Narayan, D. et al. (2000), *Voices Of The Poor: Crying Out for Change,* World Bank, Washington DC, *http://ruta.org:8180/xmlui/bitstream/handle/123456789/632/RN165.pdf?sequence=1*.

Wilkinson, R. and K. Pickett (2009), *The Spirit Level: Why More Equal Societies Almost Always Do Better,* Penguin, New York.

World Economic Forum (2011), *Global Risks 2011*, World Economic Forum, Geneva, *http://reports.weforum.org/global-risks-2011/*.

Deborah S. Rogers is affiliated researcher at the Institute for Research in the Social Sciences, Stanford University, California, and director of the Initiative for Equality. She was lead author of the white paper on human well-being, a contribution to Rio+20 from Planet Under Pressure.

World Social Science Report 2013
Changing Global Environments

58. Climate is culture

by
David Buckland

The Cape Farewell project brings environmental scientists and creative artists together to consider the challenges posed by climate change. It has sent over 200 artists to places and communities around the world to produce responses, in music, verse, prose and other forms, to human-induced environmental change.

Storytellers, C. S. Lewis said, carry meaning in a way that rational truth tellers cannot: "For me, reason is the natural organ of truth; but imagination is the organ of meaning. Imagination, producing new metaphors or revivifying old, is not the cause of truth, but its condition."

For the past 12 years, the Cape Farewell project[1] has embedded climate scientists with artists, writers and film makers to address what has been described as humanity's greatest challenge: our overheating planet and anthropogenic climate change. Working with scientists to witness and interrogate the frontlines of environmental damage, over 200 artists have gone on nine expeditions to the Arctic and one in the Peruvian Andes. Cape Farewell has also led expeditions to the islands of western Scotland, working alongside local communities as they evolve into resilient social and physical societies that are sustainable and culturally vibrant.

This pioneering programme has inspired artistic activity on an unprecedented scale, creating new music, books, films, sculptures, inspiring the arts and artists to become the brokers and narrators of environmental change. Cape Farewell's mission is to bring this creative expression into the public domain. Three touring exhibitions have been shown in London, New York, Chicago, Tokyo and Paris. There have been music festivals in the United Kingdom and Canada, and creative forums for debate and exchange. We have made two films for the BBC and Sundance USA; Ian McEwan's novel *Solar* (2010) was inspired by his journey to the high Arctic; there are new poems, pop songs and operas. Millions of people have looked at the art, read the books and poetry, listened to the music and engaged emotionally through the power of art to tell the stories of our time.

Anthropogenic climate change is stressing our environment and human communities. Extreme weather events are more frequent than ever, they are global, they threaten our livelihoods, and they cost billions of dollars. The legacy we are building for our children is likely to lead to sea level rise, widespread pressure on food production, and severe economic upheaval and conflicts over resources.

What if?

A lost number in the equation.
A simple, understandable miscalculation.
And what if, on the basis of that,
the world as we know it changed its matter of fact?

Let me get it right.
What if we got it wrong
What if we weakened ourselves getting strong
What if we found in the ground a vial of proof
What if the foundations missed a vital truth
What if the industrial dream sold us out from within
What if our impenetrable defence sealed us in
What if our wanting more was making less,
And what if all this wasn't progress?

Let me get it right.
What if we got it wrong
What if we weakened ourselves getting strong
What if our wanting more was making less
And what if all this wasn't progress
What if the disappearing rivers of Eritrea,
The rising tides and encroaching fear,
What if the tear inside the protective skin of earth
Was trying to tell us something?

Let me get it right.
What if we got it wrong
What if we weakened ourselves getting strong
What if the message carried in the wind
Was saying something
From butterfly wings to the hurricane,
It's the small things that make great change,
And the question towards the end of the lease is
No longer the origin but the end of species.

Let me get it right.
What if we got it wrong
What if the message carried in the wind was saying something?

Lemn Sissay

In November 2011,[2] Cape Farewell organised a unique gathering on the shores of Lake Ontario where 20 artists and creators from Canada, the United States and Mexico worked with eight cultural informers, scientists, economists, sociologists, eco-theologians, technologists and politicians from around the world at a two-day "workshop/expedition". How can we reform our societies and learn how to live together on this planet without

destroying it? Do we need constant growth? How can we produce the energy we need without polluting our atmosphere? How can we build a faith and belief that are symbiotic? For the past year the artists have continued to interrogate and create, and their work will become the bedrock of a four-month climate festival starting in October 2013. Entitled Carbon 14, it will reach out with art, digital and social media, theatre and music at the Royal Ontario Museum in Toronto.

The arts, at their best, articulate social and emotional trends and give expression to individual passions. When launched into the public domain as a book, a poem, a film or a painting, these objects of communication inspire and create visions; they also experiment. Good stories and narratives can change people's perceptions and help societies become more democratic.

Art has the power to move people.

The Cape Farewell experiment is to focus the creative spirit, enable our artists, communicators and cultural creatives, and harness their energy to reframe climate as a cultural challenge.

Climate is culture.

Notes

1. *www.capefarewell.com*.
2. *www.capefarewellfoundation.com/projects/carbon-14.html*.

Bibliography

Lewis, C.S. (1939), *Rehabilitations and Other Essays*, Oxford University Press, London.

McEwan, I. (2010), *Solar,* Jonathan Cape, London.

David Buckland is an artist, designer and film maker, and has exhibited in galleries in London, Paris and New York. He is the founder and director of the Cape Farewell project, which brings together scientists and educators to raise awareness about climate change and address the issues involved.