Unmaking Waste 2015 Conference Proceedings
22 – 24 May 2015
Adelaide, South Australia

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DESIGN SHIFT: a path to holistic design[1]

Stuart WALKER

Unmaking Waste Keynote Address Transcript

Good afternoon – I'm very pleased to be here and I'd like to thank Robert Crocker for inviting me to Adelaide to speak at the Unmaking Waste conference, Gini Lee for her excellent work in curating the accompanying exhibition, and all the staff and students who have helped make this event so successful.

As a way of leading into the subject of my talk, I'd like to say a few words about my own background to put my interest in sustainability and environmental issues in context. I was brought up in the industrial valleys of 'Old' South Wales – and as a boy I would walk and play in the hills and moorland above the town and go fishing in the reservoirs that were built to supply water to the steelworks that filled the valley floor. As I teenager I worked in the steelworks every summer - and I saw that the river, that started in the hills where I had played, ran down into the valley cold and clean and tasting of peat, but by the time it came out on the other side of the steel works it was a toxic mix of orange chemicals and completely dead. Later, I worked as an engineer on oil rigs in the Arabian deserts – and again I saw the impacts of heavy industry on natural places, and on ways of life that had been sustained for thousands of years and that were in complete harmony with the local environment. These experiences led me to change direction and to explore other, more creative ways of thinking and acting, and they have strongly influenced my approaches to design and design education. From studying design at the Royal College of Art in London I joined the University of Calgary in Western Canada – and again I saw pristine Nature being polluted by oil field operations – particularly at the Fort McMurray Tar Sands in Northern Alberta. And for the last few years I have been at Lancaster University where we have developed a brand new design department that focuses on design management and contemporary issues.

So in this talk I'd like to try to demonstrate how, from these various experiences and through practice-based design research, I try to address some of today's critical concerns about: the nature of our material culture; ethics and inner values; and environmental damage and waste – because, of course, all of these are closely interrelated.

The process I adopt first of all involves critique – especially of the continuing dominance of modernity and our current worldview of late-modernity … *modernist design* and its developments are inextricably tied to mass production, globalization and consumerism – much of which is based on unprecedented environmental and human exploitation, and enormous levels of pollution, emissions and waste. Any attempts to address these problems within this system – by increasing efficiencies, increasing material intensities or choosing less harmful materials may produce some minor improvements – but they fail to address the heart of the problem. For more substantial, system change, design and production have to become more closely related to context, people and place, and more suited to local needs. And we have to address deeper,

[1] This keynote address draws on a chapter in Stuart Walker's forthcoming book, provisionally titled *Design for Life*, to be published in 2016/17 by Routledge (tbc).

more meaningful aspects of what it is to be human, beyond instrumental benefits and beyond producing a constant barrage of unlimited but superficial choices. To do this we need a change in outlook – we need to develop a different worldview – which could lead to a more holistic, less destructive notion of design … and this, in turn, can contribute to a vision of material culture that is more meaningful and more connected to place. Importantly, this kind of design shift requires us to consider more reflective modes, the inner development of the person, and consideration of deeper human values. It is only by addressing these more profound questions of purpose that we can move the design agenda from one of *gradual improvement* of a consumption-based system to one of *fundamental, systemic change*.

Today, we are continuing to design and manufacture products that are useful, attractive and affordable. In doing so, we are perpetuating and, indeed, expanding the mass-production system that arose in the twentieth century. This system has been very successful in generating wealth; raising material standards of living for many; and creating jobs, but in the process it has also raised our material expectations. Household consumption is vital to this system. In developed economies such as the United States, Australia and Europe, consumer spending is the main contributor to the economy, accounting for between 55-70% of GDP according to the latest World Bank figures (World Bank 2015).

Modernism's influence continues to dominate the discipline of design and our conceptions of material culture – but it creates a sanitized world that is removed from context, Nature and consequences. Moreover, rising levels of waste and emissions, and rapid loss of biodiversity, indicate that industry responses to the environment have been grossly inadequate. Through globalization, corporations are able to exploit trans-border loopholes to avoid tax, which results in fewer revenues for public services and environmental clean-up, and a deterioration of the commons. And corporations constantly seek out cheaper and cheaper labour markets, resulting in low wages and a downward spiral of working conditions (e.g. Kara 2014). So in this system, waste can be understood not just in terms of landfill and pollution, but also in terms of its *socially* damaging effects – the waste of human talent, potential and opportunity. Attempts to address environmental issues by reducing materials and energy consumption; improving efficiencies; and adopting re-use and recycling can be understood as a form of 'eco-modernism'. It helps create greener, slightly less damaging products but it does little to move us away from the consumption-based system that creates waste and it does nothing to change a worldview in which notions of the 'good life' rest on material acquisition.

To unmake waste we must unmake the outlooks, values and priorities that lead to waste. There is a need to recognize ideas based in different values, deeper notions of human purpose and more comprehensive understandings of human meaning. These 'inner' aspects of our personhood are quite different from the 'outer' preoccupations of contemporary consumer culture. They encompass understandings of virtue, goodness and inner development that have emerged, in different forms, in virtually all cultures throughout history. It is important to recognize, too, that while a fundamental change in priorities may be required, the inner journey towards different values and a new outlook has to be taken alone. And in this endeavour, contemporary consumer culture represents a significant barrier to change. Its ubiquitous presence, the skewed values it has come to embody, and the engaging nature of its attractions all hinder more pensive, reflective modes. Our busy world of 'never off' communication and passive entertainment tends to eliminate time for the inner life. Yet, as we produce more and

more electronic gadgets and leave in our wake a decimated world of squalor and waste we seldom stop to ask ‘Why?’, ‘What is it all for?’ and ‘Where are we going?’

Scientific knowledge is always moving forward, improving our understandings of physical phenomena and the natural world. When applied to serve human needs, it can yield many benefits, but the fact that applications and technologies are always progressing also means that this knowledge is in a persistent state of change. For this reason, when it is used to develop *mass-market products* within a *growth-based economic system* that is dependent on *individual consumption*, these products will inevitably have only a limited useful life. And in our current production model this is manifested as product obsolescence, redundancy and waste. The demand for growth means that new products have to be constantly developed, which means the *rate* of product redundancy also increases. And so soaring levels of waste and emissions are *not simply unfortunate side-effects* that can be rectified through further technical advances but are fundamental to the system itself. Far more substantial change is needed – change that leads to fewer products, less consumption, and greater restrictions on advertising. A recent United Nations Environmental Report concludes that substantial reductions in waste and emissions will only be forthcoming with *“radical technological and system change”* (Fischer-Kowalski et al. 2011, xiii, 7, 30, emphasis added).

The rapid adoption of digital products around the world indicates that their benefits are clearly regarded as outweighing their costs, at least in the short term. The technologies on which they depend are on course to yield a host of ever-more sophisticated products and applications that will offer new capabilities in many aspects of life – communications, entertainment and gaming, shopping and healthcare, as well as *interconnected products, systems and services* – the so-called *internet of things*. The magnitude of investment, its vast potential, and its rapid pace of development mean that these technologies will continue to be highly dynamic for the foreseeable future. But while digital developments can provide an ever widening array of applications, there is no doubt that they are accompanied by major detrimental effects. These include the costs of societal atomization and loss of privacy associated with data tracking; the personal and social effects of stress and anxiety that attend disruptive technological change; and, of course, the environmental costs – in the next few years, the global production of e-waste is set to rise by some 33% (Tweed 2013). This will be accompanied by further resource extraction and production and increasing levels of data storage, energy use and emissions. All these effects of digital products and services are self-reinforcing. Increased distribution and use of digital devices affords greater opportunities for data tracking and targeted marketing, which constantly stokes increased consumption and more consumption means more energy use, emissions and waste and more product use. In turn, these provide opportunities for further technological developments, more digital devices, further atomization, further data tracking and targeted marketing and so on. So for all their sophistication, current forms of digital products and services actually represent more of the same – more consumption, more waste and more social division – rather than any significantly new or innovative direction.

In design, we can make inroads into eradicating waste by imagining and helping to develop forms of material culture that do not conform to this system. Attempting to adapt the present system is likely to have little effect because continual growth tied to rising consumption simply cannot be sustained on a finite planet – and there is much vested interest in not changing this system. Even so, more radical approaches are required. Our current outlook, which privileges rationalism and philosophical

materialism, provides us with a view of the world that is rooted in physical explanation. Today, this tends to be regarded as the only reliable form of knowledge and the only 'correct' view of reality but there are other, *additional*, *complementary* ways of knowing that are concerned with values and meanings. The development of more moderate, balanced ways forward *is critically tied to these deeper understandings – and to a more comprehensive worldview* that includes the subjective, intuition and the imagination. Until the modern period, these had always been a significant part of human understanding, providing a sense of purpose, enabling us to live in closer harmony with the natural world, contributing to a sense of compassion and empathy, and giving rise to some of our most creative and profound works of literature, poetry and art. Our contemporary focus on instrumental rationality, logical analysis, progress, the new, and the future has meant that these other ways of knowing, and the notions of truth, goodness and wisdom they encompass, have become increasingly marginalized and forgotten. Throughout history, serious consideration has always been given to finding balance between outer actions and inner reflection, the rational and the intuitive. A different perspective and new priorities emerge when both these sides of our nature are allowed to flourish. As the writer Henry Miller says,

"If we are always arriving and departing, it is also true that we are eternally anchored. One's destination is never a place but rather a new way of looking at things" (1957, 25).

It is this inner life beyond the senses and the intellect that yields a quality of perception far more profound than those offered by the captivating rhetoric of consumerism. To restore balance, we must give more prominence to these deeper aspects of our nature, which are cultivated through silence, introspection and contemplation. These ways of knowing are quite different from the kinds of progressive, transient knowledge that drives techno-scientific advancement. They become understood through philosophical deliberation and spiritual development and, importantly, they are also tied to the human imagination and realized through creative endeavours and the arts. The best of the arts resonates with that which is permanent in us, that which is tacitly understood but lies beyond explicit description. In doing so, artworks become enduring contributions to human civilization – always relevant, always new. The novelist Graham Greene alludes to this when he writes:

"ideas never changed, the world never moved: it lay there always, the ravaged and disputed territory between two eternities" (1938, 151).

The truths and meanings expressed through the arts do not 'progress' in the same way as the sciences and the best of them are timeless. Scientific knowledge and the advancing technologies that proceed from it allow us to achieve many practical tasks. But where science seeks to explain and describe, art is concerned with meaning making and human values. These two views of the world are largely incommensurable, pointing to what Scruton refers to as 'cognitive dualism' – two views co-existing within the same material environment but seeing it and interpreting it in different ways (2014, 32-40). Significantly too, the meaning-making endeavours of the arts emerge from the living world of human experiences: our relationships with others and with the natural world; the life-world. These are not values-free phenomena but subjective, located experiences.

Design straddles these two worlds – but the designer has neither the specialized knowledge of the scientist nor the creative freedom of the artist. The designer is a generalist who strives to find resolution between the *what* and *how* questions of functional design, and the *why* questions of meaning making and aesthetic expression. Restoring balance implies moving design beyond Modernity and consumption-driven

post-modernity to embrace this richer world of meaning and permanence. A design approach that emerges from solitude, contemplation and creative insight takes design beyond a consequentialist morality to an interiorized, principled notion of ethical behaviour and decision-making.

G. K. Chesterton argued that folk tales are timeless because they are products both of the human imagination and of many people in a particular place (1908, 10, 44). Such stories have a social value. They express the culture that arises organically from the experiences of people. And the sharing of this culture through common forms of expression helps build community coherence. These grass-roots forms of expression are living artefacts because they continue to be changed and adapted in ways that are natural and familiar. Their value lies both in the collective and the individual, in common sources and shared understandings as well as in the expertise and contribution of the individual storyteller. They allow the grain and texture of real world encounters to be more fully experienced: they improve understandings and connections; they build and bind community; and they contribute to a sense of meaning, belonging and identity.

As with stories, *artefacts* that are related to place and context can also embody common meanings and address the human condition in ways that are both located and democratic. In doing so, they contribute to a common ground and a common good that serve to connect and unite people. And over time, locally produced artefacts can be adapted and imaginatively embellished by the designer to meet new conditions and needs - offering both continuity and change. Like stories, they also involve contributions by the collective and the individual, which reflects our own nature as both social and individual beings. This kind of transition requires radical systemic change and imaginative, egalitarian visions. More distributed grassroots approaches allow a wide variety of initiatives to arise that take into account local knowledge, skills, needs and conditions, and new opportunities offered by contemporary technologies. And here there is potential for design to make a significant contribution. The resultant artefacts, and the materials, processes and meanings they embody, can serve to reflect and reinforce values, beliefs, customs and more enduring aspects of human culture. Such artefacts would *not only* be functional and useful *but also* tangible representations of more considerate and responsive attitudes. They would then be contributing *not to* a destructive spiral of consumption, disposal and waste *but to* the development of a meaningful and lasting material culture.

At the start of this talk, I suggested that to unmake waste we must unmake the outlooks that lead to waste. The development of a more grass-roots approach goes some way to achieving this but, *at the individual level*, our outlook is also shaped by our inner values, which are cultivated through more introspective modes of being. By giving due regard to inner development, we begin to see our actions in a new light and, over time, we may develop a different outlook and redirected priorities. While each of us has the opportunity to do this, those in the creative arts are also able to show, through tangible artefacts, what difference this might mean for our actions in the world. By demonstrating this difference through design we move from generalities and abstractions to concrete examples in the form of objects, which can be reflected upon. By adopting such a route, designers can bring critique and constructive change to the broader philosophical issues and normative assumptions that underlie our current approaches. This can then inform their creative work, and the resulting designs will help raise awareness and contribute to a broader shift in perspectives.

This brings us to my own practice-based approach to design research, which has developed in an organic manner and, as is to be expected in any emergent, creative process, the paths taken vary from the methodical to the serendipitous. However, the

process is more or less as I have depicted. There is a study component which consists mainly of reading the literature, writing and developing ideas and arguments in a logical, analytical, linear manner. There is a design component – which is more intuitive, synthetic and often more spontaneous. And there is a reflection component. And all these inform each other.

So as they develop, they merge into one inseparable process that leads to writings and objects. This process is then repeated over time to address different issues. And this leads to many outputs in the form of writings and objects. These, too, and the journey they embody can also be reflected upon. So I'll say a few words about the work emerging from my writings before moving on to the objects – but in reality these two aspects are completely interdependent. The writings look at the larger picture and explore theories and principles to develop an understanding of sustainability and substantive notions of human meaning. And these provide a basis for designing and reflecting on the outcomes of designing. If we look at notions about human meaning in terms of worldviews over the ages (Walker, 2013), we see that the pre-modern or traditional worldview tended to emphasise religious and philosophical priorities – which emerged during the Axial age (around 500 BCE) in various parts of the world and are expressed through the great religious and philosophical traditions – from Buddhism, to Classical Greek philosophy, to Christianity. So the emphasis here is what I have termed *Personal Meaning*. The modern era – from about 1500 – saw the rise of practical reason and a decline in religion – this was the era of the Enlightenment, scientific rationalism, the Industrial Revolution and the philosophy and belief system of materialism. So the emphasis here is *Practical Meaning*. And the postmodern era, which emerged during the second half of the twentieth century, while still dominated by the understandings of Modernity, has seen the rise of new priorities in environmentalism, civil rights and human rights in general – so the emphasis here can be characterised as *Social Meaning*. So this forms the basis of the *Quadruple Bottom Line of Design for Sustainability* that I initially proposed in 2011 (Walker 2011), in my book *The Spirit of Design* and developed further in my latest book *Designing Sustainability* (Walker 2014). It's based on understandings of human meaning: *practical meaning* includes activities that provide practical human benefit – and also takes into account their impacts on the natural environment; *social meaning* deals with social justice and equity and also recognizes the value of community, compassion and care for others; and *personal meaning* recognizes that we are also individuals with inner values, conscience, and a need for spiritual wellbeing. *Economic endeavours* are of a different order – they are seen as *a means to achieving these other three*, rather than ends in themselves. This way of seeing sustainability aligns well with many other analyses of human understandings. There are close parallels with Maslow's Hierarchy of Human Needs, with John Hick's hierarchy of Human Meaning (Hick 1989, 129-171), and with teachings within Christianity, Hinduism, Buddhism and Islam. We can express the Quadruple Bottom Line as a Venn Diagram with the three main areas to the front and economic means at the back. It is perhaps better expressed as a target diagram with practical meaning in the centre, radiating out to social and then to personal meaning. As we move out from the centre we have increasing degrees of freedom. At the practical level we have relatively little freedom – we have to have food and water, for example, if we are to survive. As we move out to Social Meaning we can choose to live in ways that are morally acceptable or not. And as we move further out to Personal Meaning we can choose to live a more reflective, examined life – or we can ignore these deeper questions about human purpose. Furthermore, If we only consider practical matters (as we have tended to emphasise within Modernity) – we have only a narrow view of the world. If we include social issues – we broaden our perspective, and

if we include personal meaning – we have a far more comprehensive understanding of ourselves in the world.

Now let's look at how these ideas can inform creative design. I'll also show how my design work has developed over time to address these understandings, and how design can contribute to a shift in perspective and outlook. In this particular, personal example of practice-based research, the process can be broadly categorized as falling into the following phases:

- Practical meaning,
- Personal meaning,
- Social meaning,
- Personal-Social and
- Holistic – where I try to bring these ideas together into some kind of synthesis.

(NB Most of the objects shown and discussed are available for viewing at: http://stuartwalker.org.uk/)

I began with the design of practical objects that incorporate one or more common elements of environmental care such as reduce, re-use and recycle. They cover things like lighting and furniture (using simple local means and re-used materials) and I explored various other functional objects from electronics to kitchen gadgets – looking at things like re-use, ad hoc aesthetics and ephemeral casings. I've also created objects that concern inner development and human values. So objects for contemplation and reflection, including an object, *Oriel Triptych* that, via the symbol of a narrow door or threshold, attempts to be relevant to many different religious traditions – it is pan- or supra-religious if you like – which seems more appropriate in our globalized, multicultural world. The presence of such objects in our lives also serves as a reminder of the importance of the inner life, which is so easily forgotten in today's busy daily routines. A similar idea is expressed in the object entitled *Stonework*, but this object is simply selected from the natural environment as a focus for contemplation – so it is beyond human concepts and is non-made. I've also created objects (*Babel*, *Cana* and *Whereof One Cannot Speak*) that refer to traditional Judaeo-Christian ideas but are expressed in the language of modernity and science. Using a similar format, compositions entitled *Land, Water* and *Air* (figure 1) ask us to reflect on our actions – and the disposability and cumulative effects of using contemporary products.

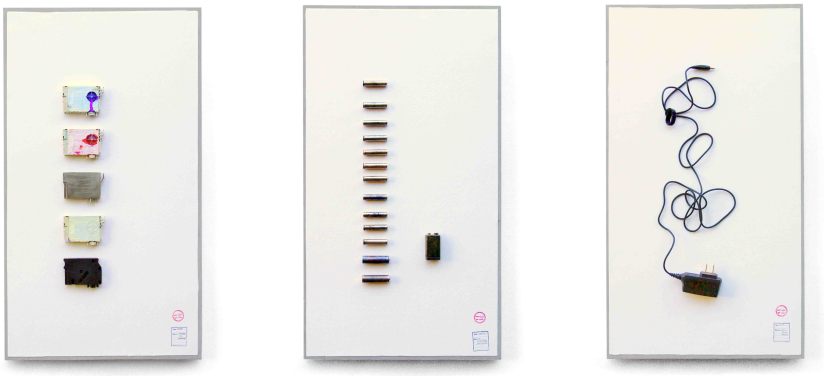

Figure 1: (left to right) *Land,* used printer cartridges, paper, recovered plywood; *Water,* used batteries, paper, recovered plywood; and *Air*, used cell phone charger, paper, recovered plywood.

By expressing ideas through objects the meanings are less definitive than text-based accounts, but they can stimulate thought and invite reflection. They exist in the world of the senses, but their meanings can transcend the physical and point to a deeper, psychological interpretation. In this way, creative design can build on but reach beyond the findings of science. This is a necessary step, because we can have all the facts but, to make a difference, the issues have to touch us personally, on an individual level. Objects can offer a form of critique that touches the emotions as well as the intellect; the heart as well as the head. Design can be used to express and reflect back to us counterpoints to societal norms, especially critiques of consumer goods and consumerism, and the broader issues they raise. Through objects we can express intuitively felt ideas about the relationship between technological objects and Nature and about our behaviours, especially addiction-like behaviours associated with contemporary devices.

My recent design work explores ideas with any specific functionality, for example, one piece looks at consigning to the past the commodified cures for the ailments created by consumerism. Consumerism is incredibly adaptive and it can turn even the psychological problems it cultivates into opportunities for further consumption. This work naturally leads on to a critique of the dominant worldview that drives consumerism and our present economic system in which individual levels of consumption are critically tied to wealth generation. This worldview still largely represents the values of modernity – even as it is evolves into late-modern or post-modern sensibilities. One piece express concern with the inordinate consumption of natural resources while another represents a cry or S.O.S. from Nature itself. This kind of design yields objects that make visible and implicitly question our unsustainable outlooks, assumptions, values and priorities. Considering modernity's privileging of intellectual, analytical, evidence-based knowledge, the work includes a piece that questions the dominance of words, abstractions and intellectual thinking, rather than a more balanced view that also includes image, intuition, subjectivity and other ways of knowing. Another piece draws attention to the existential crime we are committing by destroying the very environment that sustains us. As in Sophocles' play, *Oedipus Rex*, such existential crimes are accompanied by self-blindness. On a similar theme, a series of three pieces are concerned with substantiality and *uncertainty* – for the very reason that Modernity has prioritized the quest for certainty and pursued it though increasing abstraction.

These explorations eventually bring us back to a more comprehensive, more holistic notion of design. Emerging from attention to these inner aspects of our personhood and a shift in outlook, our design work can begin to embody deeper values and new attitudes. Transcending intellectual knowledge through visual, aesthetic and emotional experiences, design can take into account the personal, social and environmental effects – positive and negative – of object manufacture, use, maintenance and disposal. Perhaps especially through localization and place-based initiatives, design can make positive and appropriate contributions to change. Here, the technological and the local are brought together in an integrated manner that attempts to recognize the value of both. Objects that include digital memory devices such as USB sticks and hard drives as well as figurative and other forms of symbolism are attempts to find resolution between the rational and the intuitive, the utilitarian and the spiritual – centred around ideas of inner values, symbolism and memory. The *Balanis* chess set weaves together ideas about localization, our relationship to nature, history and myth, and notions of the handmade, imprecision and sufficiency.

Through such means, design can be part of a broad movement, already happening around the world, where people are seeking locally-appropriate solutions to their

material culture, their food production and energy supplies. Local approaches are flexible, adaptive and can be represented by various sectors – for profit, non-profit, as well as voluntary and amateur. They can include cooperative approaches that align with more equitable economic distribution, and family businesses that have longer-terms agendas. All these can help support an economy of *responsible production and service* rather than *an economy of consumption, disposal and waste*. And local design can be expressive of context-specific interests and values that can contribute to a sense of identity and community, thereby helping to restore many of those things that have been lost in globalized forms of consumer capitalism.

We see from these various explorations a sequence of design development and discovery in which the creative endeavour begins with outer considerations that address practical concerns. *This is where each individual is bound to begin, in the world of sense-based understandings*. However, by questioning current directions and our own assumptions, the work increasingly becomes informed by deeper considerations about values and priorities. Through study, creativity and reflection, we start to see consumerism and the worldview of which it is a part in a new light. Insights and realizations develop through dedication to inner understanding – the examined life. This leads to new priorities, and a more comprehensive interpretation of material culture, which are incorporated in what I have termed here *Holistic Design.* Through a focus on inner values, the basis of the design work changes over time; in effect, there is a reversal in the ordering – at the beginning *the movement is from outer to inner*. Eventually, this inward journey can lead to *a shift in outlook*, which reshapes the values and priorities we bring to our design endeavours – and *the movement is then from inner to outer*. While the *outer* and the *inner* are related, there is no *direct* connection. Even so, the inward path, and its attendant shift in outlook, does affect the nature of our actions in the world, including the ways in which we do design.

We can, perhaps, extend this to a more generalized version to indicate the nature of the shift from *Incremental Design* to *Holistic Design*. We begin with *incremental design*. By questioning the current condition and focussing on inner values we start to move inward or toward higher concerns. This inevitably leads to a critique of the dominant system, especially consumerism, and, in turn, this leads to a critique of the worldview of which consumerism is a part. This can cause a change in values and priorities and lead to new design decisions, which in turn can lead to a more holistic notion of design.

We see that many of the negative effects of contemporary products, such as e-waste, emissions, landfill and pollutants, are closely linked to the nature of their design and production. For meaningful change, the designer will have to develop directions that are reflective of quite different priorities and radically new understandings. Such a direction is not just a matter of outer actions, policy changes and more information. To unmake waste we have to unmake ourselves, our worldview, and the assumptions, values and priorities that lead to waste, environmental destruction and social disparity. To do this, we must recognize the importance of the subjective, the intuitive and the emotional self - and the critical importance of inner values in developing a different outlook and different priorities. This discussion represents one perspective, one personal journal and one interpretation of what this inner path might mean for design.

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Green Manufacturing

Green manufacturing: Recycling end-of-life polymers in steel making - an example of successful translation of research into industry

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Summary:

The concept of green manufacturing is something that we've developed at the SMaRT Centre at UNSW Australia. The whole idea is to think about materials being produced by using waste and end-of-life products as raw materials and the concept of green manufacturing as value adding. In partnership with OneSteel, the SMaRT Centre has developed a process to make green alloys with end-of-life rubber tyres. To date two million truck tyres have been diverted from landfill in Australia, and the technology has now been commercialised both here and overseas. We have shown that the technology of polymer injection into steel making is successful on a commercial scale and that has huge beneficial outcomes for the manufacturing industry as a whole, while at the same time demonstrating the successful translation of research into industry.

Abstract in full:

Why green manufacturing?

The concept of green manufacturing is something that we've developed at the SMaRT Centre at UNSW. The whole idea is that we want to be able to think about materials being produced by using waste and end-of-life products as raw materials. Conventional recycling is very good at addressing waste, for example a PET bottle can be re-manufactured into a new PET bottle. So we're not about to change anything in that context. The principles and concept at the SMaRT Centre is to use green manufacturing to add value.

What we are proposing is a total paradigm shift. We are about shifting the economics of it in a way that we are using the end-of-life products that are so complex, like composites and mixed plastics, which traditionally are not recyclable and therefore end up in landfill. This is the biggest challenge for society. As products become more and more complex we now have the scenario where you cannot just go back to the traditional form of recycling. So when we're talking about a complex composite material, for example carbon composite material that has carbon in it, it's got polymer, it's not just a single material and it's not just a plastic. It is inevitably a mixture and you can't just unpack it and separate the fibres out and take the polymer out because you're going to make it a lot more economically challenging. So you are going to end up with a scenario where you're never going to get the quality of the original material.

End-of-life products as resources of the future, like silicon bearing alloys and carbon bearing materials…

So we've redefined it by saying you have to really start to look at end-of-life products as a resource of elements. Let's say a traditional plastic might contain some carbon, hydrogen and oxygen. You might say, well if those are the elements that are present,

then can we not tap into those polymers as resources. For example you might get hydrogen as a molecule out of that complex material and use that as an input. Rather than seeing that as an input of plastics, but rather see is as an input of molecules that a particular product might be able to deliver. It's a very different way of looking at it; you don't have to limit yourself by saying I have to convert it into a bottle again.

We're talking about hydrogen as one example and there's carbon and oxygen and the list goes on and on. You can look at waste glass and if that cannot be recycled back to glass again, then you can look at is as a resource containing silicon. In glass as well, people will say well, aren't we recycling all the glass. But the reality is that standard glasses, the tumbler glasses, can be recycled in a traditional way by converting glass into glass. But when you've got complex glasses like windshield glass from cars, you don't necessarily have that opportunity because those glasses are not the standard sort of glass, but a mixture of glass and plastic. They're safety glasses that have been designed for a particular purpose and we know that they are designed to keep us safe in the course of accidents, and so on, so it's really about saying if it cannot be put back into a traditional glass recycling furnace what else can we do with it? We've talked about carbon and hydrogen, glass has got silicon. If we could potentially tap into that highly valuable element silicon and make some silicon bearing products… this is where our journey goes from green materials to green manufacturing.

We have shown that we can produce green alloys on a commercial scale by using tyres in the process of making steel with our industry partner OneSteel. This is an example of the transformation of end-of-life products, in this case old tyres. To date we have diverted more than two million of them from landfill. Philosophically the science we are doing can be applied to all end-of-life materials. It's about transformation and the fourth R – Reform – ultimately it's the science that tells us what can be achieved.

Last year *ABC*'s *Catalyst* show aired a program on SMaRT Centre research called 'Green alloys' and that demonstrates quite clearly through the work that was presented that materials like, for example, glass coming from the auto waste stream, can be used for high value purposes too.

Could industry develop a new business model where they are creating micro-factories and re-imagining not just their own waste but all waste?

Thinking about things on an elemental level, you can really re-imagine waste to pretty much do whatever is scientifically feasible. The concept of producing micro-factories means you're looking at cities and local councils not just being a warehouse of waste, but a warehouse of elements. That then shifts it completely because you could effectively be in the process of supplying that resource to industry, to manufacturers. And there are manufacturers who through R&D and through our partnership with OneSteel for example, show that it is possible to use waste materials as raw materials for manufacturing processes. And that's really where the shift in thinking comes in when manufacturers are willing to partner up.

In 2004 the SMaRT Centre at UNSW began its journey with OneSteel. By building that collaboration with OneSteel, UNSW and our researchers over the past 10 years have proven the science, it works, and it has also given us the opportunity to share the thinking around making green alloys. By using end-of-life materials effectively as resources, as elements of molecules that are all going to be very useful in green manufacturing, is the way of the future. Let's face it, traditional resources are becoming

more and more expensive, they're becoming not as abundantly available and they are potentially causing some degree of pollution. They're all challenges associated with business-as-usual.

So if you look at the kinds of solutions we've developed with OneSteel where green alloys – which is also known as 'green steel' – which we created in partnership with OneSteel is all about saying can we use end-of-life rubber tyres as a raw material in the process of making steel. We have now shown successfully that it can be achieved. So it's about showing not just that the R&D is successful and the fact that this technology of polymer injection into steel making can run successfully in a commercial scale, but the fact that it has beneficial outcomes for the manufacturers is a huge win.

To celebrate the ABC's 50 years of science broadcasting, they recently republished the first Catalyst story about the SMaRT Centre and our collaboration with industry, in this case OneSteel. I wanted to share this with you as it really frames the work we have done over the past decade and the amazing people we have worked with at OneSteel along the way. ABC Catalyst, 'Turning plastic waste into a resource'.

So it goes to show that there are potential opportunities that research can lead you down the path but of course cities, councils and the manufacturing industry are in the perfect position where they are sitting on top of these resources. With industry they are dealing with waste in the production cycle. With cities and councils they're collecting these resources. And I think it's a fantastic model, we have industry leading the way and councils also playing such an active role in providing that service to the community. The question is now, how do we progress that service further along?

How do we convert waste resources into higher and higher value?

If you set up something at the local community level, you can then create resources that can go back to the community itself. So there is an investment that the city has made in collecting the waste and processing it and delivering value from it, that investment can be put back into the community.

There's also an opportunity for the public to be very much part of the solution. Our ability to think of the standard model of taking your cans to metal recyclers, that's not a new concept, yet people know that you can do it for metals and metal cans because there's value attached to it. If we start to attach value to our other end-of- life products, naturally, people will put in the effort to take it across, whether it's their bins or their council boxes or whatever. In Australia we are so conscious of what we can do in playing our own part to preserve our environment and manage our own end-of-life products, we realise that we're the ones using these products so we're the ones responsible for creating end-of-life products, termed as waste and ending up in landfill. We can also be part of the solution.

The whole philosophy in manufacturing is really thinking about where there happens to be broken bike parts or CDs or e-waste – computers, mobile phones, the list goes on… that are just asking to be transformed. The things we use as part of our daily lives that we should be seeing as a resource rather than something that every 4-5 months we throw away and council collects and we don't think about it. We can be active players in partnership with the councils. Councils can have bins and say, come and put your old thongs in this old collection bin, come on the weekend and dispose of these items. It becomes part of the culture where we see it as our responsibility to really look after those products at the end of their life, not to see it as something we're throwing away

but to see it as something where we're putting in the value-added chain of re-manufacturing.

UNSW TV recently filmed at Tes-Amm, a recycling e-waste centre in Sydney where the SMaRT Centre is collaborating on a project that looks at the transformation of used computers, printers, televisions etc. into raw materials for manufacture – 'Veena Sahajwalla - the e-waste alchemist'

We are looking at the idea of micro-factories and the ability for cities and councils to partner and collaborate with manufacturers and academia to explore this.

The SMaRT Centre has been awarded by the federal government funding to look at green manufacturing, using things like end-of-life plastics and glass. So from our perspective it is a starter of that conversation. We've certainly got fantastic manufacturers who are on board and very keen to walk this journey with us. But we also would like to impress upon industry and the community that we have no shortage of ideas, we have lots and lots of ideas about what can be transformed into green materials. It's about taking the initiative and for people and groups to come together and work. I think that's the best part of collaboration, we all have our strengths.

It makes good environmental and economic sense and at the end of the day, it adds value for local communities and I think that's how we should see it as – creating new opportunities. When you start with the concept of micro-factories, there's a dynamo effect where people naturally want to share with each other their own resources and people go off and add value because there's benefit to be had. That's what transforming waste should be about, not just seeing it as a burden but truly seeing it as a resource of elements so that you can see what you're using it for, whether it's for the purposes of manufacturing metals, whether it's steel or aluminum or whether you're looking at manufacturing other composite products. It doesn't matter. It's about supporting the concept and being able to create local opportunities and that's why the term micro-factory is designed to convey the message that it's not always about trucking your waste thousands and thousands of kilometres. If you can produce things at a micro level and if the things that you create have a higher value, then it would make economic sense to do so.

The waste sector should be seen as the secondary resource sector, the re-manufacturer of products can shape new niche industries.

We now have an opportunity to create this sector that will enable us to spin off a whole range of niche outputs. And that's really what it is. We are not limited by what we've done traditionally we have opportunities through niche, high value outputs that we're producing in micro-factories.

If they are niche, and they are high value, they can be done on a micro scale. That's the important part of the message. If things are happening on a micro scale, through these micro-factories, you don't necessarily need the traditional sort of thinking that you need to have a massive, mega-factory. We could be changing that to the other end of the spectrum where it's about micro-factories which I think is quite exciting. It's about enabling a lot of scientific work to spin off a whole range of practical solutions that can be adopted. And I think it does come down to doing all of this in partnership and doing it in collaboration. How much down that journey we go and how much value we add can

be taken one step at a time but certainly, landfill should never be something we should be thinking about.

Micro-factories can provide the platform for activating social technologies and enhancing sustainable economic growth at a regional level.

The SMaRT Centre is engaging with potential industry partners to share and exchange knowledge that will enhance sustainable economic growth and also provide networks for deployment of UNSW's social technologies. These strategies will create global impact and also create opportunities to diversify our economy by using waste as a resource for green manufacturing through "factories of the future" –-micro-factories for advanced manufacturing. Taking the successful research already developed by the SMaRT Centre at UNSW Australia, low-cost and low carbon products can be produced as sustainable green alternatives. The idea is to engage with non-for-profits in Australia, such as Mission Australia who empower young people, and internationally with organisations including the UNEP (United Nations Environmental Program), to promote new partnerships with industry and UNSW Innovations.

I recently visited a regional micro-factory in Alice Springs. As a remote city Alice Springs has developed collection facilities to address the issues of landfill in collaboration with the community. The Alice Springs Waste Recycling Centre run by Jimmy Cocking, Director of Arid Lands Environment Centre, is doing some great work in this area and showing the way for others in regional areas.

At the SMaRT Centre, our aim is to disseminate green social technologies in Australia and to developing countries, to enhance sustainable economic growth and at the same time make products that add value and are safe and sustainable. When we define social or green products it's coming out of the engineering and scientific principles. We take a holistic approach to manufacturing, when you manufacture things everyone wants good value for money, but just as important is product safety.

Film links:

UNSW TV – 'Veena Sahajwalla – the e-waste alchemist'
https://www.youtube.com/watch?v=XA-vcFEBtc4

UNSW TV – 'Recycled car parts drive new product range'
https://www.youtube.com/watch?v=7yR6609zK-E

ABC Catalyst – 'Turning waste plastic into a resource'
http://www.abc.net.au/science/articles/2015/05/14/4220031.htm

ABC Catalyst – 'Green alloys'
https://www.youtube.com/watch?feature=player_embedded&v=UwHnjt4dJyM

Alice Springs Waste Recycling Facility
https://www.dropbox.com/s/2p5rket06qwbvo2/Waste%26Recycling%20Alice%20Springs_WEB.mp4?dl=0

Unmaking Waste 2015 Conference Proceedings
22 – 24 May 2015
Adelaide, South Australia

Eco-industrial parks as a niche for sustainable low-carbon urban transition in China

Dr Han

City University, Hong Kong

Industrial ecology, urban systems

The development of eco-industrial parks in China can have a positive impact on sustainable low-carbon urban development for several important reasons. First, the intermingling of industrial, commercial and residential activities in mixed-used precincts significantly reduces commuting demands. Second, a conglomeration of complementary industrial activities cuts logistics and transportation demands. Third, these developments stand at the frontline of innovation and quickly embrace green buildings and transportation models. Fourth, more streamlined, competent institutions make leading eco-industrial parks more proactive in pursuing various low-carbon development options. Last but not least, frontline eco-industrial parks serve as a testing ground for international innovative products, technologies, and business models in the field of low-carbon development.

Thanks to a specially designed preferential policy, streamlined government apparatus, better urban master development and land-use planning, and more advanced infrastructure, a number of national pioneer eco-industrial parks have become sustainable new towns in China. This presentation is based on case studies of eco-industrial parks in Beijing Municipality, Suzhou City and Tianjin Municipality. By adopting a multi-level perspective on sustainability transitions, the presentation will show how these three eco-industrial parks have served as the incubators of green building, mobility, manufacturing and service industry innovations, and thus can serve as examples whose replication could help to expedite a low-carbon urban transition in China.

Keywords: eco-industrial parks, China, sustainability, innovation

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Waste, city and resistance: The cooperative practices of the *catadores* (wastepickers) in Brazil

Professor Maria Cecilia Loschiavo dos SANTOS

University of São Paulo, Brazil

Design and social responsibility

This paper explores how urban poverty in Brazil has led urban nomads, the homeless and catadores (people who scratch their living from collecting recyclable cardboard, metals and other discarded materials), to develop strategies for survival by digging through dumpsites and landfills. These people make their living returning the discarded products and materials they find to the productive cycle and to other unexpected uses.

The activities of collecting recyclable materials by the catadores constitute an important example of this practice, which re-attributes value to garbage, to the products and materials that have been disposed of post-consumption. In Brazil, there is a long-standing tradition of excavating and re-utilizing materials and products in this manner. This activity takes on importance as a public service, as a means of generating income, and a contribution toward social inclusion and overcoming poverty.

The amount of residues and waste materials that circulate in this area speaks volumes with regard to the peverse relationship between poverty and waste/residues and, at the same time, warns us about the risks we run of transforming these vulnerable people themselves into residues and wastes.

Keywords: design, waste, Sao Paulo, catadores, homelessness, informal economy

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Unmaking Waste Dinner speech

Vaughan LEVITZKE

Chief Executive, Zero Waste SA

Thanks to Greg Mackie for the amazing and looong introduction.

Thanks to keynotes and guests; Robert Crocker for the amazing conference, which couldn't have been achieved without the amazing efforts of Katherine Thornton and Christina Penhall.

My childhood was very different from my parents.

They grew up in what was essentially the farming community in Burnside near to Adelaide, where goods and foodstuffs were traded locally. There was no plastic, or e waste, and so on — **Life was Simple.** The worst wastes were indeed poisons, in bottles that killed insects and rabbits, dogs and other vermin. Stuff like phosgene, strychnine, arsenic and the like. You know we still collect this stuff from households today.

When I was a boy I grew up with DDT, the safe insecticide, but most everything still came in glass, metal can or paper. Paper was burned, glass was recycled by the 'bottlo'. Beer bottles were collected by scouts who went door to door. People paid for the glass as it was to be refilled with the best bitter beer or woodies lemonade. The steel cans were burnt and there they rusted in piles under the lemon tree and returned to the garden or went to the garbage bin for the council to pick up weekly with ashes and other stuff like broken glasses or crockery.

Almost everything was delivered. Bread, milk in a can then glass bottles; groceries were bought from the local store meat and vegetables were also delivered by the butcher and the green grocer. We didn't have supermarkets, they came later, and changed the face of consumer life. People worked hard and **life was simple**.

We burned our rubbish in 44 gallon metal drums repurposed for the task. Organic waste was buried in the garden in trenches. Life was simple. Later we had a real incinerator – made from Besser blocks and we could really burn stuff.

KESAB (Keep South Australia Beautiful) was invented in the mid 60s, litter was brought under control with TV ads and great commercials — Dr Who, Jack Thompson, girls in bikinis sold the messages. **Life was still simple.**

Steel cans were introduced in the 1970s, as were supermarkets, but there was no need to collect the cans as they couldn't be refilled. Steel cans covered the landscape- litter became a major issue. In 1975 South Australia introduced container deposit legislation, that took care of the can issue, including aluminium, and eventually PET. In those days glass was still refillable, not anymore. Supermarkets took out the corner store, and we shopped in places where price and choice was now a premium. **Life was becoming more complex.**

The new plastic stuff sure burned well in the home incinerator. Black smoke billowed from back yards - dripping golden lit plastic from detergent containers and shampoo bottles. Incineration on Saturday night was exciting. You could get the incinerator so hot you could burn just about anything.

So our rubbish went to a tip — there it was burned, and buried, often in water. The tips were cleverly called landfills. Waste was wrapped in newspaper and the 80 litre steel rubbish bin was filled each week.

Landfills burned cables to recover copper, toxic waste dumped in ponds, with no liners, no care, no regulation. 700,000 tonnes per year into just 1 landfill. Dumps took out the metals — aluminium, copper, steel, bottles.

But soon “greenies” were complaining about the new SMOG over our cities.

Factories, vehicles and burning caused it. Soon we banned incinerators at home, and the big incinerator for household collected rubbish was closed. In 1984 we had the Clean Air Act and it essentially prevented backyard burning.

Up to now there are some amazing parallels with developing countries — and think for a moment what China is facing in respect of air quality etc.

When they stopped backyard burning, councils leapt to the cause and introduced wheelie bins.

The new replacement 240 litre wheelie bin took everything, was always crammed — as we had green waste to get rid of because we couldn't burn it anymore. Then came the garden organics collection — that you paid for — now mostly covered in your rates. We needed garbage bags, so the inventors of Glad Wrap invented the Glad Bag. Everyone needed one or two each week to keep the bin clean from the rubbish. If you used the bag you didn't have to wrap your rubbish in newspaper anymore. Plastic bags replaced paper. **Life was quite complex**.

The 1980s saw the first regulations come in with regard to waste disposal — we had the Waste Management Commission setup. That was followed by an Act in 1987, and later a small $1 levy on landfill waste measured by the size of your truck, not by weight. No data, little money and even less recycling. Of course now its $54.

Then came the recycling revolution — bundled or tied; bags; bottles separated; it caused heaps of injuries, and guys had to empty them into trucks and return the bag over the fence. Wheelie bins were the answer. We needed 3 of them.

The EPA (Environmental Protection Agency) was born in 1993 — the Waste Commission was subsumed and they regulated the waste and recycling industry. I worked for the EPA about this time, regulating recyclers. My recycling group issued more orders than any other in the EPA. The 3 bin system became the ‘look to’ standard.

But better quality landfills were needed and the existing ones were filling up and were of quite bad practice. As they closed new ones were approved. More than we needed as there was a concern that if we had less than say three, a monopoly would arise and we wouldn't be able to afford to dispose of our rubbish.

In response to the burgeoning landfill industry, Zero Waste SA was formed in 2003 by a new Labor (minority) government. We had a strategy that ceased any new landfill developments. We upped the levy (doubled it) and applied it to recycling. We achieved much over the past 11 years of modest funding and lots of collaboration (and coercion).

Nearly 80% of all South Australia’s solid waste is recycled. Around 50% of household waste. Lots of construction and demolition waste gets recycled here, its heavy and easily treated and re-used. 80-90% of bottles and cans sold are recycled in SA.

We’ve learned a lot about waste, about behaviour change, about what works and what doesn't work. We have tested and proven household organics collections, restaurant waste collections and we know how to compost without saturating everyone with bad odours. We know how to make plastic recycled products, compost fit for specific purposes. We know how to engage the community and businesses, we know how to regulate the industry. We understand education and the importance of influencing the next generations.

We understand and support source separation, high quality and low contamination of recyclables.

We've experience with levies, extended producer responsibility, user pays, and bans from landfill. We have over 30 years experience in container deposits.

We have regulated the transitions and the changes and this remains a work in progress, but we have lots of experience — good and bad.

We can use this knowledge to help others. I've personally advised governments across Australia, New Zealand, Japan, Egypt, India, and the list seems to grow.

Green Industries SA is the next iteration of Zero Waste SA and will be established from July next year to build on the success of Zero Waste SA and assist our companies develop local and international markets for their products, knowledge, systems, technology and know-how.

We will need to collaborate more, research more, build new solutions for a world that struggles with its waste.

Now I want to send a message to all of you. It's a call to action.

The world is at a crossroads — we know what's wrong. Unlike our parents, we know about climate change and resource depletion, we know how to make renewable energy, be more efficient, we know what's wrong with e-waste, air pollution and water pollution. We have the knowledge and the skills

We need multidisciplinary and polydisciplinary approaches. We need to use common language to share ideas and approaches, to solve these wicked problems. We need to embrace more holistic approaches, and we need to reduce complexity.

We can keep doing it like we are, or we can change — the future is in our/your hands. In my view there's no choice. The problems are global and we can grasp the opportunities.

Please… Make a difference, and do something.

Safe travels if you've come from afar, and hopefully we will do this again soon, somewhere.