# UNMAKING WASTE 2018

TRANSFORMING DESIGN, PRODUCTION & CONSUMPTION FOR A CIRCULAR ECONOMY

UNMAKING WASTE 2018

## Welcome

There is now more waste being produced than ever before. Certainly, there are more people in the world, and in larger cities, but they are consuming more, and discarding what they have consumed much sooner. Many more things are also now made out of materials that do not break down or have some negative environmental impact, polluting the environment or breaking up into smaller and smaller pieces, and finding their way, eventually, into our environment and also into our bodies. No one, and no thing or place, however remote, can escape the impacts of these wastes, not even the most distant animal, bird or fish, and certainly no human being. Micro-plastics, for example, are now to be found in most tap water across the world, in most foods, and especially in seafood.

We named this conference and exhibition, like the first one held in 2015, 'Unmaking Waste', because it summarises the more positive task that faces us, as researchers, environmentalists and 'makers' from many disciplines, that of 'undoing' or 'unmaking' the crisis that has been collectively created, much of it within our lifetimes. Whether we call our shared goal 'responsible production and consumption', the 'circular economy', or 'sustainable development', the task to be faced is to redesign and remake the products and systems we use, in ways that satisfy our needs, but without depleting or destroying the environment we all depend on.

We would like to welcome you all to join with us over the next three days, to share with us your expertise and insights, especially those of you who have come furthest, from China, Europe and America, including our eminent keynotes. We would especially like to thank our friends from Tianjin University, and our joint China Australia Centre of Sustainable Urban Development, for their ongoing commitment and support for our shared research and educational goals, of which this conference is an important expression. We would also like to thank our friends in government and business for their generous sponsorship, especially Green Industries SA, Veolia, the Design Institute of Australia (SA and NT Branch), Zenith, Kalleske Wines, Mountain Goat Beer and the Food Forest.

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## Delegate speakers

Between Horizons
Kim Thomson

# Sustainability

**The Unmaking Waste 2018 Conference and Exhibition team has worked tirelessly toward a minimum footprint. Some of the actions we took in order to do so include:**

Carbon neutral web hosting with Digital Pacific.

Exhibition Opening Night catering was provided by The FoodPrint Experience, a new and local Adelaide café specializing in permaculture-based, organic, native and seasonal food. Find them on instagram: @thefoodprintexperience

Conference catering was provided by Let Them Eat. Leaning heavily on the vegan and vegetarian side, the conference committee wanted to ensure that more sustainable food options were prioritized. Using local produce, Let Them Eat's vegetarian menu is free of preservatives and chemicals. Find them online: www.let-them-eat.com.au

Wine has been generously supplied by Kalleske Wines which are Certified Organic and Biodynamic since 1998. Find them online: www.kalleske.com

Beer has been generously supplied by Mountain Goat Beers which are naturally brewed avoiding all preservatives and additives and are all vegan friendly. Find them online: www.goatbeer.com.au

We ensured that marketing materials were thoughtfully chosen, and where possible made from upcycled, local, sustainably-certified and/or responsible materials:

Conference Bags: made by the Mobo Group using upcycled banner materials donated from the City of Charles Sturt. Mobo Group's mission is to help people with all types of disabilities to be the best they can be by providing employment and related support services. Find them online: www.mobogroup.com.au

Conference ball point pens: made using FSC-Certified timber with no finishing or paints, ensuring minimal processing and better end of product life options—and the inks are refillable. Find them online: www.buyecogreen.com.au

Conference badges were made by saltyreign.com (Alex Hayes) using recycled bottle caps. They can be returned for reuse or kept to continue the conversations on UMW 2018.

Conference booklets: designed to minimise and reuse waste wherever possible and locally printed by Finsbury Green on FSC Certified paper, using 70-100% post-consumer recycled content and saving over 400kg in CO2 emissions. Find them online: www.finsburygreen.com.au

Saying 'no' to single use materials: a small selection of UMW Keep Cups being sold on site to support delegates in making sustainable choices. Further, a friendly reminder email was sent prior to the conference encouraging delegates to bring their reusable water bottles and reusable coffee cups. Similarly, we chose to provide ceramic crockery for dining—rather than single use options.

# Keynote Speakers

## Low expectations: Have consumers grown too tolerant of our throwaway culture?

Tim COOPER (Plenary speaker)

*Nottingham Trent University, United Kingdom*

The throwaway society has long been questioned and yet overconsumption remains problematic throughout the industrialised world. Industry is increasingly under attack for producing short-lived goods, often described as planned obsolescence, but to what extent are consumers also to blame? In this keynote presentation Tim will share findings from recent research projects undertaken at Nottingham Trent University that have shed light on how consumers' attitudes and behaviour affect product lifetimes. He will reveal the outcome of a survey that explored whether consumers are satisfied with product lifetimes and their priorities when purchasing products. One possibility under consideration is that people are resigned to a throwaway culture and that they have lowered their expectations. If this is the case, how are industrial societies to progress towards becoming circular economies in which material cycles are slower and consumer goods last longer? What is the role of government and industry in raising people's expectations of product lifetimes?

**Keywords:** *overconsumption, consumer attitudes, product longevity, throwaway society, circular economy*

### Author Biography

**Tim Cooper** is Professor of Sustainable Design and Consumption at Nottingham Trent University. A specialist in the environmental and social impacts of product lifetimes, his research interests are multidisciplinary, embracing sustainable design, consumer behaviour, public policy and environmental values. He initiated the biennial PLATE (Product Lifetimes and the Environment) conferences and is editor of *Longer Lasting Products* (Routledge, 2010).

## Buildings as material banks: Designing for perpetual re-use

Duncan BAKER-BROWN FRSA RIBA (Keynote speaker)

*School of Architecture & Design, University of Brighton, United Kingdom*

In 2016 Herbert Kopnik wrote an essay entitled 'Why wait for the future? There could be a present without waste,' where he speculated about the launch of the iPhone 10 more than a year before the actual event. In the essay Kopnik invents a scenario where Apple Inc. CEO Tim Cook has changed the whole emphasis of Apple's modus operandi, from a company selling products, to a company selling services. Just imagine if Apple Inc. and other major producers of so-called consumables actually did manufacture products for re-use, re-manufacture; to literally be material banks for future products.

It's more than sixteen years since Professor Michael Braungart and William McDonough published their seminal book 'Cradle to Cradle: remaking the way we make things', where they constructed a near future world 'where everything is beneficial… where all materials are nutrients and everything is designed to become part of an ongoing biological or technical cycle, where we can celebrate abundance'.

So what relevance do the above statements have to a world where humans create nearly 6 million tonnes of waste every day as a consequence of nearly $100 trillion of economic activity annually? Well, although the practice and knowledge is still not commonplace I want to spend most of the time I have speaking to you all considering a number of exciting pathfinder case study projects where ingenious designers, manufacturers, suppliers, and (de-) constructors are creating products and buildings that are designed to be the aforementioned material banks for the future, as well as others who are carefully unpacking existing buildings as a material resource for 'new' developments—literally UnMaking Waste. I will also consider the potential benefits achieved by companies utilising alternative material sources or 'flows' often overlooked by affluent societies.

**Keywords:** *recycle, reuse, deconstruct, re-manufacture, design*

### Author Biography

**Duncan Baker-Brown** is the Director of BBM Sustainable Design & Senior Lecturer at The School of Architecture & Design, University of Brighton. Duncan has practised, researched, and taught around issues of sustainable development for over 25 years. Author of the *The Re-Use Atlas: a designer's guide towards a circular economy* published by RIBA, he is perhaps best known for a series of thought-provoking 'house' projects testing issues of sustainable design and resource management, including 'The House that Kevin Built' in 2008 and 'The Brighton Waste House' in 2014.

## The waste system in China: progress towards the circular economy

Guanyi CHEN[1,2,3], Dan LI[1] & Wenchao MA[1,3]

*[1]School of Environmental Science & Engineering, Tianjin University, China*

*[2]School of Science, Tibet University, China*

*[3]Tianjin Engineering Research Center of Biomass-derived Gas and Oil, China*

With the economic development and urbanization, municipal solid waste (MSW) generation quantity increases dramatically in China from 148 million of tons in 2006 to 204 million of tons in 2016, and still keep an increasing tendency. The main composition of waste in China is kitchen waste, plastic, paper, wood, ashes, woods, etc.

In the past, the Chinese government paid special attention to waste treatment system. For example, the safety disposal rate in 2006 was 52.2%, including 43.2% of landfill, 7.7% of incineration, 1.94% of composting. When the circular economy concept imported to China, the government make changes towards waste management system. 3R concept of reduce, reuse and recycle become more popular. For example, government proposed "Clean Plate Campaign" at the end of 2012, aiming to minimize food residue. In 2017, government put into force of waste source separation at home, which will improve the waste recycling rate and decrease the difficulty of final waste treatment and disposal. Meanwhile, in the recent decade, waste incineration technology with the advantage of volume reduction and energy production, spread dramatically in China. The safety disposal rate in 2016 is 96.6%, including 58.3% of landfill, 36.2% of incineration, 2.1% of other methods.

Consequently, the waste system in China make great progress from final disposal to waste management with the guide of circular economy.

**Keywords:** *circular economy, municipal solid waste, rural solid waste, treatment, management, legislation*

### Author Biography

**Guanyi Chen** is Chair and Professor of Bioenergy and Environment, Dean, School of International Engineers , Tianjin University, and Director of the China- Australia Centre for Sustainable Urban Development there. His research focuses on wastes to energy by thermal-chemical conversion with biological processes. He is a member of International Standard Organization (ISO/TC255) responsible for Safety and Environment Issues in the field of biogas.

## Making do with what we have: towards protocols for design activism for the waste stream

Gini LEE (Keynote speaker)

*University of Melbourne, Australia*

A new language for design intervention in and for materials, places and systems is emerging through altered practices explored by designers and artists drawn to the objects and forms discarded into the waste streams of the world, once their original use value has been expended. These landscapes of waste materials profoundly alter the performance of physical landscapes resulting in degraded sites alongside an attendant psychological unease in those who care for the well-being of places. Yet these conditions also enable activist responses through design thinking to regard waste collections as sites of opportunity for experimentation and reuse.

I appropriate a postproduction lens that advocates reworking things and situations and making do with what we have, to explore the works of the Unmaking Waste 2018 Exhibition seeking to reveal novel examples of a kind of thoughtful and sometimes provoking design activism achieved through regeneration of things that already exist. While employing often traditional making techniques in new ways these works confirm an ethics of appropriation towards practical and imaginative forms derived through new protocols for making and doing.

**Keywords:** *waste stream, design activism, post production, ethics, appropriation*

### Author Biography

**Gini Lee** is a landscape architect, interior designer and pastoralist and is Professor at the University of Melbourne, Australia. She was the Elisabeth Murdoch Chair of Landscape Architecture at UoM from 2011 to 2017. Her academic focus in research and teaching is on cultural and critical landscape architecture and spatial interior design theory and studio practice, to engage with the curation and postproduction of complex landscapes. Focusing on arid environments, her multidisciplinary research into the water landscapes of remote territories contributes to the scientific, cultural, and Indigenous understanding of and management strategies for fragile landscapes. Her recent landscape curation and installation practice is an experiment with postproduction and Deep Mapping methods to investigate the cultural and scientific landscapes of remote and rural Australia, Scandinavia, global archipelagos and the arid lands of western USA. Since 2014 she is an invited researcher at SLU Malmo where she collaborates in fieldwork based research into transect travel methodologies. She is a registered landscape architect and contributes to the strategic planning, design and practice of urban and educational landscapes in Melbourne and beyond.

## Transforming consumer plastic waste

Gary LEEKE (Keynote speaker)

*Centre for Bioenergy and Resource Management, Cranfield University, Cranfield, Bedfordshire, United Kingdom*

Plastic can be notoriously difficult to recycle—if plastic packaging is considered, only 14% is collected for recycling, and only 5% of material value is retained for subsequent use. Plastics that are recycled tend to be down-cycled and are not recyclable after use. Other routes include incineration or landfilling. Situations are made worse by the high cost of collection and the lack of recycling plants that deal with them. Globally, it is estimated that 32% of plastics are not collected and escape into natural systems. If a position of resource efficiency is adopted, solutions are needed to process waste plastic so that value added products can be obtained. These would ease the strain on landfill sites, and produce an output that could be sold at profit.

A solution proposed by Recycling Technologies Ltd, UK (RT) is to convert end-of-life mixed plastic into a substitute crude oil that can be used as a source of valuable hydrocarbons. Challenges arise from the heterogeneity of feedstock that has variable composition and impurities such as water and biomass. A number of products can potentially result, in particular naphtha which can be used as a polymer feedstock to produce new materials, and therefore helping to address the circular economy issue around plastic waste. Other products include heavy fuel oil which has the advantage of being Ultra Low Sulphur [S<0.02%]), gas-oil and other tailored products. The presentation highlights the technology and some of the challenges to convert end-of-life mixed plastic into value-added hydrocarbon products.

**Keywords:** *plastic-to-plastic, mixed plastic waste naphtha, circular economy, fuels*

### Author Biography

**Professor Gary Leeke** is Chair in Chemical Engineering and Head of the Bioenergy and Resource Management Centre at Cranfield University, UK. His research interests lie in the areas of recycling enabling technologies and resource efficiency. He currently leads three government funded projects dealing with the transformation of plastic waste into chemical products. Gary is advisor to the New Plastics Economy.

## Fetish, design and the fury of disposal: Questioning the consequences of the fetishization of consumption

Maria Cecilia Loschiavo dos SANTOS (Keynote speaker)

*School of Architecture and Urbanism University of São Paulo, Brazil*

The effects and the fury of disposal generate such a quantity of obsolete manufactured goods, discarded and disposable products, that they have transformed the spaces of the metropolis into a paleotechnical jungle waste on a global scale. Designer Victor Papanek and journalist Vance Packard, issued strident alerts regarding the designer's role in the face of risks of hyperconsumption and discardability, but regrettably the directions taken by the "Kleenex culture" (Papanek, 1971) and the voracious appetite of the hyperconsumerism society did not change. Despite these manifestations, nothing could stop the vertiginous process of waste production. According to another logic, these residues became part of the ecology of survival and the routine of millions of unfortunate people worldwide, articulating the topic of waste to the political, urbanistic and technological dimensions. In this context, amongst the problems of urban poverty, street-people, collectors of recyclables, are populations that have developed tactics to relieve their condition by reutilizing discarded products and materials. They reuse waste as a means of adaptation to the loss of resources and poverty, they subsist under precarious living conditions through a creative bricolage practice, that transforms waste, and the fetish of products of our compulsive consumption. This presentation rethinks the relation between design and fetishism, waste and urban poverty. It presents a brief history of fetish and the context of Brazilian culture, it discusses the definition of fetishism in the context of Karl Marx and his critique of commodity, as well as Sigmund Freud's explanation of the fetish in relation to psychoanalysis. Finally, it will consider the concept of bricolage developed by the anthropologist Levi-Strauss to refer to something that is made through the use of various materials and diverse tasks. From this approach the presentation will analyze and elaborate the concept of urban bricolage by the homeless and their creative practices of adaptation.

**Keywords:** *design, waste, urban life, homelessness, fetishization of consumption*

### Author Biography

**Maria Cecilia Loschiavo dos Santos** is full professor of Design at the School of Architecture and Urbanism, University of São Paulo, Brazil. She is an internationally recognized scholar and a guest lecturer in several universities. Her research focuses on design and sociotechnologies in Brazil, with emphasis on: sustainability, social design, socio-spatial exclusion, street dwellers and recyclable waste pickers. She is author of several books, among them *Design, waste and dignity.*

## The great lean acceleration: The result of avoiding the waste of knowing what for

Cameron TONKINWISE (Keynote speaker)

*University of Technology Sydney, Australia*

At the same moment as households are experimenting with zero waste, 'innovations' seem to lead to vast amounts of wasted products, like mountains of discarded dockless bikes. What is driving the latter? Late 20th Century Lean Manufacturing promised waste avoidance not only through improved quality in the factory and more efficient supply chain logistics, but also by 'smoothing demand.' In the early 21st Century the goldrush for tech startups with exponential growth led some developers to repurpose Lean in the hope of avoiding investing in systems that turn out to be a waste of time. A key concept in Lean Startup is the Minimum Viable Product, a quick-to-build version of an aspect of a proposed solution that can be released onto the market to learn more about what else people may value. This way of doing product development is now being applied to digital devices and not just digital systems. This presentation will enumerate the ways in which this latest translation of a philosophy that centred around waste avoidance is in fact accelerating waste. It will look at the ways in which this is no longer about design, about making decisions prior to production. It will look at how this has exponentially accelerated production and so promoted a 'first-to-monopoly' mania. And it will look at the wider way in which this has eroded trust in products being completed things.

**Keywords:** *lean manufacturing, lean startup, waste avoidance, design, e-waste*

### Author Biography

**Cameron Tonkinwise** is the Professor of Interdisciplinary Design and the Director of the Design Innovation Research Centre at the University of Technology Sydney. He has researched Sustainable Service System Design, with a focus on Sharing Economies, for over 20 years. His current research concerns Transition Design, a range of approaches to design-enabled systems-level change toward more equitably sustainable futures.

# Delegate Speakers

Five Elements seat
Sally Wickes

## Persistent organic pollutants (POPs) and adverse effects on health and environment in Rwanda

Bernardin BAVUGE

*Kayonza District, Rwanda*

There is a low awareness level among the general populace and relevant stakeholders on Persistent Organic Pollutants (POPs) and their adverse effects on human health and the environment. This often results in the continued use of POPs in agriculture as pesticides, industrial chemicals, and production of unintentional POPs from incineration, open burning, and other practices that add to the POPs level in Rwanda.

Thus, all stakeholders have a responsibility in the process but due to the lack of awareness about the issue they are not able to fulfill this role. With increased awareness, concrete steps can be taken towards the elimination of POPs in Rwanda. The most commonly encountered POPs in Rwanda, are organochlorine pesticides, industrial chemicals, most notably polychlorinated biphenyls (PCB), as well as unintentional by-products of many industrial processes, especially polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF).

POPs are contributing to air, water and soil pollution when they are suspended in the air, water and soil and carried by different routes to other areas, potentially contaminating them. Household's waste, industrial waste, agricultural waste such as pesticides (herbicides and fungicides) and medical waste constitute the main sources of environmental pollutants among them heavy metals. they must be properly managed and disposed of. Workers who recycle and dispose of POPs are exposed to dangerous materials and the environment suffers from them.

This paper is intended to disseminate information about POPs and waste management, to reinforce what people already know, and to contribute to changing attitudes and behaviors for sound environmental management of chemicals and waste and transforming waste into resources of greater value for reuse. This paper can be considered as one of primary form of intervention related to chemicals and waste management.

**Keywords:** *POPs, PCB, chemical pollution, Rwanda*

### Author Biography

**Bernardin Bavuge** is born in 1982 in Rwanda. He received BSc in Applied Science, Biotechnology Option in 2010. He is interested in Environmental Science research and is now preparing his MSc degree in Environmental Economic and Natural Resources Management at University of Lay Adventists of Kigali (UNILAK)- Rwanda (2017). He has been working at the Rwanda Environment Management Authority (REMA) since 2012.

## Fashioning change: How to motivate sustainable consumption behaviour amongst fashion students, a cross-cultural study between Nottingham, UK, and Hong Kong.

Naomi BRAITHWAITE[1] & Cassandra NG[2]

[1]*Nottingham Trent University, United Kingdom*

[2]*Hong Kong Design Institute, Hong Kong*

Despite being underpinned by a consumer-driven model, fashion continues to take huge strides towards a sustainable future. This is evident through environmentally conscious practices, for example, the production of eco-conscious clothing lines, and, the application of circular business models, that encourage recycling and reuse. While fashion evolves, there is a still an excessive volume of clothing, unnecessarily consumed and disposed of every year. This is a global problem, compounded by the availability and affordability of new styles, encouraging consumers to acquire more stuff. The challenge for a sustainable fashion future is to transform consumer behaviour.

Eighteen to twenty-five year olds are prolific consumers of fashion, and so provides a significant opportunity for exploring the consequences of consumption, with the view to initiating positive action for the future. The research takes a nuanced approach to this, by focusing specifically on fashion students, in Hong Kong and the UK. The transient nature of student life makes an interesting point of enquiry into how much is consumed, why, and what will happen to this clothing, as studies end.

Motivations for purchase, their attachment to these garments and how long they expect to wear them were explored in ten workshops in Hong Kong and Nottingham. The students were requested to quantify the garments they have at university with a view to understanding how often they are worn, and what happens to them when they are no longer worn or wanted. The objective was to interrogate motivations for purchasing behaviour, as well as understanding how the consumer values these purchases, and how this compares within these distinct cultural locations. The paper analyses the findings from these workshops, with a view to eliciting opportunities for transforming consumer behaviour.

**Keywords:** *fashion students, wardrobes, clothing, attachment, identity*

### Authors' Biography

**Dr Naomi Braithwaite** is a Senior Lecturer in Fashion Marketing at Nottingham Trent University. Her research focuses on material culture in the context of fashion. **Cassandra Ng** is Course Leader of the BA (Hons) Fashion Design and BA(Hons) International Fashion Business programmes at Hong Kong Design Institute. Previously she spent over 15 years in the Hong Kong fashion Industry.

## A circular city: An empirical approach to 3D printed up-cycling

Sophia CAMERON, Jeongbin OK & Simon FRASER

*Victoria University of Wellington, New Zealand*

Among many exacerbating environmental issues, plastic debris, with ubiquity and abundance, has significant impacts on local and global communities, environments and species. Contrary to common assumptions, New Zealand is no exception; 77% of litter cleaned up on coastal beaches in Wellington are from single-use plastics and volunteers are struggling to clean up plastic pellets on beaches. In addition, with China's new waste ban in place, less than 20% of plastic waste is recycled, and these schemes consume considerable amounts of time and energy. There is, therefore, a critical need for innovative and localised recycling initiatives towards waste minimisation and extending product lifecycles within this region. This research addresses the severe issue by investigating how Wellington post user plastic can be up-cycled using additive manufacturing and utilised for new, longer lasting products. It introduces the opportunity for a circular system that can repurpose plastic waste while benefiting local communities, schools and environments. It allows for interaction, engagement and education at every stage of the creation process and thus empowers longevity and emotional durability. More specifically, this research has employed a 'research through design (RtD) based on design criteria' approach, beginning with a materials-led investigation. Materials inform design decisions made across three case studies to demonstrate potential applications. These include a university, a sports centre and a heavily polluted beach. A range of waste plastics collected from each of the sites have been trialled with a localised, cohesive recycling, 3D printing and testing process, and the results have determined appropriate design directions and subsequent developments through an iterative design process. The applications and outcomes from this research have demonstrated how 3D printing technologies can facilitate sustainable plastic consumption, engage communities in the up-cycling process and address a throwaway society with longer lasting products.

**Keywords:** *up-cycling, 3d printing, longevity, plastic waste, circular lifecycles*

### Author Biography

**Sophia Cameron** is an Industrial Design masters student at Victoria University of Wellington, New Zealand. Her ongoing research focuses on how additive manufacturing can be employed for sustainable design practices. Throughout this process, she has made more than 15 unique recycled materials. **Jeongbin Ok** is an Industrial Design senior lecturer at Victoria University of Wellington in New Zealand. His research interests span design for safety, health and sustainability through adaptive integration of technologies including smart materials, additive manufacturing and digital processes. He is an inventor of more than 20 patented materials, systems and products. **Simon Fraser** is a Professor of Industrial Design at Victoria University of Wellington in New Zealand. He has a long track record of practice-based research in both industry and academia. His research focusses on additive manufacturing and includes new applications of digital tools and methods for designing, as well as new and more inclusive or socially empowering platforms of production through virtual systems, services and networks.

## Obsolescent by design: From the Jevons paradox to the growth economy

Robert CROCKER

*China Australia Centre for Sustainable Urban Development UniSA, Australia.*

While technological improvements over time can lead to lighter, faster, more energy efficient products, along with a reduction in the materials required to make them, these positive environmental impacts can be outweighed by an increase in the volumes consumed, as Jevons (1865) originally predicted. However, what is often overlooked by those deploying the Jevons paradox to argue against the wisdom of 'green growth', is that greater efficiencies and lower costs may also result in lower margins per unit, which can become a powerful incentive to increase the volume and variety of goods produced. Diminishing returns per unit can also encourage a recourse to some form of 'planned' obsolescence. For by ensuring premature discard, producers can sell more products within shorter timeframes, and thus compensate for reduced margins. In this way, obsolescence has become a time-based impost on the environment, even in products that are 'environmentally friendly' or potentially long-lived. This paper argues that a richer historical and economic understanding of this problem is needed before a circular economy can be universally implemented.

**Keywords:** *consumption, premature discard, planned obsolescence, environmental impacts, Jevons Paradox*

### Author Biography

**Robert Crocker's** research focuses on the relationship between consumption, waste, sustainability and design, and he has published widely on this theme, including in *Somebody Else's Problem: Consumerism, Design and Sustainability* (Greenleaf 2016), and more recently in two co-edited volumes of essays, *Subverting Consumerism: Reuse in an Accelerated World* (Routledge, August, 2018) and *Unmaking Waste: Towards a Circular Economy* (Emerald, September, 2018).

## Appetite for construction in the kingdom of BGBJ: A case study of social entrepreneurship at an Indonesian landfill

John DEVLIN

*School of Art, Architecture and Design, UniSA, Australia*

Waste management in Jakarta is at a crossroads. With the main landfill at Bantar Gebang nearing capacity the government is set to invest in waste-to-energy projects, despite some community opposition. One group who will be impacted by these changes are the waste pickers who operate throughout the city and at the landfill. Approximately 3000 families make an income through informal waste work at Bantar Gebang, usually living in shacks owned by recycling bosses, who also control much of the scavenging activity. Families continue to be drawn to the landfill in order to find some economic stability, often with young children to support. Unfortunately, for many this lifestyle becomes something of a trap. With the landfill set to close these families could face an uncertain future.

The Kingdom of BGBJ has been running as a community hub in the centre of the landfill since 2014. The hub is based around a youth club that supports approximately 80 children and young adults. Appetite for construction is a new upcycling workshop project aimed at providing educational and employment opportunities to local young adults, helping them transition away from waste picking work yet still remain present to benefit from the resources the landfill provides and give something back to their community. This case study introduces some of the socio-economic dynamics at the landfill and relates them to broader conditions in Jakarta and the region. The importance of social enterprise in integrating informal sector workers into more productive roles is discussed along with acknowledgements of difficulties faced. Finally, the paper links the findings of the case study to wider implications for circular economy and sustainable urban development.

**Keywords:** *informal waste management, social enterprise, landfill, upcycling, waste pickers*

### Author Biography

**John Devlin** is a PhD student at UniSA and co-founder of BGBJ. Since 2014 he has been visiting the Bantar Gebang landfill, helping to develop the youth club, hostel, and upcycling workshop. His research interests are in zero waste, integrating informal waste workers into a sustainable waste management system, social enterprise, and "landfill vernacular" construction.

## Optimizing total cost for an electronic waste reverse supply chain model

Linh Thi Truc DOAN[1 2], Yousef AMER[1], Sang- Heon LEE[1] & Luu Quoc DAT[3]

*[1]School of Engineering, UniSA, Australia*

*[2]Department of Industrial Management, Can Tho University, Vietnam*

*[3]Department of Development Economics, University of Economics and Business, Vietnam National University, Vietnam*

Reverse supply chain (RSC) has gained growing attention from industry, government and practitioners due to scarce resources, environmental issues, and regulations. The total cost of a RSC system is one of the important issues. Existing studies focus on minimizing the total cost of the system including transportation, operating, fixed, disposal and fixed costs. However, risks normally derive from transportation and treatment activities in a RSC operation, but current studies ignore risk influences on the overall cost as well as the performance of the RSC. This study aims to develop a mathematical model for the total cost minimization of the RSC system incorporating risk factors. The developed model utilizes mixed integer linear programming and solved by CPLEX software. A numerical example of electronic waste (e-waste) is also provided to illustrate the applicability of the proposed model. The result can identify the optimal locations of centers and the flow of different materials or items in a RSC network. This study can assist decision makers to design an effective e-waste RSC network design to achieve the sustainable development.

**Keywords:** *reverse supply chain network, e-waste, risks*

### Author Biography

**Linh Thi Truc Doan** is currently a Ph.D. student of the School of Engineering in University of South Australia. Her interest is to research in project management, supply chain management, especially reverse supply chain. She is working in a comprehensive reverse supply chain model for Electronic waste (e-waste). **Yousef Amer** is a Program Director in the School of Engineering, University of South Australia. His research interests include Sustainability in Product and Service development, Lean and Green Supply Chain Modelling, Optimisation and Simulation and Sustainable Nano-manufacturing. He has published books and many papers in academic journals. **Sang Heon Lee** is currently a program director and a senior lecturer in the School of Engineering, the University of South Australia. His current research focus is on development of efficient algorithm for green supply chain and digital image processing in agricultural and medical applications. He has published over 100 papers in academic journals and conference publications. **Luu Quoc Dat** is a lecturer in department of Development Economics at University of Economics and Business—Vietnam National University, Hanoi, Vietnam. His current research interests include fuzzy multi-criteria decision making, sustainable development, reverse logistics and fuzzy quality function deployment

## Paradoxes of waste sustainability in Singapore: Clean campaigns, technocentric recycling programs, and karang guni informal recyclers

Lyle FEARNLEY & Pearlyn NEO

*Singapore University of Technology and Design*

This paper examines Singapore's current government-led quest for "zero waste" sustainability targets in the context of the city-state's longstanding and famous campaigns to become the cleanest city in Asia. The Clean Campaigns of the 1960s have bequeathed social and technical infrastructures that make the achievement of sustainable targets difficult today. For example, the installation of rubbish chutes in every Housing Development Board high-rise building, the development of bin collection centres and waste collection services—and not merely mobilization of civic participation—is what made the goals of the Clean Campaign possible. Yet these same rubbish chutes, which make disposal so convenient from a high-rise apartment, are widely credited as the crucial obstacle to increasing household recycling rates. This paper proposes that Singapore's route toward sustainability should not be imagined as an extension or repetition of the Clean Campaigns. Rather, it must build on the alternative networks of informal recycling, which date to at least the mid-20th century, known as karang guni (Bahasa Melayu for 'gunny sack'), yet who paradoxically are being pushed aside by the official National Recycling Program. This paper ends by discussing the results from the community-based participatory research project undertaken by the team and examines the receptivity of residents towards using karang guni in their disposal habits.

**Keywords:** *waste minimization, informal recycling, social infrastructures, municipal recycling programs*

### Author Biography

**Lyle Fearnley** is Assistant Professor of Anthropology at SUTD. Trained as an anthropologist of science and medicine, he received a Joint Ph.D. in medical anthropology from the University of California, Berkeley and San Francisco. **Pearlyn Neo** is a Research Assistant at SUTD. She graduated with a double degree in Sociology and Information Systems and is passionate about producing quality research that would impact the lives of vulnerable communities.

## Walls of waste: Residential wall construction method using waste tyres filled with waste construction materials

Dr Martin FRENEY

*School of Art, Architecture and Design, UniSA, Australia*

This paper explores the practice of up cycling waste tyres and other waste construction materials in the construction of walls for residential housing and proposes further innovations based on this system. It is inspired by the Earthship sustainable housing concept (Reynolds, 1990) which utilises waste tyres filled with earth to build load-bearing retaining walls that form the exterior walls of earth-sheltered homes with very low heating and cooling requirements due to the thermal properties of the 'tyre wall'. According to a government commissioned report (Hyder, 2015) in 2013-14 financial year Australia produced the equivalent of 51 million waste tyres, a quantity that increased from 48.5 million in a previous study of the 2009-10 financial year. While there are various tyre recycling schemes and processes in Australia that are making an impact on the large quantity of waste tyres, and producing useful new materials and products, the Hyder report indicates that the vast majority of waste tyres in Australia in 2013-14 were landfilled (25%) or exported for use as a fuel in industrial processes (47%); these end-of-life 'destinations' are clearly a down cycling of this waste material. A key principle of the circular economy is to circulate products, components and materials in use at their highest utility. On this basis, taking advantage of the unique structural properties of a waste tyre for wall construction will be demonstrated as being of high utility especially when compared with other tyre recycling methods. Furthermore, this paper explores the possibilities and implications of filling tyres with other waste materials including shredded tyres and/or recycled aggregate with the aim of 'sequestering' more waste while improving the overall performance of the tyre wall and addressing current issues such as the labour involved with compacting the traditional fill material (earth).

**Keywords:** *earthship, tyre wall, retaining wall, EOL tyre, upcycling*

### Author Biography

**Martin Freney** is an academic and a designer of products and buildings. Initially trained as an industrial (product) designer (BDes at the University of South Australia), he has also developed expertise in architecture (PhD at the University of Adelaide) and permaculture (PDC at the Food Forest in Gawler, South Australia). He teaches 'design for manufacture' and 'design for environment' in the Product Design program in the School of Art, Architecture & Design, University of South Australia, he operates a sustainable design consultancy, Earthship Eco Homes, and tourist accommodation, Earthship Ironbank, which also serves as an educational facility for natural building workshops. His PhD compared the sustainability features of the Earthship with other types of homes, including a detailed study of the thermal performance of Earthships in various climates. He is the first person in Australia to gain approval from local government for an Earthship style dwelling. His interest, engagement and participation in the field of 'sustainable design' is driven by his belief that our current civilisation is threatened by some remarkable challenges many of which may be addressed, at least partially, though better design and also by new attitudes and expectations.

## Accelerating Electronics Sustainability in Australia and New Zealand

John GERTSAKIS & Rose READ

*Ewaste Watch Institute*

Electronic goods now permeate our existence—how we work, live and play. They are often essential devices that bring high utility, safety and noteworthy functional benefit. They're also a great source of leisure and recreation. However, there is also a downside. Electrical and electronic products continue to be scrutinised when it comes to their environmental impact and the consumption of scarce and non-renewable resources, including a variety of precious metals. The recently released 2017 Greenpeace Guide to Greener Electronics argues that "billions of electronics are being made, sold and disposed of every year in a cycle that drives short-term profits for electronics manufacturers, but at too high a cost for the planet we all share."

This paper will introduce an important and much needed organisation. The Ewaste Watch Institute is a new, not-for-profit, research-driven organisation based in Australia focused on accelerating electronics sustainability, stewardship and circular solutions across the product life-cycle.

This includes attention to social and consumer aspects, product design, cleaner production (e.g. closed loop), smart logistics, innovative consumption models (e.g. sharing economy and collaborative consumption), reuse, repair and recycling. It achieves this through knowledge sharing, policy review, regulatory analysis, consumer education, advocacy, debate, exhibitions, events and outreach.

Our vision is zero e-waste to landfill in Australia through increased knowledge about, and attention to, product and service design, repair, reuse and circular solutions. The development and deployment of projects, programs, policies, standards and regulations that significantly advance and accelerate electronics and battery stewardship.

**Keywords:** *electronic waste, sustainability, Ewaste Watch Institute, product stewardship*

### Author Biography

**John Gertsakis** is a sustainability and communications practitioner with over 20 years experience as an industry adviser, consultant, advocate and research academic. John was a senior research associate at RMIT's Centre for Design for 10 years. He works on a range of issues covering Product Stewardship strategy, policy reform and regulatory analysis.

As a joint non-for-profit initiative with Rose Read, he is the director and co-founder of the Ewaste Watch Institute.

## Geographies of clothing waste: Fast fashion, global perceptions and local solutions

Alison GWILT[1] & Alice PAYNE[2]

[1]*School of Art, Architecture and Design, UniSA, Australia*

[2] *School of Design, QUT, Australia*

In Australia approximately 1.2 million tonnes of clothing waste is generated annually, with many garments having a lifetime of as little as three months prior to disposal (Ragtrader 2014). Fast fashion clothing is seen to play a significant role in rising waste levels. Moreover, while globally the fast fashion industry is commonly considered to be 'waste creating', there are clothing brands, retailers, activists and NGOs working to reposition waste as a socially and economically valued resource. Frequently the positive narratives that are explored in existing literature originate from the US and Europe. In this paper we reflect on and present the voices of industry visionaries, researchers and activists working in local, domestic and regional fashion systems from a wide range of countries across six continents.

Within the paper we focus on and examine some of the strategies and approaches used to reposition waste. Our methodology involved collecting data via an online global request for textual contributions from individual researchers and research teams, which are to be published as a set of regional narratives (Bloomsbury 2019). Contributions had to conform to a pre-determined set of criteria that enabled the project team to explore and address specific themes, whilst at the same time provide new insights from across different continents.

The findings from our initial analysis of the data highlighted a range of common practices, thinking and ideas across different countries and regions. This included ideas such as local waste recast as "food" for producing new local fashion, and innovation in product service systems that address overconsumption as the root cause of waste. At the same time it is evident that there are industrial, political and cultural differences and challenges that impact on the progress of these approaches in each region. As a response to our analysis in this paper we aim to explore the ways in which opportunities and innovations seen elsewhere may support and benefit the Australian fashion system.

**Keywords:** *textile waste, valued resource, global, fashion industry, circular economy*

### Author Biography

**Dr Alison Gwilt** is a fashion design researcher, author and consultant. She explores and promotes a range of innovative design methods and approaches that enable the fashion and textiles community, from educators, to producers, and consumers, to adopt more sustainable and ethical practices. Alison's books include 'Shaping Sustainable Fashion' (2011), 'A Practical Guide to Sustainable Fashion' (2014) and 'Fashion Design for Living' (2015). She is currently Adjunct Senior Research Fellow at the University of South Australia.
**Dr Alice Payne** is a senior lecturer in Fashion in the School of Design, Queensland University of Technology. Her research interests include the fashion design process, the Australian mass-market fashion industry, and the problem of design for sustainability within the fashion context. Alice is an award-winning designer and has exhibited in Australia and overseas.

## Value addition by transforming spent coffee ground waste to bioenergy

Jayant KESKAR & Christopher SAINT

*School of Natural and Built Environments, UniSA, Australia*

About ten million tons of coffee is consumed worldwide and Australia ranks 42nd in coffee consumption with 3 kg of coffee per capita per year. A large amount of coffee waste is generated in the form of spent coffee grounds (SCG) which mainly ends up in landfill, causing greenhouse gas emissions. The SCG is organic in nature and has good potential for generation of bioenergy in the form of biogas.

Anaerobic digestion of SCG waste was tested with an Automated Methane Potential testing System to understand the embedded energy in this waste. The biomethane generation was found to be 170 L CH4/kg VS of SCG which corresponds to 58 L CH4/kg fresh SCG.

In addition, the digested solids are potentially a valuable source of nutrients including nitrogen, phosphorous and a range of micronutrients and the value of these is also discussed in this paper.

This testing data has been used for correlating the potential greenhouse gas emission reductions and further assessment on transformation of SCG waste to contribute towards achieving carbon neutrality at the University campus. Potential large scale anaerobic digestion project applications utilizing other waste resources is discussed with emphasis on SCG waste.

**Keywords:** *bioenergy, spent coffee ground waste, waste to energy, greenhouse gas emission*

### Author Biography

**Dr Jayant Keskar** is an accomplished professional with more than 25 years of experience in sustainable and integrated wastewater and waste management with emphasis on renewable energy. He has successfully contributed towards education and training, presented research papers in various international conference, worked in R & D and leadership functions, strategy development with environmental, economic, and social perspective.

## The agency of transformative repair

Guy KEULEMANS

*Art and Design, University of New South Wales, Australia*

This paper concerns the analysis of select participant interviews conducted for the research project Object Therapy (2016), in which broken objects were collected from participant owners and transformatively repaired or remade by professional designers, craftspeople and artists. Transformative repair concerns the use of repair or remaking of objects that change their appearance, function and/or significance. Concepts adapted from the philosophers Giles Delueze and Félix Guattari are used to understand attitudinal shifts that occurred between or during interviews with two participants as a consequence of their encounter with transformative repair. Deleuze and Guattari's concern for the affective properties of materiality is discussed as complementary to the methodological approach and as relevant to interest of the researchers in understanding relationships between objects, material and people in regard to ecological thinking.

The concepts of assemblage, anomaly and percept are used to interrogate the potential of causal links between perception and action. It is shown that the creative transformation of broken objects can act to shift the attitudinal components of assemblages towards action, as evidenced by interviewee engagement with both the practice and speculative possibilities for repair.

The interview analysis is complemented with an aesthetic analysis of two transformed works in order to consider aspects of material transformation that can improve the perception of repair as valuable or desirable. This discussion concludes on the observation that transformatively repaired or remade objects have a capacity to trigger an imagination of a 'transient materiality' in objects; a perception of an object's generative potential to transform. I make some concluding comments about the relationship between this personal imagination and propositional shifts in public imagination, fostered by love.

**Keywords:** *transformative repair, reuse, speculative design*

### Author Biography

**Guy Keulemans** (Ph.D, M.Des) is a designer, researcher and educator focused on critical practices of design and sustainability.

# Design construct program at UniSA: Building a circular research framework

Dr David KROLL, David MORRIS, Joti Weijers COGHLAN & Dr Arianna BRAMBILLA

*School of Art, Architecture and Design, UniSA, Australia*

Despite the prominence of the circular economy agenda, architectural design is still typically taught and practiced as an activity, progressing in stages with a clear beginning (e.g. a project briefing) and a clear end point (e.g. handover of drawings and specifications to a builder). This linear approach to architectural practice appears so 'normal' that alternatives are rarely considered. Yet, it has also been criticised for some time. The RIBA, for example, tried to place greater emphasis on post occupancy evaluation (POE) with a mixed success[1]. In practice, architects are rarely appointed for post-construction stages and their influences during construction has also decreased[2]. The architectural design studio typically mirrors this linear view of architectural practice. Additionally, the practicalities of the design studio and curriculum mean that the focus is typically on the early project stages—on concept and detailed design. Design-Build studios such as the Design Construct program at the University of South Australia have been instrumental in complementing university education with an experience of working on the construction stage of an architectural project. In recent years, architecture departments in Australia and the UK have come under increasing pressure to articulate and communicate their research outputs more effectively. This pressure has also been placed on Design-Build programs which traditionally has been focused on built structures as non-traditional research outputs. We have taken this challenge as an opportunity to rethink and articulate the research agenda of the Design Construct program by taking an ongoing project—the Fish River Aboriginal Accommodation—as the first case study for a research framework that could be reused and refined in successive projects. This paper will discuss this proposed circular design research process, how it can be applied to a case study project of the UniSA Design Construct Program and how it could be developed as an ongoing research agenda.

[1] Flora Samuel, 'Why Architects Matter : Evidencing and Communicating the Value of Architects', 2018, 65–68. [2] Tim Clark, 'AJ Housing Survey: Post-Occupancy Not on Architects' Radar', Architect's Journal, 13 February 2015, http://www.architectsjournal.co.uk/news/daily-news/aj-housing-survey-post-occupancy-not-on-architects-radar/8678486.article.

**Keywords:** *design construct, aboriginal housing, passive design, applied design research, post-occupancy evaluation*

## Author Biography

**David Kroll's** research focuses on housing and sustainable design, exploring historical and theoretical perspectives, as well as contemporary issues and technologies. **David Morris** leads the Design Construct Program at UniSA. His research interests include prefabricated construction systems and technologies appropriate for remote locations. **Joti Weijers-Coghlan** is the co-coordinator of the Design Construct Program and has an extensive background in architectural practice and construction in Australia and overseas. **Dr Arianna Brambilla's** research focuses on thermal comfort, hygrothermal performance of building components, low-carbon design strategies and thermal energy storage.

# Life style objects grown: Biofabricating sustainable products with mushroom material

Efecem KUTUK

*Michael Graves College, Kean University, United States of America*

Is it possible to grow a guitar? A helmet? A tote bag? How do we educate students about whether everyday products could be fabricated in a more sustainable manner? How do we inspire them to pursue alternative, sustainable routes in designing everyday objects? By partnering with a pioneering biomaterials company, design students were challenged to creatively use mycelium (mushroom roots) and locally-sourced agricultural waste, such as hemp and cornstalks, to create everyday objects using grown materials, with all components of their products —paint, glue, fabric fasteners—being sustainable.

This paper shares the process by which new sustainable materials science was infused into an industrial design curriculum. It includes examples of student work, focusing on key decisions and experimentations with material throughout the projects. Also, it shares the process by which students gained valuable insights into the power and potential of sustainable design by growing a diverse array of products and showcasing the outcomes in an industry exhibition to make a step toward consumer awareness.

This paper argues for the value of exploring the use of new sustainable material science in industrial design curricula with supporting information from other creatives' research findings. Also, it reflects on how to educate consumers on the far-reaching implications of non-biodegradable waste, to the point where they demand sustainable products. In addition, it explores the implications of new sustainable materials and whether manufacturers would be willing to edit their production cycle.

**Keywords:** *green material, mycelium, sustainable fabrication, mushroom material, no waste*

## Author Biography

**Efecem Kutuk** is a New York based multidisciplinary design educator and designer specializing in furniture, lighting, commercial products, sustainability, social design, design entrepreneurship, wearable technologies. Kutuk's well-rounded design background and informed aesthetic is the product of his diverse and international experiences. Efecem's current portfolio includes award-winning furniture designs, table top designs, commercial and residential interiors. He has taught Industrial Design courses at Drexel University, Montclair State University and New Jersey Institute of Technology. His work and his students' projects have been exhibited in design shows, published in prestigious design magazines and blogs. Currently Efecem is the Program Coordinator of Industrial Design at Michael Graves College, Kean University and he serves as part time faculty at Parsons School of Design. He earned his Bachelor of Fine Arts degree in Interior Architecture and Environmental Design from Bilkent University in Ankara, Turkey and a Masters degree in Industrial Design from Scuola Politechnica di Design in Milan, Italy.

## Fabricating an environmental fashion industry: The case of Ina Budde

Gabriele LETTICE & Robert CROCKER

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Closed-loop supply chain management has become increasingly important in attempts to implement the circular economy. Since the production of fashion textiles often relies on large volumes and lengthy 'linear' supply chains, the fashion industry poses a particular challenge to circular economy initiatives. Many attempts to 'close the loop' in fashion so far have relied on encouraging consumers to more responsibly return their garments to suppliers for recycling or remanufacture, without necessarily doing very much to change production itself and the supply chains involved. These solutions do not necessarily address the wastefulness embedded in the system itself, from the vast quantities of water and chemicals used in producing today's high street fashion, to conventional cutting and overruns, and the vast volumes of clothing now never even used or worn.

Based on the case of award-winning German fashion designer, Ina Budde, this paper explores what might be possible to really 'close the loop' in this industry. Collaborating with innovative software designers, Ina Budde's 'Design for Circularity' reveals the possibility of an alternative more circular fashion system, combining design for product life-extension, reuse and recycling, with new infrastructures for material recovery and extended closed loop supply chain management. This is partially achieved through a digital tool, a QR code which is integrated into each garment. This not only enables greater transparency for all those involved in the supply chain, but also allows the consumer to 'do the right thing' in an informed manner. The paper seeks to also contribute to the growing body of literature that reveals the important role digital technologies can play in supporting circular economy initiatives in this as in many other industries.

**Keywords:** *fast fashion, Ina Budde, garment reuse, material recovery, QR codes*

### Author Biography

**Gabriele Lettice** (formerly Fitzgerald) is completing her PhD at the University of South Australia. She employs a multidisciplinary approach to researching change in behaviour relating to consumption. Her research on consumer waste has included electronic waste in China, waste in the fashion industry, and organic waste practices in community organisations and their potential spill-over effects. **Robert Crocker's** research focuses on the relationship between consumption, waste, sustainability and design, and he has published widely on this theme, including in *Somebody Else's Problem: Consumerism, Design and Sustainability* (Greenleaf 2016), and more recently in two co-edited volumes of essays, *Subverting Consumerism: Reuse in an Accelerated World* (Routledge, August, 2018) and *Unmaking Waste: Towards a Circular Economy* (Emerald, September, 2018).

## Reuse of drinking water treatment sludge in mortar as substitutions of binder material

Danda LI[1], Yan ZHUGE[1], Chris CHOW[1], Xing MA[1] & Greg INGLETON[2]

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As by-product of drinking water treatment process, the volume of water treatment residuals (WTR) material has increased with the industrial development, so does the difficulties in the disposal requirement. Being a practical alternative solution for the disposal to decrease the environmental impact, sludge pre-treatment before added into mix is necessary to remove the organic component and reduce the volume. In this research attempts were made to employ both treated and untreated WTR as replacement for cement in concrete mortar mixes. Sodium hydra-oxide (NaOH) solution was employed as treatment method. As a preliminary investigation in this research 5% sludge replacement of cement was tried for both treated and untreated sludge material. 7-day and 28-day compressive strength test on control mix and WTR mixes were conducted. Focusing on WTR material properties analysis, X-ray diffraction (XRD) was used to find the mineralogical phase, X-ray fluorescence spectrometry (XRF) were used to analyse the chemical composition. At 28-day age SEM was used to investigate the microstructure and particle surface for both control mortar sample and WTR samples.

**Keywords:** *drinking water treatment sludge, reuse, cement, mix design*

### Author Biographies

**Dr Yan Zhuge** is a Professor in Structural Engineering at UniSA. Yan's main research interests include green concrete materials, utilisation of waste to construction materials and fibre composite structures. She has published more than 150 papers in the referred journals and conferences and has been invited as a keynote speaker at several international conferences. Yan has successfully supervised many PhD graduates.

## Understanding fashion design undergraduate students' perception regarding consumption

Verena LIMA & Maria Cecilia dos SANTOS

*Faculty of Architecture and Urbanism, University of São Paulo, Brazil*

This paper aims to present the perceptions of fashion design undergraduate students regarding consumption. The contemporary fashion industry has contributed significantly to the scenery of unsustainability as a whole, and specifically in its environmental dimension: the clothing sector is responsible for tons of pre-consumption and post-consumption waste. Faced with a reality of excesses, rather than look for solutions for the waste generated, it is needed to think about ways to not generate it. Thus, the consumption as a practice is a central issue to be understood and reinvented by fashion design, so that a possible starting point could be the consistent discussion of this issue in the context of undergraduate courses, in order to stimulate the students to conceive alternative models of consumption and more sustainable ones. In this way, an exploratory qualitative research was conducted with fashion design undergraduate students from three higher education institutions in Brazil, between 2016 and 2017. The data was collected through semi-structured interviews, and analyzed and interpreted through content analysis. In students' statements, it was evidenced the understanding of consumption as an emblematic practice in the context of fashion industry. Other understandings were also identified: the wish awakening and the obsolescence as decisive factors for consumption; the consumption as precondition for interpersonal relations; the power of influence of fashion industry on consumption behavior; among others. The importance of understanding about students' perception is justified since it allows the identification of issues related to consumption which are possible to be developed and deepened in the educational field, with the aim of enabling students to explore proposals that promote a more sustainable consumption.

**Keywords:** *fashion design, higher education, students' perception, consumption, sustainability*

### Author Biographies

**Verena Ferreira Tidei de Lima** holds a BA degree in Fashion Design and a MSc in Textile and Fashion. Currently, as a Ph.D. candidate at University of São Paulo, her research regards sustainability and fashion design education from the perspective of a critical pedagogy, focusing both on design and education as political acts within society. **Maria Cecilia Loschiavo dos Santos** is a philosopher and full professor of Design and Architecture at University of São Paulo. She got her MSc and her Ph.D. at University of São Paulo, Philosophy, in Aesthetics. She was a visiting scholar in postdoctoral programs at several universities. Her current research focuses on waste, social design, homelessness, recyclable waste pickers and social empowerment.

## Passifier: Concept design software for optimising energy efficiency in new Australian suburban housing

Christopher MARDELL, Ning GU, & Peter WALKER

*School of Art, Architecture and Design, UniSA, Australia*

Despite legislative requirements to encourage the construction of energy efficient homes in Australia, new homes continue to be designed and built with little consideration for the principles of Passive Solar Design (PSD), subsequently missing opportunities for significant long-term energy and cost savings. Lack of understanding by designers, builders and future homeowners is an important factor in this problem. Decisions that affect important features such as orientation, glazing, cross flow ventilation and zoning are often locked in during the concept design phase, yet many design and energy optimisation tools only provide feedback on energy performance later in the design process.

Through research investigation and design prototype development, this research will present a computational approach to integrate, optimise and automate the usage of selected key PSD principles into the concept design process of house design. The research focuses on two types of key stakeholder, namely potential homeowners and designers, and is demonstrated through the continuing development of a web-based home design software prototype. This prototype, named Passifier, offers a combination of automated layout generation using the user-specified block and room requirements, and real-time design feedback, simultaneously providing a rapid means of exploring potential energy-efficient designs to meet different customised criteria. This development is significant as it offers designers, potential homeowners, and development assessors an interactive and intuitive way to apply PSD in designing energy efficient homes, thereby improving the quality of Australian suburban housing. Further, the software can also be used for educational purposes, teaching end users and students alike about these fundamental principles and their applications.

**Keywords:** *passive solar design, energy efficiency, generative design, sustainable housing, house design*

### Author Biography

**Christopher Mardell** has a long-running passion for technology, creativity, and sustainability—particularly as it relates to the built environment—and is often exploring the intersections of these three passions: communicating ideas through writing, photography, graphic design or animation; designing energy efficient homes; or sketching ideas for new inventions.

A front-end web application developer by day, he has recently completed his Master of Sustainable Design at the University of South Australia, in which he explored the use of design and modelling software to encourage sustainable behaviour—initially by exploring potential impacts of urban policy decisions, and ultimately through the development of design apps to encourage the uptake of Passive Solar Design in new suburban housing.

Christopher lives in beautiful Adelaide, and occasionally tweets as @chrismardell.

## Plastic waste as art: Artists as provocateurs for new opportunities

Kirsty MÁTÉ

*University of Tasmania, Australia*

This paper explores through the author's own work and the work of four other artists who use plastic waste as the key material in their art practice. Sophie Carnell, a jeweller and artist; Tania Splawa-Neyman, a textile designer and artist; Linda Erceg, artist and Liane Rossler, designer were interviewed by the author to ascertain the question: 'Can art be a provocateur for offering new opportunities in the dilemmas of plastic waste?'

To discuss the findings from these interviews, I use the work of Jane Bennett and her ideas of 'vibrancy', the 'thingness' to explore the experiences of each of the artists and their use of plastic waste materials. This vibrancy, thingness, provokes a curiosity not only for the artists but for the viewers and users of their work. Curiosity for not only the material, but how the material came to be in this position of harmful waste and how it can be reused and avoided.

**Keywords:** *plastic waste, artists, hand craft, vibrancy, thingness*

### Author Biography

**Kirsty Máté** is Senior Lecturer, Program Director of Interior Design at the University of Tasmania, with over 25 years of experience in education, research and practice in sustainable design. She has recently submitted her PhD thesis, focusing on the impact of sustainable consumerism within the design of shopping 'scapes'. She is fascinated with the transformation of waste materials to test their use within interior environments.

## Does food waste management prevent food waste prevention? A review of food waste prevention research

Rudolf MESSNER, Carol RICHARDS & Hope JOHNSON

*QUT, Australia*

Waste management tackles food waste when and where it happens and after it has occurred, which is analogous to attacking the symptoms rather than the cause. This naturally leads to a consideration of food waste prevention, yet, the idea of "prevention" itself is beset by a number of conceptual paradoxes: it is considered a method of management of the waste which it was supposed to prevent in the first place, it is an ambiguous ecological behavior lacking the tangible characteristics of waste composting or recycling (i.e. prevention by its nature is invisible), and most importantly, as waste is linked to production and consumption, it is also deeply embedded in current economic norms and practices. In response to these dissonances of "prevention" and the inability of "waste management" to reduce the creation of food waste, researchers have proposed a number of new approaches, including the re-thinking of the holistic governance of food chains, the readjustment of the popular "waste management hierarchy" towards dematerialisation, and the re-appraisal of food overproduction as a key cause of food waste. This paper reviews the literature on food waste prevention, paying close attention to current thinking on the systemic over-production of food. Accepting Mourad's (2015) challenge to "think outside the bin", this work explores the links between the over-production of food and food waste. In doing so, this review both synthesizes the literature of food waste prevention and extends upon current approaches by incorporating a theoretical analysis of the linkages between overproduction, food waste and food waste prevention.

**Keywords:** *food waste prevention, overproduction, waste management hierarchy, food rescue, growth economy*

### Author Biography

**Rudolf Messner** is a PhD Candidate enrolled in the School of Management, Business School, Queensland University of Technology (QUT). **Carol Richards** is Senior Lecturer at the School of Management, Business School, at the Queensland University of Technology. **Hope Johnson** is a lecturer based in the Faculty of Law at the Queensland University of Technology.

## The essential role of regulation for sustainable consumption—successes and possibilities

Michelle MALONEY & Annabelle NILSSON

*Australian Earth Laws Alliance, Australia*

In this paper, we analyse how law and regulation can be used to address unsustainable consumption, and form a critically important part of any framework designed to reduce the amount of virgin resources consumed and help Australians live within their ecological limits and the productive capacity of the living world.

We begin with an overview of the problems created by human consumption, and an analysis of the complex economic, political and cultural barriers to reducing consumption. We then summarise a number of case studies, to demonstrate the positive role that collective responses can make—including state-centred regulation and civil society/community initiatives—to reduce the volume of material resources consumed by Australians. We then identify common principles arising from the case-studies, and apply those princples to an important driver of unsustainable consumption: planned obsolescence.

Planned obsolescence is the deliberate economic and design strategy that shortens the functional lifespan of products, to ensure consumers need to keep buying the same goods over and over again. This year, the Federal Government has invited public comment on the Review of the Product Stewardship Act 2011 . The Australian Earth Laws Alliance has been working with people around Australia, to provide input to the Review and campaign to end planned obsolescence.

**Keywords:** *sustainable consumption, waste minimisation, circular economy*

### Author Biography

**Dr Michelle Maloney** (BA/LLB (Hons) Australian National University, PhD Griffith University Law School) is Co-Founder and National Convenor of the Australian Earth Laws Alliance. Michelle manages the strategic direction and governance of AELA, including the extensive partnerships and networks that AELA has with the legal, academic, indigenous and environmental advocacy communities. Michelle also designs and manages AELA programs and events, including AELA's Rights of Nature Tribunals. Michelle's PhD examined the role of law and regulation in reducing unsustainable consumption, and she leads AELA's "GreenPrints" program, which helps community groups understand and implement Earth centred bio-regional governance. **Annabelle Nilsson** (BA/LLB (Hons)) is the Project Manager of the Australian Earth Laws Alliance (AELA) Challenging Consumption Program and leads the Planned Obsolescence law reform project. Annabelle also practices as a solicitor advising traditional owners of Cape York Peninsula, Queensland about the co-management of environmentally protected areas and the management of indigenous freehold land.

## Construction waste mapping protocol (CWMaP)': A new conceptual model towards optimising the generated construction waste and their associated carbon impact

Vasilios PAPASTAMOULIS[1], Kerry LONDON[2], Robert CROCKER[1] & Petros PATIAS[3]

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[2]*Western Sydney University, Australia*

[3]*Aristotle University of Thessaloniki, Greece*

The purpose of this theoretical article is to promote a novel conceptual model called 'Construction Waste Mapping Protocol: CWMaP' to optimise the carbon impact of the generated construction waste materials (CW). The philosophy of the proposed model advocates sustainable construction waste management and circular economy by embracing the 9Re CW policy: Rethink; Redesign; Redefine; Reduce; Reuse; Recycle; Recover; Refuse and Rebuy. The quantitative methodology of the CWMaP consists of a measuring protocol and geospatial-remote sensing methods as well; the protocol encompasses specific CW performance indicators and procedures to ensure transparent and solid data from construction sites based upon a hierarchical classification system; the ontology and epistemology of the Geographic Information Systems and Unmanned Aerial Vehicles, have been embraced in this methodology to address efficiently the location/allocation problem of the resulting CW materials, and to visualise their carbon impact. Thus, a geodatabase is being created in this case study to record and store the type and amount of the resultant CW materials in each site by geocoding them. In doing so, the engaged stakeholders (local governments; developers; contractors; collectors and waste management facilities) can be informed about the true recycling potential of CW that is produced in different venues and ameliorate their decision policy towards underpinning circular economy. Additionally, by optimizing the transportation routes of CW from sites to the final destinations through the ArcGIS Toolbox the associated carbon dioxide emissions can be reduced significantly.

**Keywords:** *construction waste, protocol, GIS, drones, carbon emissions, sustainability*

### Author Biography

**Mr. Vasilios Papastamoulis** is a PhD student researching the Construction and Demolition Waste (CDW) management field. He has experience in managing CDW for more than ten years as a site manager on several large construction projects overseas. Recently, he has joined in a relevant research project of the School of Natural and Built Environments, University of South Australia.

## Construction and demolition waste (CDW) classification problem: A pilot taxonomy system towards ameliorating the inconsistencies and underpinning circular economy in Australia.

Vasilios PAPASTAMOULIS, Jorge Ochoa PANIAGUA, Rameez RAMEEZDEEN, Ning GU, Tim MCGINLEY, Ki KIM, Wolfgang MAYER & Nicholas CHILESHE

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Recent waste reports in Australia acknowledge the poor quality of Construction and Demolition Waste (CDW) data available. Such reports are critical as they are used by decision-makers to define policy directions and establish targets. However literature suggests that there is inconsistent data collection and quantification of waste due to the lack of a common definition, the need for a classification of CDW streams, and inconsistent recording and reporting systems. Such inaccuracies have an impact on the circular economy practices in the construction industry. This study aims to ameliorate the classification problem regarding CDW that currently exists between the Australian states and territories. Therefore this study analysed existing CDW classification systems from Australia's eight state jurisdictions and the top waste producing countries. Such countries included Europe, China and the USA. This study utilises both literature review and content analysis methodologies. A hierarchic taxonomy of CDW that is based on the various properties of the materials and advocate the circular economy in Australia was also developed.

**Keywords:** *construction and demolition waste, waste classification, waste analytics, designing out waste, taxonomy*

### Author Biography

**Mr. Vasilios Papastamoulis** is a PhD student researching the Construction and Demolition Waste (CDW) management field. He has experience in managing CDW for more than ten years as a site manager on several large construction projects overseas. Recently, he has joined in a relevant research project of the School of Natural and Built Environments, University of South Australia.

## Speculative circularity: Artists as material innovators

Kelly PENDERGRAST & Maura DILLEY

*ANTISTATIC, USA and Cradle to Cradle Products Innovation Institute, United States of America.*

Redesigning our production processes and supply chains to reduce waste will require a process of critical reimagining and deep systems change. Artists are accustomed to imagining new worlds, impossible materials, and speculative systems, but their practice is often academic. In this paper we explore how artistic practice can be applied to the challenge of unmaking waste. We examine the work of a number of contemporary North American artists whose focus on circular economies and material innovation has moved beyond the art world and into the fields of design and commercial manufacturing.

The paper rests on in-depth interviews with artists-turned-innovators Philip Ross and Sophia Wang, founders of Mycoworks which uses mycelium to replace foam and leather, Abigail Glaum-Lathbury and Maura Brewer, whose Rational Dress Society project investigates new production models and material reutilization, and Sean Raspet, founder of radical flavor and algae-based food lab Nonfoods. Through conversation with the artists about their navigation of the science and economics of material innovation, the paper explores how artists have expanded their practice beyond the art world into commercial supply chains and material economies.

The paper ends with a series of insights and concrete recommendations on how artists can maximize their impact on systems and production processes without their work being recuperated or appropriated by capital, and introduces new ideas into the lexicon of circular design.

**Keywords:** *circular economy, art, material innovation, manufacturing*

### Author Biographies

**Kelly Pendergrast** is a media artist, writer, and strategist based in San Francisco. Her work focuses on environmental justice, sustainability, tech, and labor issues. As co-founder of ANTISTATIC, Kelly works with environmentalists, technologists, and social enterprises to bring clarity to complex issues and promote systems change. She holds a bachelor's degree from the University of Otago and a Master of Fine Arts from the University of California San Diego. **Maura Dilley** is the Fashion Positive Community Manager with Cradle to Cradle Products Innovation Institute. She is a movement builder designing engagement and education to bring circular economy principles into the second most polluting industry in the world, fashion. She holds a masters degree in Strategic Leadership towards Sustainability from the Blekinge Institute of Technology in Sweden.

## Digital wasteland

Thea PETERSON

*Royal College of Arts and Imperial College London, United Kingdom*

Efforts to manage a sustainable economy have increasingly turned towards digital solutions, with considerable success. However, digital solutions come with their own costs, and sustainability issues. Growing our digital economy requires the continuing construction of data storage centres, rising electricity consumption and continual heat management. These processes all directly contribute to greenhouse gas emissions, rising global temperatures and mining and depletion of metals, all problems associated with the carbon economy. Is it really better to reduce consumption of physical materials overall, if that simply means more of a drain on specific resources? With such a huge shift towards the digital, we will need a much larger sum of a much smaller range of resources, the primary one being renewable energy, and we simply don't have it. This paper examines these problems in light of the circular economy paradigm, and asks what changes consumers, producers, policymakers and designers need to be aware of in applying reduce, reuse and recycle to our growing digital economy. The challenges to creating a sustainable digital economy are daunting, but we are currently in an excellent position to foresee emerging problems and lay the groundwork for a sustainable future in ways our predecessors during the dawn of the industrial revolution could not.

**Keywords:** *digital, ICT (information communication technology), waste management*

### Author Biography

**Thea Peterson** is a graduate student on the joint masters course Global Innovation Design offered through the Royal College of Arts and Imperial College in London. She has also studied at Tsinghua University in Beijing and Nanyang Technological University in Singapore. She received her BFA from Miami University. Her work explores sustainability and the circular economy across multiple cultural contexts, both at global and local scales, utilizing both ethnographic and data driven systems research methodologies.

## Coffee on the run: Enablers and barriers to enacting pro-environmental behaviours in everyday life

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The increasing presence of large quantities of disposable coffee cups in the waste and litter streams is a concern for waste managers across the coffee-drinking world. While there have been a number of recent studies conducted on this problem, most have concerned themselves with encouraging behaviour change in coffee drinkers through a variety of financial and informational encouragements. This paper rejects this approach as largely ineffective, and instead explores the social and institutional drivers behind coffee cup waste. It describes possible pathways towards a richer and more accurate understanding of this intractable problem, and how it might be more fruitfully tackled. Reflecting upon, and building upon a trial conducted by staff from the City of Adelaide in South Australia during 2017, the paper critically examines what has become a now fairly typical attempt to shift behaviour from throwaway to reusable coffee cups using a combination of information and monetary incentives. Based on further in-depth interviews with coffee drinkers, café owners, baristas and local authority workers involved in the trial, this paper concludes that in order to meaningfully tackle the issue of coffee cup pollution, it is necessary to look beyond the individual consumer to the cultural and institutional factors currently pro-environmental coffee drinking behaviours.

**Keywords:** *disposable coffee cups, coffee culture, waste and litter, cultural and institutional factors, individualisation, consumer behaviour*

### Author Biography

**Alana Potts** is passionate about waste and solving its negative impacts on the environment. As an Honours Student in Urban and Regional Planning at the University of South Australia, she undertook a research project in collaboration with Robert Crocker and Sukhbir Sandhu, co-authors of this paper, which was funded by the China Australia Centre for Sustainable Urban Development. This project became the basis of her Honours Thesis, and of this paper.

## Rethinking ground

Chiara PRADEL

*Politecnico di Milano, Department of Architecture and Urban Studies, Italy*

This investigation begins from an empiric approach during an ongoing landscape project of a depot of inert waste to be placed in a valley in Switzerland, including considerations on the elementary actions of moving ground inside a building site. Historically, the process of re-shaping the land with earth has had great consolidated implications for metropolitan, urban, rur-urban and agricultural life: sacred, social, ecological, artistic, political and economic. Currently, within the global economic and environmental context, the reuse of earth and recycling of inert waste represents necessary political, social and design issues, as well as a fundamental aim of the 7th Environment Action Program and the UN's Sustainable Development Goals.

How can we participate in this challenge, through Landscape Architecture? This study critically interlaces theoretical patterns, crossing the borders between the vision on waste and ecology of Gregory Bateson, Braungart and McDonough, proceeding through Ecological Urbanism and the holistic understanding of the site by the topological approach developed by ETH Zürich and Atelier Girot. Realized study cases are examined as evidence or results of those methodologies and as examples of creative design. In particular, this paper highlights how large amounts of inert waste have been used for a renaturalization practice of a river delta or, through a topological intervention, for the design of an artificial mountain in a delicate environment, concluding with a cultur-scaping which rehabilitates an existing landfill, leaving behind the evidence of its earlier existence and transforming it, thanks to the cultural approach of design, into a park.

**Keywords:** *eco-design and developement, ground, renaturalization, topology, cultur-scape*

### Author Biography

**Chiara Pradel**, PhD Candidate in Architectural, Urban and Interior Design at Politecnico di Milano, Italy, graduated in Architecture at IUAV di Venezia and received a postgraduated research Master in Architecture of the Territory at Accademia di Architettura, Mendrisio, Switzerland. Her professional experience revolves around Landscape Architecture. She lives and works in Italy and Switzerland.

## Industrial design education and the circular economy: experiences from UNSW Sydney

Mariano RAMIREZ

*Faculty of Art and Design, University of New South Wales, Australia*

Since the 1970s the Industrial Design profession has been criticized for promoting wasteful consumption through such irresponsible practices as 'designing for the dump', fad-driven obsolescence, unnecessary gadgets, over-packaging, short-lived products, and so on. Most manufactured products still follow a 'cradle-to-grave' or 'linear-economy' lifecycle. This paper seeks to examine how the tide could be reversed by educating young designers to be more conscious of their agency in promoting sustainable consumption via their innovative design ideas. Submissions of third year UNSW Industrial Design students in response to a 'Circular Economy Challenge' studio brief written by the author have been analyzed, alongside their reflections on experiencing such a design challenge. The students were tasked to design a tangible product that would enhance or enable a 'collaborative consumption' or 'sustainable product service system', such that community members are encouraged or empowered into adopting more environmentally beneficial and socially responsible consumption behaviors. Their design proposals should be system innovations that shift the focus from the design of physical products for private ownership to that of an integrated mix of products and services for publicly shared access. Submissions received from students were highly varied, ranging from amenities and facilities for community members or for the general public; some free-of-charge and some pay-per-use; some fully-automated and some requiring personnel to operate and maintain the service; and some were systems which required returnable containers and refilling equipment. Post-project reflections evidenced that students had generally positive experiences in learning how to design for a circular economy.

**Keywords:** *circular economy, industrial design education, studio teaching*

### Author Biography

**Dr Mariano Ramírez** is a Senior Lecturer in Industrial Design at the University of New South Wales in Sydney. His research interests include the integration of environmental and social sustainability aspects in industrial design education and practice, the optimization of product lifetimes, enabling sustainable consumption behaviors, and product design approaches for realizing the United Nations Sustainable Development Goals.

## Design for sustainability in undergraduate courses: The state of the art in Brazil

Maria Cecília Loschiavo dos SANTOS & Marcelo AMBROSIO

*Faculty of Architecture and Urbanism, University of Sao Paulo, Brazil*

Much of the environmental cost of a product is determined at its design. It is from this premise that this work aims to understand how the academic formation of undergraduate students in relation to design for sustainability occurs. This stage of the research sought to establish the state of the art of approach to sustainability in higher courses in design in Brazil based on the evaluation of institutional documents from 40 relevant universities. The documents analyzed were teaching plans and plans for undergraduate courses in Design, Industrial Design and Product Design.

The data catalog was treated using the recurrence and articulation analysis method. The results composed a significant frame of the institutional relationship of Brazilian universities, especially in design courses, with the theme of sustainability. They also determined relevant issues for future field verification through experiences and interviews. The understanding of the current models of environmental approach in the educational background of designers is fundamental to broaden the reflection regarding its field of expertise and also to the establishment of parameters for the dialogue of teaching in design with the contemporary problems.

**Keywords:** *design, teaching, sustainability*

### Author Biography

**Maria Cecilia Loschiavo dos Santos** is full professor of Design at the School of Architecture and Urbanism, University of São Paulo, Brazil. She is an internationally recognized scholar and a guest lecturer in several universities. Her research focuses on design and sociotechnologies in Brazil, with emphasis on: sustainability, social design, socio-spatial exclusion, street dwellers and recyclable waste pickers. She is author of several books, among them *Design, waste and dignity.* **Marcelo Ambrósio** is a Doctoral student at the Faculty of Architecture and Urbanism at the University of São Paulo [USP], Master of Environmental Sciences at the Graduate Programme of Environmental Sciences at the University of São Paulo [PROCAM/USP], Bachelor of Design from the Federal University of Paraná [UFPR]. Lecturer at the Federal Institute of Paraná (IFPR).

## Blockchain: Wasted design futures?

Tristan SCHULTZ & Paula HARDIE

*Griffith University, Australia*

This paper explores how the implications of designing, or not designing, with blockchain technology for waste and other initiatives in the interests of socially responsible and sustainable futures. It describes existing problems in waste systems, while critiquing blockchain's relations with broader global resource consumption and complex material-history conditions of blockchain and waste within sharing economy and decolonial discourses. Three cases of 'blockchain and waste' (AREP, Plastic Bank and SORT) are provided. Pathways for moving forward where communities, enabled through participatory design, might actively contribute to blockchain futures in managing waste are then discussed.

**Keywords:** *blockchain, waste, critical design*

### Author Biography

**Tristan Schultz** is a lecturer in Design at Queensland College of Art, Griffith University. He is also founder and creative director of the strategic design practice Relative Creative and one of eight members of the decolonising design platform. **Paula Hardie** holds a Bachelor Design Futures and is a masters student in Design Research at the Queensland College of Art, Griffith University. She is a practicing visual communication designer working to leverage socially engaged initiatives.

## Sustainable marketing: From mythology to science

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Sustainable marketing aims to encourage consumer behaviour that improves the environmental and social outcomes of consumption. Despite decades of efforts, minimal changes in consumer behaviour have been achieved and the green consumer remains as elusive as ever to marketers. This paper explains that this is because sustainable marketing is hampered by assumptions about how buyers think and behave that marketing science has shown not to be true. Commonly accepted sustainable marketing myths are identified and empirically-based laws of marketing are drawn upon to show why they are wrong. The process and benefits of moving to view of sustainable marketing that has greater scientific underpinnings are illustrated.

**Keywords:** *sustainable marketing, green brands, consumer behavior, marketing science*

### Author Biography

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## Waste management in developing low carbon precincts

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Production of enormous amount of waste and inadequate waste management have depleted global stocks of non-renewable and renewable resources. Beyond strategies such as reuse, recycling and reduction, the more integrated strategy of zero waste provides the most effective means for reducing waste in urban environments, which adds avoidance and reduction at the start to the end of pipe solutions. As zero waste is not always affordable and feasible, circular economy treats wastes as resources and can be regulated in form of industrial symbiosis plotting the relation between wastes from one resource to other. Industrial symbiosis is realizing a value in the loss of resources in waste. The waste management can be more effective if low carbon practices are followed. The waste management system requires an effective implementation strategy with a reliable performance measurement mechanism 'indicators' to implement circular economy.

This paper reports a part of a project "Indicators for the Design, Development and Management of Eco-precincts; Mawson Lakes and Tianjin University Campus". Relevant research on low carbon precincts and waste management have been reviewed using document analysis. The paper reports findings resulting in a list of indicators pertaining to waste management in low carbon precincts. Recommendations are made on estimating the carbon reduction potential through indicators developed and measure the emission benefits by calculating the amount of emission and comparing the reduction after implementing the indicators to examine the benchmarks and the progress towards low carbon outcome in Mawson Lakes Campus in South Australia.

**Keywords:** *waste management, zero waste, indicators, low carbon precincts*

### Author Biography

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## Time to reboot: an applied anthropology of electronic waste in central Australia

Gideon SINGER

*Purdue University, Central Queensland University, Australia*

Anthropological archaeologists have increasingly integrated archaeological and ethnographic methods to make contributions to policy, public perceptions, and behavioral interventions concerning consumption, discard, recycling, and reuse (Rathje 1978; Schiffer et al. 1981; Adams 1984; Tani and Rathje 1995; Brunclíková 2016; Sosna 2016). This paper engages with anthropological analyses of waste to illuminate the dynamics of waste related social and environmental issues (Rathje 2011; Harrison 2011; Sosna and Brunclíková 2016). As one of the world's fastest growing waste streams, electronic waste (e-waste) presents a complex set of challenges and opportunities for members of the public, policymakers, and industry. Sosna and Brunclíková employ us to consider "what is waste really, and what are the most productive ways to approach it within and across the disciplines" (2016, p.1)?

Studies of e-waste within the domains of waste management (Li et al. 2009; Kiddee et al. 2014), ecology (Leung et al. 2008; Sepúlveda et al. 2010), and health (Grant et al 2013; Liu et al. 2014; Liulin et al. 2011; Song and Li 2014, 2015; Zhao et al 2010) tend to address the effects of e-waste after it has already been discarded. The Australian Bureau of Statistics (2013) defines e-waste as "waste electrical and electronic equipment that is dependent on electric currents or electromagnetic fields in order to function (including all components, subassemblies and consumables which are part of the original equipment at the time of discarding)." Internationally, a range of electronic devices including televisions, computers, mobile phones, toys, toasters, kettles and almost any household or business item with circuitry or electrical components with power or a battery supply may fit this classification of e-waste (Babu et al. 2007, p.308; Pérez-Belis et al. 2014, p.17). These definitions, however, still beg questions of how, why, when, where, and for whom do electronic objects become waste?

**Keywords:** *electronic waste, sustainability, conservation*

### Author Biography

**Gideon Singer** is an anthropological archaeologist, who investigates the dynamic relations between society and the artifacts—the physical remains of material culture which have been designed, manufactured, used, and discarded by us. Prior to graduate school he worked on archeological digs around the U.S., Caribbean, and Australia. His research on e-waste in Australia has it roots in Unmaking Waste in 2015. Throughout 2017 he conducted ethnographic fieldwork as an Australian-American Fulbright Postgraduate Scholar in Alice Springs, Northern Territory. He is currently writing a PhD dissertation at Purdue University titled "An Applied Anthropology of Electronic Waste in Central Australia".

## Comparing Australian and Chinese tertiary students' knowledge and attitudes towards the environment

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To tackle the environmental issues such as air pollution, climate change, or the loss of biodiversity created by human activity, it is necessary to raise people's awareness towards the environment. Education is one of the most convenient ways to achieve that because higher environmental problems are becoming more and more relevant at all educational levels particularly universities. Therefore, governments and universities worldwide have increasingly realized the importance of including environmental education into university curriculums. In this way, the investigation of university students' environmental knowledge and appreciation has been widely studied as the response to increased concerns about environmental degradation. In essence, students' environmental knowledge and appreciation relate to their knowledge and attitudes towards pressing environmental problems. By having basic understanding about the influences of their daily activities on the environment, it could help to formulate students' appropriate actions and behaviours as local and global citizens. This paper discusses students' knowledge and understandings on the environment, and their attitudes towards the environment in both Australian and Chinese Universities. 230 students at Mawson Lakes campus of University of South Australia (Australia) and Beiyangyuan Campus of Tianjin University (China) participated in doing an online questionnaire survey. Employing descriptive and inferential statistical analysis in SPSS, this study explores the viewpoint of students on lifestyle and their motivations, included norms, interests, beliefs, and general attitudes which taken together have an important role in determining their daily personal choices in relation to how these impact on the environment. The results of this research help to determine policy actions, particularly with regard to the educational system and curriculum can be undertaken to improve students' interest in the environment, based on the experiences of Australia and China.

**Keywords:** *the environment, personal attitudes, environmental knowledge and appreciation, Adelaide, Tianjin*

### Author Biography

**Ali Soltani** is Professor of Planning from Shiraz University and currently a Research Fellow at UniSA. **Andrew Allan** is a senior lecturer in transport, urban and regional planning at UniSA. **Chris Saint** is the Dean of Research, ITEE, and he has 30 years experience in areas of environmental science. **Ha Anh Nguyen** works as a Lecturer with University of Transport and Communications, Vietnam. **Stephen Berry** is building scientist specialising in energy and carbon impact of residential/non-residential buildings. **Jian Zuo** is an Associate Professor at the University of Adelaide.

## Social sustainability in the built environment: A critical conceptual framework

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Sustainability has been embraced in various fields and drawn attention by international and national organizations to achieve a greener and more sustainable future. Within the field of urban planning, sustainable urbanism is becoming a contemporary trend for planners and designers with the aim of addressing problems incurred by cities through legislating policies and implementing various sustainable strategies. In most of these urban strategies, they mainly target environmental and economic sustainability, and rarely consider social sustainability. Literature suggests that while environmental sustainability is important, a sustainable plan cannot be successful in the provision of residents' well-being until it addresses social sustainability. However, although considerable research has been devoted to the economic and environmental aspects of sustainability, rather less attention has been paid to social sustainability. As some researchers claim, the concept of social sustainability is not "science-based" and is difficult to be formally studied and understood. Although the concept of social sustainability is extensive, increasing numbers of studies have suggested that by enhancing certain design elements of the built environment such as accessibility and permeability, positive effects can be created on the social sustainability dimension leading to the improvement of the people's well-being. Therefore, social sustainability is important, and there is an urgent need for further research in the design domain.

This paper proposes a social sustainability conceptual framework, which focuses on the role of design in the built environment for enhancing people's well-being. The framework was developed using content analysis method and systematic literature review. This context-based and discipline-focused approach will provide a functional definition and classification for social sustainability in the built environment. The framework can assist designers and planners in formally defining and prioritizing different elements of social sustainability in their decision-making process.

**Keywords:** *urban sustainability, social sustainability, built environment, well-being*

### Author Biography

**Sahar Soltani** is a PhD student in the University of South Australia. She holds a Bachelor degree in Architecture from Kerman University, and a Master's degree in Architecture from Yazd University, Iran. She is interested in the study of the interactions between the built environment and people's behaviour. Her current work is multidisciplinary research employing computational design to explore the relationship between social sustainability and urban density.

## Tanna clay stoves

John ULLINGER

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The paper and slide presentation will tell the story of a sustainable design project on the remote South Pacific island of Tanna. It was an immersive process involving little to no budget, and a population just finding their feet after a massive cyclone wiped out housing and crops in 2015. It involved finding suitable local materials and engaging a community group of primarily women in product development, manufacture and marketing of a clay stove for domestic cooking. The stove leads to a reduction in fuel use, smoke inhalation, burns and risks to women collecting fuel.

This paper develops a theoretical and practical rationale through an examination of academic literature surrounding appropriate technology and technology transfer into developing economies and juxtaposes this with the practical experience of carrying out such a process.

Purpose: To improve conditions for women and children through simple and sustainable improvements to cooking technology without involving imported products and fuels. To establish a community based enterprise to manufacture and market products for the domestic market without importation of materials or significant machinery.

Methodology and methods: The project involved the cyclic process of action research ie Study, participation and reflection and then repeat until the project ends or a satisfactory outcome is achieved.

Photography played a big part in recording the prototyping, workshopping, manufacturing and marketing of the project

Implications: The people of Tanna are in a state of flux, rightly or wrongly the tourists are coming and they are going to move into a cash based economy from a barter system. The rationale of this product /process is that the environmental and social conditions are affected minimally and the modest economic and health effects are of benefit to the widest part of the community.

**Keywords:** *appropriate technology, sustainable development, craft, design community based enterprise, community development*

### Author Biography

**John Ullinger** completed a Masters Degree in Sustainable Design at UniSA (2017) and has been researching appropriate technology and development. He has a lengthy background in ceramics and its technology. He has a Bachelors Degree in Ceramic Design from the SACAE, Underdale (1986) and a Masters Degree in Ceramic Design for Industry from Staffordshire University, Stoke on Trent (1996).

## Exploring design methods for application of recycled materials in architecture: competition experience in Shiraz University

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In the last few decades waste increase has become a global concern. In order to reduce waste, universities, as the most powerful educational centers, have a leadership role. Accordingly, Shiraz University as one of the oldest universities of Iran has organized several related seminars, workshops, exhibitions and academic courses to improve waste reduction awareness. One of the above mentioned nationally awarded practices is ZIBAZYAFT being annually organized by the Faculty of Arts and Architecture. Started from 2011, ZIBAZYAFT National Competition aims to challenge students to find various practical methods for waste reduction via reusing and recycling materials. The competition challenges teams to recycle wasted materials for the creation of a wall, roof or canopy in creative ways. Over the last 5 years 127 teams from 30 universities have participated in the competition. In current research, firstly the presented projects were reviewed applying case study research method. The entries have three different approaches bringing life back to the wastes: I. Recycling: introducing new materials via recycling wastes; II. Reusing: using recycled materials to make new compositions; III. Reforming: changing, editing and reshaping the recycled materials to represent them in new forms. So the eateries have been divided into the three mentioned categories. In the next phase, the ranking technique has been used to evaluate the feasibility of presented projects in profession based on the several experts and professional architects' viewpoint. They have been asked to fill a questionnaire and rank the different weighted criteria suggested by the competition board. Using ranking method, the results reveal that two of the most significant criteria influencing the respondent are "site operation" and "design and architecture". It also shows that a little hierarchical relation between our three approaches are recognized by juries and participants. The conclusion also demonstrates that architects has an important role to play in construction waste minimization and reduction.

**Keywords:** *waste, recycle, reuse, Zibazyaft, Shiraz University*

### Author Biography

**Maryam Ekhtiari** holds a Ph.D. degree in Architecture from University of Tehran, and is an Assistant Professor at Shiraz University. She has expertise in environmental psychology and green architecture and her research ranges from "Quality of integral relationship between human needs, desire and architecture" and "relationship between sustainability and historical buildings" to "reduce waste". **Roza Vakilinezhad** is Assistant Professor at the Shiraz University. She had studied Architecture and received PhD degree from Iran University of Science and Technology. She is interested in sustainable environmental design, climate responsive and vernacular architecture. **Kaveh Fattahi** is Shiraz University's Director of Construction Management Office and an Assistant Professor. In 2006 he was awarded the competitive Monbukagakusho scholarship from Japan's Ministry of Education, Sports, Science and Technology. He received his Ph.D. in Architecture from Hokkaido University where he also worked as a Postdoctoral Fellow.

## Out of sight, and maybe mined: legacies of marine contamination in a circular economy

Hazel M. VANDELEUR & Craig A. STYAN

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Coastal smelters and refineries around the world have created serious pollution legacies in adjacent marine systems which are often ignored. Marine remediation is difficult and expensive, so unfortunately these legacies are frequently then left for others to address post-closure. While different technical options exist for remediating sediments, the costs of these are also often poorly understood which helps fuels the status quo of inaction. Usually, remediation of contaminated sediments is viewed simply in terms of the costs associated with dredging and then disposing of the sediments. However, the value of recoverable metals should be considered as well as whether works might be undertaken before smelters/refineries cease operations. The reimagining of contaminated sediments as a potential resource base for recycling metal ores could radically alter the way sediments are dealt with and encourage industry to clean up pollution legacies while still operating. This could in turn lead to better environmental outcomes, more efficient industry practices and new jobs. Similarly, making use of other associated facilities and metallurgical expertise is rarely considered when planning remediation activities and is a lost opportunity if clean-up only begins after smelters/refineries close.

Port Pirie in South Australia hosts the world's largest lead and zinc smelter and, with significantly contaminated marine sediments resulting from over 125 years of operations, is an ideal case study to explore the viability of the remediating the legacy of metal contamination in marine sediments. By characterizing the resource (measuring the spatial extent and level of contamination) and using systems dynamic modelling with the smelter (encompassing ecological, industrial processing and financial considerations), we are assessing resource recovery and remediation approaches to contaminated marine sediments. The outcome will hopefully guide cost-effective remediation of a significantly contaminated area, modelling an approach that could be adopted in many other places around the world.

**Keywords:** *smelters, refineries, sediments, contamination, metals, industry*

### Author Biography

**Dr Hazel Vandeleur** is a researcher for the University of South Australia in Adelaide. Hazel has spent 16 years in academia, industry and Government specializing in the impacts of industry and infrastructure on marine systems with a particular focus on sediments. **Dr Craig Styan** is lead for a group from Engineering Sciences at University College London based in Adelaide, South Australia, at UniSA. Craig's research is focused on the monitoring and managing the environmental impacts of energy and resources developments, but he also has an interest in the social aspects of sustainable development".

## Rethink rubbish: Using design to change the way we think about consumption and waste

Niki WALLACE

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The impact of consumption is widespread and a significant body of literature identifies post-consumer waste as one of our most pressing environmental threats. Designers are frequently employed to create the visual rhetoric used to persuade people to consume excessively. Products, their packaging, and associated advertising/promotional materials are created by designers—often using unsustainable thinking, techniques and materials—the outcome of which accelerates consumption and exacerbates the post-consumer waste problem.

To counter this unsustainable design activity, the Rethink Rubbish project sequesters the tools and media traditionally used by communication designers to accelerate consumption and repurposes them to foster a community of conscious consumers. The project aims to encourage sustainable consumption and active engagement in circular and sharing economies, with the end-goal of waste minimisation. Rethink Rubbish uses transition and autonomous design methods to rethink consumption and waste, and is underpinned by radical design thinking, values and framing, and collaboration. The project aims to inspire and demonstrate approaches that create change.

Rethink Rubbish is being piloted at Alberton Primary School, where opportunities to embed sustainability into the curriculum are being explored in order to build a consciousness of waste and its connection to consumption. The knowledge gained from the school's 'life sciences centre', their newly implemented 'idea shed' and their zero-waste transition, is being captured in a suite of resources that deepen the school's understanding of sustainability and support its ongoing integration into teaching and learning. The project's collaborative approach facilitates students' identification of the connected problems of consumption and waste, and their responses to the problem at large are being developed collaboratively with the support of the researcher and their teachers. This paper documents the progress of the pilot program and demonstrates how positioning the designer/researcher as author/activist/facilitator can redirect design's agency towards sustainable outcomes that use design to create change.

**Keywords:** *sustainable consumption, waste minimisation, circular economy, zero waste, transition design*

### Author Biography

**Niki Wallace** is an Australian-based designer, writer and agent of change. Her communication design practice spans print, digital and interaction design, with a focus on design for transformation and change. Niki's research also focuses on design for change and she is a PhD candidate at University of South Australia. Her thesis investigates the intersection of design for change, power dynamics and the consumption and waste problem through collaborative design methods that are underpinned by radical design thinking for sustainability. Niki is an early career academic who has embraced a zero waste lifestyle both personally and professionally.

## Small is beautiful: Re-imagining the 'economy of scale' in our food system

James WARD

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The economic objective of maximising labour productivity has caused our food system to increasingly equate "innovation" with automation and mechanisation. Scale has relentlessly increased at all levels in the system—giant farms are now tended by enormous and increasingly autonomous machines, produce is moved via huge trucks through long-distance distribution systems, eventually retailed in vast supermarkets that culminate in automated self-serve checkouts. In Australia over the last 25 years, work in the Agriculture, Forestry and Fishing sector has declined from 8% to just 3% of total hours worked (ABS figures).

Pitched in stark contrast to this sectoral trend is the groundswell of public support for local food production, both small-scale farming and local artisanal food and beverage processing. This raises the prospect of a new kind of innovation and a different attitude towards economies of scale—not scaling the production and distribution processes via extreme mechanisation, but instead scaling through pseudo-replication of small-scale, local operations. There are many potential and hypothesised benefits, including reduced supply chain length with concomitant emissions reductions, re-connection of consumers with their food system, and better recycling of wastes and nutrients. The question of optimal scale has not been studied in detail, and requires a full systems thinking approach to test the scale dependencies and efficiencies of each component (market gardening, transport, food processing, retail, waste). Equipped with sufficient data, the food system could be optimised around a new objective: determining the operational scale that maximises sustainable jobs.

**Keywords:** *market garden, food system, optimal scale*

### Author Biography

**James Ward** is a Senior Lecturer at UniSA, and conducts his research according to the philosophy 'think global, act local'. He researches global sustainability issues such as fossil fuel energy resource constraints and limits to growth, while also investigating local responses including sustainable urban agriculture and food systems, reuse of wastewater and other waste resources, and the circular economy.

## Evaluation of waste management policies on construction and demolition waste sector in Australia: focus on SA

Huanyu WU, Gillian ARMSTRONG, Yulun PAN & Jian ZUO

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Addressing Construction and Demolition waste has become a worldwide issue, which attracts attention from scholars and policy makers alike. Construction and demolition waste accounts for a large part of the waste stream of solid waste in Australia. Australian governments, at both federal and state levels, have launched a series of waste management policies during last three decades to encourage more efficient use of our resources. Despite the best intentions and efforts of all stakeholders, construction and demolition waste has increased by twenty percent between 2006 and 2015. This paper is evaluating the possible impact of legislation on waste management practices in South Australia, during a defined time period in which the researchers noticed an anomaly in the volume of C&D waste generated in Australia. Our aim is to provoke greater discussion by providing policy analysis alongside empirical Construction and Demolition waste data for South Australia. By shining a light on South Australia, this paper aims to encourage discussions of C&D waste policy in other Australian states and territories.

**Keywords:** *construction and demotion waste, waste management policy, waste management*

### Author Biography

**Huanyu Wu** is a PhD candidate in School of Architecture and Built Environment in the University of Adelaide. His started research on construction and demolition waste management in 2012. His previous studies were around the characterization of generation and flows, environmental impacts and recycling potentials of construction and demolition waste in China. **Gillian Armstrong** is a UK registered Architect and a Chartered Architectural Technologist, practiced in Manchester UK for over 10 years alongside lecturing in architectural studies. Her PhD tackles regulatory barriers to adaptive reuse of existing buildings, evaluating building populations within two Australian CBDs alongside policy and practice. **Yulun Pan** is a master student in School of Architecture and Built Environment in the University of Adelaide. **Dr Jian Zuo** is an Associate Professor at the School of Architecture and Built Environment, The University of Adelaide. His main research interest is to achieve sustainable built environment through stakeholder engagement. Dr Zuo's recent publications address various issues associated with low carbon built environment from technological, managerial, social and legal perspectives.

## Transforming pet waste for a circular economy: what are the wastes and what can be done?

Janette YOUNG[1], Zoei SUTTON[2], Sheila SCUTTER[3], Carmel NOTTLE[1] & Ali SOLTANI[1]

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Keeping companion animals or pets in human domestic spaces and lives is a global phenomenon. However, waste products related to the keeping of these animals may have negative environmental impacts including odour, public space and water pollution, and addition to landfill. Pet waste is also a health issue as it can be a source of disease through the presence and distribution of organisms such as bacteria and worms. Australia has one of the higher global rates of pet ownership with over 60% of households owning a pet (more than 25 million animals). This indicates a lot of feces, in addition to the other wastes that are associated with pets, which become part of the domestic waste stream. This research uses multiple sources to map out the breadth of information referring to pet waste, to identify the span of "pet wastes", and to scan the local and online policy and practice environments using the lens of sustainability and pet waste(s). What this reveals is a limited conceptualization of pet waste as dog feces, that merits expansion beyond predominately canines to other animals and other wastes. While there is some international evidence of trials of sustainable pet waste management, prevailing models remain focussed on perceptions of hygiene and aesthetics rather than sustainability of management. Some suggestions are made as to future directions and applications that recognize the breadth of pet waste(s) within more sustainable waste management understandings.

**Keywords:** *pets, companion animals, domestic, waste management, sustainability*

### Author Biography

**Janette Young** is a lecturer in health promotion at the University of South Australia. She has an interest in complexity and systemic thinking with a particular interest in the human: animal intersection and how relationships with animals play a role in human wellbeing and also have implications for animal welfare and social and environmental justice. **Zoei Sutton** is a PhD Candidate in Sociology at Flinders University. Her doctoral thesis critically examines the navigation of human-companion animal relationships, particularly the negotiation of asymmetrical power relations inside and outside of the home, and the impact on research when species inclusive methods are pursued. **Sheila Scutter:** After retiring from employment in universities, Sheila now has time to pursue her interests in animal welfare for pets, wild and farmed animals. While undertaking research focused on disability, education and adult learning, Sheila was actively involved in supporting Australian and overseas animal rescue and welfare initiatives. **Carmel Nottle** is a lecturer in Human Movement, Sport and Exercise Science at the University of South Australia. She has an interest in the human-animal intersection from a health and wellbeing perspective but also a particular interest in leisure activity for human companion animals and the welfare and leisure of assistance dogs. **Ali Soltani** is a visiting Research Fellow at the University of South Australia. His research interests include urban form/design, sustainable transportation planning and policy, land use planning, urban modelling and quantitative methods. He has also spent time in Japan, Turkey and Australia and is adjunct professor at University of Federico 2, Italy.

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