



re: aestheticsRECYCLED

aestheticsRECYCLED. Byera Hadley Travelling Scholarship FINAL REPORT - John de Manincor

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"Message from the Gyre" Image (c) Chris Jordan,



EXECUTIVE SUMMARY

aestheticsRECYCLED was born out of an interest in the relationship between material and idea and their collective impact on environments.

Funded by the Byera Hadley Travelling Scholarship (BHTS) administered by the NSW Architects Registration Board, I visited a number of building projects in Japan and the United States of America and interviewed some of the worlds leading architects and academics working in the area of material research and experimentation. These included:

- Kengo Kuma (Tokyo, JAPAN) - Founder of Kengo Kuma Associates,
- Robert Barnstone (Pullman, USA) - Assistant Professor at Washington State University, Pullman.
- Professor Nader Tehrani (Boston, USA) - Professor and Head of the Department of Architecture at Massachusetts Institute of Technology (MIT) and founding partner of NADAAA.
- Giuseppe Lignano (New York, USA) - Founding partner of LOT-EK,
- Dr. Mitchell Joachim (New York, USA) - Associate Professor, New York University and Co-President, Terreform ONE
- Lydia Kallipoliti (New York, USA) Assistant Professor Adjunct at the Cooper Union.
- Dr Billie Faircloth (Philadelphia, USA) - Director of Research at Kieran Timberlake Architects
- Professor Andrew Freer (New Bern, USA) Director of Rural Studio, part of the University of Auburn.

A consistent view amongst this diverse group was that, whilst architects are not solely responsible for the environment and government policy is critical to the environmental agenda, design-leadership and innovation can help to minimise the adverse impacts the built environment has on resources and habitats. Another common theme was the importance of developing close collaborations with manufacturers and fabricators in evolving and implementing architectural ideas related to performance, optimisation and material flows.

The research prompted further questions and the project is on-going.

*Edward Burtynsky Oxford Tire Pile, #4, Westley, California, USA
1999 (c) Edward Burtynsky*



INTRODUCTION

Sir Isaac Newton's Third Law of Motion "for every action there is an equal and opposite reaction" captures the thinking behind this project.

Decisions on what will be built and where are often beyond the immediate influence of architects, they are the result of complex cultural, political and economic processes. However, our actions in realising projects that arise from these machinations determine how material is composed and assembled to make form, form that defines space. These actions determine the spatial and aesthetic characteristics that combine to make what we call 'architecture'.

Through the making of built form architects are implicit in the simultaneous creation and destruction of environments. Our very existence as a profession relies on our ability to create compelling spaces and places for inhabitation. Each "action" we take in relation in this process, be it spatial, aesthetic or performance based, triggers one of Newton's 'reactions'. These 'reactions' or consequences include the destruction of 'natural' environments through the extraction of raw materials and the generation of waste via the demolition of existing building fabric and the inherent inefficiencies of construction.

Current discourse on environmentally sustainable development focuses heavily on energy efficiency, water conservation and performance. These are important matters, yet, the sustainment of planet earth requires a much broader approach. For instance, 38% of all waste in Australia is generated from construction and demolition, creating 7,980 tonnes of landfill in 2007. Australia is the second highest generator of waste per capita in the OECD. With that in mind, material origin, processing and disposal are significant issues for architects and recycling has great relevance for the profession.

Waste is an issue for multiple areas of the environment, from water and soil contamination, to greenhouse gas emissions, to poor air quality and the destruction of habitat. Non-biodegradable plastics, with their significant half-life, are of particular concern given that they persist in the environment for some time and can have devastating effects on ecosystems. The North Pacific Gyre, (The Gyre or Great Pacific Garbage Patch) is a disturbing illustration of this phenomenon.

In his book Massive Change Bruce Mau writes, "We will eliminate the need for raw material and banish all waste". He suggests a radical rethinking of material sources and, perhaps, the very notion of 'materiality'. Further investigations on the topic led me to questions around the relationship between aesthetic and spatial considerations of material selection in the making of built form and associated environmental implications, in particular the possibilities of upcycling and recycling.

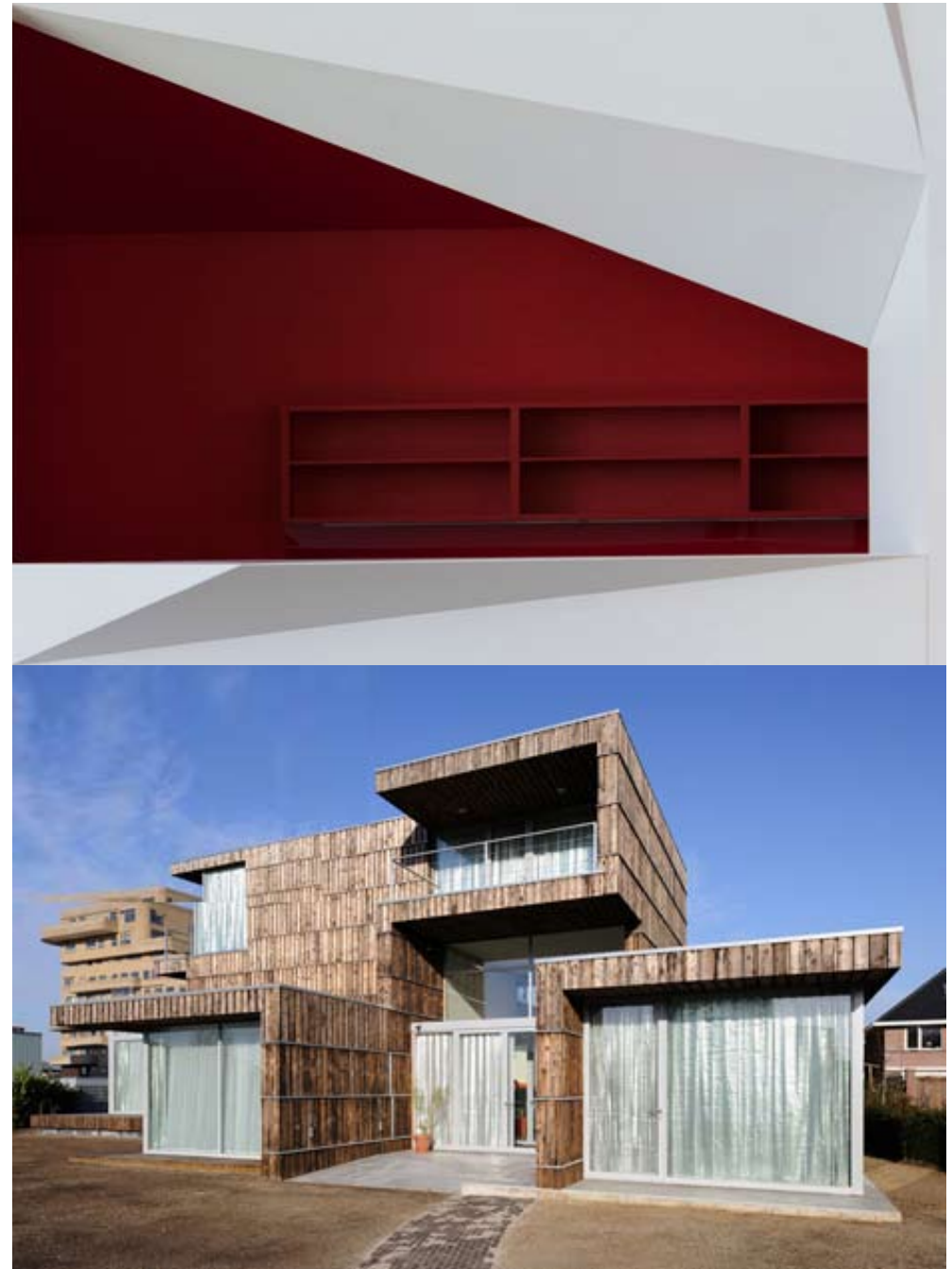
ON AESTHETICS

Historically, recycled materials in architecture have been deployed at the fringe of design culture. Projects such as the Earthships, by American architect Michael Reynolds are considered to part of an alternate, perhaps “Hippy”, culture. Whilst laudable for their ambition and resourcefulness, Earthships’ raw aesthetic is unlikely to become the preferred typology of mainstream suburbia - recycled materials are generally not valued in that regard. So rethinking what buildings made from recycled materials look like becomes an area for investigation. How can recycled materials become more valuable? Do they need to have more visual appeal? Should they look recycled?

This type of thinking about sustainability and the environment has similarities to Danish architect Bjarke Ingels’ term “hedonistic sustainability”. Ingels questions “the protestant idea that it has to hurt to do good”. This philosophy is consistent with Studio Swine’s belief that “desire is the most powerful instigator of change and action.” In “The Shape of Green: Aesthetics, Ecology, and Design ” Lance Hosey writes extensively on the role of beauty and aesthetics in the evolution of ‘green’. He notes “aesthetic attraction is not a superficial concern - it’s an environmental imperative. Beauty could save our planet.

Materials, such as plastics, can be reconstituted to create just about anything. Whilst the intermediate processes of harvesting, processing and the manufacture of recycled plastics have their own environmental issues to contend with, re-constituted materials appear to offer diverse and exciting possibilities for architecture experimentation. The challenge, if our profession is to lead the way in terms of environmental responsibility, is for architects to embrace these new materials and develop interesting high-quality projects incorporating recycled materials that may generate additional demand for such products. In doing so it may be possible to reduce our reliance on raw materials and rethink the notion of waste.

Recycled timber cladding. Villa Weipei 2012Architecten, NL. Recycled PET Counter. UTS Great Hall - DRAW, AU



EARLY THINKING

The aestheticsRECYCLED project began in 2006 with ideas for a university design studio based around what, if any, particular directions design might take when embracing recycling. aestheticsRECYCLED was run as an elective in the Masters of Architecture Degree at The University of Technology Sydney in 2007 and 2008, led in collaboration with David Welsh (Welsh and Major Architects). In 2008 we proposed to hypothetically “mine” the Gyre. The results were technically and aesthetically diverse. Proposals included weaving buildings from nylon rope, charred plastic ‘bricks’ to interlocking extrusions.

More recently UK based Studio Swine launched the Sea Chair at the 2012 Milan Furniture Fair. The Sea Chair is made from material collected from ocean waste using The Nurdler and The Sea Press. The chair is the physical manifestation of a much larger initiative: The Sea Chair project merges “craft, industry and design the project looks to harness the struggling fishing industry to produce a series of chairs created from plastic collected at sea” as a vehicle to highlight the issues of the Gyre .

In 2011 Rotterdam practice WHIM architecture proposed “Recycled Island ” an entire island made from recycled plastic harvested from “The Great Pacific Garbage Patch” as the gyre has become known. It is somewhat far fetched but, again, asks what value might waste have.



The Great Garbage Patch - North Pacific Gyre



DEFINITIONS

For the purpose of this project there are three simple categories for recycled materials

XWhere materials (doors, windows, beams) from one building are simply relocated to a new site for the same use - salvage.

RE-PURPOSED:

Taking materials, and objects from one use and using them for another, i.e.,

- cardboard bales become walls,
- parts of a 747 airplane become a hotel,
- petroleum tanker trailer becomes a bedroom,
- shipping containers become ... just about anything and everything.

RE-CONFIGURED:

A process where post-industrial and post-consumer waste is collected and processed, often these waste materials may no longer be recognized in their original form. Whilst metals are well recognized as recyclable, there is a growing industry of high performance composite materials that present new possibilities for architecture and the environment.

Examples include;

- plastic bags spun into acoustic panels,
- tyres made into flooring,
- recycled glass cladding systems,
- water bottles pulped and made into cladding systems.

There is a range of ethical (processing often takes place off shore in developing nations), environmental (transport, energy consumption) and technical (some materials do not perform as well once reconstituted) challenges to address in this field. However, as a species we need to broaden our horizons on how we reduce our impact on the planet - minimizing materials that go to landfill is but one layer in this process. A layer of latent potential.

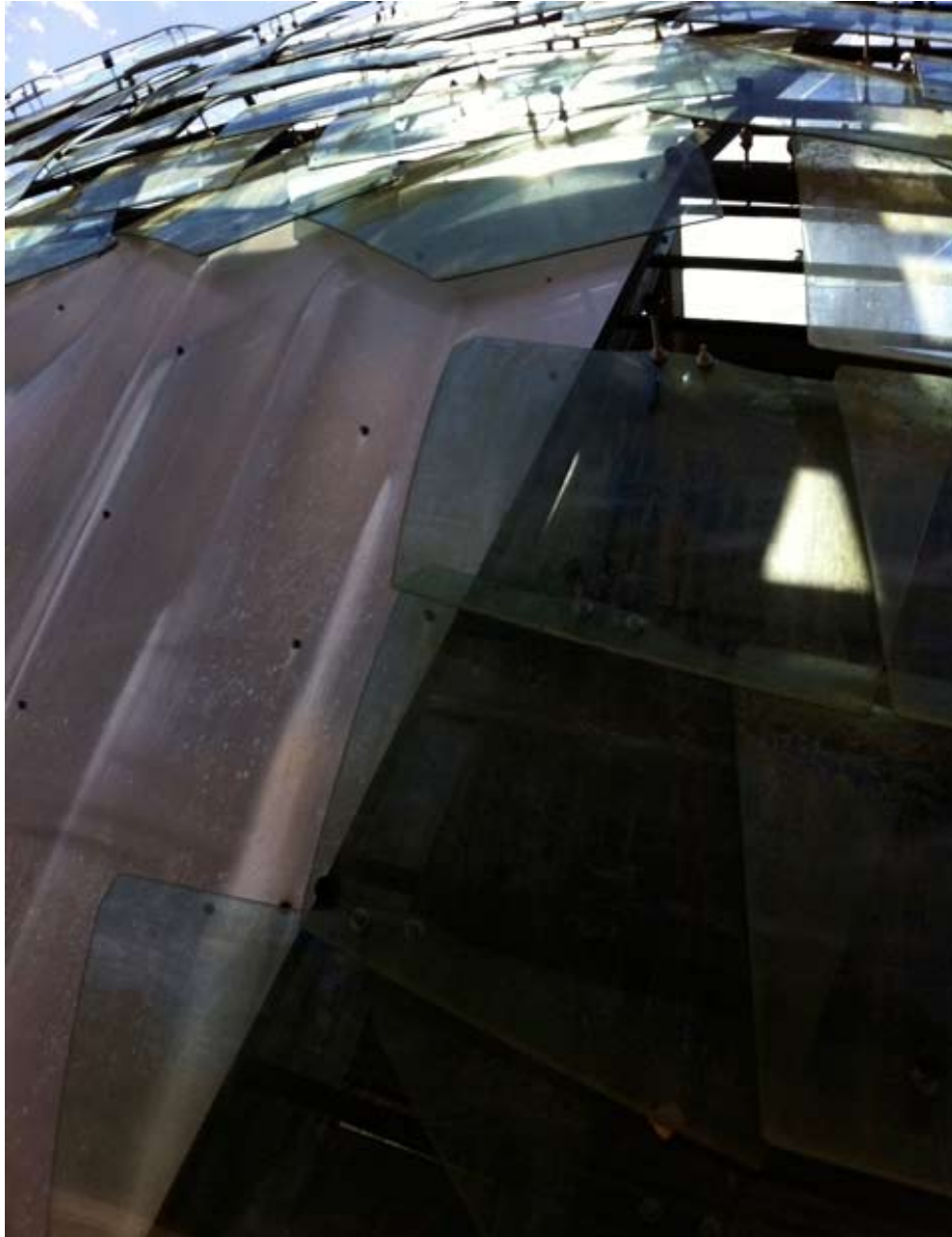
LEGISLATION LOOPS, CRADLES AND LOOKS

Legislation that demands material recovery in the building process provides a platform to create value for material previously considered as worthless. The NSW Waste Avoidance and Resource Recovery Strategy 2007 targets 66% of municipal waste to be recycled by 2014 - up from 26%, with a target of 76% of construction and demolition waste up from 65%. Similarly the Green Star rating systems in Australia, and similar systems around the world (eg the LEEDS program in the USA), provide “credits” for the recovery of demolition and construction waste.

Zero Waste is a more ambitious target. Zero Waste is a concept that has been around since the 1960's. Chemist Paul Palmer established ZWI (Zero Waste Industries) with a particular focus dealing with waste chemicals generated by the electronics industry. It is now an international alliance that “promote(s) positive alternatives to landfill and incineration”. This ‘closed-loop’ thinking suggests multiple layers of the recycling process, from re-use/ re-sale, to material harvest and remanufacture.

“Cradle to Cradle: Remaking the Way We Make Things” by another chemist, Michael Braungart in collaboration with architect William McDonough, is perhaps the seminal text on the possibilities of recycling and ‘closed-loop’ systems. They call for a complete rethink of the way in which materials are sourced, processed, used and reprocessed at the end of their useful lives. The book is heavily focused on performance and the development of processes that learn from nature, it is incredibly detailed and highly emotive. The ‘treeless’ book is printed on plastic resins and inorganic fillers, so philosophically and technically the book demonstrates that particular plastics can be used, recycled, and used again without losing any material quality. However, the book does not discuss the design and aesthetics in any detail beyond “good” design or design that is inspired by natural systems.

This is topic is the core of Lance Hosey’s book discussed earlier, Hosey delves much deeper into the topic and is at times highly critical of the green movement in progressing the design agenda citing Peter Eisenmann who notes “the green movement, like it or not, has a reputation for being all substance and no style.”



Glass Chapel - Rural Studio

EXPERIENCES AND OBSERVATIONS

More often than not the term recycling in relation to architecture and building projects conjures up images of scouring rubbish dumps and trips to salvage yards for building materials. The works that result often have similar visual qualities in that, by default, they reflect the crude nature of the material at hand: a Junk Aesthetic. This is not a derogatory term, but rather a vehicle to describe the basic aesthetic qualities inherent in this mode of construction. There are examples of this all over the planet. Most of these evolve out of necessity rather than a desire to save the planet. The occupants of shanties of the third world, or even impoverished areas of the first, salvage whatever material they can find to make shelter as a result of political and economic consequence. Material thus takes on a socio-political meaning. That the developed world is slowly (very slowly) embracing recycling through legislative reforms as a result of society's evolving understanding of our impact on the planet, demonstrates this fact further.

One example of an architectural 'practice' that works within the re-use, and re-purpose categories of recycling is The Rural Studio. Part of the University of Auburn, it is a design-build educational program that aims to teach students about the social responsibilities of the profession of architecture. Working with minimal means (i.e. almost no funding) the program provides safe, well-constructed and inspirational homes and buildings for poor communities in rural west Alabama. Early projects led by the late Samuel Mockabee, often deployed recycled materials out of necessity rather than an aesthetic preference. Here the "Junk Aesthetic", a collage of found objects and donated materials has evolved as a result of working with a set of materials not normally considered for use in buildings let alone materials of "choice" by the designer. Many of Mockabee's early projects were for people who had fallen through the gaps of the American social security system, so their material outcomes also have a socio-political aspect.



"The Pods - Rural Studio

The three-hour drive from Birmingham, for two short days visiting projects and a half hour meeting with the (perpetually) exhausted Professor Andrew Freear, was an enlightening and inspiring experience. As the program expands under his direction to include larger civic-scaled projects, Freear adds another layer that is vital in the teaching: "I want them (students) to understand the implications of what they design. Here, where they build these things they experience that first hand."

Projects such as the \$20K House, whilst not involving recycling illustrate the importance of understanding the relationships between material, construction and economics. The \$20K price tag was achieved through understanding the funding streams available to those on low incomes coupled with an appreciation of their capacity to repay loans - estimated at around \$100US / month. To establish the construction costs students work closely with suppliers and contractors, spreadsheets scatter over the walls of the Red Barn show that every nut, bolt and sheet of roofing is considered in the design and costing process.



Playscape - Rural Studio

One fascinating project nearing completion at the time of my visit was “Playscape”, one of numerous projects undertaken by the Rural Studio within the 40-acre redevelopment of Lions Park in Greensboro, Alabama.

The project began with a question of how to use an infinite supply of 55-gallon galvanized drums. The drums, originally used to hold mint oil are difficult to recycle due to the way in which the oil interacts with the surface coatings. What is relevant for the aestheticsRECYCLED project is the relationship between the material and form. The very nature of the material determines it cannot be reconstituted as scrap metal ~ thus it can only ever really be “drums”. The unexpected manner in which these drums are configured is very clever. Shimmering drums hover over a children’s maze on impossibly slender columns exaggerating the sense of adventure and risk associated with child’s play.

Experiencing some of these projects first hand confirmed two things. Firstly that humans can be extremely generous, resourceful and inventive. The works by the students are engaging and delightful, whilst the social agenda that underpins this school is humbling. Yet, secondly, in a context of expanding the possibilities of working with recycled materials to a more “mainstream” audience, re-use and re-configuration as demonstrated here has limitations.



Water Block House - Kengo Kuma and Associates

At the opposite end of the recycling spectrum sits reconstituted materials. It is common practice to recycle metals like steel and aluminium (most 'new' steel comprises 20/30% recycled material) - composites made from all manner of post-consumer and post-industrial waste. Most commonly these materials involve polymers of some form. Researching plastics within the built environment led me to the work of Kengo Kuma in Japan. Kuma has worked on a number of interesting projects incorporating recycled plastics. I was able to experience one such project as part of a larger exhibition at Gallery MA in Tokyo: "Kengo Kuma: Studies in the Organic". It included the Water Block housing prototype made from interlocking recycled plastic "bricks". The material qualities of its luminous white interior are somehow futuristic; while the cellular structure provides an immediate appreciation of the construction logic - it is a compelling experiment. This project along with other experiments by Kuma's office using plastics offers an entirely different perspective on the use of recycled materials in comparison to the bricolage often associated with material re-use. He has developed a refined aesthetic that in some ways epitomises the minimalist language we have come to expect from other Japanese architects such as Sejima, Nishizawa et al.

Kuma notes that these experimental projects would not have been possible without the generous technical support of DuPont (Japan) and local fabricators. The importance of working closely with industry was a common thread amongst many of the people I met through out my travels.



Weathering



The Naval Demonstration Project, Robert Barnestone (WSU)

The Composite Materials & Engineering Center (CMEC) at Washington State University is home to the The Naval Demonstration Project: a small but fascinating experimental building designed by architecture students under the guidance of Associate Professor Robert Barnestone. The published images of the project show a formally interesting building clad in what appears to be various types and sizes of timber boards. In fact the facade and some of the structure is made entirely from wood plastic composites that include a high proportion of recycled material. The project challenges notions of authenticity. New timber buildings have an almost universal appeal; they look 'warm' and smell 'nice'. This building looks, for the most part like a quirky timber building until one gets close.

Species, surface treatments, maintenance, climate and orientation all impact on the way in which timbers age. Six years after its construction the building has aged, for the most part, like any other outbuilding in an institutional context: weathered and in need of some maintenance. The façade is not only 100% recycled but 100% recyclable. One extreme maintenance strategy is that it 'could' be stripped, re-processed (in the adjoining workshop/labs and) remade in a relatively short timeframe with minimal environmental impact. The wood content (pulp) provides none of the traditional qualities of timber: warmth, grain, texture, character etc. Barnestone points out that WPC can be extruded or molded to almost any profile or colour. Given this fact it seems perhaps strange that that WPC are most commonly used as replacements for timber and mimic it's aesthetic qualities. Many reconstituted/recycled materials are developed and deployed in a similar way, they mimic the aesthetics of existing 'natural' products, while not exploiting the wider opportunities of their material character.



Finnish Expo Pavilion by Jaana Partanen and Heikki Lamusuo using UPM ProFi shingles



The Nava1 Demonstration Project, Robert Barnstone (WSU)

The potential of recycled materials, particularly as composites, to evolve in parallel with new tools and techniques for design, manufacture and fabrication via the digital interface appeared to be a topic worthy of further investigation.

An interesting anecdote is that the Finnish Pavilion at the 2010 Shanghai Expo is clad in a recyclable, composite material of wood-based fibres in recycled paper and recycled plastic known as UPM ProFi. It seems somewhat ironic (or perhaps encouraging) that a nation revered for its fine timber buildings might represent itself to the world through recycled plastic.

How we understand new materials and the application in architecture is a focus area of Billie Faircloth, Research Director Kieran Timberlake Architects in Philadelphia. Faircloth notes that when we examine any particular building we often find the author has explored only a few of the “constellation of variables” that go to determine its form, function ... its architecture. For example “If were to lift structure out, we could match a whole era where we talked about tectonics and the way things go together ... I think we have been in an era where we’ve listed material out of that pool.”

The advent of new digital design and fabrication technologies has sparked a new interest amongst (some) architects in material performance and more traditional conceptions of materiality - they have put material back into the pool. Swiss architects Gramazio and Kohler refer to this as Digital Materiality. Digital Materiality has evolved a particular aesthetic quality, and to some, to quote Studio Swine, has become more ‘desirable’. Again, the interaction between possibilities of recycled (reconstituted) material in conjunction with new fabrication techniques offer great scope to material scientists, architects and designers “there is much to be mined”.



Tongxian Gate House by Nader Tehrani (Office DA)

One of the worlds leading authorities in the areas of material research and digital fabrication is Professor Nader Tehrani, Head of the Architecture program at Michigan Institute of Technology, and director of Boston-based architectural practice NADAAA. Tehrani summarises his three key agenda in the teaching at MIT:

Agenda #1: The invention of smart systems ... linking figuration and configuration as an intellectual project.

Agenda #2: ...to invest academic practices back into construction... Construction ... needs to be seen as an extension of our design process, arena of power, and responsibilities!

Agenda #3: ... has to do with a cultural and technological shift. We do not live in a “crafts-based society” any longer, but this does not mean we live in a society that has lost its desire for quality, for definition, or for ambience and character. Part of the agenda is also to situate (this) craft as a mechanism to produce new forms of knowledge – through customization, material speculations and through new forms of optimization.

Each of these idea(l)s has specific relevance to the core questions of material flows. How architects and builders engage with technology to produce buildings of delight through digital craft to improve efficiencies and reduce waste is exciting territory. Tehrani points out the issues of waste and recycling form part of a wider web “The relationships between economies, scales of production scale of transportation are central to how that trickles down to the building, the very building (s) that (are) is the source of so much material waste.”

UP OR DOWN CYCLES

Recycling is by no means the sole answer to the degradation of our urban, rural and natural environments that result from inappropriate human activity. It is an important node in a complex nexus of actions and operations.

William McDonough & Michael Braungart have written extensively of their concern that “most recycling is actually downcycling; it reduces the quality of a material over time. When plastics other than those found in soda and water bottles are recycled, they are mixed with different plastics to produce a hybrid of lower quality, which is then molded into something amorphous and cheap, such as a park bench or a speed bump... Aluminum is another valuable but constantly downcycled material. The typical soda can consists of two kinds of aluminum: the walls are composed of aluminum, manganese alloy with some magnesium, plus coatings and paint, while the harder top is aluminum magnesium alloy. In conventional recycling these materials are melted together, resulting in a weaker—and less useful—product .”

One way to rethink the downcycling question is the 80/20 concept whereby if a material’s operates at only 80% of its original capacity as a result of the recycling process, then the designs deploying the recycled material need to be 20% “better”.

Upcycling is the obvious opposite of downcycling. Whilst McDonough & Braungart are cautious about recycling the Cradle-to-Cradle strategy also promotes upcycling, which reduces demand on raw materials by making use of existing ones with the potential reduction of energy usage, air pollution, water pollution and greenhouse gas emissions. New York based architects Ada Tolla and Giuseppe Lignano of Lot-EK discuss upcycling in a slightly different way, their interest lies specifically in the aesthetic qualities of the industrial object and it’s sculptural potential.

The admit that that they are culturally predisposed to upcycling since the practice of giving materials a second life in Naples, the city where they were raised, is widespread. There, over 100’s of years, the city has evolved through adaptive re-use (itself a form of upcycling) that often deployed reused materials out of necessity. Whilst the pair argue they are not interested in recycling as a starting point, they see its latent potential.



Wood Plastic Composite Jiangwang Art Centre in Shanghai

LESSONS

At the outset of my travels to meet architects and academics involved in material research, I hoped it might reveal some clear and specific “answers” to the issue of waste. Alas, it simply opened my inquisitive mind further.

Notwithstanding there are some valuable observations that have come out of the project.

Firstly, at this stage it is clear that demand for materials with recycled content is slowly growing. The issues that hinder this demand are primarily cost - waste is not yet a valuable resource. Perhaps as one Sydney architect put it “(recycled) plastic should be as valuable as gold because it’s a clever product that can last forever .”

There is not yet significant evidence based research on the case for recycling or in understanding how recycled products compare with raw materials in terms of overall environmental impact and economics. McDonough Braungart Design Chemistry (MBDC) is one company at the forefront of understanding material flows down to the “parts per million”, ahead of many government agencies yet it seems there is still along way to go.

It is clear that recycling alone will not solve the environmental issues faced by the plant. In the words of William McDonough “It’s not (just) about reduce, reuse and recycle. ... it’s beyond that ... it’s rethinking the way we deliver our promises. ”

The project has perhaps asked more questions than provided answers - the project is on-going.

AN ONGOING PROJECT

The aestheticsRECYCLED project lives on in a number of guises. The website aestheticsRECYCLED.com is the repository for interviews from this project and other thoughts on this topic. It is updated from time to time.

In the work of my practice with Adam Russell, (DRAW), we regularly explore the possibility of incorporating new composite materials made from recycled products wherever possible. Our Gallery Lane Cove project uses 350 sq.m of Regupol recycled rubber flooring. Comcork (recycled cork flooring) has been incorporated into the Great Hall at the University of Technology Sydney and a new Early Childhood Centre in Marrickville. A particularly interesting product was used for bench tops in the Great Hall; Durat is solid surface material 30-50% recycled hard plastics - it is 100% recyclable. It was milled and formed to seamlessly integrate with a “fold” in the wall of the Balcony Room. The aestheticsRECYCLED is updated from time-to-time with products and links to interesting projects.

At a broader level the thinking behind this project has evolved further and has formed the basis of my selection as Creative Director of the Australian Institute of Architects National Conference for 2013 with my life-partner Professor Sandra Kaji-O’Grady. The conference theme is “Material”. At the time of writing we are in discussion with three of the people I met as part of the BHTS and are confident they will participate in the conference.

“We cannot live only for ourselves. A thousand fibers connect us with our fellow men; and among those fibers, as sympathetic threads, our actions run as causes, and they come back to us as effects”

Herman Melville - Moby Dick (1851).

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The de Manincor clan ... generally

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Cell phones #2, Atlanta 2005 Image (c) Chris Jordan,

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Edward Burtynsky Oxford Tire Pile, #4, Westley, California, USA 1999 (c) Edward Burtynsky