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INDUSTRIAL DESIGN EDUCATORS *NETWORK*

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EDITORIAL

SHAPING INDUSTRIAL DESIGN EDUCATION IN AUSTRALIA

Welcome to our first 'prototype' issue of the Industrial Design Educators Network (IDEN) journal. By prototype, as per a design process, we envisage this issue to be the first of a series of evolving issues of the journal for the Industrial Design Educators Network. Each issue will focus on emergent themes giving a voice and forum for Industrial Design educators in our region to discuss and share industrial design education issues and research. The journal aims to fill a void between academic peer reviewed journals and consumer orientated design journals. It will exist primarily as an online product enabling easy dissemination and quick access. However, appreciating the need for a tangible 'product' we will also produce a limited number of 100 print copies. We believe this should be sufficient to stock a number of libraries as well as the shelves of the odd academic.

IDEN has over the last several years evolved as an informal grouping of Industrial Design program heads from across Australia and New Zealand. It first formed as the Industrial Design National Network in 2005 at a meeting in Canberra hosted by Stephen Trathen. The Network discussed a range of shared concerns and initiatives around benchmarking curriculums, graduate standards and employer expectations.

Its new name, IDEN, was formulated as an inclusive acronym for our NZ colleagues from across the ditch and to include in the future the greater Asia Pacific region.

The theme adopted for issue one is Shaping Industrial Design Education in Australia. The backdrop for this theme is a recent succession of educational program reviews that have occurred or are occurring at many universities. In our region University of South Australia, Canberra University and Auckland University of Technology have moved to a 3 year undergraduate program with a lead-in to post graduate study. This is based on the so-called 'Bologna model', which advocates a three-year undergraduate program with advanced courses taught in a postgraduate environment. Sometimes referred to as a 3+2 or 4+1 model. Other universities have indicated that they may also follow as periodic or forced curriculum reviews occur.

Stepping back from the educational setting there are bigger questions as to the direction and future of Industrial Design in our region. It has always been the case that employment opportunities within the narrow definitions of Industrial design have been few and highly sort after. This is likely to remain the case with a 'challenged' local manufacturing sector and the 'sideways growth' in Industrial Design professional services.

Nevertheless despite increasing class sizes and subsequent graduate numbers, Industrial Design graduates continue to find interesting and rewarding careers in diverse fields and benefit from their creative problem solving skills and knowledge of materials, process and usability. The theme of large class sizes is a theme explored in the paper by Andrew Scott and Marianella Chamorro-Koc (Teaching Strategies in the Context of a First Year Industrial Design Large-Sized Class). They outline the challenge of engaging student learning in large class studio contexts. Focusing upon the first year they describe two strategies, team-based off-site experiences, and intensive 'concept bomb' activities in the classroom as a means to reinforce leaning experience.

Beyond the immediate questions of dealing with class sizes an overwhelming response to our call for papers centres around themes of change and unsustainability. This should be of no surprise as current circumstances in our society are defined by uncertainty and change as we deal with economic and political volatility in a backdrop of an unfolding ecological crisis that many still fail to recognize and others remain indecisive as to what to do. Tony Fry's paper 'Designed Away Your Dreams' offers us a context to approach such complex and challenging questions. He challenges designers to deliver a totally different design agenda based upon a design practice of elimination, adaptation and redirection to deal with dramatic change in an age of unsettlement.

With specific regard to climate change, Jonathon Allen, Tara Andrews and Abby Mellick-Lopes ('Industrial Design is Dead. Long Live Industrial Design') argue that Industrial Design curricula must change in response to a climate-changed future and the current university climate. Designers will require interdisciplinary competencies if they are to be effective in mitigating climate change impacts, but more importantly on how to work within changed socioeconomic contexts resulting from climate change. To do so it will require design students to first develop their ecological literacy. The objective to develop designer's knowledge at critical and complex thinking is discussed by Steve Reay and Andrew Withell in their paper 'From Product Design to Design Thinking: The establishment of a new product/industrial design programme in New Zealand'. Following Auckland University of Technology's move to the 3+1 model in 2008 Withell and Reay reflect on the outcomes of the challenges, and the future opportunities of their first cohort under the new program structure. A core element to the new program was the integration of 'Design Thinking' together with traditional 'Design Skills'. The result was that students who embraced the new approach developed design solutions with deeper environmental and social values. While new 'values' become increasingly important to design, other older values still resonate in our conversations about what constitutes good Industrial Design education and practice. In the final essay, a compilation of discussion pieces by the late Jim Montague to Industrial Design staff in 1985 ('Memo to Staff of the Industrial Design Department. Sydney College of the Arts 1985'), we glimpse into the past as to the, context, concerns and vision for implementing new curriculum.

The shape of industrial design education in our region is changing, and as evident from the papers in this first issue of IDEN, is likely to change at a much accelerated rate over the coming years. We hope this journal and the educators network will be influential and contribute to shaping the changes occurring in our respective institutions. We also hope you enjoy IDEN issue no. 1 and it would be great to hear from you with regards to this 'prototype' issue by letting us know what works, what doesn't, along with your new ideas and recommendations. What would you like to see in issue no. 2? The more engagement and feedback IDEN receives from you the more relevant IDEN can become.

→ Miles Park and Berto Pandolfo

Photographs from a student field trip, taken by the authors

FIRST YEAR INDUSTRIAL DESIGN STUDIO-BASED TEACHING PEDAGOGIES AND STUDENT ENGAGEMENT

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Student engagement tends to be viewed as a reflection of learning processes, and in the context of first year university studies, it is a crucial means of an educational process that establishes the foundations for successful later year studies (Krause and Coates 2008). In the context of first year design studio teaching in higher education, fostering students' positive engagement poses challenges to design educators as current trends set these design studios to be large size classes that makes difficult to manage and follow up students' individual learning experiences. At Queensland University of Technology's first year industrial design studio classes we engage in a variety of teaching pedagogies from which we identify two of them as instrumental vehicles to foster positive student engagement. 'Concept bombs' and the field trip experience provide such platform as shown in student responses through a learning experience survey.

INTRODUCTION

According to Cross (1982) designers' way of knowing is by doing. In design, the core principles of the discipline are taught through practice where it has been traditional to use problem-based and studio-based approaches as central features of design education (Breslin & Buchanan 2008). However, to deliver successful outcomes studio-based teaching approaches are highly dependable on the type of students' engagement in class.

The Australian Studio Teaching Project Report (ALTC 2011) states that it is the studio where learning emerges through action, and that learning in a studio environment is distinguished by emphasis on project-based work, learning through praxis, learning through workshop, and learning through first hand observation. This problem-solving and project-based learning approach is the preferred approach to industrial design education at the School of Design at QUT. The aim is to help students connect theory and the application of design principles to design projects. In the context of the First Year design classes with a large number of students (120 in a design class and 400 in an introductory block delivery class); two different strategies have been undertaken: a) team-based design tasks in an intensive off-site experience, and b) intensive 'concept bomb' micro design activities in the classroom. These two strategies aim at helping the student to become acclimatised to the design process by working on a short project, learning from peer and teacher feedback, reflecting on the individual and team design process, and closing the loop by adopting immediate performance feedback on design activities. Large-sized design class experiences have shown that students are less actively involved in their learning process, do not engage in critical thinking, and that these effects leave a long lasting imprint on their learning habits (Morgado 2010). The two strategies adopted in the context of the First Year design at QUT have delivered results demonstrating a positive level of engagement of students in class and in the development of their design process, and good results with regard to the development of their critical thinking skills.

The assessment process adopted for both strategies assist students to: a) internalise assessment criteria; b) engage with criteria in a group setting reinforcing that design is a discourse activity; and c) receive rapid feedback that reinforces their learning experiences. Qualitative analysis of longitudinal student survey data reveals high student satisfaction and good levels of engagement.

This paper focuses on describing the two aforementioned strategies in the context of a large sized First Year design studio class at QUT; it discusses our notion of student engagement, and it provides examples from students' Learning Experience Survey data (LEX) to discuss students' levels of engagement as a response to the referred pedagogies. Finally, recommendations for implementing such approaches are outlined with suggestions for future development.

THE DESIGN STUDIO IN THE CONTEXT OF A FIRST YEAR CLASS AT QUT

Design studio is an important part of the design education curriculum. Its primary aim is not just to teach how to design but to develop an understanding of what design is through a creative and analytical way of thinking. It is the first place that the design student will experience the design process. This view is firmly supported on the Architecture studio tradition where the act of designing — generating, evaluating, and developing alternatives — is learned and practiced (Gross & Do 1997). According to Brocato (2009) well-established pedagogies employed in design studios are field trips; shared and well resourced physical space; expert lectures and panel discussions; pin up sessions; desk critique sessions; formal juries; consultation during class work time; and a propose-critique-iterate stance. In these pedagogies, a student's individual designing during the studio is the central activity.

These pedagogies are common to design studio based units at QUT. First Year applied pedagogies employ a field trip, a shared resources in a common physical space, expert and guest lectures, pin up sessions, round table discussions, and consultations during class work time. Design students typically undertake two design units in their first semester: a discipline-specific unit and a common foundation, *Introducing Design*.

Introducing Design caters to all First Year students from all disciplines and runs over five weeks in the first semester. A four-week lecture programme introduces design theory, process and visual thinking followed by a week of activities centred on team-based design projects in an intensive off-site experience. During this 'block delivery', all other classes are suspended allowing students to immerse themselves in design studio culture and process in an accelerated, intensive format without distractions. Three parallel sessions accommodate the large cohort of approximately 420 students supported by a teaching team of 45 academic and technical staff, tutors and senior students. Archi-

tecture, Industrial Design, Interior Design and Landscape Architecture students work in cross-discipline teams on two design projects over a period of three days in full-day studio-format teaching input. Each project culminates in presentation, formative and summative assessment allowing students to see how criteria-referenced assessment is applied to design projects in an authentic manner. Students use a reflective journal to integrate theory, reflective practice and visual thinking as their individual assessment item. This intensive experience encapsulates the design process and concludes before the middle of the semester allowing them to transfer knowledge of design and design assessment into other classes.

Another pedagogy employed in our Industrial Design classes of approximately 140 students is known as the 'concept bomb'. Students are given a five minute briefing and asked to generate one or more design concepts for a simple product. Often the brief is quite 'blue sky' and conceptual or a fairly superficial styling challenge. The session concludes with immediate tutor-guided peer-assisted assessment (Figure 1). Usually four of these exercises are conducted during the semester with the best three grades contributing to assessment. They are timed to provide a change of pace from longer design projects introducing some variety.

Figure 1: Peer assessment during a concept bomb pin-up

The common factor in field trip and concept bomb activities is intensity of experience and immediate feedback. In fact both of these activities share some of the characteristics of exams, an assessment format not widely enjoyed by students: they are sharply limited in duration; they contribute to student grades; and they require students to perform at a particular time and place.

STUDENT'S ENGAGEMENT IN DESIGN STUDIOS

Intuition suggests that students would tend to reject potentially stressful, performance intensive assessment circumstances but our experience suggests the opposite to be the case with high levels of student satisfaction and engagement. There may be several reasons for this:

- rapid turnaround assessment reduces out-of-class workload easing pressures on time-poor students;
- intensive activities can take place under guidance from staff reducing student uncertainty and indecision;
- intense activities may encourage the adoption of an immersive 'flow' state reducing distraction and enhancing task engagement;
- short duration activities provide a counterpoint to longer duration activities.

Engagement is the critical factor. The notion of students' engagement has been referred to as one with many meanings (Bryson and Hand 2007). Some of those notions refer to:

- behaviours in and around the classroom; e.g. being active and participating by asking questions;
- faculty-student interaction;
- cooperation among students;
- a dynamic relationship between learner and environment that helps student 'make sense of' and that implies more than active participation in the classroom;
- a continuum of engagement from disengaged to engaged and a number of levels within which the same student may exhibit different degrees of engagement within: the classroom, a task, a module, the university.

Student behaviour and student-staff interaction in class suggests that students engage with field trip and concept bomb activities with considerable enthusiasm. We found that intensity seems to be a key factor in students' positive engagement. Student feedback

gathered from QUT's Learning Experience Survey (LEX) illustrates this. The LEX survey asks students to comment on the positive aspects of their units as well as the aspect in need of improvement. Qualitative analysis of written LEX responses indicates student support for intense learning experiences. In *DNB101 Industrial Design 1* 20% of positive responses cited the Concept Bomb with no negative responses. In *DEB101 Introducing Design* 46% of positive comments related to the field trip activity and/or the intensity of the experience while only 7% of the negative responses featured the field trip or intensity as an issue. Examples of qualitative feedback reveal the students' positive engagement for these activities:

> *"It was great that the unit was concentrated into a third of the semester. I felt that I took more from it being in a block delivery than if I had been spending a few hours a week on it. All possible units should be delivered like this!"*
>
> *"I really liked the camping trip. What a great way to immerse myself in the studies while getting to know my new class mates."*
>
> *"I loved the Concept Bombs (Don't dare discontinue them)"*
>
> *"Concept Bombs were definitely a stand out and workshop time. These were my two favourite aspects of the unit."*
>
> *"The Concept Bombs were a really great way of getting people to work quickly under pressure."*
>
> *"...in the first 4 weeks of class I had learned more about drawing techniques than in 12 years of schooling. In addition, the week-long assessment tasks and concept bombs kept me on my toes and interested in the topic. Also, pinning our work up on the walls and having it marked during class (by the tutor or peers) ensured that we got quick and helpful feedback."*

The field trip format has also been seen to be successful with non-design students. The Introducing Design curriculum is also delivered to First Year Information Technology students undertaking the Games and Interactive Entertainment course.

> *"I loved the intensive assessment – it really put everything into perspective. Everything we learnt really came together and made sense. New friendships were also made within the unit which was really good. Originally I was petrified of this assessment but it turned out to be a really fun and enjoyable experience." (Scott and Docherty 2010)*

ASSESSMENT AS ENGAGEMENT

As the nature of many design projects involve co-discovery, staff and students explore a design problem and develop solution approaches together. This approach makes developing assessment criteria for design projects extremely challenging. Tangible assessment criteria that First Year students can meet are sometimes difficult to create before the project concludes. Student engagement in assessment is equally challenging, but just as vital. However these apparently contradictory demands can enhance each other. In situ teaching input and formative assessment from tutors, lecturers and technical staff encourages rapid learning. Meaningful and immediate summative and formative assessment allows students to see how criteria-referenced assessment is applied to design projects in an authentic manner. This knowledge, positioned early, is highly valuable for their other design units. Assessment can be considered a tool for student engagement.

CONCLUSIONS

It is clear from our experiences that students value intensive studio activities especially when combined with timely assessment and feedback. Contrary to expectations that students dislike exam-like activities students engage with field trip and concept bomb design activities with enthusiasm. There is no doubt that conventional longer-duration design projects are essential for allowing students to engage with the full depth and complexity of the design process but short, intensive design activities introduce variety to the learning experience and enhance student engagement.

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DESIGNED AWAY DREAMS

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Sitting here in my study, as in every room in our modest sized, century-old Queensland farm workers cottage, I am surrounded by things. It is starting to feel strange, as if something has happened. It has, 'the world is out of joint'. It's not just that having all this stuff no longer seems quite right, although there are a lot of things I would find hard to get rid of (and a lot it would be easy to dump). Rather it's that I, and increasingly others, have a growing sense that the still increasing acquisitiveness of especially affluent human beings cannot last, at least not in its present form. For me, this sense has arrived from three directions: knowledge of future-shaping global factors; local experience of 'the revenge of nature'; and reflection upon the notion of 'kronophobia' – the fear of time coupled with the illusion of permanence. Has all this anything to do with design? Yes, absolutely.

As I will set out to show, there is now a recoil against 'things' which is starting to deliver a totally different design agenda in which the key words of an emergent practice are elimination, adaptation and redirection. It's not a matter of design salvationism (not least as directed toward the planet – which will be around long after we as a species have gone) but simply learning how to cope by design with what, for many, will

be dramatic change. The situation to be coped with has actually already started to arrive, but as kronophobes we are mostly unable to see it.

Unless we shrink utopias to a scale at which they lack any politico-social significance, I have no doubt that utopianism is behind us and that an age of unsettlement is arriving. The changes that can be expected will exceed anything experienced in the past ten thousand years. Just looking around me, I'm certain that what we will be designing is not what I am now looking at.

PAST DESIGNERS OF THE PRESENT

'Past designers of the present' are those designers of today who are still designing according to a model of design practice and a conception of design objects grounded in continuing the materiality of structural unsustainability. At its most basic, this centres on the perpetual designing and production of object-things. The performative (including environmental) nature of object-things is not the issue, rather the primary objective should become elimination and reduction. There are vast numbers of objects-things that, in their harmfulness and gratuitousness, simply have to be eliminated or redirected. Will this have an enormous economic impact? Of course. Put absolutely bluntly we have no future without this impact. What we call our economy could just as easily be called our unsustainability machine. Sustainable development is a lie, a self-deception, a ship of fools. Sustainable design, as I now hear myself saying for what feels like a million times, almost totally sustains the unsustainable.

We have to understand that problems created in the past are thrown into the future, and as such, arrive in the continual present. This configuration is exactly what is occurring with climate change. Emissions of today constitute the future form of the atmosphere while the consequences of past emissions arrive to act upon the constant 'now'.

The production of object-things currently defines the activity of almost all designers in all design disciplines (including many who believe they are practicing sustainable design). The digital economy is not exempt — it not only rides on the back of productivity but is also the latest moment in the acceleration of productivism.

There will be no significant change of direction without the realisation that the way we design, make and use, mostly results in defuturing. As 'finite beings on a finite planet' our defuturing is effectively a negation of time. How we are, what we do, how we live is taking the species' future away. The anthropocentric trope of sustainable development being

about not harming 'future generations', besides being myopic (it just does not evoke an eternity), does nevertheless register fundamental conditions of relational interdependencies.

FUTURE DESIGNERS

Such designers are obviously not designing the future. Rather they design that which futures. Futuring equals making time.

Designing futurally means having a very different perception of what design is and of design practice — way beyond how design is presented via the design disciplines: history, theory, the economics, the media and the culture at large. The gap between how design appears and the actuality of design is gigantic. We exist in a 'world-within-the-world' that is designed — a totality within 'the world' that is not a system, that is mostly designed by anonymous 'designers'. This complexity is turned away from in favour of diversions. Design history is a case in point: just consider the difference between the sum of the content of the literature of design history (which is not vast) and the actual manifestations of past and present environmental, economic socio-cultural and existential transformative agency of design globally.

Designing futurally does not refuse the complexity of design. It deals with it not by trying to comprehend the totality but by acknowledging it in a situated sense in all it does. The means to do this comes with the concept 'relationality'. What it ensures is that whatever is engaged is never contained. The design object of address always bleeds beyond itself. It is never constituted in or by just one place or time, nor it is without directional designing agency. As should be evident, designing futurally is not object-thing focussed, but process centred. It is not mostly about the new but more about redirecting what already is.

THE CHOICE IS YOURS

All designers have a choice, though many do not yet recognise this, or that they have to go looking for it. What is the choice?

The answer is that they can cease to be 'service providers', working in a situation where the most significant design decisions have been made long before they 'come on the scene'. The alternative is to find means to initiate and finance projects of their own creation. There is not just one path to this end. Whatever the path is not without risk or

the need for the expenditure of major effort, all laced with a lot of determination. Obviously one such path is entrepreneurial and goes seeking venture capital; another is to bring project proposals to not-for-profit organisations and NGOs; and a third is to go searching for grants from government and the private sector. The mantra for the adventurous, smart, and courageous designer with imagination is 'go looking for defuturing problems and you will find a successful project.' Of course in order to succeed you have to be willing to fail and learn from failure.

WHAT IS ALTERING THE SITUATION IN WHICH DESIGNERS FIND THEMSELVES?

The general answer to this question is the slow but sure arrival of recognition that at the very core of the unsustainable is us. What 'we' bring into being animates the process of unsustainability (the process we call defuturing). This happens because we have been inculcated for so long into being unsustainable. The designed world we live in designs us as such. Being unsustainable has become elemental to our ontology. Instruction, seduction, education and desire are all part of the mix that underpins our 'education in error'. This condition is structural and we can neither moralise or engineer ourselves out of it. Rather, what we are, and what makes us what we are, have to become objects of redirection. Beyond just this general understanding of defuturing unsustainability (a big enough step!) we also have to confront what the forces of defuturing have created: the emergent conjuncture in which we find ourselves. This can be named as unsettlement.

UNSETTLEMENT

Unsettlement names a moment in human existence that recognises an ending without any clear sense of what is beginning. Along with this goes a certain feeling of foreboding that what will arrive will be unwelcome. This is both a product of signs of change and how they have been interpreted.

Change here spans the impacts of the unceasing speed of production that goes back to our prehistoric becoming as makers. The pace of production has never slowed from this moment; in fact it has constantly accelerated. Evidence of this is seen as resources are depleted, environmental damages increase, biodiversity diminishes, and

the climate changes aided by anthropogenic inputs, and hyper-consumption spins out of control globally (in the name of increased standards of living). Reason has served madness.

An interpretative confrontation with this situation shifts unsettlement from being thought of as a 'state of the world' to a condition of mind (a psychology). Traumatic events — (un)natural disasters, conflicts, economic and social collapse — prompts the move from the one to the other. Unsettlement fundamentally shifts the ground of design, not least by exposing how pathetically misplaced object-thing-based design 'solutions' are.

Two very different but equally connected responses to this situation are now going to be rehearsed.

TECHNO-NOMADS

A sub-culture is emerging that is communicating something greater than the ideas that brought it into being. It is summed up by the title and content of the book *Share or Die* (Harris 2012). This book reflects some of the imperatives and contradictions of attempting to live in a technogically-enabled way that reduces material impacts. It manifests the positive efforts of a nomadic sub-culture aiming to 'live with less' and share more, but at the same time, is based on a naive faith in technology as the means towards this.

Generally the level of reduction is defined by the lifestyle of the young, single and mobile – a favoured target is to get down to 60 items. Now obviously, this is not a prospect for a family. However, it would be interesting to discover how many object-things say four families would need if a culture of sharing between them was formed. The obvious perspective on technology is that the electronic storage of books, music and data of all types is 'object thing' eliminating. The joys and perils of doing this were made very evident by a program broadcast by the BBC (Danzico 2010). To illustrate: 'Mr Kelly Sutton is the founder of CultofLess.com, a website which has helped him sell or give away his possessions — apart from his laptop, an iPad, an Amazon Kindle, two external hard drives, a 'few' articles of clothing and bed sheets for a mattress that was left in his newly rented apartment'. He said:

> *I think cutting down on physical commodities in general might be a trend of my generation — cutting down on physical commodities that can be replaced by digital counterparts will be a fact. It's always nice to have a personal sense of home, but that aside — the internet has replaced my need for an address.*

And then there are the views of Chris Yurista who 'feels his digital possessions can now live on indefinitely with little maintenance'. He took to the 'streets with a backpack full of

designer clothing, a laptop, an external hard drive, a small piano keyboard and a bicycle — an armful of goods that totals over $3,000 (£1,890) in value. He says:

> *I don't feel a void living the way I'm living because I've figured out a way to use digital technology to my advantage... Things like records snap and wear down over time. It's upsetting. MP3s don't.*

Such a way of life turns on the availability of friends willing to provide a bed or a couch for the night, plus an external hard drive. But here is the rub: lose by accident or theft your hard drive and you lose the main prop of your life.

Such a sub-culture is symptomatic of an anti-consumerist disposition of a strand of young people in many parts of the world and echoes the feelings of a wider segment of not just the young who recognise the 'madness of things'. In actuality it flows into a far wider and more significant nascent position on nomadism.

THE URMADIC

For tens of thousands of years nomadism was the key to the survival of our species. As the climate changed, people still needed food, so they moved. As the human population grew, and with it, the size of cities, risk increases. The risks come from different kinds of climate change impacts (including extreme weather and conflicts) and from 'natural' disasters (very simply, the more people the more people at risk). As is starting to be acknowledged, a new mode of earthy habitation, based on a radical adaptation to change, is likely to arrive over coming decades.

The urmadic (urban nomadism) is one way this mode is starting to be thought. What it implies is that we humans cannot stay as we are, nor can we return to what we were. One way to go forward, while acknowledge the dominance of urban culture, is to start to conceptualise a city than can move. This does not presume this will be the only way of life, it does presume remaining or new cities will be dramatically different than those that currently exist. In all cases, living with less has to be, and will be, the norm.

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INDUSTRIAL DESIGN IS DEAD. LONG LIVE INDUSTRIAL DESIGN:

ADAPTING INDUSTRIAL DESIGN CURRICULA IN RESPONSE TO A CLIMATE-CHANGED FUTURE AND THE CURRENT UNIVERSITY CLIMATE

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Industrial Design (ID) has had enormous agency in how we now live — by determining the nature of our products; by steering everyday behaviours; by helping construct social norms; and by generating visions of what is desirable. What sets ID apart as a profession are its skill sets – its investigative process, its making, and its communications. Bound to these skills are critical and foresightful ways of thinking. Up until now, these skills have been deployed to support product consumption and a growth economy, rather than taking a lead in driving change towards more sustainable ways of living.

This paper discusses two significant drivers for ID curriculum renewal. One is inherent to the place and climate of ID in the university, the other is an inherited global concern: climate change.

The climate of ID in the university presents both challenges and opportunities. ID is a relatively new discipline in the context of the traditions and structures of the university. Like other disciplines of design, it has had to forge a scholarly identity for itself within the institution rather than depend on history for one. With its philosophy, pedagogy, knowledge and skill sets spanning Arts, Humanities, Business, Science and Technology, it does not always fit neatly within the disciplinary structure of the university. Where ID ends up being located, and the particular influence of its faculty/college/school discipline colleagues, impacts upon the structure and content of the curricula. Sometimes this brings great breadth and richness, but it can also run the risk of diluting a program and undermining discipline strengths.

As the recognition of the dramatic scale of climate change impacts emerges, it is clear that higher education will need to equip graduates with very different knowledge and skill sets. These include interdisciplinary competence, the ability to analyse and synthesise complex information and knowledge, technical and socio-cultural acumen, visionary and critical ways of thinking, and the ability to envision and communicate future scenarios that imply change to current ways of life. Both the material, practice-based knowledge embedded in ID and the pre-figurative nature of design thinking will be great assets in this context.

In recent years Industrial Design has acquired sustainability competencies through environmental management strategies such as Life Cycle Assessment that have been used to learn about the cradle to grave impacts of existing products, but also to drive sustainable design innovation. In addition, the rise of human-centred design and co-design has led to an increasing awareness of design as 'requisite equipment' for human practices (Shove 2003; Shove et al. 2007). Such knowledge and skills locate ID in a place of significant influence within the systems of production and consumption. Currently, however, ID graduates are entering a job market constrained by a shrinking manufacturing sector and the increasing 'dematerialisation' of product design in a digital era. Certainly in terms of the discipline forged in the early years of the twentieth century with an explicit consumer engineering agenda (Andrews 2009), ID is on a trajectory of decreasing relevance. This is arguably reflected in the discipline's compromised position within the university. However — and this is the central claim of this paper — there is great potential for ID to reinvent itself and apply its skill and knowledge sets to make a significant contribution to meeting the challenges posed by a climate changed future. In

order to do this however, ID needs to reinvent itself and redirect its skills and thinking to focus on mitigating that which causes climate change, and to adapt to its impacts. This will require a radical audit of its curricula to ensure our graduates are 'sustainability literate' and have the creative capacity and self-assurance to forge their own career paths in a new green jobs market.

PART 1: INDUSTRIAL DESIGN'S ID

The industrial designer, by necessity, is a generalist — able to interact with a variety of specialists involved with new product development. These specialists most typically include engineers, marketeers, ergonomists, manufacturers, and others. Trained in both technology-centred and human-centred subjects, the industrial designer can act as an interdisciplinary mediator between these parties and the intended users of products. The ability to communicate with various interested parties is important and involves active listening, problem refining, a critical thinking through of options based on past experience and new requirements, the ability to present these options appropriately as well as the artistry and craft involved in developing appropriate design solutions to problems. The social and technical aspects of Industrial Design are inextricably linked and non-linear, and require practical skills and material intuition and knowledge that can only be acquired through the *practice* of design.

In many ways design's entry into the academy has devalued the acquisition of practice-based knowledge and skills, or at least divided these unhelpfully along theory/practice lines. This is particularly apparent in the way materials and manufacturing related units have been taught in ID programs, where often the teaching is outsourced to other disciplines or taught by engineers or material scientists (Pedgley 2010). In similar fashion, some 'theory' units from art history, philosophy, social sciences or humanities are picked up by ID programs to provide a theoretical underpinning and credence to the program.

Jacques Giard wrote an article in an early edition of *Design Issues* entitled 'Design Education in Crisis: The transition from skills to knowledge', where he critiqued Industrial Design curricula with its bias towards skills over knowledge acquisition. Giard (1990: 27) argued for a redirection in curricula design with three critical points:

» Recognition and acknowledgement by the industrial design profession that their profession must, by definition, have a body of knowledge as well as a body of skills.

» The body of knowledge will come about principally through a descriptive process, such as research, pursued at both universities and in certain industries.

» It will become imperative that knowledge as well as manual skills be taught.

Over twenty years later, John Kolko (2011) summarised three key conflicts he observed within Design Education:

1. to train generalists or train specialists;
2. to emphasis skills or theory;
3. to focus more on technical or human-centred subject matter.

These conflicts reflect the particular disposition of the university which is biased against knowledge acquired though hand exercised skill. There has been a significant shift from hand-crafting of three-dimensional objects to three-dimensional digital visualisation and digital manufacture. This increased dependency on digital industrial design tools presents some significant efficiency gains, but often does so at the risk of diminishing craft-skills and knowledge. In addition, the design of curricula for a degree that is a composite of short-term, one-off subjects compromises the ability to mature and test design ideas and learn through a process of iteration and material and conceptual refinement.

The lack of making-skills, and consequently the limited technical and material acumen of students entering into University also places significant pressure on getting students up to speed in order to explore and realise their ideas in a three-dimensional designed format. Enrolling students in ID programs who may not have had any workshop or craft experience, and in many cases, entry to a program is based solely on an ATAR score with no requirement for prerequisite subjects in design, art, or technology where workshop-based activities and skillsets are acquired.

The Occupational Health and Safety (OH&S) implications of having novice makers in a workshop environment are also a risk that some universities are either unwilling or reluctant to accept and, further, under OH&S law the academic staff responsible for setting the student assignment can be held to account and fined if injuries occur. This places significant pressure on ID staff to mitigate risk, either by ensuring sufficient workshop training is in place, which has resource implications, or to adapt projects to be less

dependent upon workshop skills — all of which have bearing on curriculum.

All of this adds up to a diminishment of the vital and important dimensions of ID education. We contend that the context of climate change, particular the need for rapid adaptation of our built environments and supportive infrastructure for alternative social practices and behaviours, renews the need for ID's particular socio-technical knowledge and skills. In the early part of the twentieth century, these were used to great effect to i) drive consumption to stimulate the economy and ii) to soften the transition to modernism in the aftermath of the industrial revolution (Fry 1999). Now, these need to be redeployed to help us transition to a more sustainable future.

PART 2: THE OPPORTUNITY OF CLIMATE CHANGE

The full recognition of the scale of climate change impacts is still emerging, as is its continuing importance to higher education. The reality of a climate-changed future has highlighted the urgency for the Higher Education sector to address sustainability literacy (Thomas 2004; Sibbel 2007).

Sustainability literacy can be defined as the skills, attitudes, competencies, dispositions and values that are necessary for surviving and thriving in the current world climate (Stibbe & Luna 2009). To be literate in sustainability means more than simply 'knowing about' sustainability, it means *being able to act on that knowledge* – to judge and take appropriate actions in a given context. This highlights the *practical tasks* that are required to meet the challenges of climate change. To be 'sustainability literate' requires more than core discipline-specific competencies. It requires high-level critical thinking, innovation and the ability to work collaboratively across multiple disciplines. The quality and scale of change needed for sustainability requires building bridges between the specialised disciplinary groupings that constitute the traditional university (Fry 2009; 55). This lends support to the idea that climate change offers the discipline of Industrial Design an important opportunity for renewal.

In 1990, the Association of University Leaders for a Sustainable Future (USLF) identified a shortfall in sustainability literacy and laid out a ten-point action plan for incorporating sustainability and environmental literacy in higher education with the following rationale: 'Universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to

increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future.' (USLF 1990) The resultant Talloires Declaration (of which a number of Australian University are signatories) put sustainability literacy on the agenda for higher education internationally.

Similarly, in 2002 the United Nations General Assembly adopted a resolution to put in place the Decade of Education for Sustainable Development (DESD), spanning from 2005 to 2014, to 'encourage Governments to consider the inclusion ... of measures to implement the Decade in their respective education systems ... and national development plans.' (UNESCO 2005)

That higher education needs to address climate change imperatives has been highlighted in Australia in a study by the Dusseldorp Skills Forum and CSIRO Sustainable Ecosystems (Hatfield-Dodds *et al.* 2008). Findings show a looming green skills shortfall, particularly in technology and innovation domains in which future industrial designers will have significant influence. Their recommendations for the fostering of an innovation culture for sustainability within universities (as hubs for experimentation and research) is also suggestive of a new leadership role for Industrial Design in this domain.

It is clear that Industrial Design educators recognise the value of sustainability literacy in their courses. In Mariano Ramirez's survey conducted with Industrial Design educators in Australia (2006: 197–8):

» 92% of respondents agreed that they were 'passionate about getting students to advocate sustainability in their design endeavours'

» 90% agreed that 'sustainability should be integrated in all industrial design curricula in Australia within the next five years'

» 'Three-quarters disagreed when asked if sustainability issues should be discussed in detail in a separate course instead of consuming time in the regular design studios'

This provides a clear mandate for the renewal of ID curricula to promote sustainability literacy. But what is not clear is how best to integrate this within existing design teaching approaches, particularly where studio-based design education is being compromised in a university context.

A key question for our discipline, in response to these issues is: How can we, as industrial design educators, equip our graduates with the skills and knowledge appropriate to respond to climate change imperatives? How do we develop a new, shared agenda and

implementation strategies for sustainable Industrial Design education in Australian universities? This will certainly require an audit not only of the curricula – what to leave in a program, what to remove, and where compromises can be made – but also how it is delivered to enhance, indeed protect 'learning by doing' (Clune 2009).

There are a number of promising signals to suggest that the fundamental qualities ID offers can be redirected to address climate change imperatives through project-based education. Industrial Design's ability to envision and communicate alternative, more sustainable everyday scenarios has been capitalised on in Ezio Manzini's and Francois Jégou's International Sustainable Everyday Project (2003) which involved ID students envisaging everyday, almost prosaic scenarios of more sustainable futures. Similarly, in Australia, designers have been engaged in multi-disciplinary teams to address local climate change imperatives by generating detailed alternative scenarios for production and consumption (Allen *et al.* 2009). Chris Ryan, director of The Victorian Eco-Innovation Lab (VEIL), sees a new role for design emerging 'as a powerful tool for public visioning and for generating a dynamic for change.' (Ryan 2008: 2) This directive capacity is fundamental to design (Fry 1994: 1999) and has the potential to positively inform the change agendas of other disciplines. Design, as Margolin and Buchanan (1995) have noted, offers a path to new learning within interdisciplinary collaborations. In essence, ID has the potential to not only inform the sustainability literacy of its own graduates, but also graduates of other disciplines.

CONCLUDING REMARKS

The context of a climate-changed future confronts human populations with a new epochal framework that demands adaptive forethought and the ability to act strategically now to enable the best possible future conditions. Whilst technological innovation is critical, responsibility for our survival cannot be delegated only to technology (as suggested in Weinberg's (1966) concept of technological 'fix') nor is it dependent on the moral character or 'awareness' of consumers (which is the position so often advocated by the populist mainstream). On the basis of the preceding discussion, we seek to position ID – its social and material cultures, its practical knowledge and skills, its change agency – as central factors in enabling viable futures. In order to embrace the leadership opportunities offered by climate change however, ID's particular practice-based skills and knowledge need to be supported but also redirected with a clear agenda of enhancing the change agency of design

and its capacity to communicate its skill sets competitively in relation to the broader adaptive needs of society. This may require that ID's identity also needs to be remade, away from shame-faced attempts to become more academic and toward an embrace and promotion of its specific practice-based knowledge and skill sets. If, as suggested by the sustainability literature, there is a strong affinity between the learning by doing required to develop 'sustainability literate' graduates and the capacities of Industrial Design, such a remaking may have an important bearing on the status of design within university education more broadly.

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FROM PRODUCT DESIGN TO DESIGN THINKING:

THE ESTABLISHMENT OF A NEW PRODUCT/INDUSTRIAL DESIGN PROGRAMME IN NEW ZEALAND

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The school of Art and Design at Auckland University of Technology, New Zealand has recently developed new undergraduate and postgraduate programmes in Product Design. The development is the result of intensive research and pedagogical development in response to emerging needs of industry and of graduates. The undergraduate programme consists of a new major within the existing Bachelor of Design programme, and a new postgraduate strand in the Bachelor of Art and Design (Honours). Given that both programmes graduated their first students at the end of 2010, it is timely to reflect on the development process, and progress to date.

This paper describes the development of the undergraduate and postgraduate programmes, the unique features that underpin the teaching and learning philosophy, and the key strategies the programme is using to produce students who have strong design values, and who are not just highly skilled designers, but who are also strong design thinkers. The philosophy is underpinned by a constructivist learning and teaching approach, focusing on

developing students' independent capabilities beyond the traditional design skills. For example, students' are asked to consider the impacts of their design decisions by emphasising Design Thinking to explore social and environmental sustainability related challenges. To assist this, the programme has instigated a number of strategies including enhancing staff understanding and capability, developing design thinking process models, as well as a range of resources to support the learning and teaching.

INTRODUCTION

The undergraduate and postgraduate product design programmes at AUT University were developed in 2007, launched with the first intake of students in 2008 and have been implemented over the following years. In 2011, the programmes will have 75 students at undergraduate and 8 students at postgraduate level. The development of a new academic programme provides many organisational and operational challenges. Yet it also presents a unique opportunity to develop new approaches to learning and teaching without the constraints of institutional history and tradition, to better respond to the needs of industry, the graduates and the wider community. The development process involved considerable industry discussion, the review of current product/industrial design programmes in New Zealand and overseas, and reflections on the current direction of product/industrial design pedagogy internationally.

In essence the approach, philosophy and structure of the current undergraduate and postgraduate programmes at AUT were developed to be both appropriate to the needs of graduates, as well as a compliment to other more traditional product/industrial design programmes in New Zealand. For example a three-plus-one year structure was developed, while all other similar university programmes in New Zealand were four years in duration. Staff recognise that for most students, three years of study is not sufficiently long enough to develop the maturity, and high levels of critical and complex thinking, required to ensure that they can engage actively and effectively with the complex design challenges that many will likely face after they graduate. Consequently, the focus of the three year undergraduate programme is on developing an appropriate balance between traditional design skills, design thinking and embedding deep design values, while higher level critical reflections on the role of designer is reserved for those who continue into the more extensive honours (or higher level postgraduate) programme, where a diverse variety of practical and theoretical challenges may be explored more independently in greater depth.

UNDERGRADUATE

The undergraduate programme comprises three years of theoretical and applied course work. Approximately half of the programme is dedicated to theoretical support papers, with the remainder consisting of applied (practical) design papers taught in a physical design studio environment. A constructivist teaching approach (Morphew 2009) is used to support the teaching of studio papers, with an emphasis on developing student collaboration and increasing the level of student independence over the three years. Some of the mechanisms the programme uses to achieve these is outlined in more detail throughout this paper.

The programme culminates in a major collaborative design project usually undertaken in partnership with local communities, the design profession, and/or industry. Each year in the programme, students work on a number of sponsored projects with New Zealand businesses, manufacturers and design companies. This ensures an ongoing interface for students and staff to a professional context and helps to provide ongoing feedback on quality and standard of work generated in the programme. For example in 2010, the programme worked with leading New Zealand companies, Fisher & Paykel Healthcare, Medicine Mondiale, Trade Aid and Zespri on sponsored student projects.

POSTGRADUATE

Staff recognise that the short undergraduate degree of three years makes it difficult for all but the most successful and mature of students to be in a strong position to successfully contribute to the professional design community. Consequently, the programme encourages those students who are driven to work in the design profession, or those who are wanting to make a more significant contribution to the design profession through more advanced academic research, to further their studies via the postgraduate programme. The Honours year is considered a 'bedding in' year, where students from the undergraduate programme can further develop their core design skills while being introduced to more advanced theoretical design research through a practical, and professionally linked research project.

The focus on design thinking at postgraduate level is beginning to drive strong links and engagement with New Zealand business. This imperative has resulted in the

development of number of specific learning and teaching initiatives, including a working partnership with a number of New Zealand businesses and design organisations. Correspondingly, a close working relationship has been developed with Better by Design, an organisation within New Zealand Trade and Enterprise, vested with lifting business performance through the development of design and design thinking capability within New Zealand businesses.

EDUCATING FOR DESIGN VALUES

There is a strong consensus from staff teaching on the programme that universities have a responsibility to the continued advancement of the role of design in addressing social, environmental and economic challenges as faced by society. As a response to this imperative, and specifically to emerging world sustainability issues, design and innovation for sustainability is currently being deeply embedded in the curriculum, pedagogy and focus for the entire programme. A number of initiatives are seen by the department as a catalyst to assist in building knowledge and capability in the area of sustainability and to start to gauge student interest, awareness and understandings related to sustainability. All projects (or briefs) delivered in the programme are designed to address sustainability (at varying levels of complexity), and students are encouraged to undertake projects that advance the well being of society, on the occasions that they develop their own individual projects.

EDUCATING DESIGN THINKERS

To support the programmes emphasis on developing capabilities in Design Thinking (in conjunction with traditional design skills), the learning and teaching approach at under graduate level has expanded the definition of a 'product' to incorporate a range of outcomes i.e. 'the product of' a creative design process. The emphasis being on learning focuses on design thinking as an outcome, rather than necessarily on tangible, physical 3D product outcomes. This is supported by the teaching of design thinking principles, methods and processes in the context of studio projects.

Design Thinking is described as the study of the cognitive processes that are subsequently manifested in design action (Cross 1992). Design thinking may be distin-

guished from design by describing the cognitive processes that designers use; as opposed to the objects they produce (Dunne & Martin 2006). Through Design Thinking new patterns and concepts are conceived to provide creative solutions to problems through the use of inductive, deductive and abductive reasoning (Dunne & Martin 2006).

Owen (2007) examined the challenge of educating designers in Design Thinking for broader roles in areas outside of traditional design activities. Designers were observed to often be taught using tacit approaches (as opposed to explicit or more formal approaches). While historically effective, this approach may not provide a broad enough foundation to adequately cater for the diverse array of current design contexts. Consequently, there is a need for more formal Design Thinking courses to be developed, as well as a new type of academic leadership in this area (Owen 2007). Dunne and Martin (2006), Brown (2008), Lindberg et al. (2011), Gumienny et al. (2008), Lockwood (2010), and Owen (2007) all identify a number of key attributes and themes that underpin, or are central to the concept of Design Thinking. The following describes some of these key themes:

Human-Centeredness:

Having a deep empathy for (and understanding of) the people whom you are designing for, is a critical aspect of Design Thinking. Design thinking is "powered by a thorough understanding, through direct observation, of what people want and need in their lives..." (Brown 2008: 86).

Creativity and Experimentation:

Underpinning the unique 'world view' that designers possess is the notion of an optimistic outlook driving creativity and experimentalism. Designer Thinkers assume that no matter how challenging the constraints of a given problem are, at least one potential solution is better than the existing alternatives. (Brown 2008)

Integrative Thinking:

Designers not only rely on analytical processes, but also exhibit the ability to see and grasp the key (and sometimes contradictory) aspects of a problem and are able to synthesise new solutions that go beyond, and dramatically improve on existing alternatives (Brown, 2008). In addition, the idea of integration between the creative, and the traditional concurrent business analysis is important. (Lockwood 2010)

Design Thinking Models and Processes:

Design Thinking is underpinned by a number of key process models, and methodologies which have evolved from the design profession. While sequential (step by step) process models play a core role in Design Thinking education, Design Thinking principles ask for much more adaptability and flexibility of design workflows than sequential models suggest Lindberg et al. (2008). Design Thinking "is not a substitute for design, but rather a methodology for innovation and enablement." (Lockwood 2010: 11)

LEARNING AND TEACHING STRATEGIES

To support the learning and teaching approach, the programme development process, and to enhance staff capability, a number of key strategies have been implemented. These include:

Design Studios:

Careful consideration was given to the development of physical studio spaces, as key to developing a programme culture supporting design thinking approaches. Each year group is allocated a large, open plan studio space, with individual students provided with well-equipped personal workspaces (see Figure 1). The programme encourages students to work as much as possible in the studio spaces and to create an environment that is supportive while supporting an atmosphere of positive critical reflection on design decisions and processes. To facilitate this students are encouraged to display their design process work, prototypes and display models throughout the design process.

Figure 1: Example of undergraduate studio space

Augmented Studio:

In addition to the physical studio the programme team is developing a number of online initiatives to complement and enhance the physical learning environment. In 2010 programme received an AUT Centre for Learning Teaching grant to develop and integrate electronic portfolios in the product design programme curriculum. This involved the undertaking of a detailed literature review and case study, designing a delivery system, and to trial the use of the Mahara Electronic Portfolio Software (*Mahara Open Source Portfolios* 2011). This will be further developed with the introduction of Web 2.0 tools into the learning environment in 2012.

Design Thinking Toolbox:

To further support the Augmented Studio, an innovative, online Design Thinking Toolbox was developed and trialled in a number of practical design studio projects in 2010/11. The toolbox is a flash/PDF resource with 36 key design thinking methods (see Figure 2) considered core in the design thinking approach. The resource includes a summary of each method, examples of 'best practice' student work and links to related resources. The success of the initiative has resulted in it being further developed for wider integration into the programme, where it may be more thoroughly evaluated and improved.

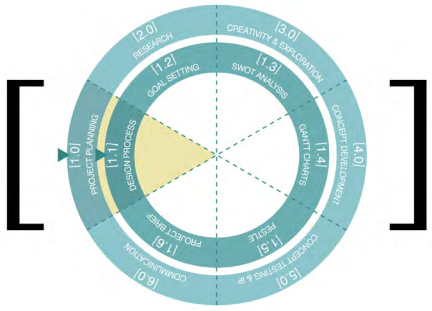

Figure 2. Design Thinking Toolbox Interface

Three Day Design Challenge:

In the middle of each year, all the students in the programme are brought together, from year one through to postgraduate level, and are challenged to undertake a 'real world' design project in mixed year level groups over 24 hours or three days (this alternates each year). Each challenge is an exciting opportunity to involve students in a meaningful project, with an inspiring external partner. Students gain the valuable experience of working closely in a team situation, and to collaborate with their peers from different year

groups. In 2010 Sir Ray Avery, chief executive of Medicine Mondiale, challenged the students to design and construct a working solution to a key aspect of a newly developed infant incubator for use in developing countries. The goal of the project was to develop a method of humidifying air with few, if any, moving parts, as little electricity as possible, and to last for a period of 10 years with no (or minimal) maintenance.

Design Thinking Workshops:

As a result of the growing capability in teaching design thinking, and through the professional relationships developed, an opportunity was identified for the AUT Product Design department to develop and deliver design thinking workshops to businesses and organizations. The workshops target key executive staff of businesses and organisations who wish to integrate design thinking as a strategic business process. The workshops are hands-on in nature, and business executives are partnered with postgraduate Product Design students to undertake a specific design challenge over two days using Design Thinking principles, tools and processes. This provides individual businesses with an overview and experience of design thinking, while concurrently allowing Product Design students to work in collaboration with business leaders (see Figure 3).

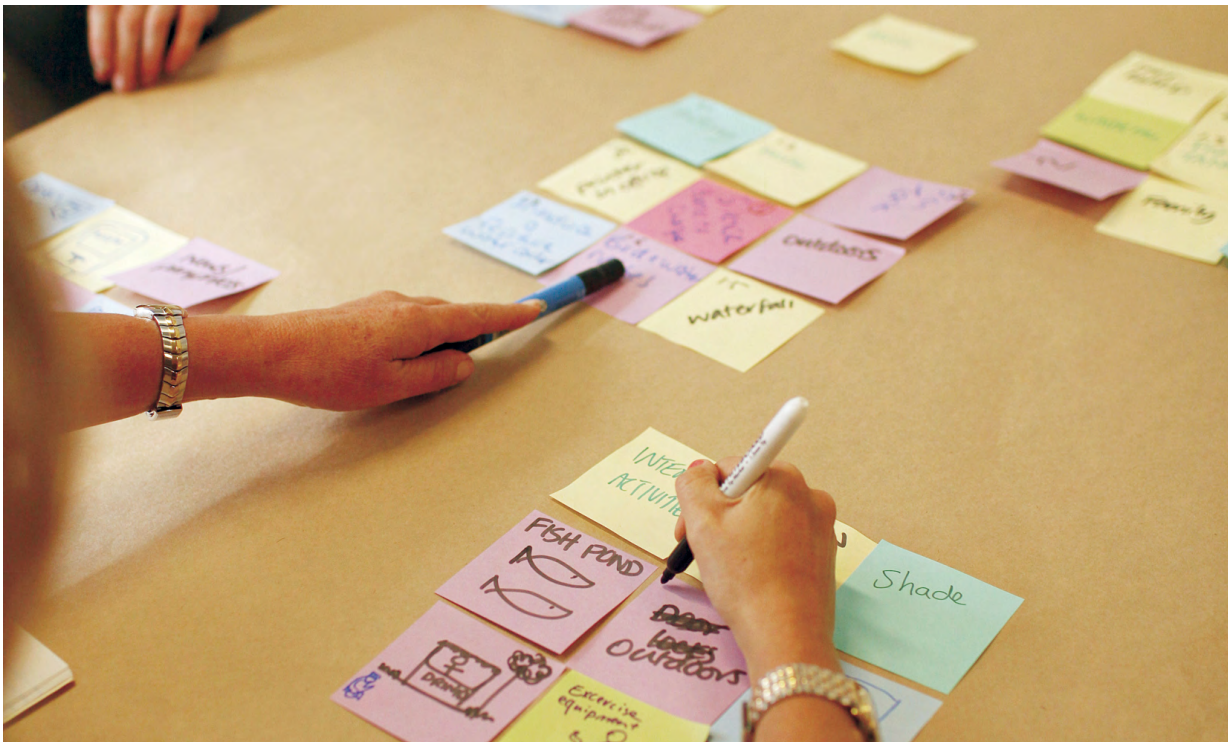

Figure 3: Design Thinking Workshop

DISCUSSION

Developing, launching and growing a new programme was always going to be a difficult and challenging task. Staff believe that while it has been a short time since implementation, a number of key indicators demonstrate that the approach is effective. Feedback from industry and both academic and design profession reviews indicates that the top end of the students working at both undergraduate and postgraduate level, are producing design work which is of international quality. In particular, these are most often those students that have embraced (i.e. selecting and undertaking projects with) deep environmental and social values, and who have integrated Design Thinking approaches with traditional design skills.

A number of students from the first cohorts of students have been recognised in national and international design competitions. For example Michael Grobelny, a postgraduate Product Design student in 2010 developed an alternative surfboard solution project, titled Cleaner Waves, that uses materials and processes that are of low environmental

Figure 4: Cleaner Waves

Figure 5: Mobile Apartment Garden

impact, while providing a high performance surfing experience (see Figure 4). Michael was a finalist in the 2011 Industrial Design Society of America, IDEA Awards; received a Gold Award in the 2011 New Zealand Best Design Awards; and was the winner of the 2011 Australasian Student Design Awards. Nancy Wang, an undergraduate student, was also a finalist in the IDEA Awards for Mobile Apartment Garden (see Figure 5). A number of other students received gold awards in the New Zealand Best Awards.

While there has been some excellent early recognition for both programmes, staff also recognise that there is a number of emergent issues to be addressed as part of the ongoing development process. In particular staff have noted that there is often a tension between emphasising Design Thinking over traditional design skills within a very limited time frame and structure. Staff have found that the higher achieving students generally embrace and thrive with this approach, while low achieving often students struggle with managing the intellectual complexities with managing more complex projects. A strategy needs to be developed to better support these students.

Based on discussions and the ongoing reflections of staff, a number of key areas of have been identified that would benefit from further development and focus as part of the ongoing programme development.

- Develop strategies to further empower students to develop more independence earlier in the undergraduate programme, so they take more control of their learning.
- Develop stronger links between the undergraduate and postgraduate programmes.
- Develop closer relationship with industry partners, charities and organization, with the expectation that students undertake a deeper exploratory level of theoretical and applied Human Centered Design research using Design Thinking methods to support practical solutions to opportunities that are identified.
- Group postgraduate projects by themes, i.e. collaboratively based individual projects with overlapping contexts.
- Develop further relationships with complementary product/industrial design programmes, both within Australasia, and internationally. This includes developing both student (particularly at postgraduate level) and staff collaborative design and research projects.

CONCLUSIONS

While the development of new academic programmes present many organisational and operational challenges, it also offers a unique opportunity to develop and try new

approaches to learning and teaching without the constraints of institutional history and tradition. This paper has described the development of undergraduate Product Design programme in the Bachelor of Design, and a new postgraduate strand in the Bachelor of Art and Design (Honours) at AUT University. It has presented the underlying philosophy and approach to learning and teaching that produces students who are not just skilled designers, but who are also strong design thinkers, and who have deep values behind their work.

Feedback from industry, reviewers and the design profession has indicated that this approach is working, particularly for higher achieving students who have embraced design values and design thinking as a core to their study. The programme staff acknowledge that there is still more development and refinement needed for this approach, especially the need develop strategies to better support students at the lower end of the achievement spectrum, in particular those undergraduate students who struggle with critical and complex thinking.

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JIM MONTAGUE – MEMO TO STAFF OF THE INDUSTRIAL DESIGN DEPARTMENT

SYDNEY COLLEGE OF THE ARTS 1985

Jim (James) Montague was head of Industrial Design at the University of Technology, Sydney, formally Sydney College of the Arts, from the early 1980s until mid-1990s. He was an influential design educator and remembered with affection by many of his colleagues and those many students who studied Industrial Design under his guidance. Students would be enthralled with his tales of the design elite from the United States, such as various Bauhaus émigrés, as well as Eames, Saarinen, and of his friend Chuck Owen from Illinois Institute of Technology. This would be complemented with engaging slide shows drawn from an extensive collection of images that would be precisely prearranged on an ingenious vertical light box before loading into duel Kodak carousels. His wife Mary, also a designer and who has run a successful design consultancy for many years, has kindly offered a selection of his writing from those formative years of Industrial Design at Sydney College of the Arts.

The following is a compilation of discussion papers circulated to staff during the 1980s. They offer an insight into his knowledge of design education and to the pressing concerns of teaching Industrial design at the time.

— Miles Park

THOUGHTS ON DESIGN AND INDUSTRIAL DESIGN EDUCATION

J MONTAGUE 1985

Design, and Industrial Design in particular, is in the process of turning a corner, of altering its mode of practice and its relationship to its clients and the production and distribution of manufactured products. To many practicing designers these changes are uncomfortable or even threatening.

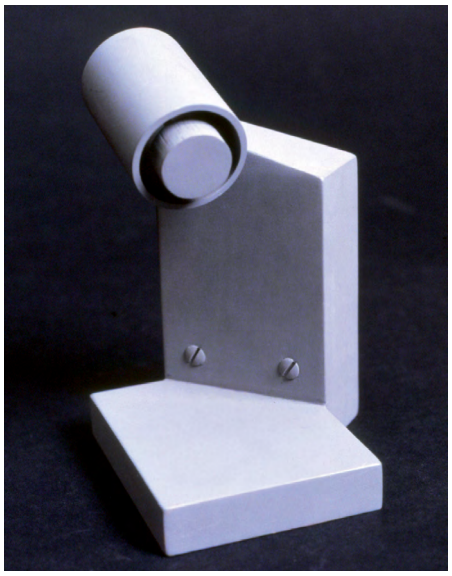
For many users of design services this changing role is almost as confusing as it is to some of the 'old guard' designers. To make the best use of design, in the long term, an appreciation of what is happening or about to happen can be of great value to the design using community.

Formalized design education really started in the 1930s. It was largely craft based and was more concerned with form and the individual making of form than it was with the functional performance of the product. Education either followed the current practice of design or one of the various theories. Teaching staff tended to be highly dogmatic in their approach to form manipulation or tied closely to the practical skills of presentation or production techniques. The early institutional instruction was based on the needs of the practice as it then existed and as such was more of a training course than an educational activity. Design students were taught to perform rather than to make decisions. There were, of course, several schools which tried to include more planning in their curricula and, indeed, several which ignored the immediate needs of the design profession by looking beyond the current state of the practice and suggesting other ways of doing things. The 'flavour' of each course was affected by the nature of the institution in which it was lodged. The Art School based design programs tended to retain the old craft based aesthetic with a form oriented approach without much, if any, reference to technology.

Design courses taught in Engineering institutions tended to stress the technical and 'practical' aspects of design, often at the expense of a sensitivity to product aesthetics. If the purpose of a design education is to prepare students not only to work in, but to exert a positive force on the process of product development for some time into the future then it must concentrate on those aspects of the practice which are likely to remain constant or which will only change slowly. One of these involves the designer's information base. Information is, itself, transient, but the need to search for information will remain a constant

problem for designers. The basic means of gaining access to information and strategies for the application of information are activities will which serve the designer as useful 'skills' for many years.

If education, as an activity, can be defined as 'learning how to learn' and training as 'learning how to perform' then a well balanced design program will contain the appropriate proportions of each. At least a minimum of 'training' should be retained. The practice still operates in both modes and requires designers who are comfortable in both. It seems reasonable in design education to concentrate in the earlier years on more of the training (skill, practice) experiences and in the later years with more opportunities to engage in research and to learn independently. Even this ability, however, must be introduced at an early stage. Neither should be totally isolated from the other. Nor should any of the teaching staff specialize in one to the exclusion of the other. This can lead to the thought, on the part of the students, that they are independent and competitive modes of practice. This belief can also affect the relationships of the staff to each other and to the total program. All of the classes, no matter what their prescribed content, should contain elements of both learning activities. Some, by their nature, will be heavily biased toward one or the other, but in a design school the attitude of exploration (part of the learning how to learn) should be present in even the most conventional course content. There is as much room for 'creativity' in engineering drawing as there is in objective drawing and as much hard information in classes in photography as would be expected in manufacturing technology. Design education must do more than simply provide for the current needs of the professional practice of design.



Left: Year 1 component form study
Above: Year 1 tactile form hand tool

TO STAFF OF THE INDUSTRIAL DESIGN DEPARTMENT.
25 SEPTEMBER 1985
DISCUSSION PAPER ON DESIGN EDUCATION – 'HANDS-ON'

FROM: JMONTAGUE

This is the first of what will be a series of papers dealing with some of the educational issues we must face in the immediate future.

1. BACKGROUND

We have all heard or read about the impact of TV saturation on the present school age generation. We have all noticed the differences between students who had some sort of accessible home workshop and those who didn't. Some of these previously common experiences lead to an 'innate' understanding of things structural and mechanical. Things either fell down or they didn't, they worked or they didn't. It didn't take an engineering education to figure out what had happened and how to fix it. Our experiments were scaled to our capacities and interests. It was through the accumulation of many unstructured, informal learning experiences that they, and we, learned about he world of things before we were taught about it.

2. THE PROBLEM

We can't screen our applicants for these previous experiences or we would have very small, and rapidly shrinking, entering classes. Another fact of current society is that women are usually less experienced in the 'hands on' skills of making things of a structural/mechanical nature than males, but there are certainly many males who share this problem and may have an even more difficult time in admitting their ignorance. How do we give them, in accelerated form, a range of hands-on experiences they didn't have through their home life or their previous education?

If our goal is to prepare our students to survive in and to take control of the professional situations in which they will find themselves five years or so after they complete the course we must stress basic principles, those which are likely to be useful for many years to come. One of these principles or capacities is developed by direct use of tools and simple machines to solve problems. I stress the direct use of equipment. It doesn't do very much good to emulate the second hand TV experience in trying to develop an appreciation of the

effect of a tool on a material. It is a little like watching a film on bicycle riding and never trying to do it yourself.

3. PROPOSAL

Our program, in the first year, must be structured to give as many of those free-form learning experiences as possible. The emphasis should be on exploration, investigation, discovery and analysis and not on getting 'correct' answers to posed problems in which we know and conceal the 'truth'. A correct answer does not give a very good indication of the ability of the student, it could have been a matter of luck and neither understanding or knowledge. The biggest problem in this plan is to assure the safe use of the tools and machines safe for the user, and the equipment. A careful and thoughtfully graded series of projects should be developed to build skill and confidence in the students. Not everyone will need the same introduction, students from country areas, both male and female, generally have a greater affinity for tools and processes than their urban or suburban counterparts. All projects should be 'open ended' so that there is no single correct solution, just those which are more sophisticated. These students should receive as much instruction and coaching as necessary and as many demonstrations as possible, but they must do the actual work themselves. It is crucial that no physical assistance be given to these less experienced students. This is necessary to ensure that they have really learned to use the equipment and that they can be expected to employ it intelligently to solve problems at a later date.

5. IMPLEMENTATION

We now have a curriculum whose content is largely controlled by the personalities and interests of the individual staff members. There is no intention of removing this personal element from the program, indeed it should be encouraged to give life to the classes. What is necessary is a framework of agreed upon goals toward which each staff member is working, each in their own area of specialisation. The development of a course content structure and set of goals would be of great assistance to new part-time staff who now are thrown in the deep end and are expected to swim to our sometimes obscure targets. I suggest that we start with the three-dimensional class; Technology Workshop, which we might re-name Workshop Technology, to be followed by Objective Drawing, Industrial Design, Engineering Drawing, Design History and our own Computing basics.

TO STAFF OF THE INDUSTRIAL DESIGN DEPARTMENT DISCUSSION PAPER ON DESIGN EDUCATION – 'OBJECT DRAWING'

FROM: JMONTAGUE

1. BACKGROUND

The Objective Drawing classes have become a solid base upon which we can build professional design presentation skills. One of the peculiarities of design drawing is that the objects being drawn do not exist. This means that the entire context and means must be invented by the designer based on general principles and conventions. We recognise the growing importance of CAD systems in design and see the time in the not-so-distant future when all exploration and presentation drawings will be produced electronically. There are some offices, overseas, which are doing this now. It will be some time before it happens here and until that time comes drawings will have to be made by hand.

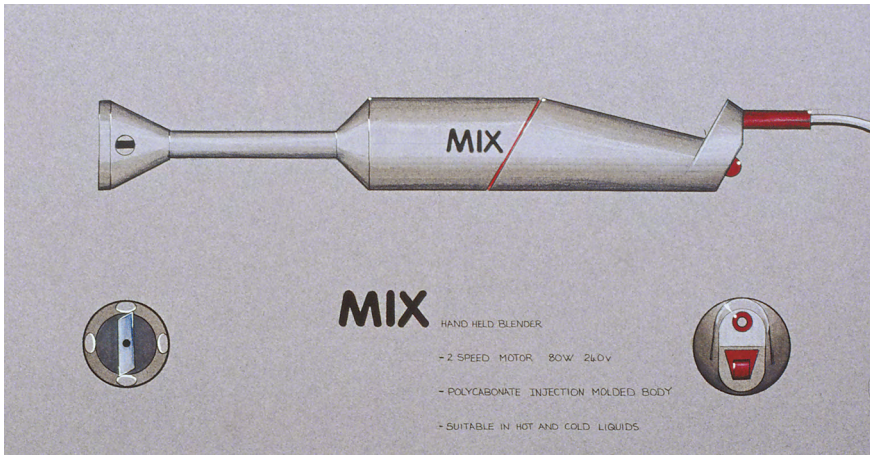
2. CURRENT SITUATION.

We are all aware of problems in the application of these early skill building experiences to the projects assigned in later years. We must face several unpleasant facts.

First, our entering students do not draw. This may be due to the kind of applicant we attract or it may be a factor of our screening policies, but this is a notable weakness in the first year classes.

The second fact is that they do not seem to become more interested in drawing after completing the mandatory Objective Drawing class. Drawing remains one of the onerous tasks associated with a design project. It seems that only in the third year will the odd student become interested in producing thoughtful exploratory drawings as a part of the design process.

A third fact is that, whatever else a student has as strengths, the absence of design drawing skills puts our graduates at a distinct disadvantage in the marketplace. Our program and our graduates have been widely and publicly criticised by officers of the Australian Design Council because of this shortcoming.



Year 2 rendering

3. OUR PROBLEM

It seems quite evident that unless our students achieve at least a basic level of drawing ability they will not be thought of as 'professionals' by much of the design community and will not feel the equal of those who possess this skill. The basic problem lies in the fact that few, if any, of our students feel comfortable drawing, either to try out ideas or to explain their ideas to others. These are the sorts of drawings which can be done on the backs of envelopes. They can have a great deal of informality, but must be clear and must convey the essence of the idea. The act of drawing must be so natural that it doesn't interfere with ideas being explored or explained. As we all know this can only come from drawing continuously. It cannot be achieved in class time alone. Drawing must become second nature, a major way of 'talking' to oneself and to others.

4. PROPOSALS

Drawing must be required in all design and design related classes as a part of the problem solving process. There need not be an orthodoxy to the style of drawing required and exploration of a variety of methods should be encouraged with examples of alternative drawing styles presented when ever possible. Each student should develop a personal style with which they are comfortable and which is consistent with the purpose of the drawing. High quality tools and materials must be used if 'professional' drawings are to be achieved. A formal presentation of design proposals should be required at some point in each project. The presentation quality should be critiqued as well as the content of the project. A separate assessment should be recorded and averaged into the project grade. The style and placement of graphic and typographic elements on the presentation board should be consistent within any student's presentation.

EXHIBITION REVIEW

DIGIFACTURE –

INDUSTRIAL DESIGN AND ADVANCED MANUFACTURING: A NEW RELATIONSHIP

BERTO PANDOLFO

Digifacture was an exhibition of product designs staged at Fraser Studios, Sydney, in August 2010. The designs presented were the result of a collaborative research project between Advanced Manufacturing Services Pty Ltd, Australia and the University of Technology, Sydney (UTS).

The Digifacture project investigated the extent to which Selective Laser Sintering (SLS) could streamline the product design and manufacturing process. SLS is an advanced rapid prototyping technology that fuses plastic or metal powder into a solid part by melting it locally using a laser beam. The major difference between SLS and conventional rapid prototyping is that the parts constructed using SLS have superior structural integrity.

The field of Industrial Design like so many others has been greatly impacted on by the digital revolution. Computer Aided Drafting (CAD) and Computer Numerical Control (CNC) machinery have significantly changed how industrial designers design and develop products for manufacture. A core activity of the industrial design process is the construction of models or prototypes, which since the late 1980s has been facilitated by the

Photographs from the Digifacture opening by Adi Firstman

technology of rapid prototyping. Early examples of this technology were hindered by issues of poor resolution, susceptibility to humidity and temperature, fragility and high cost. The latest machines produce parts that are similar in strength and detail to parts made using conventional manufacturing techniques. This now places rapid prototyping technology in a position of great interest; can conventional manufacturing techniques be replaced by this new technology?

The project invited practicing industrial designers to work with a team of industrial design students from UTS. They were asked to develop design solutions that best take advantage of the SLS process. The direction of each project was open to be influenced by the expertise of each of the invited industrial designers.

The invited designers were Bert Bongers, Jos Mulder, Roderick Walden, Berto Pandolfo, Douglas Nash, Shelden Vaughan, Adam Goodrum and Stefan Lie.

The designs presented varied across a broad spectrum of typologies including; home-wares, eyewear, bicycle componentry and custom designed computer interfaces. Furthermore a number of differed features of the SLS technology were exploited; geometric complexity, strength and integrity and part consolidation. The rationalisation of parts was a key driver to the Mountain Bike Crank Arm design by Roderick Walden which unified three separate parts; the spindle, drive side crank arm and spindle bracket into the one piece. Additionally, the process allowed for Walden to design an open structure that maintained strength but reduced material usage and therefore the final weight of the part.

As costs of SLS parts become more attractive we will no doubt see industrial design modify again in accordance with what SLS and similar technology is able to offer, firstly, in terms of design opportunities and then in new ways to manufacture.

CLEANER WAVES

MICHAEL GROBELNY

AUT UNIVERSITY.

Cleaner Waves is an alternative surfboard solution that uses materials and processes that are of low environmental impact, and provides a high performance surfing experience.

Finalist, 2011 Industrial Design Society of America, IDEA Awards

Gold Award, 2011 New Zealand Best Design Awards

Winner, 2011 Australasian Student Design Awards

For more information see: www.youtube.com/watch?v=iq3Bww1w_ms

DOWNHILL SKI SIMULATOR

EDDI PIANCA,

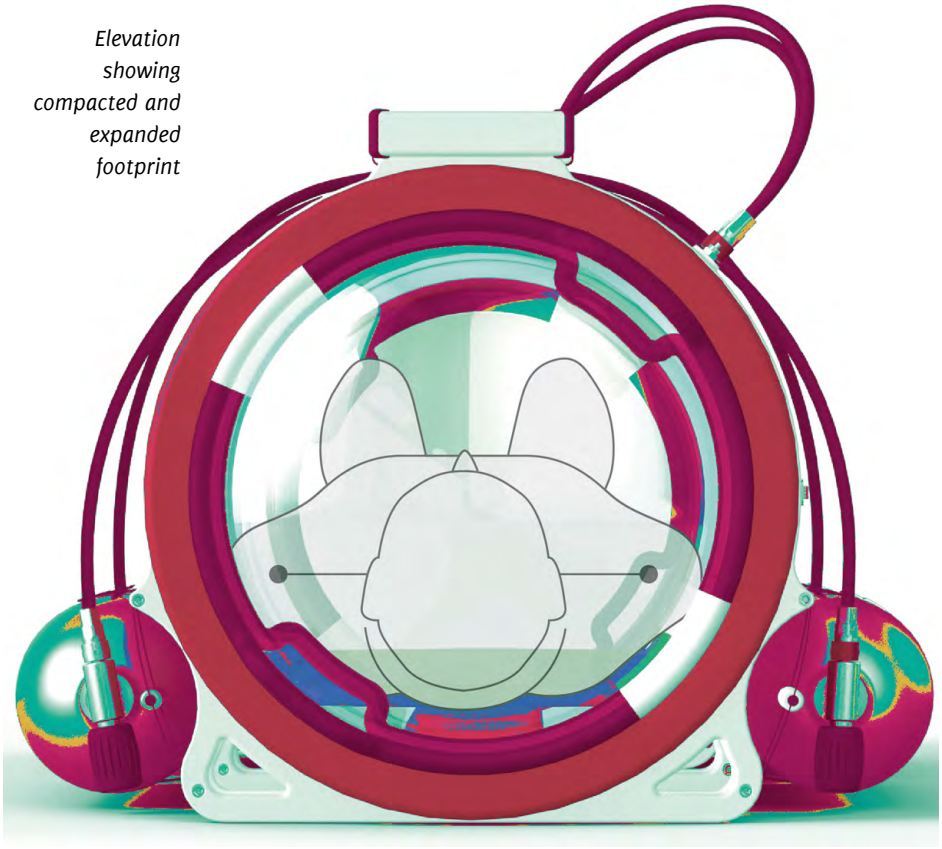
UNIVERSITY OF CANBERRA

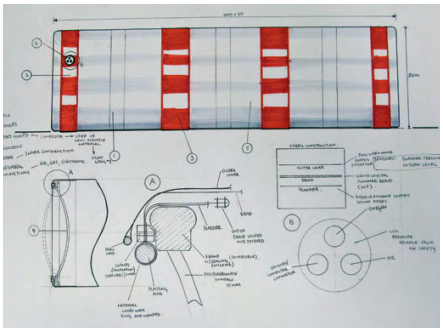
Industrial designer Dr Eddi Pianca skiing on a new downhill ski simulator he designed and developed. Results from experimental tests using the new simulator (conducted by Eddi Pianca and supervised by Emeritus Professor Bill Green) provided tentative evidence that for the first time a complex whole body activity (parallel turns in downhill skiing) learnt on a simulator can transfer into the real world.

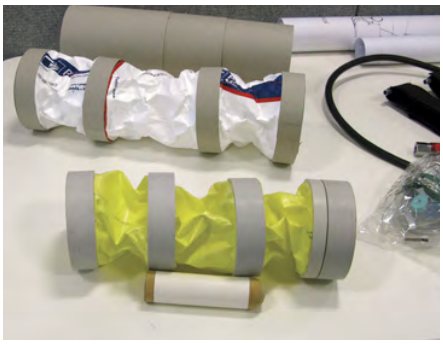
This project culminated in the award of a PhD degree:

Pianca, E. 2011, The Learning of complex whole body activity (Downhill Skiing) by Simulation, Unpublished doctoral thesis, University of Canberra.

Elevation showing compacted and expanded footprint







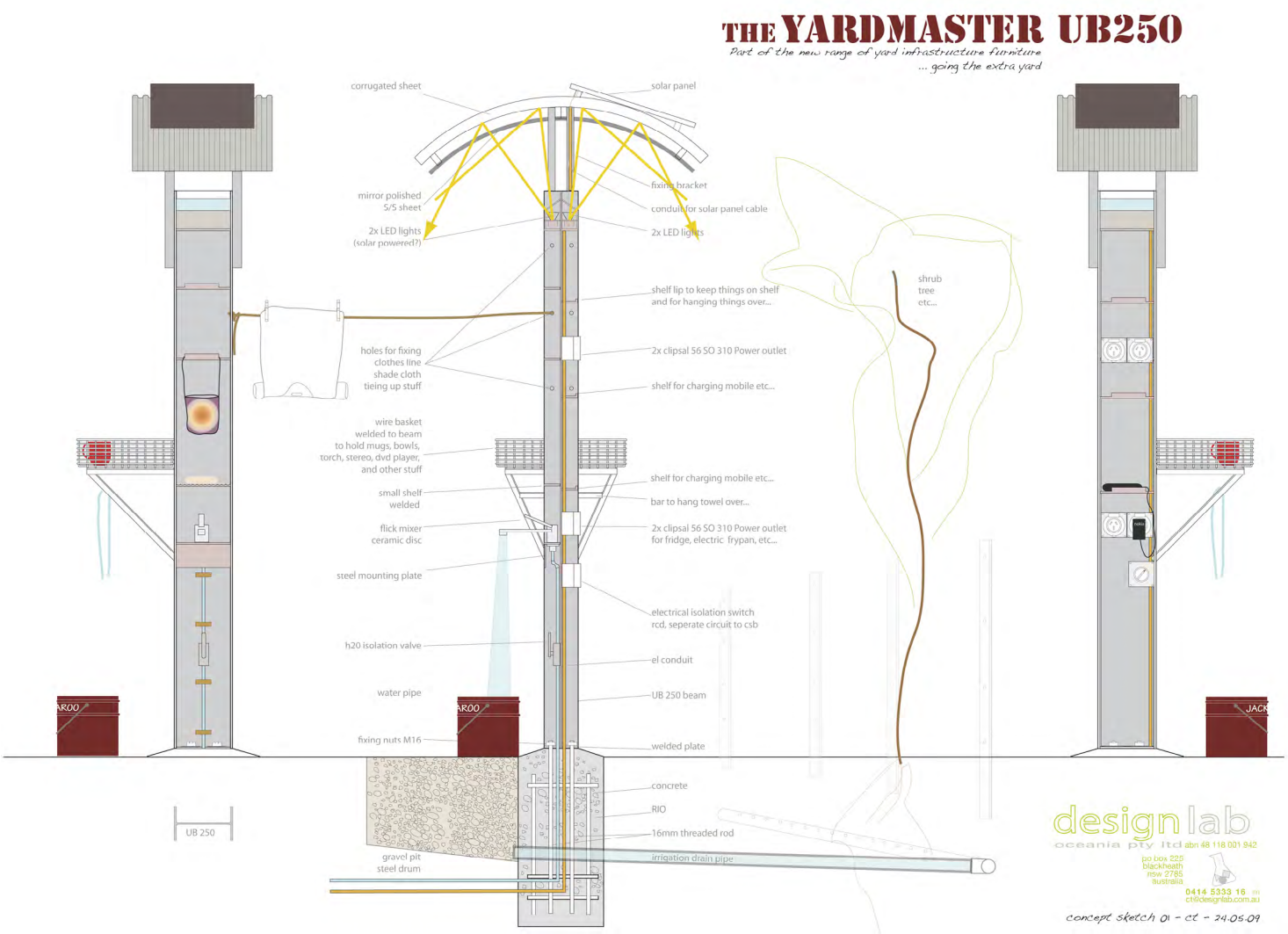
ATMOSPHERE

ALFRED CHING,
UNIVERSITY OF NSW

Atmosphere is an on-site solution for the treatment of decompression illness ('the bends') which can occur in scuba divers who remain underwater for prolonged periods or as a result of rapid ascent to the surface.

Chances of survival and full recovery are increased by eliminating transit times to on-shore facilities. A flexible cylinder made from composite fibre braiding along with rigid support bands gives the unit its strength to maintain elevated pressure and allow it to be fully collapsible, reducing its storage footprint on-board ship.

Above:
Design development of collapsable chamber and pressure rings and ergonomics study
Photographs: Miles Park 2011



Initial concept

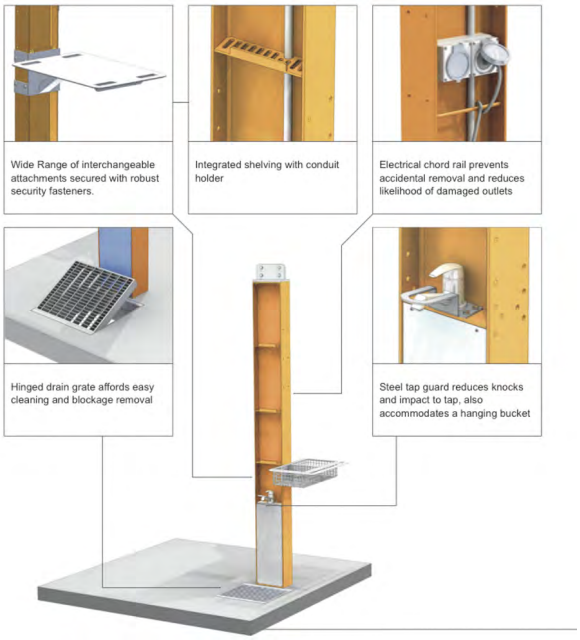
YARDMASTER

CHRISTIAN TIETZ,

UNIVERSITY OF WESTERN SYDNEY

The Yardmaster UB 250 is a design response addressing the impacts of chronic overcrowding in remote Indigenous communities. It is part of a range of 'yard infrastructure furniture'.

The yard is part of the living environment and needs to provide amenities to take the pressure off overcrowded and ill-performing houses. The Yardmaster is a step towards providing basic services in the yard.



Left:
Development of concept showing features details

Right:
Yardmaster in house yard with two lights, two tables, two small shelves and tap, power points on the opposite site

The effects of crowding can be reduced by designing useful yards and edge spaces around the house such as verandahs, decks, sleep outs, shady areas for summer and sunny, wind protected areas in winter. (National Indigenous Housing Guide 2007)

Overcrowding is one of the main problems facing Indigenous Australians and contributes towards ill health. Resulting in people utilising yards and areas surrounding the house as living environments. At present yards are typically barren and lack facilities. Data from the National Indigenous Housing Guide (2007) shows around a third of houses have no yard fencing, less than half have any sign of outdoor cooking facilities and 16% of houses without verandahs.

In response to these findings a utility unit was developed to support a variety of yard based activities such as food preparation, cooking and sleeping. Associated with these actions are the storage of gear and equipment, the charging of mobile phones, powering TV's and DVD players, kettles and batteries, access to water for filling up billy cans, washing hands, children and clothes, food and pots and pans. This in turn requires storage for soap, clothes and a place to dry washing. At night it requires light. To store and be able to prepare food above 900mm helps to keep dogs away form the food and makes preparation more hygienic and rewarding. To provide suitable support for these lifestyles significantly contributes towards reducing overcrowding. It takes the pressure off the utilities in the house and its residents. It provides an improvement of existing, unsatisfactory ad hoc practices.

A range of specific components can be bolted on as required and includes tap, power points, lights, small and large tables, washing tub, shelves, clothes line and a sealed roto-moulded storage unit.

The research involved field trips, literature reviews and drawing on the long standing working expertise of an interdisciplinary team of an anthropologist, a medical doctor, an architect and housing manager intimately familiar with the field.

The prototypes are designed to activate the usefulness of the current yard areas by contributing towards implementing the nine Healthy Living Practices (1994), aiming to improve residents health through better living environments.

This project was part of the winning submission for the international UN Habitat WORLD HABITAT AWARD, won by HealtHabitat in October 2011. Christian Tietz is the National R&D manager for HealtHabitat and developed the original concept for it. Christian is also a lecturer at UWS in Industrial Design.

The initial prototypes have been installed on Groote Eylandt. For this particular location a set of units were identified and included an illuminated carport column, a free standing food preparation and a washing and clothes drying column.

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