Cumulus Working Papers

Melbourne

24/09

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Ken Friedman and Harriet Edquist

38° South

On behalf of RMIT University and Swinburne University of Technology, it is our pleasure to welcome you to Melbourne and to our conference, Cumulus 38° South: Hemispheric Shifts Across Learning, Teaching and Research.

Swinburne and RMIT were among the first universities outside Europe to join the Cumulus family of art and design schools and we are delighted to have you here. Melbourne is the design capital of Australia. Our robust professional community sets the pace for Australian design practice and the great universities of this city lead Australian design education. Our galleries, museums and art schools make this a cultural centre as well.

Our two universities differ in the scope of our education. RMIT offers architecture, urban planning and art along with design. This conference takes place as RMIT inaugurates the landmark building of the Design Hub, a jewel in RMIT's vibrant city centre campus. Swinburne is unique among Australian design schools in its exclusive focus on design, emphasising sustainability, research and the role of design in the global knowledge economy. The academic staff at both universities maintain active professional practices at the international level and both conduct advanced research around the world.

As Nobel Laureate Herbert Simon said, design is the process we use to change existing situations into preferred ones. To do so, we create products and services that do not exist today. We imagine and build the future. This requires creativity, experience and skill, along with strategic thinking and tough-minded analysis.

Art is the process that allows us to give voice to human experience. The philosopher Paul Ricoeur described the artistic process as a way to bring symbolic, structural and temporal resources together to narrate our experience, telling stories that call out to be told, shaping our world as we tell them.

In the current Australian context, both art and design are framed within the creative industries. There is more to creation than creativity, though. In design, we evaluate creative work to see what works and what doesn't. In art and design alike, we look beyond industry and economics to greater questions of human value, to the quality of life and to the contribution we make to our fellow human beings through the skills and services we offer the world.

Some of you are only here for Cumulus in Melbourne. Others started in Aotearoa, New Zealand, at the Unitec conference, and some will go on to the Monash–Swinburne–Victorian College of the Arts conference – Writing Intersections.

Whether you've come for a few days or a few weeks, we welcome you.

This nation is a great island in the sea, a home of memories, a home to many peoples. When you leave us, we hope you'll take with you your memories of Australia and the people you meet here. To borrow Shakepeare's words, we hope that you 'carry this island home in your pocket …and, sowing the kernels of it in the sea, bring forth more islands'.

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Christian Guellerin

I received a strange question yesterday. What is your strategy for Cumulus? It is a very strange question because the answer is obvious to me.

Where are we heading? It is very clear for the members of the Board, it has to be very clear for all the members. Cumulus wants to be the most important association of design education, art and media in the world. Nothing more, nothing less, and we are on the way to achieving it.

We are a body of 150 institutions, universities and colleges, and as I already said, we will probably reach 170 members for the next General Assembly in Genk in May 2010. We promoted recently the network in the US, Korea, China and now in Australia and we are continuing to grow.

What is the strategy to achieve this goal? It is the most simple strategy imaginable. We are based on a very successful economical model, the model of Facebook, the model of Wikipedia, the model of Twitter, the model of Internet: the model of contribution. You want to participate, you want to share, you want to learn, you participate, you share, you learn… if you don't want to do it, you don't have to.

You share, you learn what you want, when you want, how you want.

Cumulus is a platform for networking. We let institutions organise what they want, promote their own strategy of development, like in Melbourne, and affirm their experience of research. They propose their own programme and they invite members to participate and to debate. The General Secretary is careful to leave time and room for sub-groups, coffee-breaks and networking. It was remarkable in Melbourne. We had plenty of time to talk, to exchange greetings, questions and business cards and to debate. We had plenty of time to exchange moments of emotion and happiness.

As I told you it is the simplest strategy… and as it is so simple, it is very complicated to achieve.

As the teacher of Management I once was, I can tell you that sometimes the most simple thing is very complicated to put in order.

Because some of us maybe have the impression we can do a lot more… of course, but this implies imposing things, and in this case, to impose research, to impose good design, interesting questions, and to define finally what is good and what is bad…and then, you have broken the model which has made us so successful and that all the other international associations envy.

And it is very difficult to be simple perhaps because humankind has the tendency to believe that if it is not complex, it doesn't exist.

I used to teach my students, the most difficult thing to do when you are a manager is to delegate… Is it a joke? Of course, not… because you always have the feeling you could do better… and sometimes, it is true, so true. You take the work of your neighbour and you put polish on it and you have done better. You must try to resist doing so, because next time, your neighbour will not do anything.

Cumulus is a network whose strategy is to help you to contribute and to work together. Let us grow, let us be the most important network for design education. Continue what we have undertaken together. This is our strategy. The same strategy as Facebook, as twitter.

I want to thank you for coming to Melbourne, I warmly thank the members of the Board, we had a very productive meeting yesterday, we are preparing the Green Award, a book about professionalisation and careers, we are studying some partnerships with professional organisations… Thanks to the General secretary in Helsinki.

And to conclude, I want to frankly thank the team here in Melbourne, the keynote speakers, the steering committee, Steven, Ken and Helmut who are at the origin of the globalisation of Cumulus. What you have done is great, it was good, it was instructive, it was friendly, it was warming… It was Cumulus.

Christian Guellerin
Director General Nantes Atlantique
President of Cumulus

Dori Tunstall

Transdisciplinary Performance Script with Images

Introduction

Dori stands formally down-right stage.

Dori
Transdisciplinarity…that which is between, across and beyond all disciplines. Transdiscilinarity…as described by Basarab Nicolescu, "Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge." As an anthropologist in the field of design, my work has always been transdisciplinary. It is probably the essence of my being to work between, across, and beyond all disciplines. Yet to talk about transdisciplinarity, one must first have an understanding what disciplines are. For it is only once you are centered in a discipline that one can move between, across, and beyond.

The players slowly move from various parts of the theater. Some from below, some down the diagonal stair-case. Some from the sides of the stage.

So how does one come to an understanding of disciplines? One could consider them as macro-theories about how one understands the world and one's place in it. But not theory with a capital-T, rather theory as anthropologist Alan Barnard describes it as a set of questions, assumptions, methods, and evidence, QAME. In the trans-disciplinary context, Barnard's idea of theory QAME allows us engage in a conversation of what are the questions of design, anthropology, engineering, or business; what are the assumptions that each discipline brings to the table, how does each discipline approach answering its questions, and what does it use to communicate to others as evidence or proof. Defining theory within a flexible framework of QAME enables both academics and practitioners between, across, and beyond disciplines to discuss the similarities and differences in how they build and utilize knowledge.

The players should begin to move on to the center stage at the periphery. Thus, when it gets to the point where Dori says "we will demonstrate" it should be clear that the players are involved.

As I live between, across, and beyond the disciplines of design and anthropology, we will demonstrate the QAME of these two disciplines. As we move from these single disciplines, we will demonstrate of the transdisciplinary QAME of design research and design anthropology.

Part 01: Anthropology
Anthropology…the study of humankind across time and space.

The players are doing their dance in the center space before the rise in the stage. The Anthropologist Zoe explores what they are doing from a distance. She sits on the side and watches them.

In any introductory anthropology textbook, it states that the fundamental question of anthropology is "What does it mean to be human?" The anthropologist investigates that question from a variety of perspectives: from the distant past in archaeology to the near future in socio-cultural anthropology, and from human biological diversity in physical anthropology to the symbolic diversity of languages in linguistics. The meaning of that humanness evolves over time, but the field encompasses the breadth and depth of exploration of the human condition.

The Anthropologist Zoe moves closer to the dance. She tries to learn it from just watching.

From that question of what it means to be human, one can explore the assumptions of Anthropology. Philosophically, the anthropologist tends to be grounded in an empiricist tradition, where to quote Alan Bernard we come "…to understand what is true based on what we are exposed to". Thus, one has to yield to what you see, smell, taste, hear, and feel to know the world. In its most positivist form, anthropology concerns itself with how the quality of the recording of experience affects our knowledge of human experience.

Zoe mimes trying to record what the dancers are doing. She is frustrated that she cannot learn it from recording it.

This leads to further assumptions of how experience needs to be recorded and compared across time and space and, as close as possible, from the perspective of the phenomenon studied. Why? Because greater exposure to human experience means greater understanding of what is true. In its most humanist form, anthropology is concerned with what is "unique in human experience" whether it comes from the interpretation of "texts" or the direct sensing of the reality of common human feelings.

The Anthropologist Zoe places herself in the middle of the dance. She learns the dance.

Methodologically, anthropology, especially cultural anthropology, prefers participant-observation, which directly ties into anthropology's assumptions about the need to be "present" to experience phenomenon. In participant-observation, the anthropologist herself is the instrument of data collection. It asserts that to know the range of human experiences one must empathetically experience it.

The princess of the tribe, Britney, gives Zoe the umbrella as a mark of having learned about the tribe. Zoe does the dance alone with the umbrella to show she has captured it.

How does the anthropologist convince others that she has understood what it means to be human? She presents evidence in forms that our communities find persuasive and convincing. In cultural anthropology, that form is the ethnographic monograph. It consists of the anthropologist's descriptive account of having been there and what she learned about the perspectives of the people studied as part of evolving ideas of what it means to human.

The players except Zoe move to the back and change into the Designer's "concepts" by donning masks. Zoe continues to think about the umbrella.

So the QAME of anthropology is the question: What does it mean to be human? Its assumptions are empiricist, its methods are participant-observation, and its evidence

is the ethnographic monograph, the story of the anthropologist's experience from the perspective of the people studied. This is different from the QAME of design.

Part 02: Design

Zoe, now a designer, begins to try out the cocktail umbrella. She doesn't like the way it moves and throws it down. She takes a thinking pose to think about the right umbrella.

While the anthropologist asks, what does it mean to be human? The primary question of the designer in practice is "How do I create successful artifacts, communications, and experiences?" While the definition of success is open (in the terms of success for whom, under what circumstances, with what materials), the fundamental question of design in practice remains how the use of, for example as Steven Heller describes in graphic design, "practical theories of color, perception, and symbolism" inform greater commercial or personal design success.

The first "gothic" thought/concept, Jared, works his way towards Zoe, the designer and hands her the gothic umbrella. She moves the umbrella around, but gets frustrated by its limitations.

The main assumption of the designer is that she works to intuit what would be successful. Her ability to correctly conceptualize grounds her in the philosophical rationalist tradition. Philosophical rationalism is defined by the Descartes's idea, "I think therefore I am."

In the mind of the designer, there is an ideal thing that has specific characteristics based on how the human mind is hardwired for harmony and beauty. Through sketches, then computer renderings, then prototypes, the designer makes manifest in reality the a priori ideal of thing to the best of her ability.

She puts it down and takes another thinking pose, in which the "lady" concept, Britney, slowly makes her way to Zoe. Zoe the designer plays with the lady umbrella and finds it limited as well. She puts it down and takes another thinking pose, maybe miming umbrella movement gestures as the "bold" umbrella, Thom, slowly makes his way to Zoe. Zoe explores its form.

To aid in the process, the designer's preferred method is visual research. Being there is a mediated experience through the collection and organization of visual artifacts. In most cases, these artifacts are then categorized according to formal design elements of color, line, shape, value or tone, texture, form, and material. The visual research processes of documentation and arrangement serve to inspire creativity, distill a visual vernacular, and/or identify gaps in the visual landscape for competitive advantage. This focus on artifacts allows the designer to make interpretations without interference from alternative contextual meanings.

Zoe the designer is less frustrated with the bold umbrella, but she stills discards it. She thinks about what she really wants from the umbrella as the white umbrella, which makes its way over to her from Britney. She explores its form, seemingly satisfied.

In design practice, there are tremendous variations in genres of evidence depending on the category of design. One thing that they all have in common is that there is a separation between the design of the artifact and its manufacturing. The artifacts of designing are not the end products, but rather the prototypical representations of the product.
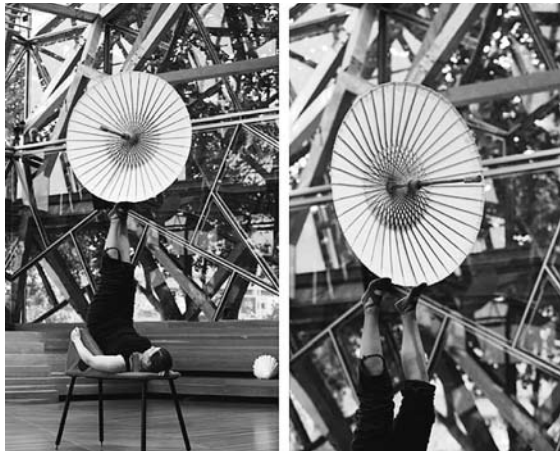
Zoe does her piece for 2 minutes. The other players remove their masks and prepare for the next section of the piece. They possibly engage with the audience.

Dori starts the audience clapping.

Ahhh…success. The evidence of success in design is the granting of awards based on those prototypes or their final mass reproduction. To summarize, the QAME of design is the question how do I design a successful artifact, its assumptions are rationalist, its methods are visual research, and its evidence is a prototype.

Part 02.5 Transdisciplinary transitions

The players have moved to the back of the stage.

Transdisciplinarity…that which is between, across and beyond all disciplines. Transdiscilinarity…as described by Basarab Nicolescu, "Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge."

While anthropology and design represent single disciplines, design research and design anthropology represent fields that are between, across, and beyond disciplines. They are the remix of questions, assumptions, methods, and evidence that leads to new forms of knowledge and understanding.

Part 03 Design Research

The players see the pink umbrellas. They jump up and down individually trying to reach them.

Design research, as defined by the Society for Design Research, has as its fundamental question, "What is the process of designing in all its many fields?" The question is explored through either the emphasis on design methods, exemplified in the work of John Chris Jones or Brenda Laurel; or on design epistemology or ways of knowing, exemplified in the work of Nigel Cross and Bryan Lawson. As such, the questions of design research are not those of how people make sense of their world, but rather how designers make sense of their world.

Thom and Britney and Jared and Zoe pair up. Thom and Britney first try to stand on one top of another's backs to reach the umbrella. Jared and Zoe watch and then imitate them, and reach a little higher. Jared and Zoe climb and sit piggy back to reach. Thom and Britney watch and imitate getting a little closer.

As a trans-disciplinary field, design research's epistemological assumptions range across stances of rationalism or empiricism, mostly often landing in pragmatism. Charles S. Peirce explains the pragmatist position, which does not attribute any different essential mode of being to an event in the future or the past, but only has two different practical attitudes. Neither does it take *Forms* to be the only realities in the world or the reasonable purport of a word to be the only kind of meaning there is.

Thom and Britney climb and sit on one another's shoulders to reach the umbrella. Jared and Zoe watch and then imitate them, and reach a little higher. Jared and Zoe stand on each other's shoulders. Thom and Britney watch and imitate.

Design research uses a variety of exploratory, generative, and evaluative methods depending on the discipline from which the researcher hails. Research that seeks to *understand* design's ways of thinking tends to

adopt philosophical, historical, experimental and cognitive psychological methods. Research that seeks to *inform* the design process tends to draw upon cognitive observational, and performative methods.

Thom and Britney lift each other to reach the umbrellas. Then Jared and Zoe. They each get closer and closer.

Defining the evidence for design research is extremely difficult. In fact, the only commonality is the importance of the verbal presentation—either in the form of lectures, conferences, or client presentation. So how it is that design research, whose subject is based on the visual forms, has as its evidence an aural form? Because, the design research endeavor, in alls its diversity, only shares at its core the presentational structure of design knowledge in the form of research goals, methods, and outcomes.

The player teams successfully reach the umbrellas and celebrate.

In the QAME of design research, the question is what is the process of designing in its many fields, its assumptions are pragmatist in nature, its methods vary depending on the researcher's centered field, and its evidence is the verbal performance of knowledge.

Part 04 Design Anthropology

The players line up in the front of the stage.

Now we come to design anthropology as a trans-disciplinary praxis. It takes the fundamental question of anthropology and places it within a framework to inform design research and design practice: "How do the processes and artifacts of design come to help define what it means to be human?" Design anthropology reorients the focus design research and design practice from what designing is to what is designing's social, cultural, and environmental impact. How people change in relationship to design.

They open up their costumes to reveal their colors. They open up their umbrellas and begin the dance with their matching umbrellas.

As a hybridization of design and anthropology, design anthropology adopts the empiricist stance from anthropology, but remains open to the rationalism of design. There is a bias towards empiricism that is tempered by pragmatism, and propelled by an ethical stance towards a critical understanding design's wider ramifications. Because the criteria of engagement is not success but rather unknown, resulting insights can lead to strategic prohibitions as much as strategic solutions.

The players continue to dance with the umbrellas, breaking out to do their own things.
They move in pairs to dance with umbrellas. They run around.

The design anthropologist uses a variety of methodological approaches to answer her questions about how designing affects people and their environments. The two preferred methods that emerged out of places like E-lab and Doblin are the in-context interview and visual story. The in-context interview reinforces the anthropological assumption that the researcher needs to be there in order to experience the phenomenon studied. Multiple researchers immerse themselves not to just understand about design artifacts and how they are used, but also deeply about the people who use them. Visual stories are a way to be there when the researcher cannot be there physically. People are sent a booklet with questions and a digital camera, video

camera, or digital blog URL with instructions to visually document their activities, attitudes, artifacts, environments, people, and processes. The researcher is then allowed to "be present" without being present, but it is the subject's own language, perspectives, and choices about values that is documented, not that of the design anthropologist or anthrodesigner.

The players gather together in the center.

The evidence of understanding is represented through the experience model as pioneered by American firms such as Doblin and E-Lab. The experience model is a visual representation of the key narrative elements of a specific human phenomenon. It represents a truly trans-disciplinary artifact arising from the negotiations and visualizations of meaning between anthropologists and designers.

So the QAME of design anthropology is the question, How do the artifacts and processes of design help define what it means to be human? Its assumptions are a tempered empiricism. Its methods are the in-context interview and the visual story. Its evidence is the experience model.

Players keep dancing for three-four minutes. When they line up again at the end, the music fades.

Conclusion

Transdisciplinarity…that which is between, across and beyond all disciplines. Transdiscilinarity…as described by Basarab Nicolescu, "Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge."

As an anthropologist in the field of design, my work has always been transdisciplinary. It is probably the essence of my being to work between, across, and beyond all disciplines. I hope that it becomes the essence of your work as well.

Thank you

Applause.

I like to thank my collaborators, the A4 Circus Ensemble: The artistic director of the performance and contortionist, Thomas Worrell; foot juggler, Zoe Robbins; contortionist, Britney Portelli; and contortionist, Jared Wright.

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KEYNOTE Helen Verran

Design as Knowledge / Knowledge as Designed
Different Logics of Seeing and Thinking

A controversial claim that might strike many of my readers as rather odd: design is taking over work that, through much of the 20th century, was done by epistemology. Design and epistemology are not usually thought of as related in social function, let alone as in some way alternatives, so that odd claim needs some development. But first I want to explain briefly why making this argument matters.

Many social theorists suggest that we are currently going through an era of profound change in the ways power flows effect social control. Recognising this I suggest that design and design education need to see themselves as embedded in wider questions concerning relations between knowledge and governance. And further I claim that situations where practitioners of disparate knowledge traditions with differing ways of seeing, of thinking, and of working the world struggle to work together, are a rich resource for design and design education in recognizing their role in governance in this emergent knowledge/power era.

The corollary of my claim that design is replacing epistemology is that design is not solely a matter of technique. Design is a knowledge community with working concepts that solve problems in one way and another. And those concepts, rather than just emerging as technical solutions to some self-evident problem, should be thought of as in some sense designed, and as such designed in better and worse ways. I am particularly interested in that 'better and worse' in conceptual design in cross-cultural and postcolonial situations. The design knowledge community needs to take different logics of thinking, seeing, and feeling seriously.

Perhaps we'd better start by reminding ourselves about some of what the terms 'epistemology' and 'design' conjure up. Epistemology makes claims about knowledge and articulates theories about knowledge. It is concerned with what, in particular circumstances is reasonable and worthy of belief. Along with the adjectives 'epistemic' and 'epistemological' the English word epistemology, often regarded as an arcane philosophical topic, is derived from the Greek word *epis-*

teme (knowledge). A scientific theory, like for example the theory of the world having a stable climate system that nevertheless can be destabilized by an increase in 'greenhouse gases', should be epistemically valid. That is it should be backed up by evidence that is salient to that proposition, and which has been carefully gathered and assembled.

So what is the public work that epistemology does? What is this social role for epistemology that I claim seems to be of lesser importance in today's world, than say through most of the 20th century? Knowledge, epistemology, governance. That's the triumvirate I'm calling up here: particular sorts of power/knowledge nexus we might say, using a Foucauldian frame. Here propositional knowledge articulates ends, which in turn are taken as determining policy and processes.

Design on the other hand comes down to us from Latin. *Designare* in contrast to *episteme* seems to embed purpose and the notion of means adapted to ends. Knowledge, design, governance then names alternative power/knowledge nexus, mediating a different pattern of power flows. So in suggesting that design is taking over much of the socio-political work that used to be done by epistemology I am pointing to the emergence of alternative relations between knowledge and governance; different sorts of power flows through the institutions of governance.

Design as Knowledge. Beginning with questions about design *as* knowledge, we might ask, for instance, 'How is design knowledge?' Answering this we could point to its being a discipline, as institutionally located, as having particular histories and specific sets of concepts. We might also ask 'Where is (disciplinary) design knowledge?' In collective institutional processes; in individual practices of design professionals. And 'What sort of a thing is (disciplinary) design knowledge?' A set of standards; community of practitioners. What is the epistemic status of rightness in design? And what are epistemic practices in design—how are we going to evidence claims that *this,* but perhaps not *that,* is good design. These questions are all about design as discipline.

Changing from 'Design as knowledge' to 'Knowledge as designed', I suggest we can plot a major shift in modernity. If we juggle the juxtaposition of the terms design and knowledge as general and particular, we see a shift from a disciplinary, epistemically-minded modernity to a process, design-minded modernity. Of course, design as knowledge community as a discipline is caught up in this shift, but it is involved in a unique and significant way.

My contention that the significance of epistemology in governance is decreasing while that of design is increasing, relates to what many see as a shift from a productive/disciplinary society to a communication/compliance society. While epistemology is a central element in doing knowledge in the productive/disciplinary society this centrality is passing to design in the shifts to doing knowledge in the communication/compliance society. Taking this seriously we see that design professionals are no longer comfortably on the margins but rather quite central to the current era of knowledge/power relations.

It is commonplace nowadays to identify eras with alternative styles of relating knowledge to governance. And we owe that general insight largely to Foucault.[I] He helped us see the disciplinary society with its signature panopticon just as its dominance was beginning to fade. In sensitising us to the disciplinary society and its production of disciplined bodies—both individual and collective he juxtaposed it to the sovereign society —which we see killed off again and again in popular portrayals of the French Revolution. In that old regime knowledge as God-given and absolute paid no attention to the detailed life of subjects. Relations of knowledge and power were of a different order than in those familiar to us.

The new order that many social theorists see us as entering into goes under many names. Postmodernity (Jameson); liquid modernity (Bauman); second modernity (Beck); soft capitalism (Thrift); untra-rapid modernity (Virilio); control society (Deleuze); audit culture (Strathern); society of the instant archive (Derrida).[II] All agree that this is quite a different sort of change than Foucault identifies in juxtaposing what he called sovereign and disciplinary societies.

I have developed the label of compliance/communication society from Deleuze's description of what he calls the control society. It is in this switch that I want to think about the newly emergent relations between design and knowledge. As I see things it is boundaries that are the focus of knowledge/power here, and order is achieved paradoxically through continual re-ordering. As I tell the switch in modernity that we are currently living through, it is one of movement from a concern with value and its conservation, to order and its conservation, a capacity that becomes possible only through continuing re-ordering.

In his book *Foucault*, Deleuze, an influential philosopher of the 20th century (and a friend of Foucault)[III] suggested that a way of taking Foucault seriously would be to look more closely at three kinds of power: sovereign power, disciplinary power, and a third emergent form of power which works through the control of communication. Continuing this theme in conversation he claims

We're definitely moving toward "control" societies that are no longer exactly disciplinary. Foucault's often

taken as the theorist of disciplinary societies and of their principal technology, *confinement* (not just in hospitals and prisons, but in schools, factories, and barracks). But he was actually one of the first to say we're moving away from disciplinary societies, we've already left them behind. We're moving toward control societies that no longer operate by confining people but through continuous control and instant communication… In a control-based system nothing's left alone for very long

In control societies … the key thing is the code: codes are passwords… the language of control is made up of codes indicating whether access to information should be allowed or denied. [But] it's not a question of asking whether the old or the new system is harsher or more bearable… It's not a question of worrying or hoping for the best, but of finding new weapons… We ought to establish the basic sociotechnological principles of control mechanisms as their age dawns…[IV]

In asking about knowledge as in some sense designed, and asking in particular what this means for design knowledge, I see myself as taking up the challenge that Deleuze throws out here. In beginning I note that design is deeply implicated in the articulation of those "sociotechnical principles of control mechanisms". I want to extend Deleuze's challenge by insisting that it is crucial for us as scholars to see how our disciplinary knowledges are implicated in those 'principles'. We need to be able to ask about our double participation, our participating both in the academy as an institution of governance, and in those everyday situations where design comes to life. But in addition, in order to do responsible and ethical work as scholars we need to be able to consider those principles in cross-cultural and postcolonial situations where radically different logics of thinking, seeing, and feeling hold sway. These will involve design professionals thinking through what concepts are *as such*, as they participate in design work, and what characterizes design concepts as particulars, and how they work. Here I want to propose design work in cross-cultural and postcolonial situations as methodologically important in the first and ethically in the second.

To explain what I mean by this, in the next few paragraphs I describe two situations I have written about previously.[V] In my descriptions we see participants from radically different knowledge traditions who are trying to work together. What I am describing here are contexts that design professionals might find themselves in were they to take seriously Deleuze's challenge and my extension of that challenge to cross-cultural and postcolonial situations.

The tensions we see in these contexts bring to the fore puzzles around the nature of concepts as such, and in particular. The first points to some brilliant design work that opened up a generative way to use those tensions in connecting. In the other case that genera-

tive tension effected separation. In concluding I draw out what I think design professional can learn from this in ethically and responsibly taking on the challenge of working in cross-cultural and postcolonial situations in the emerging era of the communication/compliance society.

My first short description involves conceptual design of number, and the second of place. A more philosophical way of naming what I'm pointing to in these stories is 'ontology' or to use and even more arcane philosophical term what happening here is 'ontic politics'. Ontology is a branch of metaphysics. It can be understood as a science that studies "being" in general, involving such issues as the nature of existence and the categorical structure of reality. Clearly, as a science ontology produces rather odd theories and engages rather different rules of evidence compared to, say, environmental science. Ontology can be defined as the study of ontics, which involves systematic and justified accounts of various 'doings' of reality. As I explained earlier, this arcane exploration can be thought of as concerned with conceptual design, but only on one condition. We must hold to the premise that concepts emerge and 'clot' in embodied and embedded collective material practices.

In large part because of the ways children are taught numbers and arithmetic in primary school, it is not at all obvious to most users of numbers that they have particular conceptual designs, nor that the design features that numbers have are sustained in embedded and embodied collective material practices. Numbers are generally assumed as pure, given, and abstract.

I found a way to see through this story about numbers with much painful unlearning when I found myself teaching Yoruba primary school teachers in Nigeria in West Africa in the 1980s. Yoruba number differs in its conceptual structure from the orthodox number of Western science that lies at the core of all primary school teaching of number. This difference tripped me up quite often, but particularly when I found myself watching lessons that were delivered in Yoruba. The number that came to life in those lessons worked with an alternative generalizing logic.

Think of the way you understand number as working. It collects together units—these might be 'things' if we are counting, or centimeters or litres if we are measuring. Saying this in a more formal way scientific ways of using numbers embed the relation one/many: define a unit and then ascertain how many. What I met in many counting lessons in Yoruba schools were numbers with the relation whole/parts as the core of their conceptual design. In the opening pages of my book *Science and an African Logic* I describe a particularly disconcerting lesson where through a design innovation one teacher had children in his class bring to life number that was neither and both Yoruba and scientif-

ic number. This was a number that retained the whole/parts relation at its core but incorporated a conceptual vocabulary of Western scientific number. This young man was not a design professional but he showed me how it is possible to design number and modeled a way of going on that both reveals what numbers are as concepts and what responsible design work is in a postcolonial primary school classroom

My second case concerns those committed to the conceptual design of place as it is found in Aboriginal Australia, struggling to work with place as conceptually designed in environmental science. Remember that the condition of my using the phrase conceptual design here to describe what others might call ontology, is that we take it that concepts come to life in collective *in situ* practice. This is of course a condition that is shared neither by the Aboriginal concept of place— an account of place as transcendental, nor the scientific concept of place—an account of place as empirical location in a space-time grid. Those Aboriginal and scientific concepts of course involve actual practice but unlike my translating account of concepts in neither case are those sets of actual practices taken seriously in a constitutive of concepts.

The occasion in the case I am referring to here, is a series of workshops arranged to show scientists the methods of Aboriginal land management. During these workshops the place of the Aboriginal knowledge tradition—a transcendental place, clashed openly and explicitly with the place at the core of environmental science- an empirical place. The gulf between the two widened. Here *separation* is a conceptual design outcome.

What do these instances of conceptual connection and separation tell us about design that takes seriously the potential offered by cross-cultural and postcolonial situations? Design professionals need to understand the nature of design knowledge and its concepts, in an era when relations between power and knowledge are changing. They also need to learn to recognize their double participation in institutions of governance and in the everyday where entities. Towards that end these cases remind us that all entities, whether conceptual, or actual physical objects, have life in collective practice, and that both connection and separation rendered in material practices are design outcomes. Second they remind us that both connections and separation mediate power flows, and that design is agential in effecting such separations and connections and thus in mediating power flows.

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KEYNOTE Mark Burry

Supporting the silos: transdisciplinary design research as defender of the disciplines

With pride design disciplines have risen above the status of ancient guilds to that of professions, but how relevant are disciplines today when global challenges are emerging with dimensions and demands that we have not been able to contemplate hitherto? How might design research meet these challenges more effectively by looking beyond the silos without necessarily dismantling traditional discipline strengths?

Within the 'guilds' the distinctiveness of analogue practice is threatened by digital design's universality and ease of application. Digital tools and processes are now common across craft domains that were previously highly specific in their needs and expertise, and the presumptions that went with them. Within their discipline silos designers risk being unfamiliar with innovative approaches to teamwork in which creative thinkers, diverse in their makeup, can unify through alternative approaches to creative leadership.

It is not clear that the old has to be thrown out in favour of the new. Digital and analogue approaches to design as synthesis do not need to form a mutually exclusive dialectic. The tensions between senior designers experienced in one medium for one task and the new generation of designers fresh from college, digitally adept and possibly dismissive of tried-and-tested approaches to design exploration are age-old. These tensions do need not be exacerbated by the new technologies at our disposal but how do design practices keep abreast of shifts in technology and the implications for their practice, and how do design schools ensure that they remain fresh and alert to the unexpected opportunities that are there to be taken-up? How do we maintain design competence at the right level to ensure there is the necessary confidence for creative risk taking? And how might design schools and design practices look to each other for leadership, and not stall further in their discipline-protectionist quandaries?

My keynote address focused on these contemporary dilemmas and considered three important messages for design researchers and their funders. Firstly, creative exploration and experimentation are the natural inclinations of designers, and design research begins with design education with a greater transdisciplinary approach. Secondly, design researchers need to aim collectively for a louder voice to announce our potential contribution to enriching human experience while protecting our degraded planet from further assault. Thirdly, we might make more of that 'difficult nexus' between design education, academic research, and design practice. I argued that a transdisciplinary approach to art and design research in all three domains – undergraduate, postgraduate and practice – is the most appropriate mechanism today to participate in the quest for solutions to problems more typically tackled exclusively by scientists and technologists. In so doing I posited that to worry about the benefits (or otherwise) of maintaining or dismantling discipline silos on the one hand, and the advantages of digital versus traditional design practice on the other are relatively trivial concerns. Of greater urgency is the task of finding ways for designers to assert the wider value of their creative activity as a research goal in its own right – that is, design as research.

Summary of the keynote presentation

Figure 01 opens the topic of transdisciplinary design research as the defender of the design disciplines, not as 'homogeniser' or route to an emerging species of 'Jack of all trades'.

Figure 02 looks at the difficult nexus between the university (academy), research and practice. It makes the point that despite the fact that many desire to escape the inevitable dialects between any two of these three components many ideal circumstances have to be fulfilled first. The presentation goes on to suggest the shifts in thinking, teaching and practice are required for this to take place, and that in my experience a transdisciplinary approach works well.

Figure 03 explains the dilemma in my own field of architecture. Even if architecture is a discipline it spawns sub disciplines which themselves lead to divisions and associated internecine tensions in many schools. In the case of architecture broadly speaking the sub disciplines range between pure technologies such

Conventional disciplinary mix: the institutions' complicity in maintaining the status quo

Convergent discipline mix: institution-Internet fusion increases transdisciplinarity

Design Research Institute
CONTEXT

Multidisciplinary
a variety of disciplines occurring simultaneously **without** making **explicit possible relationships** or **cooperation** between them

Jantsch, E. (1970) - Towards interdisciplinary and transdisciplinarity in education and innovation

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Design Research Institute
CONTEXT

Crossdisciplinary
various disciplines where the concepts or goals of one are imposed upon other disciplines, thereby **creating a rigid control from one disciplinary goal**

Jantsch, E. (1970) - Towards interdisciplinary and transdisciplinarity in education and innovation

RMIT UNIVERSITY

as building construction and materials to more esoteric domains including theory and philosophy. Figure 04 shows how a digital design overlay can mitigate against the presumed separations by offering different means of engagement between them. Students might look at the 'philosophy of construction', for example, and a shared dialogue with experts in both fields mediated through digital design enriches the traditional separations of skills within the disciplines. There is an implied enrichment not replacement or subversion. Having said this the loosening-up of the dialogue can lead to fragmentation as emerging new specialisations, and considerable blurring of the boundaries. But is this is seen as improving the dialogue between the different members of a transdisciplinary design research team, then such loosening-up can be promoted as being an advantage, not necessarily a disruption.

So what is 'transdisciplinary' anyway?

Definitions vary. The two we work with, or at least work between, are from the Julie Thompson-Klein camp (transdisciplinary design research involves a project

and an outside party – eg industry, practice, or business), and the 'T shaped' model of teams composed of individuals with deep skills and knowledge and wide understanding across their domain of interest. Figures 05 to 08 inclusive look at structural differences between multi, cross, inter and trans disciplinary teams. It is not necessarily helpful to refer to 'cross' when we mean 'trans'.

Is there a look and feel to a transdisciplinary design research team?

Taking as my example our design research institute at RMIT University in Melbourne (DRI – Design Research Institute) we are divided into five project domains, which we describe as *streams of enquiry*. These range from hard technology to applied and fine art. These are shown in figure 09 as the vertical crimson bands. There is an attendant risk here, of course: the emergence of new silos to replace the old. We have used a contextual overlay (as per Figure 04) as '*domains of practice*', which are shown as blue horizontal bands. These domains of practice are intended to help provide an intellectual and outside world-oriented fusion across the streams of en-

7

Design Research Institute
CONTEXT

Types of Design Collaboration

Interdisciplinary

a group of related disciplines having a set of common purposes and coordinated from a higher purposive level

GOALS e.g. Product

Characterisitics:

• Discipline based

• Carries a distinction between pure (or fundamental) and applied

• Normally produced by individuals

• Produced in universities or traditional research centres

• Subject to quality control by peer review

• Is inherently local or localised

Gibbons, M (1994) - The New Production of Knowledge

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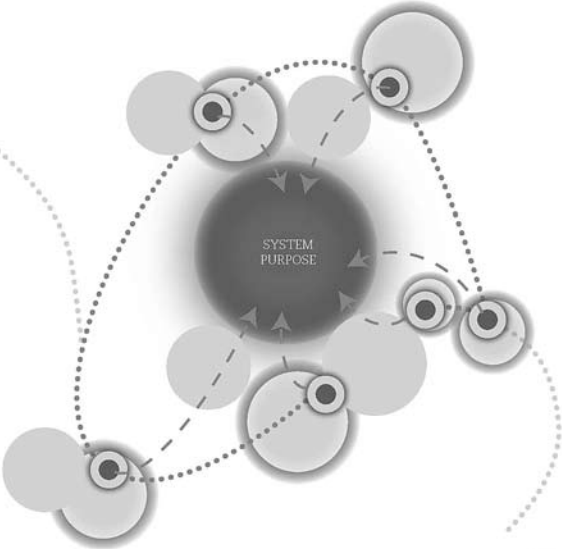
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Design Research Institute
CONTEXT

Types of Design Collaboration

Transdisciplinary

the coordination of disciplines and interdisciplines with a set of common goals towards a common system purpose

SYSTEM PURPOSE

Characterisitics:

• Produced in the context of application

• Heterogeneous in terms of the skills and experience brought to it

• Produced in diverse sites

• Characterised by the production in teams

• Subject to social accountability and reflexivity

• Subject to the quality control of market acceptability as well as peer review

• Global or non-localised

• Transforming praxis of those involved

Gibbons, M (1994) - The New Production of Knowledge

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9 STREAMS OF ENQUIRY

Design Research Institute

CUSTOMIZING SPACE / RAPID MANUFACTURE / INTERVENTION THROUGH ART / GEOPLACED KNOWLEDGE / URBAN LIVABILITY

DOMAINS OF PRACTICE

Context 1: Optimisation

Context 2: Interactive Art and Interactive Design

Context 3: Spatial Information Architecture

Context 4: Adaptive Change

Context 5: Technology Interfaces

RMIT UNIVERSITY

10 STREAMS OF ENQUIRY

Design Research Institute

CUSTOMIZING SPACE / RAPID MANUFACTURE / INTERVENTION THROUGH ART / GEOPLACED KNOWLEDGE / URBAN LIVABILITY

DOMAINS OF PRACTICE

Context 1: Optimisation

Context 2: Interactive Art and Interactive Design

Context 3: Spatial Information Architecture

Context 4: Adaptive Change

Context 5: Technology Interface

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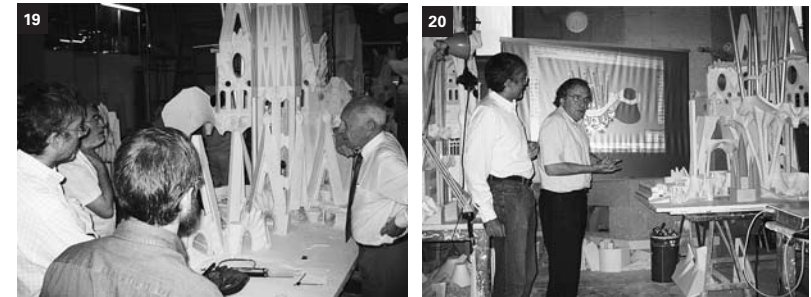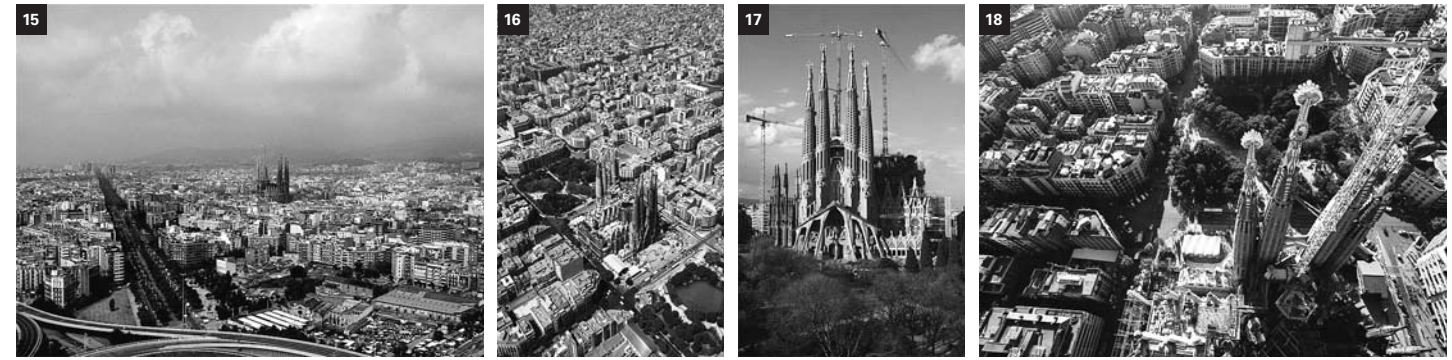
quiry to help ensure we do not inevitably suffer the consequences of what might otherwise be taken simply to be arranged marriages.

The subtle difference between Figure 09 and 10 is that Figure 09 shows what happens when there is no special effort to catalyse a dialogue, whereas Figure 10 implies that with catalytic input there is an intimate weave made between the projects and the contexts. In the case of our research institute, the formation of the institute is intended to be that catalyst.

How might we inform this position from practice?

In my presentation I described a relationship that I have had for over 30 years contributing to the ongoing construction of Antoni Gaudí's major oeuvre in Barcelona: the Sagrada Família Church. This project is a prime example of transdisciplinary design research at work, both in Gaudí's time (1883 until his death 43 years later in 1926), and for our time still involved with the complex operation completing the building so unfinished at the time of his death 84 years ago.

Figure 11 shows the hanging model that Gaudí used to design the Colònia Güell Chapel in the outskirts of Barcelona. This is the first example I can find of an interactive design model being used for any architectural project where the structural engineering and the architectural design is undertaken simultaneously to produce an 'undrawable' building. He was designing not just in 3D but effectively in 4D (interaction by adding and reducing the distribution of mass to induce corresponding changes in form).

Gaudí photographed the model of the inverted church and painted over the resulting plates to explain the project to his client, Count Eusebi Güell. To build such a complex project the hanging model, scaled at 1:10, was located in a shed alongside the building site from which crucial spatial information was drawn. This meant that Gaudí had to visit the site several times a week and apply himself very closely and hands-on with the builders.

Figures 13 and 14 show the interior of the crypt which, for all the innovation was the only part of the building that resulted from 8 years research and 6 years of construction. The problem was its complexity going beyond the technical means of the day. Nevertheless it is a glorious result even if the bulk of the building never came to be. The Sagrada Família Church afforded an opportunity for Gaudí to profit from the experience of Colònia Güell Chapel, eventually abandoned in 1914. Correspondingly he devoted his remaining 12 years seeking to improve the dialogue between all the collaborating designers – architects, model makers, engineers, craftspeople, artists and builders, and he sought to achieve this by offering an overlay – to use the term for the third

time. In this case the overlay was second order geometry that involved three ruled-surfaces principally: hyperboloids of revolution of one sheet, hyperbolic Paraboloids, and helicoids.

Figures 15 to 18 inclusive attest to the amount of work that still needs to be done despite the interior being scheduled for completion in 2010. Gaudí's transdisciplinary design research legacy, however, lives on with the current team charged with completing the building. Figures 19 and 20 are the key to the project not being saddled with a label of being an anachronism; rather it points to the future of architecture in several key ways. Both figures point to two of the principal transdisciplinary design research aspects. The first is the easy association between all members of the design team from day one in any new subproject. Gaudí's original team of architects, model makers, engineers, craftspeople, artists and builders (significantly expanded to include a variety of designers more fit for the 21st Century) are as significant a presence on site today as they were then. We all form one team – not a motley crew of consultants. This simple and obvious construct goes against the procurement system for nearly all large architectural projects, and points to a required rethink about how we might design together more effectively. My point is that a digital design overlay can be very effective as the contemporary transdisciplinary design research vehicle, so much more difficult in times past. Our procurement systems for buildings are more aligned to the pre-digital *modus operandi* than that which we can all profit from today. Clearly more design research is required in this area.

Figures 21–23 show transdisciplinary design research spaces in diverse locations: RCA (London), Loughborough University Engineering department's 'Research Hub', and the current MediaLab at MIT. These institutions are encouraging many disciplines to share project space, in a way that echoes the way that Gaudí set up his atelier. My core message is that transdisciplinary design research in the academy, working closely with practice and industry, and involving students by offering a project space convenient to all provides a very clear direction to move our collective mission forward: the defence of individual design discipline expertise while enriching each discipline through intimate collaboration around design projects (wicked problems) to challenging for one discipline struggling on its own.

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Keynote Abstracts:

Elizabeth (Dori) Tunstall
Design Between, Across and Beyond Disciplines

Cross-cultural design, design for development, social design, and design and politics are areas into which design is expanding its reach. Anthropological and design thinking are converging as design expands its intentional impact on the world. Buckminster Fuller once said that the best way to predict the future is to design it. Tunstall believes that anthropology provides the social and cultural understanding to ensure that designing the future has more positive outcomes than negative ones for the people affected.

Tunstall will present an engaging insight into how design and anthropology operates between, across and beyond disciplines in order to create a unity of knowledge about the present world. At Cumulus she will work with contemporary circus arts group, A4 Circus Ensemble, to perform the trans-disciplinary benefits of design and anthropology's interactions.

Helen Verran
Different Logics of Seeing and Thinking. What's Design and Design Education Got to Do With it?

A controversial and perhaps odd claim: design is taking over the social work that, through much of the 20th century, was done by epistemology. This claim is part of an argument that design and design education need to consider their role in an emergent, contemporary metaphysical project, recognising that disparate knowledge traditions embed alternative logics — differing ways of thinking about and working with our worlds. Taking this claim seriously implies that knowledge traditions can be connected and separated in better and worse ways, and that we need to learn to explicitly engage what we might call a politics of ontological design. These philosophical claims will be developed by telling stories of working with Yoruba teachers in Nigeria in the 1980s. It was in this work that Verran stumbled across and learned how to understand the claim that logics of knowledge traditions differ. This led Verran to

suggest that numbers themselves are in some sense collectively designed. Verran will build on these stories by discussing some of the difficulties of designing databases that can work with, and not against, the logical structures of a particular Australian Aboriginal knowledge tradition.

Mark Burry
Supporting the Silos: Trans-disciplinary Design Research as Defender of the Disciplines

With pride design disciplines have risen above the status of ancient guilds to that of professions, but how relevant are disciplines today when global challenges are emerging with dimensions and demands that we have not been able to contemplate hitherto? How might design research meet these challenges more effectively by looking beyond the silos without necessarily dismantling traditional discipline strengths?

Within the 'guilds' the distinctiveness of analogue practice is threatened by digital design's universality and ease of application. Digital tools and processes are now common across craft domains that were previously highly specific in their needs and expertise, and the presumptions that went with them. Within their discipline silos designers risk remaining unfamiliar with innovative approaches to teamwork in which creative thinkers, diverse in their makeup, can unify through alternative approaches to creative leadership.

It is not clear that the old has to be thrown out in favour of the new. Digital and analogue approaches to design as synthesis do not need to form a mutually exclusive dialectic. The tensions between senior designers experienced in one medium for one task and the new generation of designers fresh from college, digitally adept and possibly dismissive of tried-and-tested approaches to design exploration, are age-old. These tensions need not be exacerbated by the new technologies at our disposal. How do design practices keep abreast of shifts in technology and the implications for their practice, and how do design schools ensure that they remain fresh and alert to the unexpected opportunities that are there to be taken-up? How do we maintain design competence at the right level to ensure there is the necessary confidence for creative risk-taking? And how might design schools and design practices look to each other for leadership, and not stall further in their discipline-protectionist quandaries?

Burry's keynote address will focus on these contemporary dilemmas and will consider three important messages for design researchers and their funders. Firstly, creative exploration and experimentation are the natural inclinations of designers, and design research begins with design education with a greater trans-disciplinary approach. Secondly, design researchers need to aim collectively for a louder voice to announce our potential contribution to enriching human experience while protecting our degraded planet from further assault. Thirdly, we might make more of that 'difficult nexus' between design education, academic research and design practice. He will argue that a trans-disciplinary approach to art and design research in all three domains – undergraduate, postgraduate and practice – is the most appropriate mechanism today to participate in the quest for solutions to problems more typically tackled exclusively by scientists and technologists. In so doing he will posit that to worry about the benefits (or otherwise) of maintaining or dismantling discipline silos, on the one hand, and the advantages of digital versus traditional design practice, on the other, are relatively trivial concerns. Of greater urgency is the task of finding ways for designers to assert the wider value of their creative activity as a research goal in its own right – that is, design as research.

Tara Mallie, Michael J Ostwald

Aboriginal Architecture

Merging Concepts from Architecture and Aboriginal Studies

Abstract

This paper adopts a cross-disciplinary research approach which merges concepts and knowledge from architecture and from Aboriginal studies to explore how the process of design can support the future social and cultural needs of Indigenous building users. Through case study analysis, the paper presents observations that assist in creating new practices, processes and knowledge in architecture. In addition, an important component of the paper is its conceptual or theoretical framing. In this paper, literature on Aboriginal architecture is critically interpreted from the point of view of the Indigenous Research Methodology; an approach which sets a strategic agenda for planning and implementing research in a clear and conscious attempt to reclaim control over Indigenous ways of knowing and being. Accordingly, this textual research uses, for the first time in the discipline of architecture, a "decolonising methodology" that acknowledges the research project's post-colonial framework while actively considering the racial identities of Indigenous designers and building users.

Key Words: Australian Aboriginal cultures, contemporary architectural productions

Introduction

While in the architecture discipline, new models for representing Aboriginal identity in the form of a building are being constantly developed, they are typically only tested or critiqued from an architectural perspective. Mathilde Lochert (1997, p. 8) argues that such works are examples of colonial discourse which creates and entrenches specific and constraining concepts of Aboriginal peoples, identities and cultures. Architectural and design discourse, and especially as it is represented in the media, tends to function from within such existing colonial frameworks; the same frameworks which shape contemporary community perceptions of Aboriginal peoples in Australian society.

This practice is problematic because mainstream media is responsible for perpetuating the colonial conceptual framework wherein representations have a tendency to simplify and romanticise ideas of "Aboriginality" and "authenticity" that are framed within readings of the historic past, the Dreaming or a connection to country. From the point of view of this colonial framework, Aboriginal cultures are fixed in an unchanging past and delineated by a singular set of values. Architectural design strategies that work within this fixed perspective attempt to recover the past through incorporating traditional Aboriginal attitudes, customs and beliefs that are presented through unchanged historical descriptions. In recent years this practice has resulted in a growing number of buildings that evoke or resemble abstract representations of Dreaming Ancestors and animal totems. From a colonial or fixed theoretical perspective this may be seen to be reasonable, but, through a case study of such a design, the present paper identifies a range of problems with the approach and suggests alternative strategies.

The case study at the centre of the present paper is the Karijini National Park Visitors Centre (2001) designed by John Nicholas from the Perth architectural office of Woodhead International BDH. The Karijini National Park Visitors Centre in Western Australia supports an interpretative experience of the surrounding environment. In addition, the plan of the Visitors Centre abstractly refers to a significant cultural symbol for the local Aboriginal peoples. The Visitors Centre contains Aboriginal cultural references and symbols in an attempt to represent the identities of the local Banyjima, Kurrama and Yinhawangka Aboriginal peoples. The purpose of the paper is to question the use of Aboriginal animal totems as a design strategy. At the heart of this endeavor is a critical shift in theoretical framing away from the colonial or *fixed* perspective and to an alternative, "decolonising" or *fluid* perspective.

The shift in theoretical framework this research adopts is an important first step in addressing one component of the problematic history of cultural mis-representation that exists between Indigenous and non-Indigenous peoples. The project relies on an interdisciplinary approach that combines concepts and knowledge drawn from architecture and from Aboriginal studies. This approach contrasts with the majority of architectural scholarship on Indigenous peoples that tends to focus on the significance of the architectural design or on

the way in which Aboriginal peoples use and perceive space (for example see Rapoport, 1975). In contrast, this research uses a decolonising methodology or Indigenous Research Methodology (Battiste, 1996; Rigney, 1997; Nakata, 1998; and Smith, 1999). This implies that the research acknowledges its post-colonial framework while actively considering the racial identities of Indigenous designers and building users. This conceptual framework relies on consideration of the attitudes, values and epistemological traditions of Indigenous peoples (Fig. 1). The decolonising methodology explicitly "reframes" actions and events from Indigenous perspectives. Thus, architecture is not investigated from a singular, architectural perspective. Instead, the proposed method critiques examples of Aboriginal architecture from an understanding of the practices, needs and beliefs of Indigenous peoples in an attempt to transcend current boundaries and thinking. The ultimate aim of this endeavour is to explore how design practices, processes and knowledge can support the future social and cultural needs of Indigenous building users.

The decolonising methodology acts through a process of "reframing" that seeks to correct false claims, to interpret or re-interpret actions and events from Indigenous perspectives and to re-think current definitions of Aboriginality in architecture. Thus, "reframing" takes greater control over the methods used to discuss and position Indigenous issues (Smith, 1999, pp. 153–154). This conceptual framework centres the Indigenous voice of the researcher within the architectural discipline and engages with the emerging field of Indigenous architecture.

In summary, this paper is an examination of key concepts and issues associated with the way in which Australian Indigenous cultures have been portrayed within contemporary architecture and the wider built environment. The "built environment" in this context incorporates urban design, landscape architecture, interior design, and some industrial design in addition to architecture. This investigation will occur through an analysis of existing literature, primarily drawn from the field of architecture. This review is supplemented with literature from the fields of Aboriginal studies, art, sociology and anthropology to consider Aboriginal peoples' identities and their connection to Dreaming Ancestors, animal totems, country and the environment. Furthermore, the discussion and analysis is informed by first hand observations and recordings of the case study building and by an analysis of primary and secondary texts and materials (architectural plans, design sketches and models). This information is then synthesised into a critical textual analysis. Importantly, the present paper does not attempt to define what an "authentic" Aboriginal architecture might be, and it is not concerned with the relative success of this building from a financial or social perspective. It is also impossible in a short paper to explain the full complexity of the Aboriginal peoples of Australia and the Torres Strait Islands.

Karijini National Park Visitors Centre

The Karijini National Park Visitors Centre is surrounded by the semi-desert landscape of the Karijini National Park (formerly Hamersley Range National Park) in the remote, iron-ore rich Pilbara region of Western Australia. The Karijini National Park is at least 1400 kilometres drive north from the city of Perth. Alternatively, it is 120 kilometres north-east of the town of Tom Price (Fig. 2). The Karijini National Park is the second-largest national park in Western Australia. It is a flat, arid terrain that is dissected by a contrasting, network of ancient geological formations, tree-lined gorges and plunging waterfalls. The purpose of the Karijini National Park Visitors Centre is to provide an introduction to the natural and cultural history of the region. The stated goal of the centre is to support an interpretative experience of the surrounding National Park, its geol-

ogy, flora and fauna, in addition to the local Aboriginal peoples and their culture (Anon. "Karijini Visitor Centre").

According to the architects, Woodhead International, the Karijini National Park Visitors Centre represents "an endeavour to interpret its setting and give expression to Aboriginal culture through modern architecture" (Anon. "Karijini Visitor Centre"). This suggests that the Visitors Centre was shaped by two main themes or approaches. First, the local Aboriginal community's relationship with the landscape was used as a source of design inspiration. For this reason, the striking weathered, deep red-brown, curved steel walls that emerge from the landscape represent the "rocky escarpments created by geological forces and weathering over time" (Department of Environment and Conservation). Whereby, the shape of the twisting and turning walls conjures up images and memories of the impressive, geological formations of the National Park gorges (Fig. 3). Second, the building's design was intended to conceptually represent the local Aboriginal community through the metaphoric application of Aboriginal totems. Furthermore, it is reasoned that this image of a culturally significant symbol "was abstracted and extruded into a series of simple curved walls that symbolize the footprint of European settlers on the Australian landscape" (Muir, 2004, p. 20). The later design intention will be further considered in the remainder of the paper.

It is commonly stated that the local Aboriginal community chose the *Kurrumanthu* or goanna as a culturally-significant symbol to be represented in the design of the building (Muir, 2004, p. 20). Maitland Parker, the National Park's chief ranger and member of the Banyjima tribe, comments that the *Kurrumanthu* was chosen because it "symbolises us in coming from our beliefs, our country and earth" (cited in Susskind, 2001, p. 45). In an attempt to make the use of the goanna reference more acceptable, and to move away from "kitsch" theme park representations of Aboriginal animal totems, the architects at Woodhead International generated organic, curving walls to create an abstract, goanna-shape in the plan of the building. Anne Susskind (2001, p. 45) claims that the goanna is present in three parts. First, the tail represents and accommodates information on the local Aboriginal peoples' history. Second, the head contains the shop that symbolises the future business direction of the traditional Aboriginal custodians. Lastly, information about Aboriginal law is located in the centre of the Visitors Centre, or stomach of the goanna, which emphasises its importance in guiding all aspects of Aboriginal cultures.

In order to understand the significance of animal totems, it is necessary to briefly consider the Dreaming. There is no single or holistic definition of the Dreaming; different Australian Aboriginal peoples possess varia-

Fig 3: The twisting and turning walls evoke the geological formations of the National Park gorges. Karijini National Park Visitors Centre (photo), Pilbara region, 2001, Architect – John Nicholas. *Source:* Author.

tions on their understanding of the concept. During the Dreaming, Ancestral Beings travelled across the world shaping the landscape. The topography and geography of a place are thus significant and sacred features; indicators of the Ancestral Beings' creation journeys. To Aboriginal peoples, the landscape is a literal record of "who were here, and did what" and "who are here now" (Strehlow, 1947, pp. 30–31). The Ancestral Beings also specified and outlined systems of beliefs and values, rights and obligations, relationships and the lore for everyday living. Information about the Dreaming and Ancestral Beings has been passed on from generation to generation through Dreaming stories, songs, dances and art works. Consequently, all aspects of Aboriginal peoples' lives and knowledge are intertwined with the Dreaming. The Dreaming is the basis of all aspects of life in traditional Aboriginal societies (Edwards, 1988, p. 13). In addition, in the Dreaming, Ancestral Beings established Aboriginal peoples' relationships with their totems. Totems are important in traditional Aboriginal communities because they provide "a way of ordering the entire universe and all the species who inhabit it" (Voigt and Drury, 1998, p. 117). They define who a person is and organise their rights, relationships and responsibilities to each other, Ancestral Beings, plant and an-
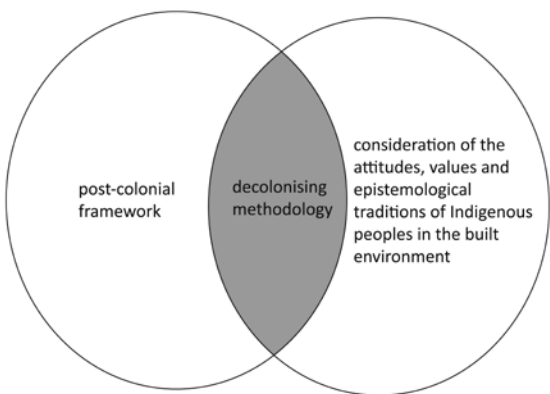

Fig 1: Decolonising Methodology in Architecture. *Source*: Based on Smith (1999). **Fig 2:** Location of the Karijini National Park Visitors Centre.
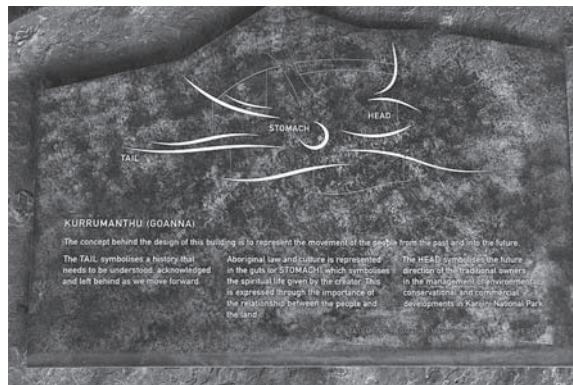
Fig 4: Building floor plan imprinted on a bronze plate. Karijini National Park Visitors Centre (photo), Pilbara region, 2001, Architect – John Nicholas. *Source*: Author.

Fig 5: Life-like sculpture of a goanna in the external display area. Karijini National Park Visitors Centre (photo), Pilbara region, 2001, Architect – John Nicholas. *Source*: Author.

Fig 6: Graffiti imprinted onto the exterior curved walls. Karijini National Park Visitors Centre (photo), Pilbara region, 2001, Architect – John Nicholas. *Source*: Author.

Fig 7: Windows frame and reveal the surrounding landscape. Karijini National Park Visitors Centre (photo), Pilbara region, 2001, Architect – John Nicholas. *Source*: Author.

imal species, and particular places or sites in the landscape. For this reason, in a spiritual sense, there is no division between the individual, Ancestral Beings, totems and the landscape. The Dreaming transcends time in the way in which it connects the land and the people to the past and the present, while also shaping the future.

However, the building's association with the goanna is only obvious through a close inspection of the floor plan. In order to make this connection more apparent, in the external display area a life-like sculpture of a goanna is positioned alongside a floor plan of the building that is imprinted on a bronze plate (Fig. 4 and Fig. 5). Although, when entering the building, the display of the life-like sculpture of a goanna and the building floor plan is almost overlooked, because the brightness of the exterior contrasts with the dark, covered interior area. Also, the meandering walls direct the visitor to enter and explore the building, rather than stop to contemplate the meaning and significance of the floor plan. Without this explanation of the architect's source of design inspiration, the reference to the goanna would be overlooked (Toland, 2003, p. 53). Susskind (2001, p. 45) argues the Visitors Centre is based on an abstracted goanna; which is "in line with the [A]boriginal tradition of expressing connectedness to the land through the depiction of animals." Although the question necessarily arises: from whose perspective does this make the Visitors Centre "Aboriginal"?

From the project's initiation, it took six years of community consultation, where "the architects and exhibition designers followed strict [A]boriginal protocol, often travelling for days to listen to the thoughts of tribal elders" (Susskind, 2001, p. 45). The local Aboriginal peoples were consulted on the site selection, design concepts and the interpretative displays (Toland, 2003, p. 54). Aboriginal peoples in the Pilbara want employment and training prospects in the resource and tourism industries (Olive, 1997, p. 12). However, no employment opportunities were provided for the local Aboriginal

peoples throughout the construction of the building or the installation of the exhibits (Toland, 2003, p. 54). The Visitors Centre also only provides employment for a small number of local Aboriginal people in the retail shop. As a result, Aboriginal peoples from nearby communities consider the Karijini National Park Visitors Centre to be "a White Man's building" that is designed by "the White Man", for the use of "the White Man" (cited in Toland, 2003, p. 54). This is also due to the fact that the huge imported steel panels from Perth were used in preference to local labour and materials. Thus, regardless of the inclusive design process which engaged with the local Aboriginal peoples, and the suggestions from the local people that the building might be inspired by the shape or form of the goanna, the building has somehow failed to become Aboriginal Architecture and has become instead its antithesis: "white fella" architecture. Here the tension between the colonial conceptual framework (which positions the building as "authentic") and the Indigenous, recolonising perspective, (which sees it as touristic and potentially degrading) begins to become apparent.

In their search for "genuine" sources of Aboriginal design, the architects of Karijini Visitors Centre have used the abstract image of an Aboriginal animal totem and the local Aboriginal community's relationship with the landscape as sources of inspiration. These representations of Aboriginal culture are literal; they propagate the mis-representation of Australian Aboriginal peoples as "primitive". As such, this "fixed" design approach endeavours to salvage traditional Aboriginal beliefs that are unchanged from pre-contact times. For instance, the architect Nicholas likens the graffiti imprinted onto the exterior curved walls of the Visitors Centre to contemporary rock art (Susskind, 2001, p. 47) (Fig. 6), in a dubious attempt to further "Aboriginalise" the building through the media. It is problematic for the Karijini National Park Visitors Centre to be considered a "white fella" building by the local Aboriginal

people while tourists view it as a reasonable representation of local Aboriginal culture. An appropriate cultural centre should express aspects of Aboriginal culture from a range of perspectives, and include contemporary as well as past practices and beliefs.

While the fixed, colonial nature of the formal strategy employed in the building is potentially problematic, there are aspects of the building which appear to reflect a more sensitive and appropriate, decolonising or fluid framework. For example, the Karijini National Park Visitors Information Centre's large frameless glass windows assist to reveal to the visitors in the interior of the building the incredible external surrounding environment (Fig. 7). The Visitors Centre also has the ability to adapt and adjust to future periods and continuously shifting needs of building occupants. Both of these strategies support the "fluid" understanding of changing cultural values and forms of representation. However, in adapting the Visitors Centre in plan, the building form, function and meaning would lose its original significance because the metamorphic shape of the Aboriginal animal totem would be compromised. Whereas, in elevation, the Visitors Centre can maintain its original association with the initial source of inspiration, even as it develops. Consequently, in regards to possible future alterations and additions, the Karijini National Park Visitors Centre is: from a cultural perspective, partially fixed and rigid (in plan, in the building's siting and in its capacity to represent the goanna); as well as being fluid and flexible (in elevation, in its formal ability to evoke the landscape). It was anticipated that the building "will become the focal point for the establishment of Aboriginal cultural tourism [in the Pilbara] while tourists will have the opportunity to learn about the park's natural, cultural and historical values" (Department of Environment and Conservation). The RAIA Awards Jury argues that, architecturally, the Visitors Centre "is a spectacular contribution to the Karijini National Park and to Australian architecture"

(Jury Comment, 2001). However, the Karijini National Park Visitors Centre's cultural expression is debatable, due to the attempts to "Aboriginalise" the building through the abstract but literal use of Aboriginal animal totems and the local Aboriginal peoples' relationship with the landscape as sources of design inspiration. Furthermore, the design of the building did not provide the anticipated employment opportunities for the local Aboriginal peoples, either during construction, or after the completion of the Karijini National Park Visitors Centre.

Merging Concepts

The current paper explores the way in which certain discourses about Aboriginal peoples and cultures are maintained through architectural form, expression, materiality and program. Ultimately, the simplification, mystification and appropriation of Aboriginality denies the possibility of an architecture that thoroughly addresses local Aboriginal peoples' needs (spatially and symbolically), in addition to respecting their natural environments. As researcher Ian McNiven (1998, p. 47) argues, the "problem is more than a clash of belief systems – it is a clash of powers to control constructions of identity." As a consequence, "[w]ho controls the past controls the future: who controls the present controls the past" (Orwell cited in Russell, 2001, p. 93). For example, the use of totemic representations appeals to the "authentic" and "primitive" concepts of traditional Aboriginal cultures and continues the flawed colonial tradition while reinforcing contemporary touristic expectations. This is not a reasonable representational strategy. Therefore, there is a need to eliminate the classification and categorisation of Aboriginality in architecture, to create a new language that is focused on the future, rather than continually looking at the past. Furthermore, the concepts of "authenticity" and "primitive" must become redundant in order to create a "decolonised", culturally appropriate Indigenous architecture.

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Finally, representations of Aboriginality in architecture are a relatively recent addition to the discipline. Consequently, a great deal of critical evaluation still needs to occur in architecture, while simultaneously taking into consideration concepts from Aboriginal studies. Such future research to assist in creating new practices, processes and knowledge in regards to Aboriginal architecture may include:

- investigating alternative spatial and symbolic design strategies to appropriately address the variety of Aboriginal cultures;
- creating a new language for Aboriginality in architecture that is focused on the future;
- processes to increase the principles of a "decolonised", culturally appropriate Indigenous architecture;
- restructuring the architectural syllabus to consider and understand the history of Aboriginal cultures and their implications for contemporary Indigenous peoples and their built environments; and
- further architectural representations of Aboriginality, so as to assess their consequences and to verify how future discourses about Aboriginal peoples and cultures are being preserved.

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An Interpretation Design Pattern Language:

A propositional conceptual tool for interdisciplinary team members working on interpretation design projects.

Abstract

Ideas and information about natural and cultural heritage are communicated through the designed interface of interpretation. Interpretation design has emerged as a new field of design as graphic designers work on complex, large-scale projects that communicate about natural and cultural heritage sites and objects. Research into designer's contribution to interpretation projects indicates the need for a better dialogue between designers and other team professionals. This paper introduces a 'pattern language' methodology, which proposes a shared language for use by interdisciplinary teams working on interpretation. Interviews with designers and a synthesis of research findings from the fields of interpretation, education, visitor studies and psychology inform the construction of the pattern language. Articulating shared concepts from these disciplines as a common pattern language aims to strengthen the professional practice nexus between the fields of design and interpretation.

Keywords: communication design, graphic design, interpretation, natural heritage, pattern language, interpretation design

1.0 Introduction

Interpretation design has emerged as a new field of design, as graphic designers work on complex, large-scale projects that communicate about significant natural and cultural heritage sites and objects. Designers and other professionals collaborate on multi-disciplinary interpretation projects teams which may include writers, scientists, historians, anthropologists, builders, artists, architects, rangers, researchers and bureaucrats. This paper draws on research that examines how the dialogue between these disparate professions can be better facilitated. As yet there is no integrative framework facilitating the fields of design, visitor studies and interpretation to work together. While reviews of visitor behaviour in museums and heritage places have been conducted (Patterson and Bitgood, 1990) no attempts have been made to integrate design and the related fields of visitor studies and interpretation (Moscardo, 1996; Ettema, 1997, p197). This research introduces a conceptual tool developed from architect Christopher Alexander's 'pattern language' approach (Alexander et al., 1977) for use with team based interpretation projects.

1.1 Interpretation Design

The term *interpretation,* in museum, heritage and tourism contexts, is used in relation to the presentation of an object or place to an audience. Since the early 1980s, communication designers have been contributing to an emerging, yet relatively unexamined field of design, *interpretation design*. The emergence of interpretation design over the last decades of the twentieth century, as a hybrid of spoken and visual traditions of communication, positions interpretation design as a new field sitting at the intersection two professions; interpretation and design. Where interpretation originates from a background of spoken language, through narrative and storytelling, design comes from a background of visual language, communicated via graphics, images and text. This communication is multi-faceted, uses a range of communication platforms, is site-specific and presents objects and places of natural and cultural significance to mobile audiences in highly public and visited places. Interpretation design projects are typically concentrated in settings such as visitor centres, national parks, botanic gardens, historic sites, and museums. These projects have posed designers with new challenges beyond those of traditional graphic design projects. Interpretation design projects typify the practice of contemporary designers who work across media and disciplines, engaging with the content, issues and ideas at the core of the communication.

Taken as a whole, the design profession in the latter part of the 20th Century has transformed, redefining it-

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self from a position of 'occupying a well-defined, limited role in a production sequence, to a more comprehensive, richer and more challenging professional engagement' (Friedman, 2000, p15). Design activity now operates within the knowledge or creative economy with an emphasis on research, strategy and systems, rather than objects. This type of professional practice is more collaborative and team-based than ever before, with designers working in complex situations determined by linked networks of multiple stakeholders. Design is no longer seen as a value-added extra, but is now recognised as a complete process, incorporating problem identification and solution strategies, project management, and production.

As an emergent field, interpretation design has attributes that clearly characterise it as a form of contemporary design practice. Diverse media platforms communicate complex messages that educate, raise awareness and provide experiences for visitors. These experiences are human-centred and fit into a larger system of knowledge relating to natural and cultural heritage. Typical projects are large-scale, complex and interdisciplinary, drawing on the expertise of a diverse range of specialists working in clusters and teams, as it is impossible for any one person to possess the breadth of expertise necessary. Friedman describes a successful contemporary designer as 'a leader who organises teams when one range of talents is not enough' (Friedman, 2008, p11).

2.0 Methodology

An outcome of this research is a conceptual tool developed as a practical aid, which draws on a wider base of knowledge beyond design and is for use in team-based collaborations. The conceptual tool is based on architect Christopher Alexander's pattern language (Alexander et al., 1977) and aims to bring together diverse bodies professional knowledge. Alexander's pattern language was initially developed in the 1970s as a critique of modernism. Practically, the tool aims to develop a shared language which has a relational and multi-pathed approach to the type of problems encountered in interpretation design. I am proposing that a pattern language approach is suited to a more postmodern form of practice such as interpretation design, requiring a relational, recombinant approach and is complex and multi-voiced rather than universal and linear. This propositional tool aims to further orient interpretation designers towards future ways of working.

2.1 Grounded Theory

The research methodology used in this work is aligned with the process of Grounded Theory, a methodology that has evolved over four decades since its inception by American sociologists Barney Glaser and Anselm Strauss in 1967. Grounded Theory originated from American sociology in the 1960s as a reaction to extreme, abstract empiricism. In contrast to abstract theory, Grounded Theory, as the name implies, is 'grounded in data which have been systematically obtained by social research' (Abercrombie et al., 2006, p174). In using this approach, cycles of research occur, new questions emerge and further research is conducted. This research is grounded in the practice of leading designers, seeking to generate some broad explanatory principles that help toward the practice of interpretation design.

Where the methodology is most closely aligned with Grounded Theory is in the *process* and the sequencing of the investigation through a series of iterative cycles through which theory was generated. Where the methodology differs from Grounded Theory is in the grouping and coding of the data. This research does not adhere to the same coding process of grounded theory, instead a range of diverse data, was analysed and sorted through searching for common patterns of problems, issues and themes. As much of design research and design practice focuses on a 'problem finding' and then a problem solving approach, a pattern finding methodology emerged as an appropriate and suitable method to group and sort data. Thus pattern finding, grouping and sorting, intrinsic stages of the investigation, are embedded in the larger cycles and loops of investigation. This investigation follows a non-linear path, the stages of which are illustrated in the diagram below.

A conceptual thematic framework emerged from literature reviews, interviewing designers, analysing artefacts and sites, identifying patterns and problems and investigating how designers collaborate. From this program of research, a theoretical position emerged and a conceptual tool for use in interpretation design was developed as a practical outcome of the research. The tool, an interpretation design pattern language was based on findings from two research methods, a survey of designers and a synthesis of multi-disciplinary research.

2.2 Pattern Language

Architect and mathematician, Christopher Alexander and his colleagues developed a conceptual tool called a 'pattern language' in the 1970s in response to his growing disenchantment with the formal methods used in architecture and urban design. Alexander and his colleagues in the seminal book *A Pattern Language* (Alexander et al., 1977) propose the pattern language methodology to be used in architecture, building and urban design. A significant motivation in Alexander's philosophy, expressed throughout his work, is to capture what Alexander refers to a 'quality without a name', which was present in buildings that fulfilled the needs of their occupants but was difficult to define, formalise or prescribe. Their aim was to encapsulate certain commonly occurring problems observed cross-culturally in the planning and building of houses, communities, and regions. In response 'patterns' were developed as approaches to fulfil the real needs of people who lived and worked in buildings. Alexander's patterns rather than being fixed prescriptive solutions were generalisations that could be adapted and extended for locally appropriate settings. Despite criticism of Alexander's work, particularly from within the field of architecture (Protzen, 1980; Dovey, 1990) the pattern language approach has been widely adopted by many other disciplines including the field of software development (Griffiths, 2004; Lea, 2003), industrial design (Junestrand et al., 2001), education (Jessop, 2004), organisational management (Salingaros, 2004) and landscape architecture (Kaplan et al., 1998). As well as a conceptual tool that can be applied to many contexts, the pattern language approach is particularly well suited to interdisciplinary projects where a diverse range of professionals need to share concepts, constructs and ideas while working towards common project goals. Erickson (2000) argues that Alexander's methodology is well suited for any project where multi-disciplinary teams need a *lingua franca*, or shared language, to be able to communicate with each other. The research in this paper uses multidisciplinary interpretation design projects as the professional domain to develop a pattern language to encourage and facilitate dialogue between team members from overlapping disciplines. While this research spanned a number of stages outlined in Figure 1 the pattern language was developed from (a) data gathered from interviewing designers and (b) from a synthesis of research findings in related disciplines.

3.0 Results and Discussion

3.1 Interpretation designers survey

Eight Australian interpretation designers were interviewed representing a broad cross section of projects including those projects for national parks, local councils, interpretive trails, zoos, forestry, private forest industry, sporting organisations, conservation organisations, indigenous heritage and historic sites. The designers represented have worked on projects in Australia spanning 1991 to the present. Many of these projects cover major visitor centres for heritage management clients including national parks. Survey responses were collected, grouped and coded according to the particular issues they raised, the question to which they were responding and the identity of the designer. Several patterns emerged that related to common issues and themes for these designers. The responses were grouped around these issues:

- Complexity and the interdisciplinary nature of interpretation projects.
- Experience of collaboration.
- Challenging aspects of interpretation projects.
- Skills needed for interpretation projects.
- Design management and project management.
- Ideological commitment.

The majority of designers agreed that interpretation projects differed significantly from more traditional graphic design projects, with designers identifying interpretation projects as being more complex technically, spatially and from a project management perspective. Designer's comments also revealed the interdisciplinary nature of interpretation projects, with this approach having the potential to enlarge and extend the designer's repertoire. One designer responded:

Also in some cases there is the creative melding of other professions; architects, interior designers, writers and artists into the process that can stimulate and offer another way of viewing which takes it beyond the normal scope of work this designer does in the every day (Designer 1).

The increased inter-disciplinarity of interpretation projects led to observations about collaboration. The designers interviewed in this study all recognised the importance of good collaboration in interpretation projects. The strengths of working collaboratively were described as stimulating, creative, and 'achieving an integrated dynamic'. Responses also acknowledged the difficulties of collaboration, including working with inexperienced team members, lack of co-ordination between team members, dominating egos, and personality problems. The designer's responses indicated that successful collaboration was not a given, it requires skill, patience, good communication and time management.

3.2 Collaboration

The designers interviewed all recognised the importance of good collaboration in interpretation projects and acknowledged the increased need for collaboration and team work. The positive aspects of working collaboratively were described as stimulating, creative, and 'achieving an integrated dynamic'. The comments of the following designers sum up the strengths of working collaboratively and highlight the increasingly blurred boundaries between disciplines:

Coming up with the initial concepts as a member of a team has been a great experience of my professional life; I guess if you have the right people together it is a very creative milieu. With the people I was involved with, we didn't stick rigidly to our areas of expertise, and felt able to contribute ideas across the board. It worked very well (Designer 2).

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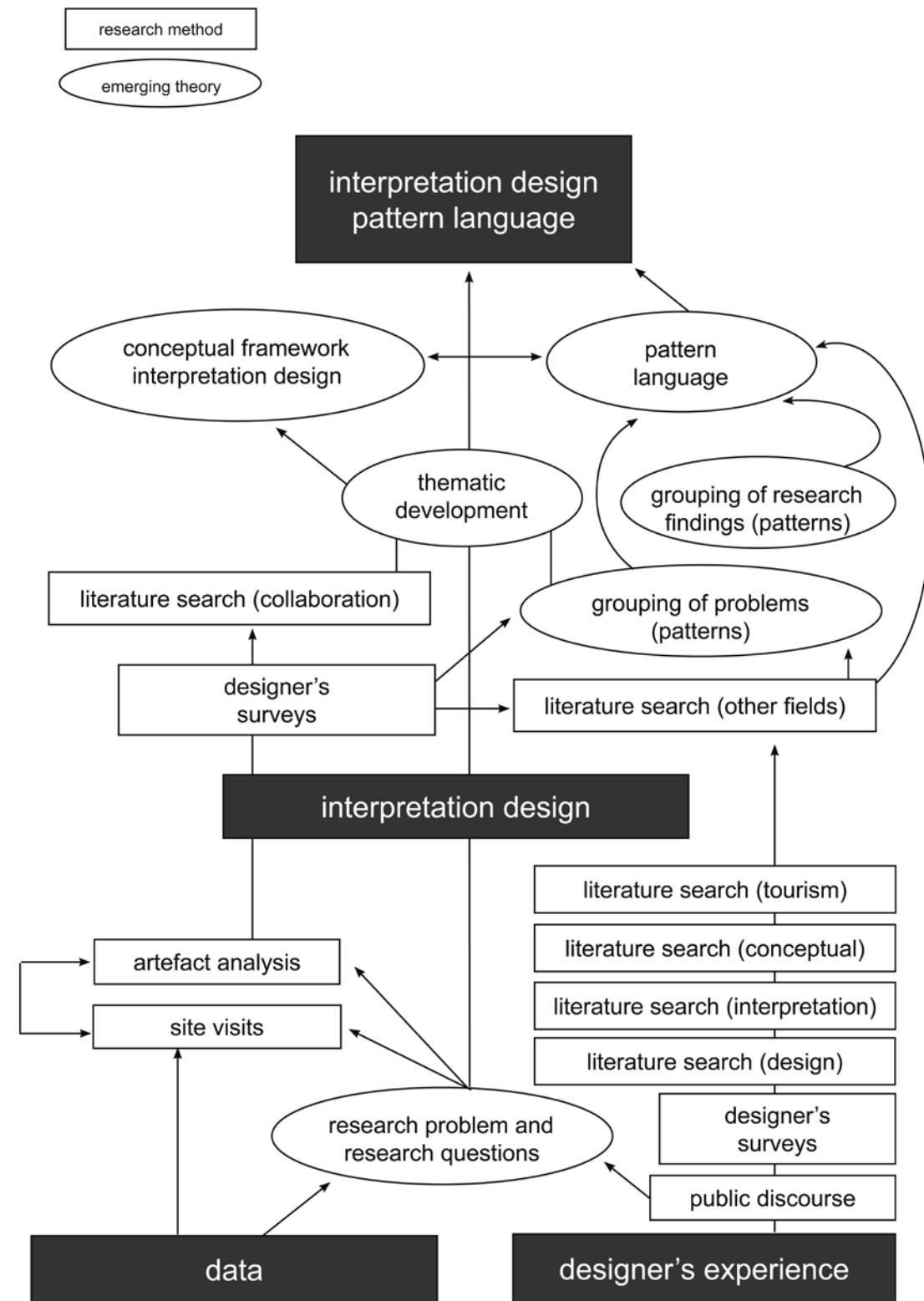
Figure 1: Overview of research methodology process

Evidence both from the literature and from designers found that that the fields of interpretation and design lack dialogue and an integrative framework that brings the fields together (Moscardo, 1996; Ettema, 1997, p197). This issue is not limited only to interpretation design. Good collaboration is a critical issue facing designers and others attempting to solve pressing problems. The current literature on collaboration can be summarised with the following observations. Firstly, there is an emphasis that collaboration is critically dependent on communication and finding ways for stakeholders to negotiate shared meanings and understandings (Cross & Clayburn Cross, 1995; Sonnewald, 1996; Chiu, 2000). Secondly in the absence of well developed models, the literature is forward-looking, predictive, and searching for new models and ways of working (Conklin et al., 2007; Thackera, 2006, 2007). Thirdly, the literature offers useful conceptual constructs already in existence that can be adapted to encourage new ways of working in interpretation design (Nigten 2007; van Dijk 2007).

3.3 Interdisciplinary research findings
A second strategy leading to the development of the pattern language came from conducting a literature search which yielded a large body of relevant professional and academic knowledge under-utilised in interpretation design. Research findings from the fields of education, psychology, tourism studies, museum studies and visitor studies as well as literature about the professional practice of interpretation were examined to establish common problems and patterns in interpretation settings. Findings were synthesised and built on an existing review of literature by Paterson and Bitgood (1998) also extending a framework developed by Moscardo (1999). While this research comes from diverse discipline perspectives it was evident that certain grouping and patterns were emerging. The patterns form a cluster particularly suited for interpretation design problems, but the same patterns may also be relevant or apply to other communication design problems and other design disciplines. The patterns are human-centred in that they are predicated on participation and it is anticipated that they will be added to and adapted. The first group of patterns (1–7) are led by the research findings from the disciplines visitor studies, museum studies, psychology and education.

1. Control – Visitors need to be given control over their experience.
2. Comfort – Visitors need to feel safe in an environmentally comfortable setting.
3. Personal connection – Communication needs to connect with visitor's personal experience.
4. Challenge/curiosity – Communication should challenge, intrigue and encourage questions from visitors.

5. Participation/interaction – Interactive and participatory experiences and exhibits, lead to high levels of visitor attention and recall.
6. Variety/multi-sensory – Communication using multi-sensory attributes has more impact.
7. Flow – Interpretive settings can be personally enriching, rewarding and restorative enabling people to have 'flow' experiences. (Csikszentmihalyi, 1990)

A second set of patterns (8–10) assist designers and teams to find a common language and sense of place for the local project site. These patterns relate to place-based interpretation

8. Reading Place – Creating a inventory of the visual and sensory elements of place records a non-verbal language of place
9. Lexicon for Place – A lexicon of place acknowledges the different ways people view the same location
10. Visual metaphors – visual metaphors of place can assist a team communicate about place.

This group use designer-led approaches to the site itself and are to be used to enable team members to respond to place and establish a communicative vocabulary of both text and image. These patterns assist in generating a visual language for the project, a common language between interpreters and designers using a human-centred approach. Primarily, the patterns focus on the visible dimensions that visual communicators or communication designers work with; however, as designers are engaged in designing wholistic experiences, the patterns may also include non-visual aspects such as sound, taste, touch and smell.

3.5 Pattern language development
The interpretation design pattern language was developed in 3 stages:

1. Summary of findings.
2. Problem identification.
3. Design responses to the problem.

Firstly, findings from the literature review and designer's responses were summarised to identify ten patterns. To illustrate the pattern development process, the stages of development of the first pattern CONTROL are outlined in detail below. This table details the process of creating the patterns.

Stage 1 – Problem identification
The first stage of the pattern is to identify and name the problem. The findings from literature search were grouped according to commonly occurring themes and patterns.

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Pattern: 1 Control

RESEARCH FINDINGS AND CONCLUSION	AUTHORS/ STUDY
• Visitors should be given control over their experience.	Moscardo 1996
• Successful museum learning requires visitor's sense of self-determination and control.	Perry (1992)
• Interactive exhibits which give visitors some control over their experiences, result in higher levels of visitor attention	Bitgood and Patterson (1988)

Next, the pattern is phrased as a problem. In this case *Control* when phrased as a problem becomes *Lack of control.* When visitors encounter a lack of control in visitor and tourist settings, researchers have documented negative experiences including a passive distancing from the meaning of exhibits (Tyler, 1995) insecurity (Kaplan et al., 1998) incompetence (Olds 1990), mindlessness (Moscardo, 1996), anxiety (Olds, 1990; Pearce, 1998; Pearce & Black, 1984) fatigue (Gilman, 1916; Robinson, 1928) and a general sense of being overwhelmed by the amount of information to process.

Following Alexander's system this can now be named as the problem statement.

Problem: People can feel overwhelmed by and distanced from information in museum and interpretive settings.

Stage 2 – Design strategies
Within the interpretation design pattern language framework, design strategies that deal with the problem *Lack of control,* include *Visual hierarchy and Layering.* Following Alexander's model, these are not fail safe, prescriptive solutions; but can be read as generalised strategies that can be customized for specific local projects and settings.

Design Strategy – Visual hierarchies
Hierarchies are a design strategy used to deliver information in a gradual manner. This principle is utilised in many design systems found within interpretation design. Using systems of hierarchies to regulate the pace of information helps to reduce the effect of overwhelming visitors with information. Designers develop systems of visual hierarchies to prioritise certain information, and to give order to the remaining detail. For example, hierarchies regulate the layout of type and image on a page, the composition of a sign or poster, the navigational space on a website or computer interactive as well the physical layout of an architectural space. One interpretation designer explained a strategy used in his practice to give a hierarchy to information. Devising three levels of information according to the amounts they believed people could comprehend. In interpretation settings, they coined the terms:

• *Headline* – for a short grab of text to emphasis basic themes and encourage a return visit.
• *Bus stop* – for the amount of text one would absorb on a bus shelter panel, while waiting for a bus and includes easy to read brief explanations so the sense of the message is gained readily.
• *Novel* – the amount of text people would read if they were really interested in the topic and wanted to study it in more depth.

These levels of text have a corresponding visual form, which is easy to envisage in printed format (as a headline, bus stop or novel), but they could also translate into web form as a browser link (headline), one to two screens full of text (bus stop) or a .pdf article (novel). The same strategy can be 'designed into' a 3D space, where the visitor is gradually revealed more detailed information as they interact with an exhibit.

Design Strategy – Layering
Layering, revealing and staggering are further ways to create visual hierarchies, whereby the physical structure of the communication is revealed in a gradual manner. The visitor may be required to interact with a three-dimensional structure to reveal all the segments of a story or layers of meaning; or information could be made available through audio visual information delivered at different points. The strategies of *Visual Hierarchies* and *Layering* are not limited just to this pattern and *control* is one pattern belonging to a larger framework. Similar to Alexander's methodology, each pattern can be cross-referenced with other patterns to form 'a language' to address a particular design problem. Other patterns related to giving audiences control are:

4. Personal Connection
5. Participation/interaction
6. Variety/multi-sensory

The scope of this paper only allows detailed discussion of one of the set of patterns that together form a language as a group. Following Alexander's layout each pattern is laid out with an interpretation design example to illustrate and follow up references (Figure 2.).

4.0 Conclusion
In the spirit of Alexander's original pattern language set, these patterns have been written for use by all participants in the design process—for designers, interpreters other team members, collaborators and stakeholders, not necessarily at an 'expert' design level, but devised in such a way that makes the language open and accessible. At the risk of simplifying complex concepts there are references included in each pattern for further investigation.

PATTERN 1: CONTROL
Problem
People can feel overwhelmed by information in museum and interpretive settings.

Design strategies
• Create interpretation environments that reveal structured information in a staggered way, and allow audiences to control the flow and pace of information.
• Use *Visual Hierarchy* strategies to deliver information in a structured and gradual way.
• Use *Layering* to reveal information in a staggered way.

Therefore
Using the design strategies of *Visual Hierarchy* and *Layering*, enables audiences to feel more in control, as they are able to direct their own experience in interpretation settings. When audiences can engage with heritage spaces through interactivity, rather than simply having institutional values and information reinforced, they can actively participate with, and in some cases, contribute to exhibits and experience. When the flow and pace of information has been designed using structured visual hierarchies, information is more accessible and less overwhelming.

Visual hierarchies
The use of visual hierarchy as a strategy to deliver information in a gradual manner is a principle utilised in many design systems found within interpretation design. Using systems of hierarchies to regulate the pace of information helps to reduce the effect of overwhelming visitors with information. Designers develop systems of visual hierarchies to prioritise certain information, and to give order to the remaining detail. For example, hierarchies regulate the layout of type and image on a page, the composition of a sign or poster, the navigational space on a website or computer interactive as well the physical layout of an architectural space.

Layering
Layering, revealing and staggering are further ways to create visual hierarchies, whereby the physical structure of the communication is revealed in a gradual manner. The visitor may be required to interact with a three-dimensional structure to reveal all the segments of a story or layers of meaning; or information may be made available through audio visual information delivered at different points.

EXAMPLE: MARIA ISLAND COFFEE PALACE

Interactive dinner table setting with audio.

Maria Island Coffee Palace, Maria Island National Park, Tasmania.

The Coffee Palace visitor centre on Maria Island National Park, Tasmania, allows visitors to interact with the heritage building, inviting them to occupy and use what was old 'coffee palace' accommodation. In the dining room visitors can sit at dinner tables whose settings correspond to particular years of the building's history. Sitting at the table triggers an audio presentation relating information from the appropriate historical period. Visitors are also encouraged to play the piano, take reading material from bookcases or inspect collections of objects nestled in sliding drawers in the drawing room. Hierarchies and structured visual systems are used to layer messages and information, held within drawers, in books, and via the audio environment. The tempo of the communicative atmosphere is quiet and relaxing, where visitors can sample from a diverse menu of offerings, selecting media they feel most comfortable with.

Figure 2: Layout of Pattern 1 Control

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A propositional conceptual tool for interdisciplinary team members working on interpretation design projects.

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A propositional conceptual tool for interdisciplinary team members working on interpretation design projects. 39

Articulating shared concepts from the fields of interpretation and design as a common pattern language aims to strengthen the professional practice nexus between the fields of design and interpretation. The patterns and strategies here are not new or ground breaking. What is new is the synthesis of design and interpretation wisdom into a practical form. The patterns described developed from this research are a starting point, with more patterns to be added over time with use on particular projects. At present the pattern language remains a conceptual tool, however the next stage of applying the tool to an interpretation project will test its relevance and potential to strengthen collaboration and communication among interpretation project teams.

The Interpretation Design Pattern language is designer-led, initiated by a desire for better collaboration between designers and other professions. The patterns are grounded in a search for recurring themes in literature and research as well as listening to professional commentary from designers. The pattern language does not provide ready made solutions or answers, but rather offers insights from an extended range of disciplines that may trigger strategies in interpretation. It is motivated by exploring the territory beyond and between the different professions, less interested in differences, yet still being respectful of other disciplines. The intention is that in harnessing a richer resource of experience, knowledge and professional wisdom from disciplines other than the fields of design and interpretation individually, interpretation design will continue to strengthen as a field, be agile and adaptive to change, future-focused and evolve as a significant contributor to the discourse about Australia's natural and cultural heritage.

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"The underlying axiom of design as a discipline is that there are forms of knowledge peculiar to the awareness and ability of a designer, independent of the different professional domains of design practice. Just as the other intellectual cultures in the sciences and the arts concentrate on the underlying forms of knowledge peculiar to the scientist or the artist, so we must concentrate on the 'designerly' ways of knowing, thinking and acting." (Cross 1997, p. 46)

Abstract

Design education is changing as a result of an expanding body of research into, by, and through design. Fashion design process is only just starting to be recorded, documented and validated as a legitimate design discipline with its own knowledge structures. Fashion design studio no longer focuses on the creation of a design artifact, but uses a design pedagogy that emphasizes the design process and cognition through open-ended learning tasks.

What are the epistemological issues at the core of fashion design – where a major part of design process is an understanding of the relationship between flat pattern and form, and the intimacy of the human body?

How do we educate a student in "designerly thinking", and how does the cognitive content of design thinking become a reality in contemporary fashion design education?

Key words: design education; design process; fashion design; design cognition

Introduction

What are the epistemological issues at the core of fashion design – where a major part of design process is an understanding of the relationship between flat pattern and form, and the intimacy of the human body? Wearing is a creative and transformative engagement with the self. Placing oneself within a constructed form (the garment), with the possibility of modifying that form, or being modified by it, is the ultimate three-dimensional experience. When an object of material culture is placed on the body it symbolically extends the self (Belk 1988). We feel the fabric on our body, see the form, and respond to the texture and colour – where it touches our skin, moves around and across us, and conforms to or constrains the body. The garment can be seen as an active subject in a web of relationships between persons and things. This can be either an individual or collective experience where the garment acts upon both wearer and viewer. Fashion design epistemology can be explored through knowing and knowledge about design, making, clothing, and wearing.

Design and fashion design

We can define design as "the collected experience of the material culture, and the collected body of experience, skill and understanding embodied in the arts of planning, inventing, making and doing." (Report by The Royal College of Art, 1979 by Bruce Archer and colleagues cited by Cross 2006) This covers history – and very importantly, making. The material culture of fashion design is the culture of the technologist – of the designer, doer and maker. In fashion design we need to consider the designer as maker and the maker as designer. This is crucial in terms of how it is taught. There is a practical knowledge base that students must acquire – pattern making and construction; in parallel with the acquisition of the design skills they need to use the technical skills creatively. There is a need to create intimacy with

materials – an acquired familiarity that becomes second nature and this knowledge becomes so much a way of working that it seems intuitive. The garment idea proposed by the designer has to be reconciled with what is and isn't make-able, and wearable – which is where the knowledge of construction and fabrication is essential. The immediacy of fashion design is important – we need to respond quickly to materials and construction as we go – so the notion of design as a process of reflection-in-action is particularly important.

Fashion design practice

Design is referred to as problem solving – so what is the fashion design problem? It is not as simple as the human race needing something that can be worn to protect the body from external elements. In fashion, the designer simultaneously constructs their own problem during which time they attempt to solve it. The problem is extremely complex in that the designed garment must have a resolved aesthetic; must have some kind of relationship with the body; should explore the fashion elements of silhouette, design lines, proportion, colour, pattern and fabrication; moreover, be "real" – can it be constructed, if so how?

Design culture relies on nonverbal modes of thinking and communication – in fashion design we use drawing[1], formal technical illustration, toiles[2] and patterns – which serve two functions. They record ideas and are consequently aids to internal thinking, as well as aids to communicating ideas and instructions to others. Ideas for garments are generated, primarily through drawing, in response to gathered information that inspires and informs. A concept will emerge from the inspirational material, and technical information will assist in the assessment of feasibility. Colour palette and fabric choices are considered and garment ideas are further developed towards creating a single garment or a series of related garments (a collection). The speculative garment is then created through drape (working directly on the stand) or drafted using flat pattern making techniques, then toiled (sampled) in calico to test the shape, detail and methods of construction. The toile is then modified and the information transferred back to the pattern. This process is repeated through toiling until the desired outcome is achieved. During this process the initial design idea may change and evolve, and the designer moves continually between two-dimensional (2D) and three-dimensional (3D) development. Samples may be constructed to test technical construction detail, especially as it relates to final fabrication and construction. The fully

resolved garment may then be constructed in its final fabrication. This is the sample or prototype garment.

Design knowledge resides as much in the processes as it does in the product. The strategies of designing reveal the intimacies of thought, while the design knowledge that resides in the product itself – the garment – is an embodiment of the process. The knowledge embodied in the processes of design is as valuable in design learning as the knowledge embodied in the products of design. It is essential that the assessment value of the design process is as heavily weighted as the assessment of the design artifact in order that the students develop these abilities parallel to one another.

Fashion design pedagogy

Fashion design studio no longer focuses on the creation of a design artifact, but uses a design pedagogy that emphasizes the design process and cognition through open-ended learning tasks. Open-ended, meaning that more than one appropriate response exists, and there may be many ways of constructing that response.

My personal design pedagogy is based on industry experience; teaching experience; and contemporary industry practice, as well as detailed observation and reflection about my own practice and research; and framed by an intention to focus on cognitive content. I explore ways of working and knowing within the studio environment with a view to some or all of the following as successful fashion design outcomes. Successful in that the 2D outcome:

- Uses active research methods
- Creates inventive responses to research, ideas, images and other gathered information
- Tells an evolving story through drawing, text, and the documentation of 3D development
- Is readable to someone else (this includes the pattern as well as drawings)
- Is a record of a process

And, effective in that the 3D outcome:

- Has a relationship with the body
- Has a resolved aesthetic sensibility
- Has been constructed using appropriate techniques/methods
- Demonstrates an understanding of the fabrication and it's appropriateness for the end use In between the 2D and 3D sits
- A demonstrated understanding of the relationship between flat pattern and the form that it creates.

Cross (2006, Chapter 1, p.9) states that "teachers of design have a responsibility to be as articulate as they possibly can about what it is they are trying to teach, or else they can have no basis for choosing the content and methods of their teaching". My intention is teach students the

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1 The term "drawing" will be used throughout this paper to describe design drawing – a hand drawn, informal sketch
2 A toile is a sample garment, or section of a garment

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fundamental knowledge needed in fashion, and an ability to act – to design – with that knowledge. Studio should offer an environment where students acquire and apply knowledge simultaneously, as design knowledge is best understood if imparted in the context of application.

In fashion design, the knowledge that resides in the designed object (the garment) tells a multitude of stories about a tradition that encompasses methodologies (such as tailoring and drape); fabrication (for example – wool suiting, silk jersey, hemp); and construction (flat felled seams, rever collar, dolman sleeve). In the past fashion design teaching would teach pattern making and construction using a craft based model – where the student would copy an example, and learn through replication. There is still value in this way of learning, and when making is combined with an understanding of design process, a new world of understanding opens up for the design novice. There is no way to understand making, other than going through the process of making. Drawing develops spatial reasoning ability, and visualization skills are necessary for envisioning, specifying and creating complex designs in 3D. Hands on making does this. It is crucial that academically based fashion design education retains making as part of its pedagogy.

The complex design process elevates design beyond the reach of the craftsman – in this case a dressmaker, where garments are made by copying or adapting what has been done before. Studio learning is important "because of the nature of design knowledge and the fact that it is so richly intertwined within designing itself" (Downton 2003, p.51). Design education is about creating processes for the student to go through – so that they will understand through experience the design knowledge embedded in the act of designing itself. Downton (2003, p.101) describes the design process as an interaction between the ongoing making of a representation and the evolving knowing of the designer making the representation. There are learning increments embedded in the process – which are more useful than a single, technically successful outcome that has been arrived at through no design process at all. This is the purpose of weighting process heavily in design education – to acknowledge the value in the development of ideas and ways of working. Downton states, "It is a mistake to concentrate on finalized representations; they represent what was decided through the inquiry undertaken and attempt to communicate it" (2003, p.101). The inquiry and its communication in fashion manifests in the exchange between the designer, the drawing, and the toile.

There is a difference between clothing production and fashion design in the same way as there is a difference between a building and architecture. There are knowledge requirements to be met; the designed garment must "display knowledge that can be characterized

as either additional to that required for the production of a (garment), or not additional but at least exemplary or refined" (Downtown 2004, p. 120). The fashion design outcome – whether two or three dimensional, will demonstrate the maker's knowing as well as their knowledge. The knowing is for the individual – a never-ending process that relates to doing; the knowledge will manifest itself physically in design outcomes. Knowing will come from self-reflection, and is the ability to understand the design processes and outcomes experienced – it may be seen as an awareness of the knowledge. My goal is to make students aware of both knowing and knowledge.

The ability to think in a "designerly" way creates a sustainable design practice. My pedagogical intention is to immerse the student in processes and situations that stimulate designerly thinking through a series of design encounters within the studio environment. These encounters focus on cognitive content through drawing, pattern making and toiling, as well as criticism and reflection. The use of these as studio tools builds ability in students to generate ideas that become problems; to generate solutions to these problems (that becomes design development); and the utilization of design process strategies that integrate making and thinking, that in turn become a loop of conjecture/solution/reflection that the designer continually plays – and sometimes backwards.

Drawing as part of fashion design process: the use of analogy and observational drawing as tools

Drawing for fashion design development is NOT fashion illustration[3]. Drawing is a thinking and reasoning aid, and assists cognitive processes. First year students are introduced to life drawing, drawing the clothed figure, rendering textiles, texture and drape, exploration of different media, observational drawing; and fashion specific requirements of silhouette, proportion, line and detail. These are essential 2D "tools". 2D drawing is taught within the context of 3D representations, which contextualises the relationship between 2D and 3D. These representations serve as a base for more advanced learning.

The thinking process of the designer hinges around the relationship between internal mental processes and their external expression and representation (Cross 2006, chapter 3, p.33). Once ideas become externalised the drawing itself becomes a reasoning tool. Drawing helps the designer find unintended consequences. The information that emerges during the design process cannot be predicted prior to undertaking the design activity

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3 Fashion illustration is a realistic or expressionistic rendering of a fully resolved garment or outfit

or task. Ideas emerge as to pathways that may be taken, and this exploration gives glimpses of what might lie ahead. The fashion designer will latch onto and try different configurations and multiple versions of this emerging something in order to take it to a higher level of resolution. The first idea should never be the last, nor will it be the best. I refer to the drawings as "your mind on paper" – show us what you are thinking – what Schon refers to as "a reflective conversation with the situation" (1983, cited by Cross 2006).

We need to teach the student how to recognize an emerging idea as successful and worth pursuing. Drawing in fashion design identifies what needs to be known about the developing concept and promotes the recognition of emergent features and properties of the garment ideas that make sense. They help the designer to shift to new alternatives selectively and pursue them creatively. Goldschmidt (cited by Cross 2006, chapter 3 p.37) refers this to as the "dialectics of sketching", the dialogue between "seeing that" and "seeing as"; where "seeing that" is reflective criticism and "seeing as" is the analogical reasoning and reinterpretation of the sketch that provokes activity. Drawing enables and promotes the kinds of thinking that are relevant to the particular cognitive tasks of design thinking.

In second year tailoring studio, a guided observational drawing exercise uses a sourced jacket, which is placed on the stand – re-configured, inside out and gradually dissected. Drawing has a loosening effect, which facilitates re-interpretation and prevents mental fixations. The student draws what they see from various angles – experimenting with different media and methods (such as continuous line drawing) to create representations of the jacket on the page. These drawings are then used as a starting point for further exploration. How can we see the jacket in new and different ways? Observational drawing can inform the student about what is, as well as what could be.

Productive thinking is based on devices for changing the direction of thought. Creating student tasks that build in such devices will take the student on an expositional journey. Analogy is one such device. Goldschmidt (2001 p.199) proposes that the use of visual analogy in problem solving is an example of similarity-based reasoning, cognitively facilitated by imagistic operations. Goldschmidt's theory is that evidence suggests that this valuable type of reasoning – using analogy – helps the designer "better understand abstract concepts and to fully exploit their capacity to retrieve and implement previously acquired knowledge". It is a strategy for learning to design, in that it facilitates the acquisition of new concepts.

Visual analogy can be used to access indirectly related design information and make new associations. In a creative search analogies can be identified and used

in fashion design to inform shape, colour, construction and even function. What does it remind you of? What does it look like? Encouraging students to establish relationships through analogy shows them how to abstract a design and generate possibilities. It allows the exploration of form from new perspectives, and creates new trajectories and tangents to explore. This in turn develops an ability to recall relevant design information. Breaking down a reference into smaller components will also show students how to abstract a design to generate more possibilities of analogical transfer.

As the student becomes more familiar with the 2D representation it gradually becomes routine then automatic. At this point we are able to focus on the drawing's semantic content. The development of the lower level representational skills is a prerequisite for the high-level reasoning and actions of the expert designer (Eastman, p.174).

There is a danger in the current trend towards fashion design students simply recording 3D development with a camera, and not responding by drawing, as it bypasses cognitive involvement. This means an inability to draw on experiential knowledge – as it has not been internalised – that impedes the building of fashion design knowledge.

Pattern making and toiling as part of fashion design process

A major part of fashion design is the relationship between flat pattern and 3D, and how pattern making relates to the body. We don't work with space – we work with form – the form of the garment and the form of the body. "Form literacy" in fashion design is the ability to generate and interpret form – the knowledge in forming, recognizing and interpreting complex shapes that sit around and against the body. These complex shapes are developed from multiple components such as sleeves, collars, and pockets. Form literacy is developed through observation, drawing, pattern making and construction. Eventually the student will be able to read and draft patterns; to be able to look at a flat pattern and mentally assemble it. And, conversely, have the ability to mentally image the 3D form, and what the pattern could look like in order to achieve that form. Pattern making fluency is indispensable in relation to form literacy, and becomes a basic, assumed skill.

Pattern making is a means of achieving a shape around the body. The body, and the basic body block remains constant; and the goal of the pattern making process is to develop pattern pieces that will fit together and function. The body is a form, and the garment is sculptural; but this form actually moves, and this must be taken into account in the cut of the garment. Pattern making is a mix of analytical and creative thinking. Once the student has learnt to manipulate formal con-

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figurations, they can move on to experiment with their own design ideas in creating form. The basic rules of pattern making are based on sound principles, and when understood thoroughly, the rules can be broken, as it will be "a creative decision allied to sound reasoning" (Aldrich 1989 p.5). The basic body block determines critical shapes, sizes and other variables; and pattern making uses standard annotation, so that how the garment is to be constructed is inherent in the pattern (straight grain, notches, cutting instructions and so on).

Pattern making can inform, or respond to, a design idea. Designers modify their expectations about the final result in response to new information gained through the process of design. That is, the speculative design artifact itself will change in response to things that happen during the design process. It is highly likely that the garment design will change in response to the form that is continually evolving through pattern making and toiling. The first pattern draft challenges the designer to create the form and shapes they have drawn. This is where form literacy comes into play – and the designer may draw from reference points such as analogy and precedent. My contention is that the fashion design process continues from a 2D design proposition through pattern drafting and toiling. Fashion design must move between 2D and 3D, in order to establish what the speculative garment actually is. Design doesn't suddenly stop, and making begin.

Downton (2004 p.17) states that a designer potentially engages in three conversations with the material of the design. One conversation is within the designer's head – where an imagined object can be changed or developed; another is with a 2D representation (usually a drawing) of the design; and the third conversation may be with a 3D representation of the design. In fashion these conversations are continuous, interchangeable, definitely not sequential, and very noisy. The visual representing of an idea may be two or three dimensional – and the notion of a 3D "sketch" as an investigative tool, is pivotal in fashion design studio, as well as in professional practice. The importance of pattern making and construction skills cannot be overstated. There is a direct relationship between technical ability and the generation of design concepts – the stronger the pattern making and construction ability, the more advanced the design possibilities. This takes on added importance in the current backlash against disposability, and poor construction and fabrication.

Writing and talking about design – critical evaluation and reflection as part of fashion design process
Goldschmidt refers to the teaching modes of instruction and reaction (cited in Salama 1995) both of which are needed to drive fashion design studio. Individual-

ized instruction guides students in how to draw from research, utilize appropriate methodology and develop design ideas through drawing, pattern making and toiling. Reaction is also necessary, throughout this design process, in the form of informal feedback or formal crits, to help the student understand what has, and what has not, been a successful design outcome and why. Students need to understand the difference between external sources of knowledge and their own perceptions, and the necessity for external knowledge as a means of evaluating their own ideas (Salama 1995).

Studio is not simply a passive space to work in, but an interactive tool for learning. It is a space for discussion, conjecture, reflection, and articulation. Studio, by its very nature, must be empirical, but the research and knowledge that informs what takes place in the active studio space may be theoretical and abstract. The purpose of fashion design education is to teach students to design garments; this knowledge manifests itself primarily in drawings and toiles. But we also ask our students to talk about their work, informally to peer groups, and more formally to lecturers in crits. When it comes to explaining the work it becomes more than just images and toiles. Design becomes textual as well as visual. Writing and talking can explain, explore, justify and identify. Students are encouraged to annotate their work alongside design development drawings. This annotation may be statement of fact, speculation about construction, an exploration of abstract concepts, an explanation of connections between research and design responses, or simply a description of what they have drawn. Verbal articulation is crucial in the development of a fashion designer and thinker, and is an essential tool for knowing.

There needs to be an awareness within the student to ensure engagement with the processes – in order to be "initiated into the content of the activity or forms of knowledge in a meaningful way" (Peters, referenced by Cross 2006, Chapter 1 p.4). We have to try and build awareness into learning tasks and environments in order to develop the students' intrinsic cognitive processes and abilities. Critical thinking, reflection and feedback by both lecturers and students are necessary in order for this to work, and there has to be an interactive engagement throughout the whole process, not just at the end when an "outcome" has been produced.

Fashion schemata are numerous and sophisticated. An experienced designer looks at a garment and sees an assemblage built of garment components, fabrication and technique. This designer "knows" the garment intimately. Fashion design schemata becomes embedded in our language and drawing, and verbal articulation encourages the student to build knowledge and use these codified terms in context. The building of this knowledge requires that students be exposed to and

seek out precedent through images, texts and artifacts. Our drawings are encoded texts, which, when combined with conversation that shares ideas based on concepts or schemata, becomes the complex language of fashion design.

Conclusion
The encoding of fashion knowledge is "a complex, multi-modal structure" that uses technical knowledge; design development; historical and cultural information; form literacy; and critical assessment (Eastman 2001, p.175) – that all come together by 4th year to enable the student to draw analogies, and reference precedents and parallels with their work in order to explain, justify and contextualise it. The student can build on their formally learned knowledge through information continuously learned experientially – which will continue in their professional life after graduation.

To take fashion design education from trade school to design discipline we need to ensure analysis and understanding of the design process itself. In doing this, we firmly establish the value of cognition and process as more educationally meaningful than the design object itself (Oxman 2001, p.273) and teach a sustainable design practice based on designerly ways of knowing, thinking and acting.

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Gabriel Harp

Design Ecology

Abstract
This paper describes a heuristic for the integrated assessment of design ecologies and an explanation for the maintenance of these complex networks. The assessment model builds upon interpretations from cultural anthropology and ecology to create a heuristic for characterizing the distribution, abundance, and interaction of design concerns at different scales and for multiple actors. I employ information theory and the evolution of cooperation to provide a mechanism for the stickiness of integrated ecological, social, and material-based networks and the degree to which these factors influence design decisions. The examples allude to alternative social roles for artists and designers than have been emphasized in the past for their part in catalyzing cooperative networks and solving difficult problems.
Keywords: Design, Transdisciplinarity, Integrated Assessment, Heuristic, Wicked Problems

1. Introduction

The title of this paper refers to its purpose, which is to attempt to organize an integrated assessment for the ecology of design. The term *ecology* comes from the Greek word *oikos* meaning 'house' or 'home'. Correspondingly, this paper aims to locate the place of design at multiple scales and across heterogeneous actors using a framework of integrated assessment (e.g. Ravetz, 2000). My intent is not to specify a framework for ecologically sustainable design work, but I do suspect that recognizing other relevant actors and participants will allow sustainable propositions to follow. In another vein, my aim is to encourage an expansion of the problem space where artists and designers can contribute. This begins with the ways problems are defined.

We tend to encounter a certain type of problems in the news every day as controversies over resource availability and demand, peace and conflict, adaptation and complex coordination, and how best to achieve equity among individuals and groups. Solutions to these problems have been especially elusive in history. Urban planners Rittel and Webber (1973) call these "wicked problems" because their social dimensions mean they cannot be adequately described, falsified, or optimized. This

description places wicked problems in stark contrast to the relatively tame problems for which science and engineering are equipped. This is because the practices in science and engineering are organized to claim certainty and exclude many of the social dimensions that would otherwise complicate things.

Funtowicz and Ravetz (1993) categorize different kinds of problems using the degree of uncertainty–how much information one has about the nature of the problem–and the stakes involved. The stakes usually refer to the consequences for failure, which was also a distinguishing characteristic of Rittel and Webber's wicked problems. Funtowicz and Ravetz use the degree of uncertainty and stakes to invoke an expanded set of methodologies resulting in what they call *post-normal science*. Their expanded methodology calls for the inclusion of extended peer communities from outside of "expert" disciplines to help lend legitimacy and quality control to these high uncertainty and high stakes problems. This is a move towards greater democratic participation, information transparency, and increased assurance that the output of scientific work is valuable for policy and action in a dynamic world. It also suggests that changing our perspectives about how these problems are approached and by whom may facilitate the development of more robust social, ecological and technological systems.

My goal here is to offer an alternative view of the disciplinary space that artists and designers can call home. I have a second goal to insinuate designers as agents of the extended peer communities referred to by Funtowicz and Ravetz where the job of the artist and designer is to mediate collections of people, places, and things that can contribute solutions to wicked problems. However, in order to do this, I need to put forth a few points about diversity.

1.1 Diversity

When it comes to both tame and wicked problems, diversity is important to our ability to make small improvements to existing situations. Groups composed of individuals with different sets of cognitive perspectives yield better solutions than more homogenous groups for the sorts of tame problems encountered in science and engineering (Page, 2007). Their perspectives are mappings from objects, events, or situations to mental representations that come from our experiences with information, locations, and relationships. However, diver-

sity only really works for these tame problems when the participants have similar mental models, or fundamental preferences, of how the world operates (Page, 2007). The difference between fundamental preferences and perspectives is important because it helps us see why wicked problems are so much more difficult to solve than tame ones. Tame problems are characterized by elements and perspectives that, when properly identified and ordered in the correct configuration, may allow us to solve the problem. With heterogeneous actors and scales involved, wicked problems tend to be much more complex. Consequently, we often suffer from the inability to agree on the source or nature of the problem in the first place, not to mention the identity and order of possible responses. This is because our differences in experience, learning, expertise, and perception do not necessarily overlap.

We also have rational and irrational preferences that contribute substantially to our development of the diversity needed to solve problems because they admit different ways of ordering things and of interacting with the environment. Rational preferences limit the number of alternatives one has to take into account in order to reach a decision—i.e. only "sensible" options are relevant. Because "nonsensical" alternatives make so many more combinations possible under irrationality, a large amount of processing power is needed even beyond the capability of today's computers in order to analyze the dynamics of diversity using a model or simulation. This creates a limitation for our understanding of diversity and why it matters for problem solving. This is especially true for modeling difficult problems that require multiple alternatives, simultaneously.

Consequently, it is sometimes argued that irrational preferences result from unclear thinking (e.g. Page, 2007). However, an alternative perspective is that cognitive biases, risky or riskless contexts, the choices themselves, and the information we receive affect our assessment of preferences, judgment, similarity, and beliefs (Tversky and Shafir, 2003). Previously, behavior was thought to be predictable because people make choices in their own interest. We now know that we neither have access to all of the available information about a choice nor the ability to process that information meaningfully all of the time. Economists Richard Thaler and Cass Sunstein explain how *choice architecture,* the infrastructure of decision making, is shaped by the form and arrangement of information and can help people make better choices in line with their own preferences (2008). The principles they describe are aimed at helping people simplify alternatives and make decisions under more meaningful and less information-dense circumstances. That is, they show how diverse perspectives can be adapted to each other using the elements of visual and interactive form: typography, ordering, scale, repetition,

and other elements. This is where I believe artists and designers can play a renewed and proactive role in civil society.

When artists and designers are trained to recognize and value their roles as brokers of information and meaning, they can be the agents who bring diverse people, social groups, and choices together to solve wicked problems. My proposition is that artists and designers open the landscape to new solutions to these problems 1) by augmenting peoples' understanding of their own fundamental preferences, effectively allowing them to find common ground, and 2) by adding design processes that will allow people to make meaningful choices and reduce the cognitive dissonance and uncertainty associated with wicked problems. However, in order to do this we may need some additional levers and institutional arrangements to perform this work.

1.2 From Interdisciplinarity to Transdisciplinarity

Interdisciplinary practices can integrate diverse ways of working and interacting. Julie Thompson Klein describes interdisciplinary learning as "neither a subject matter nor a body of content. It is a process for achieving an interpretive synthesis, a process that usually begins with a problem, question, topic, or issue" (1990). Boix Mansilla elaborates, describing interdisciplinarity as "the capacity to integrate knowledge and modes of thinking in two or more disciplines to produce a cognitive advancement – e.g., explaining a phenomenon, solving a problem, creating a product, raising a new question – in ways that would have been unlikely through single disciplinary means. … the integration of disciplinary perspectives is a means to a purpose, not an end in itself" (2005).

While interdisciplinarity might be viewed as a form of cognitive integration, transdisciplinarity is the application of interdisciplinary solution finding when applied to wicked problems. It can be thought of in terms of its cognitive *and* its practical integration. When concepts, theories and methods are applied across disciplines and groups working to solve wicked problems, they are effectively being tested for their robustness and value for multiple communities. Extended peer communities such as those outside a discipline are therefore important for the propagation of transdisciplinary work and for negotiating its value in multiple instances, places, and forms. However, in moving information, tools, ideas, practices, and meaning from one community to another, a great deal of translation must occur if these transplanted practices are going to make any sense in their new context.

I compare interdisciplinarity and transdisciplinarity because students and teachers face critical decisions about how to apply forms of knowledge and the basic patterns they describe, as well as the arrays of artifacts

they put up as candidates for everyday use. Social networks are shifting rapidly, if only due to the rapid urbanization of many of the world's inhabitants. I also believe students and teachers face a mounting challenge and responsibility to increase the number of participants in the design process. If you consider the multiple scales of design, from the nano scale to the planetary scale, negotiation is paramount for the successful deployment of sustainable technology in these social and ecological systems.

This paper then is an attempt to complicate the matter of design when it interacts with social and ecological systems. By conflating two sets of interpretations from the fields of cultural anthropology and ecology, I hope to stimulate discovery of predictive models and courses of action based on the specifics of actors or individuals involved. The goal here is to manage uncertainty by enhancing students' capacity to integrate diverse perspectives and to synthesize different implementations across communities. The benefit is posed as the invocation of a larger suite of interactions and solution space for students to consider, along with the emergent and unexpected processes that can result from those interactions. I caution that this is not by itself a predictive model for action. It is a bit like rearranging the shelves in the library so that you can turn around and discover a new book or topic, something you were not expecting given your location in the stacks, your office, or your discipline. It does not tell you what to do, but it might add something useful.

2. A Heuristic for Framing Interactions

A heuristic is a rule applied to an existing solution (in this case, design) that generates new solutions or possibilities (e.g. It answers the question, "who do we consult and who has a stake?"). Heuristics tend to be more valuable when there is uncertainty rather than when pre-existing interpretations of the world are already agreed upon. This heuristic developed Russell Bernard's matrix for finding research topics in cultural anthropology, which represents a common interpretation of factors (hereafter, "sources of uncertainty") important to cultural anthropology (1996; Table 1).

Bernard's interpretation works pretty well for humans, but if we rely solely on cultural anthropology we might fail to include the concerns of others like plants, animal, majority perspectives, or even ourselves. If we take as our goal the design and emergence of preferred situations, we need to keep ecological concerns in view if we are going to include a measure of justice for everyone and reduce the amount of risk we face. Drawing from the field of ecology, I have added an additional interpretation to Bernard's matrix that asks how biological, cultural, and material sources of uncertainly matter

at different levels of ecological scale (Table 1; column 2). This is relevant because knowledge in these domains is increasing rapidly, and as that knowledge increases, there is often a corresponding series of designed interventions by people. These additional categories allow us to consider the designed interaction, even if they are not standard practice in anthropology or any other discipline. It asks, "What happens when we merge the work of cultural anthropologists, ecologists, and cognitive psychologists, designers, economists, and evolutionary biologists?"

Their interactions between categories may suggest sources of emergent traits or mechanisms of failure. At a minimum, they facilitate thinking and working with these other sources of uncertainty in mind. I have dispersed them across the grid as a simple way of making sure that each interaction is accounted for and considered (Table 2), because accounting is a major way to bring participation and sustainability to the design process (Boyce, 2000; Bebbington et al., 2007; Frame and Brown, 2008; see also Latour, 2006). The grid arrangement also points to areas where the interactions can be particularly relevant for organizational goals. For example, traits that are uniquely human touch on motivations, while the interactions of human-generated 'stuff' seem uniquely qualified to inform us about the robustness of our ecological and technological systems. The grid also helps us recognize that the interactions can be bidirectional, with "arrows" of material or sign/semeiotic causality (i.e. "What is driving what?") arriving from any level or actor (Lemke, 2000).

3. Design Ecology

With this set of interactions in mind, we can see a sort of design ecology begin to emerge. Design ecologists study the distribution and abundance of the design concerns, their interactions, and how their architectures are maintained. Much like ecologists concerned with the distribution, abundance, and interactions among species, design ecologists study biotic, social, abiotic, and technological sources of uncertainty that structure the origin and maintenance of products, infrastructure, and services that support human and non-human flourishing. Ecological models have been used in the past as analogies for design-based systems including theories of competition among firms (Hannan and Freeman, 1977), mimicry or convergent relationships between design systems and natural ones (Beyus, 2002), industrial flows (O'Rourke, et al., 1996; Verhoef, 2004), and artifacts (Krippendorff, 2006). Here, my goal is to start to connect the concerns of each of these together in an integrated fashion so that we can start to enlarge the perspectives needed to design robust systems before we prematurely exclude the ones

Table 1.

Social Research Methods and Design Ecology Framework Compared.

Social Research Methods Interpretation (Bernard, 2000)	Design Ecology Interpretation
	Genetics
Internal States	Cognition
External States	Phenotype
Behavior	Behavior
	Material Aggregations
Artifacts	Artifacts
Environment	Population
	Community
	Landscape
	Ecosystem

Table 2.

Sources of Uncertainty in a Grid Arrangement Help to Integrate and Assess Design Ecologies.

we need most. To describe and arrange these ecologies, designers and artists may need some "material" to work with. Here I think mutual information, cooperation, and preferences can help.

3.1 Mutual Information

Mutual information is a term from information theory that describes the amount of information one thing tells about another thing. It is the reduction in uncertainty of one thing due to knowledge of another (Cover and Thomas, 1991). If we ask how information is shared between each of the different sources of uncertainty, we may be able to get a sense of how they are connected and how they might respond to each other. Mutual information provides a mechanism for observation and engagement.

3.2 Cooperative Networks

Social networks endure because they are able to maintain mechanisms for stabilizing their interactions. Network reciprocity describes a process that allows entities to form enduring cooperative networks (Ohtsuki et al., 2006). It serves as an example of a strategic game that simulates cooperation in groups where an individual's success in making choices depends on the choices of others. Relationships endure over time from the benefits of interaction. Defectors or cheaters do not pay to a cost to their neighbors, but they nonetheless benefit from the donations of their neighbors. Because it is a network, neighbors form clusters, help each other, and despite those defectors, are expected to persist when the ratio of benefits to costs is greater than its average number of neighbors (Ohtsuki et al., 2006). Networked reciprocity creates heterarchies, or interlinking, between actors and individuals. This allows conditional or power-sharing roles to develop when one's ability to be successful is influenced by the choices of others and vice-versa. Consequently, defining the size of the network of interactions in an important step in being able to determine the likelihood that cooperative design ecologies will form.

3.3 Preferences Redux

If our goal is stronger cooperation and more cohesive networks, it might make sense to reduce the number of participants or actors in that network to those that are going to "work well" with each other. This might mean behavioral coordination, but it may also mean that clear and informed understanding between participants, whether they are people or things. Designers can limit or arrange choices and help focus preferences, effectively limiting the number of actors and uncertainty in a network. By designing information and interactions to increase mutual information and refocus preferences, artists and designers can facilitate cooperation, perhaps even on the most difficult problems.

Consider time as a special example. One of the ways we design and coordinate systems is by arriving and departing at the same time. In whatever shared space we inhabit and work, we are able to communicate and perhaps even reach "common ground." Clocks are visual information sources that help us limit our choices, making it possible for us to connect facets of behavior, artifacts, populations, and cognition together and into the places they need to be to do work or whatever we decide we need them for. When we coordinate our clocks, we increase our mutual information and limit our network size, making cooperation possible by increasing our common ground—sometime figuratively and sometimes literally as well. Clocks are a social technology, invented for the purposes of communication and coordination. My question is, "Are there other social

technologies that can be created by artists and designers to provide similar services and that will help us solve some of the more difficult problems of cognitive and social coordination?"

4. Role and Characteristics of the Design Ecologist

In taking together the things I have presented here, there are a few final heuristics for teaching, learning, and designing that I think will become even more valuable in the coming decades.

The first comes from the concept of *interessement*. Sociologist Michel Callon (1986) describes interessement as, "the group of actions by which an entity attempts to impose and stabilize the identity of the other actors it defines through its problematization." This means that a role for artists and designers is in the communication of identities, goals, and avenues of coordination when they get involved and frame problems through their own ways of working. The value they create is arrived at in the way problems are reshaped, assumptions examined, and new channels for communication found when they are made visible for potential stakeholders. Designers can then be thought of as mutual information builders for diverse groups. A further question is, "How do we then design for communication between humans and non-humans?"

Role and identity is important, but what artists and designers make and do is also critical. I like the concept *boundary objects* as a target for the types, forms, and functions of things that exist and interact in social spaces. According to Bowker and Star (1999) boundary objects:

> "…are those objects that both inhabit several communities of practice and satisfy the informational requirements of each of them. Boundary objects are thus both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use and become strongly structured in individual-site use. These objects may be abstract or concrete… Such objects have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting communities… Boundary objects arise over time from durable cooperation among communities of practice."

Here again I think artists and designers have a distinct role to play in aiding the development of these objects. Maps offer an excellent example. Within the map's boundaries, real and imagined places or objects can be represented with more or less convention and with changes over time. Different people can use maps for different purposes.

A third heuristic not altogether different from *interessement* is the concept of *network entrepreneurship*. A network entrepreneur is someone who brokers ideas across structural holes in organization and networks (Burt 2004). Structural holes are areas of emptiness or gaps between social groups. The epistemological and methodological gap between the arts and sciences is a good example. According to Burt, individuals (and possibly groups) that provide vision across these gaps create advantages and opportunities that are a form of social capital. The work that these types of individuals do is based on the assumption that within group variation and the diversity of ideas is less than the variation and range of possible solutions achievable between groups. Network entrepreneurs position themselves to draw from these different sources of cognitive or other contextual variation while seeking solutions, ideas, and ways to connect. If an individual is involved in designing a boundary object, the degree to which they engage in network entrepreneurship may increase the suitability of that object across different communities *because* they are communicating with and engaging with those communities.

Interessement, boundary objects, and network entrepreneurship, taken together, suggest a final set of teaching and learning goals. Burt's (2004) characteristics of network entrepreneurs and Rhoten and Pfirman's (2007) interdisciplinary behaviors were the starting points for these guides, but I have reframed them somewhat here. These goals provide questions that can be asked of assignments and projects and may serve as a set of characteristics to encourage in behavior as well.

4.1 Adaptation

Are tools, artifacts, concepts, data, methods, metaphors, or results adapted from different fields and/or disciplines? Are individuals in one or more groups aware of the concerns of the other(s), and does that awareness create common ground? Do these result in the creation of new value chains for social, economic, and epistemological development that can be applied in new contexts and in response to shifting norms, values, and environmental conditions?

4.2 Coordination

Does it promote seeking, exchange, and/or creation of tools, concepts, data, methods, or results across different fields and/or disciplines? Are collaboration, infrastructure, and participation enhanced? Are practices transferred that have the potential to create value from one group in another group?

4.3 Knowledge-Networking

Does the work or play involve engagement in domains that sit at the intersection of or the edges of multiple fields and/or disciplines? Are seemingly unrelated things "drawn together" either out of analogy or other cognitive tool?

4.4 Framing

Is there engagement in topics that not only draw on multiple fields and/or disciplines but also serve multiple stakeholders and broader missions outside of academia? Is there synthesis of new behaviors and beliefs that combine the concerns of diverse groups?

5. Conclusion

The Australian Public Service concluded that the prime skills needed to address the problems of governance include working across organizational boundaries, engaging stakeholders, and influencing citizens' behavior. The Public Service Commissioner's report says that, "People with connecting skills will be increasingly valued—people who can build up relationships across the public, private and non-profit sectors and leverage these relationships to build networks of mutual benefit. There is also a need for policy makers to be aware of and apply behavioural change theory." (Tackling Wicked Problems, 2009). Artists and designers are some of these people, and they should become more directly engaged with these tasks. Training the next generation in these kinds of skills is itself a difficult passage point, but it is also a kind of stimulus to help push us past the current threshold and into a new space of possibility and coordination, perhaps finding new design ecologies along the way. As teachers and mentors, we can help emerging professionals develop these skills, but in order to do so we may need to shed our own biases and assumption. We have taken the first step by showing up here to communicate together. What's next?

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Designers' Experiences of Intuition

Coaching intuitive skills as part
of creative design process

Abstract

The intuitive discovery of ideas is an important for creativity. Yet there is limited discussion on how intuition is experienced and understood by designers themselves. Experiences of intuition are often absent or neglected. Lack of discussion and understanding on intuitive experiences can hamper the education of novice designers who have limited experience with their creative process. Novice designers are often unsure and rely heavily on normative models for understanding their experiences.

Based on our experience in coaching intuition for designers, interviews with designers, and a survey of intuition literature, we call for legitimization of personal intuition experiences. We propose an approach to advance experiences as part of the personal creative process for utilization and development of intuition as a skill.

Keywords: Design, intuition, education, experience, development

1. Intuition essential to creativity

Intuition is considered to be essential to the creative process (Goldberg, 1983; Boden, 1994; Policastro, 1999; Bastick, 2003). In addition, intuition in decision making can also be highly useful, accurate and in some situations superior to rational reasoning (Gigerenzer, 2007; Klein, 1999). Yet there is very little overall agreement as to how the process of intuition exactly works (Betsch, T. 2008; Sinclair & al., 2005; Bastick, 2003). The confusion surrounding intuition has lead historically to mystification of intuition as a form of 'divination' or as something completely unexplainable (Atkinson & al., 2003).

Intuition has also historically been grouped together with the body of tacit knowledge and the act of ser-endipitous tacit knowing (Polanyi, 1962). Further, highly developed intuitive creative professionals appear to be using intuition also as an active and intentional skill for making decisions, which in turn may draw from tacit knowledge sources (Sternberg et al., 2000).

Recent research has shown that the process of intuition can be at least studied at the periphery – that is right before and after moments of intuitive thought (Hogarth, 2008; Petitmengin-Peugeot, 1999; Policastro, 1999; Klein, 1999). In addition, there are plenty of non-scientific explanations for intuition that attempt to model and make sense of intuition (Brennan, 1988; Lloyd-Mayer, 2007; Sheldrake, 1995; Vaughan 1978).

This paper discusses *experiences* of intuition described by designers and creative artists, attempts to explain their importance, and focuses specifically on *how to handle intuitive experiences and how to develop intentional intuitive skill*. The paper does not make an attempt at *modeling* intuition further and the concept of intuition is taken from the monolithic definition implied by the dual process models of cognition (Betsch, 2008).

2. Significance of personal
intuition experiences

Personal intuitive experiences can be extraordinary, multi-sensory, and appear as extra-sensory in their character (Lloyd-Mayer, 2007; Guiley, 2001; Petitmengin-Peugeot, 1999). Due to their character and difficulty in verbalizing them, such experiences are often not studied personally or researched at more general level (Petitmengin-Peugeot, 1999). However, based on the literature and the our own experience it is important to accept and reflect on the personal experience for the development of intuition (Hogarth, 2001; Brennan, 1988).

We have interviewed two dozen of highly experienced creative artists as well as students and professional designers about their experience and use of intuition. In addition, literature search has uncovered more of personal stories of intuition. The stories are important for two purposes. First, they show how personal and sometimes extraordinary experiences appear as highly important to the person who has experienced them, granted they are given a trusting environment in which to accept, share and make sense of them. Second, these experiences lie often beyond the normative and as such are very delicate. They easily lose their meaning if they are over-fitted to pre-given normative models of how designers ought to think and act in order to be consid-ered respectable or professional. That is, the personal truth embedded in such experiences becomes useful only when they are made visible and accepted as they are – without overt rationalization, which risks denying their meaningfulness.

Novice design students are at the beginning of their journey as designers, just getting started in managing their personal creative process. Many are also very unsure of their professional competence. We have noticed that the students interviewed face challenges in expressing and verbalizing their experiences of intuition. It is not easy to talk about the highly personal experiences, partly due to the fact that their vocabulary might be limited in describing such experiences (Wallace, 2007; Brennan, 1993). The students also find it demanding to admit the existence of extraordinary experiences, or to talk about them without distorting them through rationalizations.

Rationalizing one's own experiences through normative cognitive models can hinder the development of intuitive capability: experiences can be denied altogether (e.g. 'trick of the mind'), they can be over-fitted to certain categories (e.g. 'a mere heuristic'), or their explanations can be evaluated as erroneous (e.g. 'your reasoning is just biased towards that outcome'). This rarely advances the students' understanding of their own intuitive experiences. For the purposes of modeling intuition with the intent of developing it, we have found it beneficial to include several different, even contradicting models of intuition in their education practice (see references, particularly Bastick, 2003; Betsch, 2008; Gigerenzer, 2007; Hogarth, 2001; Lloyd-Mayer, 2007; Polanyi, 1962; Sheldrake, 1995; Sinclair, 2005). As no single specific definition of intuition exists (Sternberg et al., 2000; Betsch, 2008) , it is likely that the multitude of varied intuitions also manifest differently (Goldberg, 1983). The plurality of intuition models has made it easier for students to find meaning in their experiences by fitting a suitable model to their personal context of experience rather than vice versa. The aim is to give tools to designers for personal sensemaking, and therefore several alternative non-scientific models have been introduced to the students (Brennan, 1993; Sheldrake, 1995; Vaughan, 1978). Designers' have the luxury of not being limited by validity alone and should consider the utility of models alongside with their scientific validity (Nelson & Stolterman, 2002).

The student feedback appears to confirm that making sense of personal experiences increases the understanding of personal intuitive process. Better understanding in turn leads to an increased ability to use the knowledge gained through intuition. The highly experienced designers and artists interviewed report further that intuition is the most significant method guiding their creative process. The intuition has grown dur-ing years or decades of personal experiential experimentation. Our teaching experience suggests that understanding intuition at large and on level of personal experiences in particular can lead to a positive feedback loop, where use increases understanding, which in turn further increases the use of intuition in design.

3. Coaching intuitive skills

Intuitive thinking appears to be both a personality trait (Bastick, 2003) and a developmental skill or ability (Bastick, 2003; Hogarth, 2001). As a skill, intuition potentially develops through a continuum that changes according to practice and experience (Baylor, 2001; Mielonen, Keinänen, Raami, Rouhiainen, 2009). Designer's domain intuition can develop through acquisition of expert knowledge (Hogarth, 2008). Further, the development of intuitive skill may benefit from managed practice, which is dependent on quality of corrective feedback (Hogarth, 2001, 2008). Due to the initially non-conscious nature of intuitive thought it is often modeled as utilizing the tacit knowledge source created by implicit experience. However, the source and the act are at least partially different (Sternberg et al., 2000). While tacit body of knowledge is an important source to intuitions, if the skill of using intuition is under-developed or unused, this tacit knowledge may offer very little additional benefit for a designer. Further, while the skill of rational thought is officially accepted and taught, the skill of intuitive thought is often bypassed or assumed as a given (Hogarth, 2001). What remains for education of intuition is the accumulation of potential intuitive knowledge sources (e.g. tacit knowledge) through continued experience and the subsequent development of expertise in particular knowledge domains.

Our experience is that designers often lack access to more intentional training of the thinking intuitively (for brevity, 'intuitive thought' is referred to as 'intuition' for the remainder of this paper). While non-professional intuition is undoubtedly used every day, it's intentional application and development is often neglected. This is due to many factors, some stemming from cultural-historical baggage such as changes in educational trends (McCoy, 2005), and others from difficulty of consciously training non-conscious processes (Varela, 1999). However, we believe that intuitive skill can be practiced, even if no clear-cut practice methods that guarantee success exist.

We have been coaching more than hundred design students on a course called *Coaching Creativity* in Media Lab at the University of Art & Design, Helsinki. In this class we have experimented with different educational approaches that we believe can foster the students' understanding of personal intuitive experiences. Based on student feedback to these approaches de-

scribed below, we observed positive qualitative changes in the use of intuition among students. The students report that they experience the exercises from course as meaningful, and that they help them to trust and learn more about their personal intuition. Based on our teaching experience on the courses, the following approaches have been found constructive (details follow after the list):

- Create an environment of trust for sharing intuition experiences
- Accept and appreciate the personal experiences
- Linger in the personal sensations and perceptions
- Embrace the ambiguous and the extraordinary
- Open up to all sensations and tune into intuition
- Practice recognition and separation of internal signals
- Reflect on the process and accuracy of personal intuition
- Deepen understanding of intuition by sharing, discussing and reading

When the social environment feels safe students are able to share personal stories and experiences outside the norm. Some students achieve a feeling of trust sooner and their stories encourage others to join the discussion. Feelings of acceptance and safety have been best achieved in small groups through informal discussions. One of the most important factors to promote is personal validity. Since each student's intuition may appear differently, and as the reactions are very personal, it is important to stress that there is no one true way to experience or interpret intuition. Discussions focus on reflection of personal perceptions and processes connected to intuitive moments (e.g. emotions, stimuli), which students have documented in their personal learning diaries.

Further, students can be guided and encouraged to develop methods for sensitive observation. This starts by accepting personal feelings, affects, sensations and states – however minute. Being sensitive to one's own internal states helps to develop the ability to monitor them and find meaning in them. Observation, sensitivity and meaning-making form the basis of intuitive practice and reflection: intuition is practiced as a way of knowing and judging, and this process is then reflected on.

We feel it is essential to foster the appreciation of everyone's own authentic experience, instead of overfitting one's intuitive experiences to a single pre-given model of intuition that does not make personal sense. Therefore the student as well as the teacher needs courage and patience to face ambiguous and incomplete situations; this requires tolerance to linger in the original sensations without trying to normatively grade these perceptions. As an example, some students report that

their intuition is based on emotional responses, while others stress the total absence of emotions is essential in order to get reliable information through intuition.

Tuning into intuition is about opening up all senses to all perceptions, including those that feel extra-sensory. An important part of the process of accepting unusual personal experience is opening one's mind to new sensations and perceptions that may have been previously denied, and acknowledging their part in the creative process (Lloyd-Mayer, 2007). Great benefit have been found from mental exercises, in which the placement of consciousness is 'moved' either within or outside of the body (e.g. feel one's thought inside the stomach or above one's head). Through these exercises students appear to get closer to the original sensations. For example, one exercise encourages students to observe the sensations outside of their bodies by stating that their body is not limited to what's inside their skin. The students report they are able to reach new kind of information, which many of them feel as clear, trustworthy and easy to access. Sometimes students report that the new information is contradictory to their previous reasoned judgments, but that the new intuitive understanding is what they trust more when making decisions.

We have discovered that observation of personal perceptions develop a sensitivity to distinguish signals related to intuition. Observation combined with shared discussions help students to develop the ability to recognize their specific intuitive signals. This is essential when practicing intuition as a skill separate from unconscious behavioral habits, emotional response patterns and the like.

We encourage students to constantly apply intuition in small matters of personal life. If a student is lacking trust in intuitive skills, it can be beneficial to nourish intuition through imaginary trust, i.e. believing and acting to be an intuitive person. Through trust, even if initially a fake one, one can observe vague signals, which may give hints on how intuition operates. This feeds back encouragement to further personal experimentation, resulting in a positive feedback loop: the signals become clearer, trust grows, and practice increases.

Practice and trust appear to be crucial steps when interpreting intuitive signals and reliability of intuition (Nadel, 2006). Remarkably, the trust in intuition can grow even if it turns out that not all intuitions are correct. This requires appreciating the fact that intuition is a skill that can be improved and that not all signals rising from the non-conscious are necessarily worthwhile intuitions. Further, reflection after the intuitive moment may reveal essential information of the process of personal intuition: sensations that originate from valid intuition or sensations that are may mask reliable intuition (e.g. strong moods).

We have been using several exercises to practice these skills, i.e. meditation, mindfulness, focusing of attention, breathing, relaxation and concentration exercises. For reflection it has been beneficial to keep a diary of intuitive process, observing specifically awareness and quality of sensations, actual intuitive judgments and decisions made, as well as resulting success and satisfaction. Through this, the nature and causality of personal intuitive process may slowly reveal itself, and its intentional application can be increased.

When eliciting students' personal stories of intuition it has been beneficial to present various models of intuition. We have been using stories of famous artists and designers where they reveal the intimate and sometimes extraordinary nature of their personal intuitions, which students can compare to that of their own. Through this reflection students are able to deepen their personal understanding of intuition on personal level and in general. Alternative non-scientific literature presents alternative models of intuition and consciousness, which we have found to be beneficial in helping students give meaning to their own intuitions (Mielonen, Raami, Keinänen & Rouhiainen, in preparation). It is important to engage students in sense-making of their own intuitive experiences and also to let them share these meanings trough reflection with peers.

4. Legitimizing intuitive experiences

Much of the experiences told by students on courses or which appear in the literature may feel extraordinary, even supernatural when experienced. A novice designer often reflects himself with a public image of the designer – which these days usually excludes such experiences. However, intuition is a very personal experience (Bastick, 2003). Therefore it is important to remain open-minded towards all kinds of feelings and perceptions, and consider them valid in the sense of first person lived experience (Petitmengin-Peugeot, 1999).

According to psychologist Elizabeth Lloyd-Mayer we suffer from an underlying cultural disinclination for publicly acknowledging certain highly subjective, highly

Legitimizing Experiences

			Aim
Challenge	"Hunches are just feelings"	"Decisions based on facts"	Acceptable
Tacit	Expert silent knowledge	Heuristics & Pattern matches	Non-normative
			Interpreted
True	Subjectively true	Signals requiring interpretation	Useful
			Feedback
			Improved
Use	Accuracy through trial and error	Development only through use	Shared

personal experiences. We're especially reluctant to credit those personal and subjective factors when it comes to things we prefer to be dictated by rational and objective thinking. The fear of appearing credulous leads many people to disavow their personal reality, which can paralyze their creativity (Lloyd-Mayer, 2007).

One of the methods of the coaching course has been a first person perspective on intuition. The highly personal intuition experienced are legitimized: the experiences are subjectively true, regardless of how scientific models. This act frees the designer to pay attention to the intuitive signals, to learn more about personal intuition – as well as to acknowledge the information gained through intuition. In the progress of our teaching we have seen students frame their intuitive experiences as meaningful events to themselves and become encouraged to use them in their creative work. Through a transformative process students' progress step-wise in their attitude towards personal intuitive experiences: First they understand that is it is common, even desirable to have these experiences even if the they cannot be always put into words properly or that they may appear quite unusual when explained. Then the students learn to appreciate that these intuitions can be used to guide their own design decisions – alongside with their rational, deliberate faculties. Finally, the designers can intentionally utilize these experiences and even develop them further as a skill.

In addition to personal sense-making, students have been introduced to models that view intuition primarily as a judgment heuristic, which is prone to judgment errors and reasoning biases (Betsch, 2008). This leads easily to grading of one's experiences normatively with cognitive models. This is not often fruitful for the purposes of developing intuitive capabilities.

The normative grading of personal intuition experiences according to models poses problems for the development of intuition. Especially the scientifically educated designers can often err on the side of over-rationalization when thinking about their own intuitive experiences: experiences not accepted or legitimized by models may be rationalized as useless or denied altogether before their usefulness has even been tested. We have experienced this type of "validity over utility" attitude in their own and in their students' thinking. Often the suspension of judgment of experiences requires considerable effort and justification on the part of the one experiencing. Without actually trying to use intuition and suspending one's disbelief, further development of intuition is difficult.

Regardless of the models chosen, we argue that students benefit from not only making sense of, but also from accepting and trusting their own intuitions. This acceptance is fostered through external legitimization: shared stories and presented descriptive models can
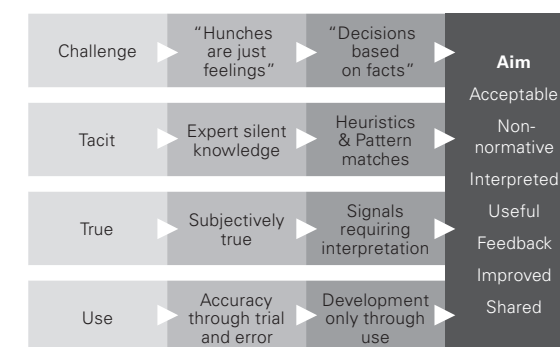
ease the students in accepting the sometimes peculiar nature of their intuitions, and help them to further use their intuitive capabilities (Taylor, 1998; Brennan, 1993). In effect, students frame their intuitive experiences as desirable and meaningful events to themselves and become encouraged to use them and talk about them. Based on our experience, this process can lead to a transformation in the students, which becomes evident as marked qualitative leaps in student's creative process and creative output.

5. Conclusion

We have argued for the essentiality of personal intuitive thought in developing designers' thinking. Further, we have noted how important and yet delicate the personal experiences of intuition are for the people within the creative process. We believe that by accepting, trusting, observing and testing these experiences it is possible to develop intuition further as an *intentional skill*. We also believe in helping people to make personal sense of their own experiences, instead of fitting them normatively to models of thought. In addition, the application of stories and alternative models frame even the more extraordinary personal experiences as acceptable, thus legitimizing their existence and enabling their sharing. Through this process, reflection on the personal experiences of intuition becomes essential to the development of intuition.

Yet, many issues are unknown for the development of a more integrated approach towards intuition education. The developmental continuum of intuition appears unmapped and the targeted methods for specific types of intuitions within this continuum are incidental at best. We are pursuing further educational experiments to advance these issues in practice.

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Anita Kocsis

Designing with the experiential in digitally augmented exhibitions

Abstract

The ways in which audiences interact and make meaning of digitally augmented exhibitions is an important design determinant. In such an interdisciplinary project, the design, the museum and new media encounter the problem of the experiential. A creative experimental analysis of audience experience employing aesthetic visualisation semiotics drawn from the principles of information design, computational aesthetics and human centred design is argued as a relevant adjunct to an exhibition providing fresh perspectives and new knowledge to interdisciplinary stakeholders. Interactive, experimental artifacts, known as *field* and *body,* provides a conceptual map of the exhibition experience relying on the creativity of audience participants in making visible, legible and tangible their personal reception of a work. The data yielded reflects abstract notions of audience experience engendering a discussion about the phenomenological, curatorial and cognitive effects of the digitally augmented exhibition.

Keywords: Co creation, user experience, information design, digital container

1.Introduction

Human centred design and the museum have undergone parallel changes regarding the position of the audience. Human centred design refers to the philosophical and theoretical discussion focused on prioritising the human being in the overall design program (Preece, Rogers & Sharp 2002, Hanington, 2006, Buchanan, 2006, Sanders, 2006). Human centred design is a broad term that acknowledges the concept of the user surpasses 'use' to incorporate a sentient person situated in their world. In reframing their nature and practices, museums have also come to understand their audience as plural in its composition (Macdonald, 2006, p.31). Barbara Sudick (2006) argues that each person shapes their dialogue with an artifact

and constructs their own unique understanding of a message "influenced simultaneously by intercultural, cultural, social and personal contexts" (p.186). Understanding the museum visit as a participatory social activity privileges the experience of the audience as a requirement to be addressed in the museum's audience research activities (Kelly, 2004, p.49). Paralleling the challenge to designer-driven from human centred and participatory design, the museum-as-expert and the audience-as-novice communication model is now commonly seen as an anachronism stemming from an overtly didactic past. Indeed, Douglas Schuler and Aki Namioka (1993) could be writing of human centred design or contemporary museum practice when they argue,

> *participation stands in contrast to the cult of the specialist. In the specialiast model … [t]he question is presented to the Expert who will eventually produce the Answer. With this approach, those most affected by the conclusion must sit idly by, waiting patiently for enlightenment (p.xiii).*

For Helena Friman, (2006) museums' future hinges on "their relationship with the public" (p.55). Following André Malraux, she takes the idea of the 'museum without walls' to challenge museums to merge with potential communities. This she argues requires the museum to shift its focus from what the museum is to what it does. Friman (2006) argues that for most museums it's not enough to have sophisticated well designed exhibitions; talented curators and marketing staff "must adapt a new strategy and use their resources with the public in a more creative way" (p.56).

Such philosophical developments have seen the call for museums and other cultural heritage institutions to adopt technology to expand the dimensions of peoples' interaction with their programs and collections, while still promoting learning. L. Smith, (2001) argues that technology is transforming all aspects of museum activity, bringing about fundamental shifts in the operation of cultural and knowledge institutions. Angelina Russo (2009) reports on the role social networking has played in connecting organizations and audiences (p.2). The development of digital exhibitions has enabled diversification and disseminating exhibition content facilitating more democratic outcomes for museum visitors. For instance, as curators recognize the potential for multiplicity of meaning, they are compelled to become less didac-

tic and more open in their choices of exhibition form and content, taking on the role of facilitators of experience and learning, embracing a multiplicity of representational techniques and processes based on intercommunication with visitors (Kelly, 2004, p.50). Yet discussions of digital presentation systems in the museum are often mired in the fetishization of technological advancements, which fail to grapple with museums' major challenge in mediating exhibition content, technology and audiences.

Where museum activity encompasses not only the presentation of cultural objects and information but also experiences, correlating audience experience with the digital immersive augmented exhibition (digital container) is argued as equally important as the technology. Therefore the museum and its contributors cannot afford to deploy digital technology without understanding processes of mediation or adopting human centred approaches.

The 'appearance' of the audience in the philosophical domains of museology *and* design is an important concurrence. Over the last ten years, a move towards an inclusive and interpretive paradigm of practice concerned with better understanding people has affected a number of disciplines within the museum, including audience research, museum pedagogy and exhibition evaluation (Hooper-Greenhill, 2004). Audience research in the museum is an umbrella term that comprises visitor studies, visitor research, evaluation and market research (Kelly, 2004, p.49). Measures of success based on the museum's ability to transmit knowledge on a functional level, albeit important, particularly in reference to science and natural history exhibitions, have lost currency along with behaviourist models of audience research where the museum visitor is examined in terms of the effectiveness of their response to the museum's stimulus (Macdonald, 2006, p.320). Within such a model, design served the role of 'packaging messages' to help pass over the expert-visitor divide (Macdonald, 2007, p.150).

The role of designers, like that of the museum visitor, has shifted from a passive position of waiting to receive a mission to an active one of exercising influence over the content and form of exhibitions. For example, summative museum exhibition evaluation sees the exhibition not as a fixed destination, but rather something under continual evaluation and change. Michelle Henning (2006) argues that this shift can be traced to the 1970s, when "museums began to employ professional communicators and designers to mediate their messages to the public" (p.314). Designers, once tasked with delivering an attractive medium for the presentation of content, began to act as translators and facilitators of information, a role which today has become integral to the conception of many museum programs (Macdonald, 2007, p.150). Design is increasingly acknowledged as central to the visitor's experience, with potentially pro-

found connotations for determining the inherent character of that experience (Macdonald, 2007, p.150).

The effort to create a progressive museum model more responsive to the needs of visitors requires communication between audience research, design and museum practice. Understanding people and their role as interlocutors of an exhibition or an entire museum program demands innovative research methods. This is evidenced both in audience research and design practice. Co creative, participatory human centred design methods assist in exhibition concept development as well as the evaluation of exhibits where visitors are no longer considered 'an undifferentiated mass public' (Hooper-Greenhill, 2006, p.363, Sanders, 2002, p.5). The intention is that audience and designer gain new knowledge as they are "as active interpreters and performers of meaning-making practices within complex cultural sites" (Hooper-Greenhill, 2006, p.363).

The resurgence of Benjamin Gilman's (Gilman in Kelly 2004) observations of people in the 1880s identifying visitor fatigue underline an interest in the phenomenon of the audiences experience. Gilman concluded that prioritising the aesthetic and curatorial in exhibitions without considering visitor-focus was in danger of being poorly designed. He specifically argued that the physical wellbeing of the visitor affected and impeded on the reception of the exhibition (p.51). This paper extends on Gilman's notion of well-being to include the emotional, the social and thus felt responses of audiences in a digital immersive exhibition.

1.1 Communication spaces

Falk, Dierking, and Adams (2006) argue that, "in a world that allows for multiple perspectives, the conditions for meaning have become as important as the meanings themselves" (p.325). For design, these conditions of meaning are relative, the act of communication framed by several key conditions, which Frascara (2006) argues, "provide a context, a code, and a possibility … [and] also allow and constrain the communicational outcome" (p.xiii). Frascara (2006) uses the terminology of frames to explore the nature of a communicational event, which he sees as always situated. For Frascara, communication is a constructive as well as a transmitting act. Not only is it "something that always happens in a setting", communication designers forge "'a space', where the public meets the message" (p.xiii). This 'communication space' proposed by Frascara is not based on designers' intuitions or authority. Sudik (2006) argues that the communication space is a dialogic medium for processing information transactions, operating "like a conversation – always adjusting, changing direction and focus with stops, starts, and surprises – between individuals or groups with different cultural backgrounds, life experiences, thinking, or cognitive styles" (p.186).

Communication spaces require negotiation between designers and audiences. Communication spaces may be physical or virtual, or take the form of containers as in the case of digital immersive museum exhibits. Frascara locates the communicational power of spaces in the objects that populate them as well as in the characteristics of the spaces themselves.

What are the characteristics of the communicational potential of the spaces provided by an interactive digital augmented 3D stereoscopic immersive exhibition (digital container) such as the PLACE system (Shaw, 2009)? Investigating 'an experience' in the digital container is fundamental if we are to follow human centred design and museum research paradigms. What are the transactions between the audience and these digital immersive spaces? How are the messages provided by the content providers, constructed by and received by the audiences? What is the influence on the combinatorial factors such as the dynamics of the interior, the audio, 3D stereoscopic animation and presence of others? How does the audience actively contribute and build their experience of these digital containers? How is it possible to convey or discuss these abstract phenomena? Furthermore how can all stakeholders engage in the discussion? Here the questions outweigh the answers found in the literature. Design of 'multiuser systems' that expand into new areas of audience experience are in urgent need of attention (Krippendorff, 2006, p.208). Investigation of 'an experience', through the interactive artifact of the digital container is proposed as a collaborative activity. An analyses of 'an experience' in the digital container aims to generate co creation activity between the designer, audience, content providers and technology.

1.2 An analyses of audience experience in the digital container

A study of PLACE-Hampi consisted of a questionnaire that was conducted in conjunction with the exhibition, *Spark to Pixel* at the Martin-Gropius-Bau, Berlin, 2007 (Kenderdine, Shaw & Kocsis, 2009). The questionnaire was designed to generate a mix of quantitative and qualitative information about audience experience in the PLACE-Hampi exhibit. PLACE-Hampi based on an interactive projection system, invented by Jeffrey Shaw, has today integrated stereoscopic 3D projection amongst other features documented at http://place-hampi.museum. Its main attraction is the motorised platform that lets the viewer rotate in their projected point of view in 360 degree within its large cylindrical screen enabling a multi-media multi-sensory presentation of the archaeological, historical, and sacred locations at the site of the World Heritage of Vijayanagar in Hampi, southern India (Kenderdine, 2004, 2007, 2008).

An analysis of the findings bought new information pertaining to the audience's world within the exhibition space (Kenderdine, Shaw & Kocsis, 2009). This informs the creative and experimental framework of the interactive artifact known as *field* and *body*. Furthermore findings about the social and the co-experiential aspects of the exhibition audience inspired aesthetic visualisation of the audience experience via the interactive artifact. This artifact is proposed as an adjunct to a digital container exhibition. The interactive artifact aims to provide a post exhibition debrief whilst facilitating for stakeholders of a digital exhibition project a creative participatory avenue in the exploratory, generative and evaluative phases of research and design (Hanington, 2007, p.3). The interactive artifact provides an abstract and experimental visualisation of an equally abstract and difficult to qualify expression, namely ones experience of the exhibition.

1.3 A phenomenological approach to audience experience

The difficulty with experience, however, is that we can only experience our own life, what is received by our own consciousness. We can never know completely another's experiences, even though we have many clues and make inferences all the time (Turner & Bruner, 1986, p.5).

While a discussion of experience would not appear to require specialist knowledge, since it is a universal concept that we can all relate to on some level, a concise understanding, framing and conceptualisation of the term is not easily accomplished. Experience design, audience experience, user experience and HCI reveal that definitions across the 'experience studies' community are inconsistent.

In the context of the author's investigation, the concept of experience is described as qualitative aspects of human thought, activity and behaviour. Here experience is defined as a synthesis between abstract reasoning and the senses. It enables the designer to identify and make useful the difference between the learnt and the felt, between intuition and formal knowledge, and between the objective and analytic and subjective perspectives. Dewey's (1979) account of 'an experience' serves as a workable context informing the meaning attributed to the design of the interactive artifact. An experience is defined by a clear start, completion and a cohesive trajectory. Dewey thus clearly distinguishes an experience as marked by a sense of fulfillment, unity and completion. It is this working definition of experience in conjunction with a pragmatic phenomenological framework that forms the context for drawing specific insights about the audience experience in the digital container. A phenomenological account proposes that the task for researchers is "to make manifest the incessant tangle

or reflexivity of action, situation, and reality in the various modes of being in the world" (Orleans, 2000, p.2101). Phenomenological studies undertake analyses of small groups, social situations and organizations using a number of qualitative techniques, methods are employed to uncover the subjects "life world" (Orleans, 2000, p.2101).

The complex and abstract nature of an audience's inner life challenges the process of extrapolating the meaning of experiences. Its fleeting and effusive character and its unclear temporal nature – the fact that experience seems suspended in time between presence and its memory – makes difficult any attempt at defining experience. As Wilhelm Dilthey (1976) argues,

the relationship between experience and its expressions is always problematic […] and the relationship is clearly dialogic and dialectical, for experience structures expressions, in that we understand other people and their expressions on the basis of our own experience and self-understanding (p.161).

Therefore it is proposed that representing such an abstract and subjective concept requires collaborative experimentation that engages in co creative activities in order to generate further discussion. A visual sensorial and interactive activity ideally can facilitate the interpretation of an experience given that the structure of experience is a hermeneutical and reciprocal process in which revealed is the intimate connection between experience and representing experience: "experience structures expressions and expressions structure experience" (Turner & Bruner, 1986, p.5).

Sharon Macdonald (2007) argues that although audience research encompasses issues of media, sociality and space and recognises an active pluralist audience, "that there has not yet developed a significant language in which to describe and analyse the phenomena on which they focus" (p.158). Evidently, the work of sketching out this horizon and of finding a language for a technological phenomenology presents challenges. Macdonald (2007) also suggests that devising an 'affective syntax' of exhibitions or a common set of rules seems a rather complex project (p.159). Nonetheless, the interactive artefacts *field* and *body* aim to further the discussion pertaining to audience experience in the digital container where the functional criteria become complemented by phenomenological criteria. As design values have moved from "objects to experiences, from procedure to situation, and from behaviour to intent" (McCullough, 2005, p.50). Designers have changed the question from "How is it used?" to "How does it feel to use?" This phenomenology of engagement as suggested by Malcolm McCullough (2005) is evident in the work of designers that build technologies and digital arti-

facts around the everyday. However the phenomena of experience of the digital container in design research has attracted seemingly little descriptive and analytic focus whereas schematic frameworks and experimental toolkits dominate research methods. The experimental artefacts in this paper aim to generate participation and discussion.

The conceptual understanding of the phenomenology of an experience in the digital container was based on an analytic framework from a questionnaire in 2007 of the audience experience in a digital container (PLACE-Hampi). The analyses and the findings (not discussed in detail in this paper) play a vital role in informing the design of the interactive artifact. The components of the analytic framework belong to a set of psychological and physical, sensual and supra-sensual, individual and social, and intellectual and affective parameters. The set is structured by the concepts of emotion, embodiment, scalability, composition, spatio-temporal, 'flow', and coexperience. These components are crucial to better understanding 'an experience' in the digital container. Key concepts pertaining to an experience as part of the questionnaire focused around "specific propositions, questions, or activities" (Yin, 1981) of the digital container developed by the author were clustered thematically and listed as follows:

- Orientation / navigation / negotiation / time in the space / spatio-temporal
- Bodily experience of the space / embodiment
- Relationship between user and screen content
- Relationship between user and interface usability / participation / orientation
- Level of immersion ('being there', presence, sense of travel)
- Flow (time spent, level of involvement)
- Social experience levels: individual and co-experience

2.0 The post exhibition interactive artifact
2.1 Background
Post analysis of the questionnaire uncovered the social and largely co experiential life of the audience in the digital container. Secondly anecdotal discussion with the participants disclosed that they had hoped for follow-ups or further discussion given the extensive and somewhat grueling length of the questionnaire. The lack of opportunity to share, discuss and learn what others had to say about the exhibition, directly after the exhibition became a predominant criticism post the questionnaire. The designer saw the opportunity for a co creational activity for all stakeholders employing the language of interaction design and computational aesthetics to provide an abstract, visual platform to portray elements of the exhibition experience.

2.2 About the interactive artifact

In the context of digitally augmented spaces, audience experience research can become integrated into the installation experience as a post installation activity. As in human centred design, in codesign and in participatory design practice, the designer is required to bring together non-design stakeholders as the advocate for the audience. The audience experience can facilitate brokering in order to communicate across disciplinary boundaries and across the stakeholders' embedded knowledge's and practices (Kocsis & Barnes, 2008).

The findings pertaining to audience experience provide a series of designerly observations that relate the technological capability of the PLACE platform to its effective experiential dimension. The work of visualising experience brings together a number of disparate elements. Visualisation can overcome the limitations of text-based questionnaires that can be laborious to interpret and counter-intuitive to the post-installation interpretation of the audience experience. Using a visual language and an easily understood metaphoric concept, a postinstallation artifact can utilise the representational potential of digital media native to the installation in order to enable participatory audience feedback. Here it draws not only on the audience's experience of the installation, but also on the creativity of audience participants in making visible, legible and tangible their personal reception of a work. The psychology of participation means that, following the installation, the audience can debrief cognitively while interacting with an easy-to-use and easy-to-understand visual interface.

Similarly, seeing their own experience visualised in relation to other audience member's experiential expressions stimulates and furthers the co-experiential aspect and creates a sense of communal meaning making. The visitor/participant/audience member is no longer atomised, but can understand his or her own reception in the context of others. At the same time the continual evolution of the interactive artifact makes conceivable a non-local, possibly transnational, possibly online virtual, extension of the installation where the duration of the work is not limited by the museum location.

Current work on the artifact uses Processing (Fry & Reas, 2007, Greenberg 2007). The development and design of the artifact was in collaboration with designer, programmer (Hwang, 2009) and online participants. The physical interface consists of mouse and touch screen connected to customized data projection. Designs of both physical and virtual interface are aimed at intuitive participation and the existence of a terminal is compelling in itself; no instructions are needed. The cognitive difficulty of the post exhibition artifact is designed to be significantly less than that of the installation.

The two interface design iterations titled *field* (figure 1) and *body* (figure 2) demonstrate examples of interactive co-experience. Both designs are developed in regard to the semiotics of software studies drawn from the principles of information design, computational aesthetics and user centred design. The two themes have been chosen to illustrate the capacity of computational aesthetics and making meaning of data. The interface motifs and iconographic display can be designed to correspond to the exhibition or installation for the purpose of thematic consistency.

In the current interactive artifact the interface *field* is a virtual field comprising virtual flowers that grow over time. A flower represents a single participant's responses, while the field represents all such responses in a collective form. The attributes of the flower (height, colour, petal shape) depend on the responses prompted by the dialogue boxes. The virtual field exists in real time. The progress of time is represented by the background sky changing from night to day illustrated by colour hues. Here nature iconography is used to express and illustrate visitor experiences and to elicit a phenomenological spectrum of responses.

While the *field* interface of the interactive artifact researches emotional and cognitive states, the *body* interface focuses on embodiment and physical reception of the installation. The interface *body* specifically questions bodily responses of the work over time. The virtual on-screen body maps colour-coded 'visual', 'aural' and 'spatial' visitor responses. These responses are further divided into age and gender statistics. The embodiment responses over time form colour clusters. These clusters reveal physical sensorial reception patterns.

The interfaces are designed to provide a real-time enjoyable activity in the presence of other visitors and co-participants. Interface responses become visible in real time and are represented in correspondence to all other responses. The interface thus "encourages us to leave our isolated self and interact with a greater social group" (Bullivant, 2005, p.5). The following conceptual diagram (figure 3) represents the interface in situ.

The interfaces collect and contain valuable audience experience data. Stakeholders and designer can discern patterns of data over time, can monitor the fluctuations and experiential progress of an installation, and the real-time data can be deployed in rapid re-design processes. The data in its visual form, as images, provides a conceptual map of the exhibition experience. The continual evolution of the data (as more and more responses are fed into the interface) also provides an installation experience history that "makes the human response a constantly active and evolving interface" (Bullivant, 2005, p.5).

4. Conclusions

Field and *body* are examples of a dynamic and evolving post installation artifact. It draws audience participation and provides a space for experiential and cognitive debriefing. It constitutes audience research that is contiguous with the installation in medial and experiential terms. The data yielded can inform stakeholders about the epistemological, curatorial and cognitive effects of a new media installation, and the ways in which audiences interact and make meaning of the new digital worlds. One of the key finding of the 2007 case study is the co-experiential aspect of PLACE (Kenderdine, Shaw & Kocsis, 2009). In the data a distinct sense of 'togetherness' among the audience, and some tacit and overt forms of collaboration and conflict become visible. Indeed the co-experience potential is significant and stands in marked contrast to conventional museum visitor behaviour. Interface use here constitutes the intersection of intimate personal reception of the work, and the social dynamics of PLACE. Thus, PLACE technology and co-experience are not only not opposing factors, but are deeply interconnected. While the technology allows the displacement of selfawareness, the interface use generates levels of performativity.

Subsequently interface negotiation and dwelling dispersion combine to produce hitherto unknown modes of operation, modes that were not explicitly designed for, namely, performative coexperiential ways of being in the space. Given this information this paper further seeks to investigate these important issues over time, over a number of exhibitions and across varying cultures. *Field* and *body* aims to facilitate this enquiry albeit on an abstract and contentious form of experiential and qualitative data collection.

The experiential data can serve a number of functions. Firstly, it can enrich the stakeholders' future codesign work, because data is present at the outset of a project. In the case of PLACE, the data should be eminently useful in conversations between content providers, artists and curators. Furthermore this conversation can be ongoing as technology allows. In addition, this can overcome the traditional separation between content providers and the audience, as the data can illustrate to non-artist stakeholders how audiences, and under what conditions, interact in digital containers.

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Modelling Sustainable and Optimal Solutions for Building Services Integration in Early Architectural Design

Confronting the software and professional interoperability deficit

Abstract:

Decisions made in the earliest stage of architectural design have the greatest impact on the construction, lifecycle cost and environmental footprint of buildings. Yet the building services, one of the largest contributors to cost, complexity, and environmental impact, are rarely considered as an influence on the design at this crucial stage. In order for efficient and environmentally sensitive built environment outcomes to be achieved, a closer collaboration between architects and services engineers is required at the outset of projects. However, in practice, there are a variety of obstacles impeding this transition towards an integrated design approach. This paper firstly presents a critical review of the existing barriers to multidisciplinary design. It then examines current examples of best practice in the building industry to highlight the collaborative strategies being employed and their benefits to the design process. Finally, it discusses a case study project to identify directions for further research.

Keywords: building services, decisions, integration, multidisciplinary, design modelling

1. Introduction: Services Integration in Early Architectural Design

Given contemporary awareness of global environmental concerns, the imperative to reduce energy consumption and associated carbon emissions can no longer be ignored by stakeholders and practitioners in the Architecture, Engineering, and Construction (AEC) industry.

The effects of global warming demand that increasing attention be given to the procurement of buildings that are more sustainable in both their construction and operation. Despite this, building services, one of the major components of energy usage and cost, are rarely considered as even constraints in the early stage of a design, let alone as potential driving factors for form and spatial configuration.

Presently, on a global scale, the buildings sector is responsible for 33% of all energy-related carbon dioxide emissions (Intergovernmental Panel on Climate Change, 2007). Furthermore, in Australia, 18% of the nation's emissions can be attributed to commercial buildings (Intergovernmental Panel on Climate Change, 2007), with the ongoing operation of heating, ventilation and air-conditioning (HVAC) systems accounting for over 60% of the energy consumption responsible for these emissions (Department of Sustainability and Environment, 2006). However, it is atypical for the implications of either passive or active thermal comfort strategies to be explored in any detail in the early modelling of a building proposal, despite the possible environmental and financial benefits that stand to be gained from this approach (Drogemuller, Crawford, & Egan, 2004). In order for the form and geometry of buildings to be considered in response to performance-based considerations, such as energy efficiency and building services optimisation, multidisciplinary integration is required in the early stages of the design process when the proposal is still flexible and malleable (Tavares & Martins, 2007).

In this paper, the term *interoperability* refers both to the technical ability to exchange and use information across a system, as well as the capacity of professionals in diverse organisational structures to work together. This social capacity to *inter-operate* is vital in *performance-based design*, where the building form is not developed solely according to architectural considerations, but is instead generated in response to performance factors such as energy consumption and comfort control strategies, and requires simulation and analysis throughout the design process to be evaluated effectively (Kolarevic, 2003). The idea of performance-based design is considered distinct from the concept of *building information modelling (BIM)*, which has a more technological basis and is defined as the development of a digital representation of the physical and functional characteristics of a facility, serving as a shared knowl-

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edge resource for information that is more than simply data concerning geometry (Aranda-Mena, Crawford, Chevez, & Froese, 2009).

2. Barriers to Multidisciplinary Collaboration

The increasing complexity of sustainability and building performance issues requires multidimensional tradeoffs across a range of disciplinary objectives, rather than simply experiencebased guidance towards a solution (Clevenger, Haymaker, & Swamy, 2008). This necessitates a shift away from present information-oriented methods, toward process-oriented methods that encourage a dialogue between all parties involved, in order to formally and accurately capture design intent and information interdependencies for exploration and optimisation (Haymaker & Suter, 2006). Both architects and engineers must learn how to modify their tools and their skills to accommodate the significantly different types of knowledge and work processes being brought together (Frazer, Tang, & Gu, 2001). Only by engaging in this manner can an integrated, collaborative design process emerge that has the capacity to resolve performance and design constraints simultaneously, and subsequently catalyse innovative building solutions (Holzer, Tang, Xie, & Burry, 2005).

However, there are a number of social and technical barriers inhibiting multidisciplinary design collaboration, most of which are focused around how and when information is shared between the different parties involved in the delivery of a project (Haymaker et al., 2006). To date, research has tended to focus primarily on finding solutions to only the technical problems, specifically, looking to improve issues of interoperability through the refinement of data exchange standards and customisation of application programming interfaces (Boddy, Rezgui, Cooper, & Wetherill, 2007). One of the fundamental downfalls of this approach, however, is that the design tools that have emerged from this direction of enquiry tend to favour documentation and management tasks that arise once the design of the building is already substantially underway (Lawson, 2005).

The subsequent result is that the current suite of computational tools available to designers are lacking in their ability to support decision-making and supplement tasks associated with resolving interdependencies between performance criteria and form in the early stages of projects (Schlueter & Thesseling, 2009). Performance-based simulation tools are largely discipline-specific and primarily used by engineers to substantiate a chosen proposal late in the design process, rather than to explore alternative solutions through analysis and evaluation early on (Flager, Welle, Bansal, Soremekun, & Haymaker, 2009). While there is the capacity to provide high resolution analytical data, the concurrent lack of ability to seamlessly integrate with

software packages from other design domains means that computational advances are not being utilised to their full potential, and can actually inhibit the multi-objective exploration of possible solutions (Kolarevic, 2003).

The underlying problem that is evident is that the design software available exacerbates the lack of communication currently already existing in conventional practice. The tools that support high resolution design solutions have developed more rapidly than the framework of communication that is supposed to be sustaining them, and the result is a lack of cohesion between overarching project objectives and the computational methods for achieving them (Holzer, 2007). Paradoxically, collaborative design endeavours have been demonstrated to be more successful when integrated design infrastructures and communication networks are in place prior to the implementation of multidisciplinary technologies (Nikas, Poulymenakou, & Kriaris, 2007). It thus becomes crucial to acknowledge that design strategies must be established in response to knowledge and process interdependencies, and not dictated by the use of generic computational tools, so that information is placed in a context easily understood by the whole design team (Cheng, 2003). A refocussing of collaborative tactics is therefore called for that reflects support for process integration, as well as technological integration, in the early design stages, to ensure the integration, rather than dissemination, of knowledge (Augenbroe, de Wilde, Moon, & Malkawi, 2004).

3. Current Multidisciplinary Practice

Current practice is supporting a transition away from a linear work flow that promotes engineering as mere support for architectural design, toward a multidisciplinary approach where performance-based tools and processes provide the mediation between the participants and the design (Janssen, Frazer, & Tang, 2002). More consideration is being given to whole of building lifecycle considerations earlier on in the design process, which is necessitating the embrace of integrated design policies, technologies and processes (Succar, 2009). The two approaches that have gained acceptance in current research on these collaborative initiatives are the development of virtual design and analysis tools (Shelden, 2009), and the implementation of integrated communication and information management strategies (Haymaker et al., 2006). The first of these approaches relates to the idea of technical integration, while the second relates more to the concept of social integration.

One Island East is a seventy storey commercial office tower in Hong Kong that was procured through substantial implementation of virtual 3D building lifecycle tools (Figure 1). Gehry Technologies were consultants to the design and construction of the virtual mod-

el for this development, the complexity of which can be seen in Figure 2, which depicts the mechanical, electrical and plumbing services (Gehry Technologies, 2009). In this project, Building Information Modelling (BIM) facilitated a high degree of information integration and data exchange between members of the design and construction teams and the client, to improve the integration of building components (Boddy et al., 2007). The objective of this process was to minimise cost and construction time, which was achieved through the use of multidisciplinary integrated modelling tools that allowed for the optimisation of the sequencing of construction stages (Gehry Technologies, 2009).

In this case the decision to implement a computational tool that integrated immensely complex and detailed building information compromised the ability of the design model to remain flexible to design modifications and alterations (Shelden, 2009). Collaborative design exploration and optimisation in the conceptual phase was restricted in favour of efficiency in the management of documentation and detailing tasks late in the design process. This clearly demonstrates the inability of existing collaborative technologies to support multidisciplinary design prior to the basic geometry of the building being established definitively (Holzer, 2007). In order to facilitate performance-based design explorations, more flexible frameworks that support the communication and management of multidisciplinary information and processes in the conceptual phase of the design are required (Haymaker & Suter, 2006).

Council House 2 (CH2) in Melbourne, the first six green star rated building in Australia implemented a collaborative design process that commenced with a two week multidisciplinary charrette for the development of the schematic proposal (Figure 3). The charrette process enabled 70% of the design and building systems to be resolved in the initial concept stages, an example of which can be seen in Figure 4. It also improved communication and understanding between the disciplines and professions involved in the project, as well as affecting a six month reduction in design and tender time from what was originally predicted (Hes, 2006b). Although this approach necessitated additional upfront investment, for the design and installation of all the environmental features in the building, it is predicted that this will have paid itself off in six years, through savings on energy and water consumption as well as over one million dollars a year in increased staff productivity (Hes, 2006a).

The success of the CH2 project can largely be attributed to the considerable attention given to thermal comfort schemes in the development of the conceptual design. Rather than acting as a restriction to the design or hindrance to the realisation of the project, the consideration of services in the conceptual design phase be-
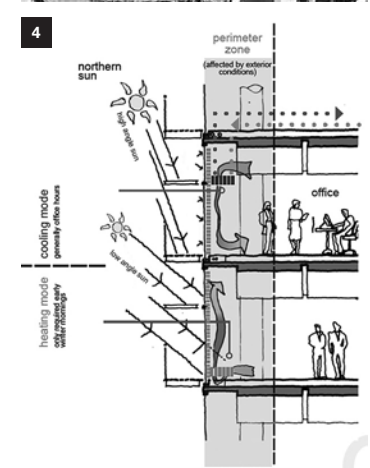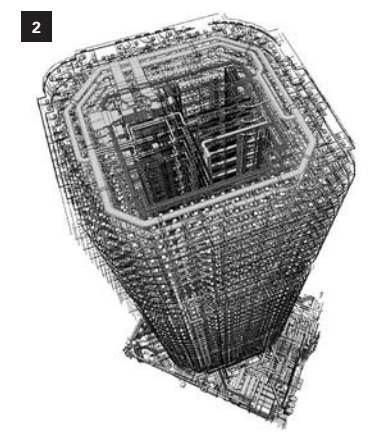
Figure 1: One Island East, Hong Kong (Gehry Technologies, 2009).
Figure 2: Mechanical, electrical and plumbing model for One Island East (Gehry Technologies, 2009).
Figure 3: Council House 2, Melbourne (Fortmeyer, 2008).
Figure 4: Heating and cooling strategy for Council House 2 (City of Melbourne, 2006).

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came a driving factor in the building's form, to maximise the quality of the interior environment while minimising energy usage and associated carbon emissions (Hes, 2006b). While these outcomes alone are quite an achievement, this process could be further augmented and strengthened through the development of low-resolution integrated modelling tools that permit the iterative testing of design solutions early on, rather than relying on precedence-based knowledge and methods from the consultant team (Nicholas & Burry, 2007).

The following case study from the Queensland Government Project Services demonstrates how similar strategies employing services integration in early architectural design are presently being investigated in Australian public practice. By exploring how the objectives of improving user comfort and minimising energy consumption can influence design, with an emphasis on developing *both* social and technological integration in parallel, this illustrates that more innovative and sustainable built environment solutions can be generated.

4. Case Study: JCC Project

The commission of the Joint Contact Centre (jcc), a 5100m² office located in Brisbane for nonemergency police calls and general government services, provided a unique challenge to the design team at Project Services. Not only did the program call for the accommodation of 375 employees and the operation of the premises 24 hours a day, but the client required a green-star outcome of six stars. Due to the green star rating scheme having a heavy emphasis on energy efficiency, the mechanical and electrical engineering teams were involved in the project from its outset, as part of an iterative design process that also involved architects and structural engineers.

Forty-five different services-design scenarios were modelled and analysed in the conceptual phase, examining variations to the basic form that included orientation, the presence of an atrium, the inclusion of cooling towers, alternative façade designs, alternative roof designs, the use of passive and active chilled beam cool-

ing systems, and changes to the floor to ceiling height. Six of these different variations can be seen in Figure 5. Each of the iterations examined the impacts that these variations had on the somewhat conflicting performance criteria, exploring the tradeoffs required between spatial organisation, and hvac, lighting and structural systems, to obtain an optimal design solution. For example, in order for the necessary lighting levels to be achieved during the day entirely through the use of natural light, to reduce energy usage, floor to ceiling height would have needed to be 4.5 metres. However, this would have increased the cooling load for the building, as well as placing an increased burden on the structural system, which subsequently would have led to a significant increase in both operational energy usage and construction costs. Further investigation revealed that the placement of an atrium along the building's central axis provided for these lighting levels at only a 3.45 metre floor to ceiling height, with just a negligible increase in the cooling and structural loads.

Once the form of the massing model had been established, more refined iterations were undertaken that looked at the performance constraints of chilled beam cooling systems. Variations considered were for minimum internal temperatures of 18°C and 16°C, and then again for 16°C with a 20% reduction in air speed. The criteria for evaluating the options weighed the quantitative result of total energy consumption against the qualitative measurement captured by the percentage predicted mean vote (pmv) of people considered comfortable. In this case the option that saved the most energy also provided the greatest comfort. It should be noted however that each of these predictions was based on empirical measurements and made certain accepted and standardised assumptions with regards to building usage, which can only ever be an abstraction and estimation of the actual situation. Regardless of these possible discrepancies however, the benefit gained from running a series of simulations arose from the ability to compare the performances of a number of design options.
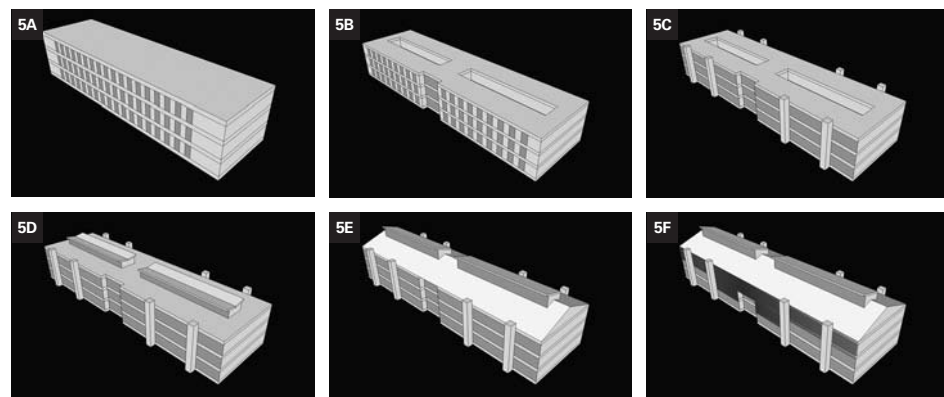
Figure 5: A selection of the various design models explored: a) floor to ceiling height of 4.5 metres; b) floor to ceiling height of 3.5metres with central unenclosed atria; c) addition of cooling towers; d) enclosed central atria; e) roof pitch of 23°; f) addition of window shading.

The jcc building was a pilot project for Project Services that demonstrated an integrated bim approach to modelling not achieved previously in the practice, combined with a collaborative multidisciplinary approach from the outset of the project. Not only were all disciplines working on the same central model for the design development and documentation of their individual contributions, but analysis software was specifically chosen for its ability to link to the 3d modelling program being used, Autodesk's Revit™, and therefore facilitate performance evaluations of the design as it progressed. In this case, the energy analysis software employed was ies's Virtual Environment™, which has an established link to Revit™, and initially allowed for the architectural model to be transferred with minimal remodelling. It should be noted however that each option had to be modelled individually, as the software being used lacked both parametric capabilities and the capacity to transfer information bidirectionally. In addition to this, the simulation files took some time to set up, as the analysis software required a substantial amount of detailed information regarding building services. The responsibility for these early design investigations fell heavily on the engineers, as opposed to the architects, due to the expert nature of the analysis and interpretation required, making apparent that the tools being used did not adequately support conceptual exploration or multidisciplinary integration.

Despite these obstacles, this strategy proved quite effective in providing information to the designers regarding decisions to be made to improve the sustainability of the building early on. However, as the design began to progress and the solutions were refined, the model became more detailed, as can be seen in Figure 6, and this integration between disciplines became difficult to maintain. Part of the problem was caused by underlying software and hardware incompatibilities that materialised as time progressed. However, the deeper issue that emerged was a lack of interdisciplinary understanding about the process requirements of other design domains. Further to this, what became apparent was that the individual disciplines lacked awareness concerning bim modelling inputs and outputs at the different stages of the design process, which also explained the minimal involvement of the architects in the initial design evaluations. Models were often overloaded with unnecessary data while simultaneously not containing sufficient information required for analysis when passed from one discipline to another. This was quite obvious when the engineers attempted to use the architectural models for analysis only to find that rooms had not been modelled as enclosed spaces and therefore could not be used to represent thermal zones. In the later stages of this project, the engineers had to remodel the building from scratch to perform the ne-
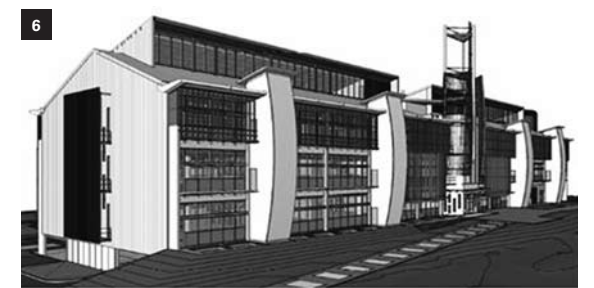
Figure 6: Developed design model.

cessary analyses, due to a combination of inaccuracies in the architectural model as well as problems with the file translation between software packages.

What becomes apparent from this case study is that there is a definite need for the different disciplines involved in the building design process to further improve their understanding of each other's information needs. The analysis itself is invaluable, but only if there is effective communication and adequate comprehension of the implications arising from specific design objectives. This must be achieved not only through clearer communication of design intent and improved knowledge integration, but also through more rigorous adherence to the modelling standards set by the practice, so that consistent representations are maintained throughout the design process to facilitate mapping between disciplinary models. Appropriate levels of abstraction must be negotiated to allow for a more efficient transfer of design and analysis data between the disciplines, rather than continuing to engage building information modelling with the aim of producing a perfect virtual copy of what is intended for construction (Mahdavi, 2004).

While bim theory dates back several decades, it has only recently started to become prevalently accepted in practice, and as such, it is still falls short of supporting the early design process, in favour of assisting documentation (Holzer, 2007). As well as the obvious problem of software compatibility, the high resolution data structures lack the capacity to selectively filter or prioritise specific project information, creating conditions of over-constraint that often hinder the early iterative exploration of the most imperative design criteria (Burry & Burry, 2008). Lower resolution project representations, consisting of lighter data-sets, are required to support early stage design enquiries, when changes to the form of the design can vary dramatically and be quite sensitive in response to the performance variables being considered (Holzer, 2007). This will involve methods which support abstraction and prioritisation of project criteria in the early design stages, in order to test multidisciplinary optimisation strategies in a manner that promotes creativity and innovation (Mahdavi, 2004).

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The issues of integration and interoperability exhibited in this case study, which persist throughout design practice as a whole, must be overcome to provide a means by which to explore the interrelated nature of performance-based criteria in creative and effective ways (Kolarevic, 2003). By managing the level of detail in building models, there is the potential to be able to explore a greatly increased number of design and analysis iterations in the conceptual stage of a project, through the semiautomation and management of the setup and execution of digital simulation tools (Flager et al., 2009). This transition to an integrated and iterative process would then lead to design solutions with improved performance outcomes, and result in a more sustainable built environment.

5. Conclusions

Appraisal of this case study serves to highlight the difficulties that arise from engagement in multidisciplinary collaboration and makes apparent the areas of the design process that require further work to recognise the full potential of technological advances in the AEC industry. It is becoming increasingly obvious that present information-oriented methods are insufficient for collaborative design endeavours, and that what is needed instead are *process-oriented methods* that support *multidisciplinary design exploration*. If performance-based integration is to be achieved in the early stages of design exploration, then a collaborative strategy is required that focuses on *facilitating the communication and management of processes and knowledge, as well as data*.

If the next generation of tools for multidisciplinary design and optimisation could focus on supporting information interdependencies and design evaluation processes, we might then be able to engage in holistically integrated design practice. To traverse the disparity between collaborative technologies and collaborative processes, these tools will need to have the capacity to negotiate different levels of multidisciplinary information in a manner that is appropriate to the phase of design exploration. This is particularly relevant when considering the process of energy analysis involved with assessing the integration of services and architectural design, where the information is bidirectional between disciplines.

Only by reducing the complexity of these modelling and energy analysis design processes begin to present themselves as potential generators of innovative and sustainable building solutions, rather than act as deterrents to their own use (Ellis & Mathews, 2002). Additionally, given the inaccuracies inherent in these performance evaluation models, it is vital to recognise that overly complicated analyses quite often fail to produce precise performance data,

due to small changes in the design having significant impacts on the energy usage (Clevenger & Haymaker, 2006). While they have their place, complex and overly comprehensive simulation tools are not always necessary as comparisons of alternative options can be substantially more valuable than the absolute results themselves (Ellis & Mathews, 2001). This is particularly the case in the conceptual design phase, when many aspects of the form and services are only preliminary, and likely to be modified or altered as the design progresses, especially if performance requirements are tested and fed-back into the design development loop.

The environmental and financial benefits of integrating services design in early architectural conceptual modelling cannot be ignored despite the technical challenges that present themselves. At a time when global ecological and economic issues have intersected in ways that hitherto have not caused such concern, we can react positively by increasing our attention to the procurement of buildings that are more sustainable in terms of their construction and operation. It naturally follows that for building services, as one of the major components of energy usage and cost, to begin to have greater prominence as core driver in the design process, a greatly improved software interoperability will need to be complemented by improved communication strategies between collaborating disciplines.

6. Acknowledgements

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Simone Taffe and Carolyn Barnes

No More Design Experts?

Meeting the Challenges of the Emerging Role of the Design-er-Facilitator in Graphic Design

Abstract

The reorganisation of societies around differentiation, diversification and distributed systems challenges graphic designers to better understand the contextual and human dimensions in design projects, the era of standardised communications having passed. Some design debate holds that audience participation in the design process better aligns designs with audience's needs and perspectives, challenging the graphic designer's established role as a creative and communication expert. Arguments for the ethical and pragmatic benefits of participatory design can seem compelling, but the task of including audience members in the design process is not straightforward. This paper responds to Jorge Frascara's argument that graphic design needs systematic case studies to build knowledge of practice. It reports on a project that used participatory design to research the use of information materials on asthma risk and management, focusing on the need for dedicated methods to help end-users contribute their creative ideas and problem-solving abilities to the design process.

Keywords: Participatory design, graphic design, design tools and methods, design facilitation

1. Introduction

The diversification and fragmentation of contemporary audiences represents a major challenge for graphic design, demanding greater specialization in designed communications. Jorge Frascara (2004) highlights the imperative of specialization in graphic design, describing graphic design as the creation of visual objects that aim to inform or influence a *specific* audience, or encourage it into action. Each year, a multitude of graphic designers around the world seek to engage their audience through the creation of designs that are 'understandable, usable, interesting and if possible pleasing' (Frascara, 2004, p. 54). Yet a section of the graphic design liter-

ature questions how designers arrive at the form and content of designed communications, challenging the appropriateness of the designer-driven message (See, for example, Forlizzi & Lebbon, 2002).

Some large design projects incorporate market or social science research into the target audience, but a majority of designers work without such knowledge. Since the late 1970s, the literatures of usercentred and participatory design have debated the relationship of the end-user to the design process. Both emphasise the humanity and diversity of end-users in the aim of developing more effective designs, seeing design as the creation of relationships with people, not the production of things. The inclusion of 'user designing' marks the critical distinction between user-centred and participatory design (Carroll, 2006, p. 3). However, although participatory design is widely discussed in the design literature, few published studies discuss its application to graphic design. Arguably, three main issues block its uptake here. Firstly, graphic design's close relationship with commercial activity emphasises business objectives over audience needs and preferences, the profit motive making it difficult to incorporate significant audience research into communication design projects. Secondly, where graphic designers assume the role of communication experts to claim an intuitive understanding of the communication task, audience input becomes irrelevant. Thirdly, where designers' innate creativity is seen to drive the design process audience input again becomes extraneous.

This paper reports on a study for the Asthma Foundation of Victoria, which investigated the nature and purpose of designed communications on asthma risk and management. The Foundation had a profusion of information materials, both print and digital, developed over an extended period with consequent poor relations between individual pieces and sets of information. Proposing a systematic communications strategy for the Foundation depended on understanding how diverse stakeholders used its information, providing a robust context to explore participatory design processes. Our paper focuses on the use of dedicated design tools for building the participative relationship, the merging of designers' skills and users' knowledge of the communication task being vital to unlocking the espoused benefits of participatory processes in more effective and democratic designs (Prahalad & Ramaswamy, 2004, Sanders, 1992). By presenting the study for

the consideration of designers and design researchers, we hope to build knowledge in the application of participatory processes in graphic design, leading to greater interest and success in their use.

2. Method

The paper uses case study methodology, critically reflecting on a program of three participatory design workshops held for the Asthma Foundation in 2008. The workshops included 12 staff of the Foundation from the group responsible for public education and outreach, these individuals being key users of the Foundation's information on asthma risk and management while having close knowledge of the information needs of people with asthma and their careers. The design team comprised four communication design masters students from the Faculty of Design, Swinburne University of Technology, working under the guidance of an experienced design manager and studio art director. Three of the students had industry experience. We directed the project, framing the range of design activities undertaken. The study trialed nine participatory design activities, including information auditing, persona building, user scenarios and verbal-visual games. Our paper discusses the challenges and contradictions in the application of participative processes in graphic design, seeking to reveal causal relationships between the nature of design activities and the scope for designers and other project stakeholders to come together to draw on each other's knowledge.

3. Results

The participatory workshops produced valuable insight into how the staff of the Foundation use designed communications to deliver information on asthma risk and management to the public, providing a basis of knowledge for the revision of the Foundation's communications strategy and materials. This included the identification of key audience segments, detailed information on audience characteristics and behaviors, perceptions of the strengths and weaknesses of existing information materials and many creative ideas for new communications strategies. The workshops also highlighted the obstacles to building participative relationships in co-design. Three key findings about effective methods for participatory design emerged from the study: the advantage of tightly-scripted, smallgroup activities over loosely-framed, whole-group activities; the resistance to ranking and critical revision of design ideas; and the benefits of verbal-visual games in relationship building and knowledge transfer. Our study also showed that cycles of progress and regress distinguish participatory design, pitching activities between work and fun being important to sustaining the participation process until the way forward for design becomes clear. In the discussion sec-

tion, we build on our findings and the arguments of others to address the challenges of participation and ways to resolve them.

3.1 Tightly scripted activities

Our study found that tightly-scripted, small-group activities were better at uncovering critical participant knowledge than the open-ended, whole group activities such as brainstorming and swot analysis commonly used among design peers. One activity involved an audit of the Foundation's information and promotion materials in which participants selected their favourite and least favourite items, pasting them onto A2 boards. Participants then added post-it notes to the items to comment on their strengths and weaknesses. In initial whole-group discussion in Workshop One, there was great reluctance to criticise the Foundation's information materials. However, when working in small, selfselected groups the participants became highly engaged in sifting through the different pieces of information to find and comment on especially liked or disliked items. Some participants voiced strong opinions during this activity, making comments loud enough for everyone in the room to hear, such as 'People really like this.' and 'It's a useful resource, but it's a matter of storage and remembering it's there.'

The information audit established a key issue for a new communications strategy for the Foundation, workers' comments and annotations identifying confusion over whether the Foundation's main role was raising money, raising the organisation's profile, raising public awareness of asthma or helping individuals and their carers manage asthma. The hands-on nature and intimate setting of the smallgroup activity seemingly made participants less self-conscious about expressing frank opinions. The information audit also highlighted the duplication of information and the negative effect of staff turnover and computer technology problems on the Foundation's provision of information to the public. The workers' guarded responses to the presentation of each negative finding of the information audit during the Workshop Two confirmed the importance, but also the sensitivity of these issues.

3.2. Positive feedback

Frascara (2004, p. 54) depicts graphic design as an opportunistic and synthetic activity; designers quickly frame and rank a variety of design propositions to identify the most promising directions, rapid conceptualisation and problem-solving a product of designers' role in developing a saleable culture in a commercial world, on time and on budget. Arguably, designers can rapidly propose and sift potential ideas because they do not have an emotional attachment to the context for design. The Asthma Foundation study revealed that the

opposite is the case in participatory design. Workshop Two reviewed ideas from Workshop One, asking participants to rank issues from the information audit using a set of cards the designers had created. The participants' response to this activity was defensive, the cards being perceived as painting an inaccurate, negative picture of the Foundation's information materials even though they accurately reported staff members' comments. The designers and staff members resolved to change track and discuss the positive aspects of the information materials, which proved to be much more effective in filtering out weak ideas, suggesting that participants will arrive at good ideas in good time.

3.3. Verbal-Visual games
Our third finding was the value of verbal-visual activities in encouraging participation and overcoming barriers between designers and audience members. Ehn (1993) cites Ludwig Wittgenstein's idea of the imperfection of communication systems to challenge the idea that lay participants must fully articulate their needs and desires in the participation process. Ehn argues that design tools such as ideation exercises, visualisation methods and prototypes are all representations that enable participants in design to see new dimensions in existing circumstances and practices. For Sanders, the graphic designer's main challenge today is developing innovative tools to enable people to express 'those ideas and feelings that are often so difficult to express in words' (Sanders, 2002, p. 7).

As an icebreaker, we brought the staff of the Foundation and the designers into the one group, asking everyone to write a word related to the idea of information on a card. Each person then passed the card to the person on their right, whose task was to draw an image of the word. For example, in response to the word 'consistency', a second person drew three equal-sized squares. The card then passed to a third person, who we asked to guess the original word. In this activity, the need to draw was met with much joking and laughter. One reluctant drawer complained 'But I can't draw'; another commented 'I won a prize for drawing in primary school'. Some participants teased others that the quality of their drawings made guessing the original word impossible. The activity built familiarity between the designers and Foundation staff and made the serious work of the workshop seem less confronting. It also highlighted the challenge of conceptualisation through text and image, an undertaking intrinsic to graphic designers' work.

4. Discussion
When the aim of graphic design is to sell an idea, product or message, it makes sense to understand the audience, especially today. Drucker and McVarish (2009) argue that the end of the era of mass media and con-

sumption and the development of new information and communication technologies have seen everyday people become active selectors of designed messages and, increasingly, cultural producers in their own right. They argue that such changes require graphic designers to better understand the 'conditions of use' for design, not just produce 'effective or aesthetic displays of useful information' (pp. 337–338). Traditionally, however, clients have engaged designers to provide professional services based on their creative expertise and technical knowledge (Reich, Konda, Levy, Monarch, & Subrahmanian, 1996, p. 179). Conversely, many graphic designers see themselves as frustrated artists whose individuality and inspiration is restricted by clients' lack of vision and budget. For Ilyin (1997), graphic designers' self-understanding as experts and artists encourages disdain for clients and audiences, whose needs and interests are disregarded in favour of play with the formal languages of graphic design. The need to communicate a particular message to a specific audience places limits on graphic designers' creativity, but it is only in a handful of graphic design projects that audience research encumbers design activity.

Misunderstanding the relationship with the people they serve is an entrenched issue for many expert fields. Over two decades ago, Donald Schön (1983) highlighted the dilemma of society's lack of confidence in professionals despite their primary role in delivering expert knowledge and services to society. A broad literature argues that everyday people have much knowledge to contribute to the design process. Sui (2003, p. 64) highlights the issue of 'user-unfit designs', suggesting that future designers need to become less dominant in the design process so that audiences' requirements drive designed responses. Yet there are obstacles to building participative relationships in design. Initially in our study, both the staff of the Foundation and the designers were ambivalent about each other's role and skills. The young designers expressed reservations about participatory processes, one commenting 'in the end it's our role to design the outcomes'. Some Foundation staff commented positively on the creativity and fresh insights of graphic designers they had worked with in developing information materials, but criticised the tendency of some designers to ignore crucial advice or aspects of a design brief to pursue an individual creative agenda. Staff gave examples of designers' creative latitude leading to seriously flawed results, such as a fridge magnet describing the key steps in asthma first aid having unreadable type.

Like many small organisations today, the Asthma Foundation provides a dynamic and testing work environment in which individuals and teams share common goals, perform mutually dependent tasks and are jointly responsible for communal outcomes (Kozlowski

& Bell, 2003). When confronted with the diverse practical and organisational issues faced by the Foundation's staff in working with information, the designers reported feeling 'bogged down, lost and irrelevant'. These issues ranged from annoyances like the storage of brochures in the workers' lunchroom and unreliable computer systems to major conceptual challenges like understanding the Foundation's core business. Initially, the designers saw the complexity of issues as a major impediment to proposing a new information system for the Foundation, especially when the body of user research did not yet include the needs and perspectives of the Foundation's diverse public audience for information. On the other hand, the staff member's high level of design awareness surprised the young designers. In the information audit, they commented freely and authoritatively on poor choices of typeface, colour and imagery and provided vital information on the usefulness or redundancy of individual pieces of information, validating their presence in the design process.

Given such divided views, participatory design processes need to incorporate specific strategies to address the reluctance of lay participants and designers to collaborate through design. Theories of participatory design suggest that success in design depends on the quality of information gained from people about their needs and preferences, hence the requirement for innovative design tools and methods that allow lay people to directly contribute their knowledge and creative ideas to the design process in ways that are integral to design (Hanington, 2003, pp. 17–18). When this occurs, new ideas about how to approach a communication task can be major. In an activity aimed at dividing the audience for information on asthma risk and management into key segments, the Foundation staff showed the design team that the current divisions according to age, gender and asthma triggers were less important than framing information around people's emotional responses to asthma.

The 'Dear Designer Booklet' activity had staff cut images from magazines to represent a day in the life of a specific asthma sufferer they selected, using speech bubbles to describe a common situation in which that person might find themselves in respect of their disease. The resultant A4 booklets represented an important design resource, each persona and scenario a distillation of the participants' great experience of working with people with asthma. These included the embarrassed teenager who no longer wants to discuss or properly manage their asthma, the frightened, elderly ex-smoker in a remote rural location experiencing breathlessness with only a telephone for contact with the outside world, and the three year old with asthma playing in a sandbox watched over by an anxious mother. The segmentation of asthma sufferers accord-

ing to feelings of anxiety, distress, embarrassment, fear or shock could never have been discovered without the co-design process. It identified a potential new conceptual approach for the Foundation's communications strategy to be further investigated through participatory workshops with members of the Foundations' audience for information.

4.1. The designer as facilitator
Jorge Frascara (2004, p. 8) describes the future graphic designer as a guide, advisor or coordinator, who supports audiences and decision-makers to achieve what is required through their original analysis, creativity, realism and experience in working with people. This facilitation role shifts the emphasis in graphic design from visual matters to human factors. It also means sharing control of design with representative audience members, the new critical and creative task for graphic designers being the development of design tools that mediate between audience's contextual knowledge and their own visual expertise and production knowledge. Here, the design process becomes a forum for negotiating diverse design options, replacing the usual subject-object relationship of designing *for* an audience by the subject-subject relationship of designing *with* members of that audience (Spinuzzi, 2005). However, Carroll (1996, p. 288) warns that designers may not have the skills to be effective mediators. Certainly, clients, audience members and designers are separated by their differential facility with language, conceptualisation and visualisation. Typically, designers are reluctant to talk about things in words and audience members may feel they lack the skills to visualize their ideas.

Our study showed that dedicated strategies can disrupt the traditional roles and self-perception of the designer and dissolve the distance between expert and lay participants in the design process. Tightlyscripted activities allowed the workshops to keep moving forward until a level of trust and mutual respect developed between participants. Where the design team initially doubted the worth of the codesign process, by the third and final workshop they had became excited by the possibilities of the facilitation role and the scope to understand the real context for design. One designer admitted that without this engagement, any designs produced, no matter how aesthetically and conceptually innovative, would have been irrelevant. The complementary benefit of participatory design is that knowledge of design spreads throughout societies, demystifying the design process and gaining respect for the work of the designer (Frascara, 2004, p. 58).

In the Asthma Foundation study, the early use of verbal-visual games identified concepts and issues that resurfaced throughout the workshops and demonstrated the bridge-building potential of design tools

when something substantive is created between end-users and designers (Kensing & Munk-Madsen, 1993, p. 79). Creativity theory also stresses the value of turning the mind to other things to allow new creative ideas to emerge, de Bono (1977, p. 11) highlighting how activities such as daydreaming, walking or driving allow the mind to freely wander. For de Bono, gaining insight is more effective where available information is creatively restructured through activities such as lateral thinking, it being difficult to transcend a typical way of seeing unless one can escape the restrictions of pattern thinking. In the Asthma Foundation study, the information audit exercise appeared to move participants beyond their usual, uncritical approach to the Foundation's information materials, releasing their opinions and triggering insight. The combination of designers and staff members working in small groups worked to unlock ideas by giving participants confidence to speak out (Perry-Smith & Shalley, 2003, p. 96).

5. Conclusions

Published studies (Dagron, 2001, Valente, 2002) show that designed communications are ineffective where audiences are not included. Certainly, in today's crowded communication sphere selling a message requires more than the combination of traditional graphic design and market research techniques. Audiences increasingly demand a stake in the creative process, challenging the idea that designer's creativity and intuition are enough to ensure the success of designed communications. Film producers whose aim is box office success rigorously test alternative film endings for audience response. Apple iPods offer people diverse colour and interface options and allow consumers to create personalised internal directories. Auto manufacturers are designing niche cars with their customers. These examples evidence the emerging role of the designer as mediator and facilitator. For Friedman (2003, p. 511), the designer's role is that of a 'synthesist' who understands and organises the range of talents needed to frame an effective design strategy. For Sui (2003), the goal for the designer is no longer the provision of fixed solutions, but rather facilitating a conversation with end-users in the aim of identifying the key parameters for design.

When future designers include representative audience members as key associates in the design team, the success of design may hinge on the development of effective participatory tools and methods. This paper argues that tightly-scripted activities with small groups distract participants, allowing integral ideas to surface, where in whole-group contexts participants may be reluctant to engage with design. Positive commentary is more effective than the established design technique of ranking and critical revision of design ideas, which

creates resistance from lay participants who perceive it as critical of the ideas of others. Verbal-visual games create a relaxed atmosphere for sharing participant knowledge, breaking down perceived status barriers between designers and lay participants.

The insights gained from our study represent participatory processes as a promising addition to graphic design practice, though within limits. Any program of participatory design is distinguished by the people involved, the duration and order of activities and the nature of the underlying communication task, each of which may conflict with general principles. Even so, the shift to participatory practices is likely a force that graphic design cannot resist. If designers accept they are not the only experts in respect of the communication task, they may find that embracing a facilitation role introduces a new dimension of creativity into design, the development of effective and empathetic design tools empowering audience members to unleash their own creativity and problem solving capacity.

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Andreas Hopf

Renaissance 2.0

Expanding the morphologic
repertoire in design

Abstract

In the Renaissance, the arts and the sciences were
considered an inseparable whole – and open-minded
cooperation between distinguished artists was com-
mon. The majority of the contemporary scientific com-
munity is similarly attuned by collectively splicing to-
gether countless individual threads of knowledge, pav-
ing the way for new methods and applications. This
paper argues that a likeminded *modus operandi* would
befit the design professions; the prevalent protection-
ist and romanticist approach is insufficient for design-
ers to act both as competent intermediaries of change
and domesticators of science and technology. Al-
though designers are increasingly gravitating to politi-
cal issues and systemic contributions to society, they
will be engaged in the shaping of the physical world
for some time yet. To that end, the morphologic reper-
toire should be expanded, as has long since been the
case in the domains of architecture and the arts.

  Keywords: Design, Morphology, Nature, Science,
Mathematics

1. The Status Quo

More than ever, we are confronted with a synchronicity
of challenges ranging from an endangered ecologic to
an erroneous economic system; equally subjected to
global political disaccord and torpidity. All the while,
the ramifications of scientific research – whether of
methodological or technical nature – continue to infil-
trate and affect all aspects of life. In particular, the ac-
celerated propagation of ip-enabled technologies is re-
shaping our interaction with the physical world.

  The present scenario yields a wealth of opportuni-
ties for change and engagement alike – assuming that
economy, environment and ethics are not antagonised
en route to a more sustainable world. This is the context
within which the design professions and design educa-
tions have to continue readjusting their focus, assum-
ing wider responsibilities and become scientifically
minded in the process. To that end, new levels of artic-
ulation are necessary – akin to a writer's command of

an extended vocabulary and grammar allowing for ex-
perimentation with language and meaning to find new
depths of expression.

1.1. Modus Operandi

On the whole, the design professions are involved in
very diverse activities; and design practitioners per-
form manifold tasks in varying roles over the course of
their individual activity. While more designers turn to-
wards the sciences in their desire to absorb and trans-
late research into pioneering concepts, the outcomes
of such collaborations, albeit initiated with good inten-
tions, often result in factitious appropriations for "the
gloss of scientific validity" (Aldersey-Williams, 2008).
The proliferation of superficial knowledge in on – and
offline media – and designers' transient ardour for the
nexus of nature, science and technology – confront us
rather often with *parascientific* and *paraphilosophic* jus-
tifications.

  In particular, a recurrent issue is that, in reaction to
the status quo, designers tend to envisage themselves
being empowered with a decisive authority on par with
that of politicians, financial and industry leaders, assum-
ing an almost epic role as solitary agents of societal
change (Maldonado, 2007). Undoubtedly an alluring and
well-meaning proposition; but in reality, the majority
of design professionals is firmly aligned with the capital-
ist modes of production and value generation, suscep-
tive to reflective engagement mainly within the frame-
work of their clients' corporate strategies (Morelli, 2007).

  The prevalent *modus operandi* within the design com-
munity is by and large characterised by compartmental-
isation and protectionism insofar as the methodologies
of analysis, creation and realisation are rarely shared,
publicised or subjected to critical public debate. Why
the level of inter-individual and inter-agency co-oper-
ation is still substandard compared to that of the inter-
national scientific community is unclear. But arguably,
such risk-aversive professional conduct is inconsistent
with the highly respectable goals with which many de-
sign practitioners publicly associate themselves.

1.2. Dematerialisation and Rematerialisation

It has been suggested that the advance of technological
convergence and human longing for shared experienc-
es signal the onset of a world characterised by *piece-
meal dematerialisation*. Supposedly, the design profes-
sions will shift their focus to immaterial aspects such
as the conception of services and mediation of societal

processes and, in doing so, rising to the present global
challenges (Thackara, 2005).

  Although there is no doubt that the disappearance
of certain products and entire categories – and their
subsequent *rematerialisation* in form of sustainable so-
lutions – is a momentous research topic both econom-
ically and ethically, we should not jump to conclusions
and apply *Occam's Razor* to the paradigm of private
ownership without further research. Surely, peoples'
propensity to *experientialise* their environment cur-
rently leads to the emergence of open-source design
initiatives and the like; but we cannot be sure that the
majority of humankind is yet prepared to be released
from its sedentary role as consumers of products in
commodified societies (Debord, 1967).

  To give an example of how designers can enmesh
themselves in a complex web of social, economic and
ecologic interdependencies, let us consider a seem-
ingly trivial conundrum; evaluating the designing of a
bread-baking machine versus a bread-delivery serv-
ice versus a community bakery. We could argue that on
one hand, in terms of activating the consumer whilst
raising nutritional awareness, the designing of the ma-
chine is preferential. On the other hand, a traditional
bakery has location-specific advantages as facilitator
of communal communication and a superior cumu-
lative energy balance. Then again, a delivery service
might generate employment for unskilled members of
the local community; but in return this could put a pre-
mium on the average bread price, enticing consumers
back in the fold of discount supermarkets. Without an
analytical mindset and tools, it is all but impossible to
make a qualified decision on which route a designer
should take in such cases.

  Ultimately, whereas in certain product categories
the consolidation of functions or changes in people's
behaviour is stimulating the amalgamation and incre-
mental disappearance of products, we cannot preclude
with certainty that those very same behavioural chang-
es may stimulate the appearance of new ones. And, af-
ter all, the physical reality of human interaction with
the world – the indisputable *createdness* of our envi-
ronment – entails *per se* that designers will not be able
to dispose of their role as gatekeepers to the world of
objects so soon (Maldonado, 2007).

  Nascent digital processes in designing and fabrica-
tion on the one hand, the advent of social media and co-
creative strategies on the other are changing the prod-
uct nexus. Objects become dynamic – and part of dy-
namic solutions. Embracing the sciences will empower
the design professions to promote and mediate these
changes in a more substantial and qualified manner.
Through consultation of nature's *inventory* and its
analysis in the mathematic *observatory*, language and
grammar in design should be expanded to develop new
characteristics (aesthetics, flexibility, efficiency, etc.)

and methods (participatory, self-regulatory, autopoi-
etic, etc.) in the *laboratory* of the design sciences.

2. Morphologic Repertoire

To begin with, it is important to establish that neither
form nor structure or composition thereof has *a priori
significance*; their adequacy can only be evaluated ac-
cording to well-formulated criteria relating to their in-
tended application (Williams, 1972).

  When we define the *morphologic repertoire* (mr) as
the infinite repository of all possible forms, structures
and their potential correlation, we are faced with an im-
portant issue – its origin. Here, an epistemological ques-
tion arises: if we would possess *a priori* or *innate knowl-
edge* of the mr, accessing and expanding it would be
simply an act of *mental evocation*, akin to the romanti-
cist understanding of genius (Safranski, 2007). But, be-
cause the mr is infinite and exhibits *emergent* qualities,
reliance on *serendipity* or *tacit knowledge* would amount
to a restricted vocabulary – often found at the root of his-
toric-dogmatic and temporal-commercial aesthetics or
styles. But, before entering the aesthetic debate too soon,
designers should adopt an unbiased and inquisitive
mindset to acquire *a posteriori knowledge* with such
methods as are fit to the cause – from whatever source.

2.1. Education

On the whole, design educations convey access to the
mr through canonical, experimental – or no substan-
tial methodologies whatsoever. The first, having cul-
turally and historically emerged, is at risk of becom-
ing outmoded, because the circumstances leading to
its inception may have changed or the issues it was
intended to address may have disappeared altogether.
However, they are sound methods to *initiate* design-
ers to the mr as such. The second, predominantly mo-
tivated by an aesthetical cross-disciplinary discourse
(Akner-Kohler, 2007) is problematic because it side-
steps kinetic, performative or computational aspects;
yet it provides a foundation from which to explore fur-
ther. The third approach consigns designers to the lim-
its of commercial software and shifting visual trends,
often giving rise to me-too concepts or stylistic mim-
icry. All three fall short of an in-depth investigation of
the natural and mathematic mr, ignoring its potential
to address the aforementioned challenges the design
professions should see to.

  Some proponents engaged in the contemporary dis-
course about an expansion of the mr are concerning
themselves primarily with matters of computation (Ter-
zidis, 2006) – in some way bypassing the wealth of pro-
cedural dynamic processes present in nature itself and
reducing the discourse to programming issues. While it
is true that programming is essential for the simulation,
analysis and realisation of algorithmically generated
morphologies – whether relating to nature or mathe-

matics – an approach that takes into account the entire human sensory apparatus should not be neglected.

By coupling the discourse about the MR to the introductory basics of established practices – neither precluding intuition nor antiquating existing knowledge – a strategy becomes apparent: Exploiting designers' intuitive curiosity for latent aesthetic potential in nature and the sciences – and subsequently transforming curiosity into consolidated knowledge.

3. Inventory: Nature

For some time, biological terminology *contaminates* language and thought. Why this happens remains unknown, but we can speculate that it expresses the perceived subliminal scientification of our existence or a means of reconciliation with an incomprehensibly complex world; possibly a typical reaction to societies in crisis (Sachs, 2007). Businesses strive for *organic growth* and aim to *crystallise* their *brand-DNA*, investors provide *seed* capital to start-up companies, advertisers seek to *infect* potential customers through *viral* marketing, aiming to initiate *contagious behaviour*, architects adopt *genetic algorithms* to *evolve* concepts according to *environmental fitness criteria* – and some designers appropriate nature's symbolic and iconographic reservoir of floral and crystalline motifs.

Taken designers' open-mindeness and inquisitiveness, a surprisingly limited set of *deficitary symbols* (leaf, tree, double-helix, hexagon, the colour green, etc.) continues to permeate the creative disciplines to a degree that we could be tempted to purport that nature's vocabulary is nearing exhaustion. In most cases, design inspired by nature serves as the *greenwashing* ingredient in commercial marketing strategies, bestowing a sustainable aura on otherwise mundane products and services.

In *On the Parts of Animals* Aristotle conjectured that *nature does nothing for nothing*, which alludes to *nature does everything economically*, foreshadowing a fundamental paradigm for the contemporary discourse on sustainability. Victor Ruprich-Robert justified the iterative invention of natural ornaments in Architecture on the premises that the repertoire of nature is infinite and the end of evolution remains forever unknown (Ruprich-Robert, 1876). Artists such as August Strindberg and Paul Gauguin saw themselves as devices of nature, not as her storyteller, a notion to Spinoza's differentiation of *natura naturans* from *natura naturata*. The current paradigm shift – from designing *after* nature (*homological* design) to designing *like* nature (*procedural* design) – has historic roots in philosophy and the arts. In his fable *On Rigour in Science*, Jorge Luis Borges depicts an empire in which the discipline of cartography became so exact that the empires' map arrived at the size of empire (Borges, 1946) – illustrating the pointlessness to aspire to absolute homology: It is impossible to rebuild

nature, because such task would imply nature's duplication. Therefore, designing from nature with materials and processes quite different from nature – a constraint we will have to accept for some time yet – will inevitably result in objects and systems *with their own nature* (Negrotti, 2008). The outcomes from nanotechnology, genetic or tissue engineering research show how difficult it is to transpose these results due to the issues associated with scale-invariance.

4. Observatory: Mathematics

Mathematics and science are not required to appreciate nature – to transform appreciation into consolidated knowledge they are. Mathematics is not a science; its proofs are *mental constructs*. These are final universal truths – existing autonomously from physical reality – unlike scientific findings that are provisional, because they can be empirically falsified. The debate whether mathematic proofs are either *found* or *invented* is still open.

Unfortunately, mathematics rank low on the agenda in the design professions, possibly because of prejudices developed from inadequate schooling. Mathematics and creativity are often seen as incompatible – Renaissance or contemporary artists would find such notion rather absurd (Kemp, 2006). The prevailing mathematic understanding of what geometry comprises, is fairly rudimentary. Although most designers have long since ventured beyond basic rational *Euclidean* geometry – proficiently manipulating Bézier curves and NURBS surfaces to create *freeform* shapes – there seems to be little understanding of what is actually happening in doing so. The inflationary use of terms such as algorithm, emergence or topology lacks sufficient selectivity, often rather clouding these topics with *parascientific* significance or outright nonsense.

The relevance of mathematics for the design professions is twofold: First, the dynamic properties of animate and inanimate nature (growth, decay, adaptation, kinematics, etc.) can be described and applied to the designing of objects and systems; what can be observed *prima facie* does not reveal everything about the intrinsic formative processes. After all, what we see in the physical world at any scale is nothing but the result of "the forces that are acting or have acted upon it." (Thompson, 1942). Second, many fields of geometry spawn morphologies *sui generis* – beyond observable reality – revealing highly relevant properties (stress-resistance, surface-minimisation, space-partitioning, etc.).

4.1. Algorithmic Design

The first mathematical algorithm is ascribed to Eudoxos of Cnidus (≈ 375 B.C). In principle, an algorithm is a finite sequence of well-defined instructions that, from an initial state, leads to one or many end-states with determinable or indeterminable results. Cooking reci-
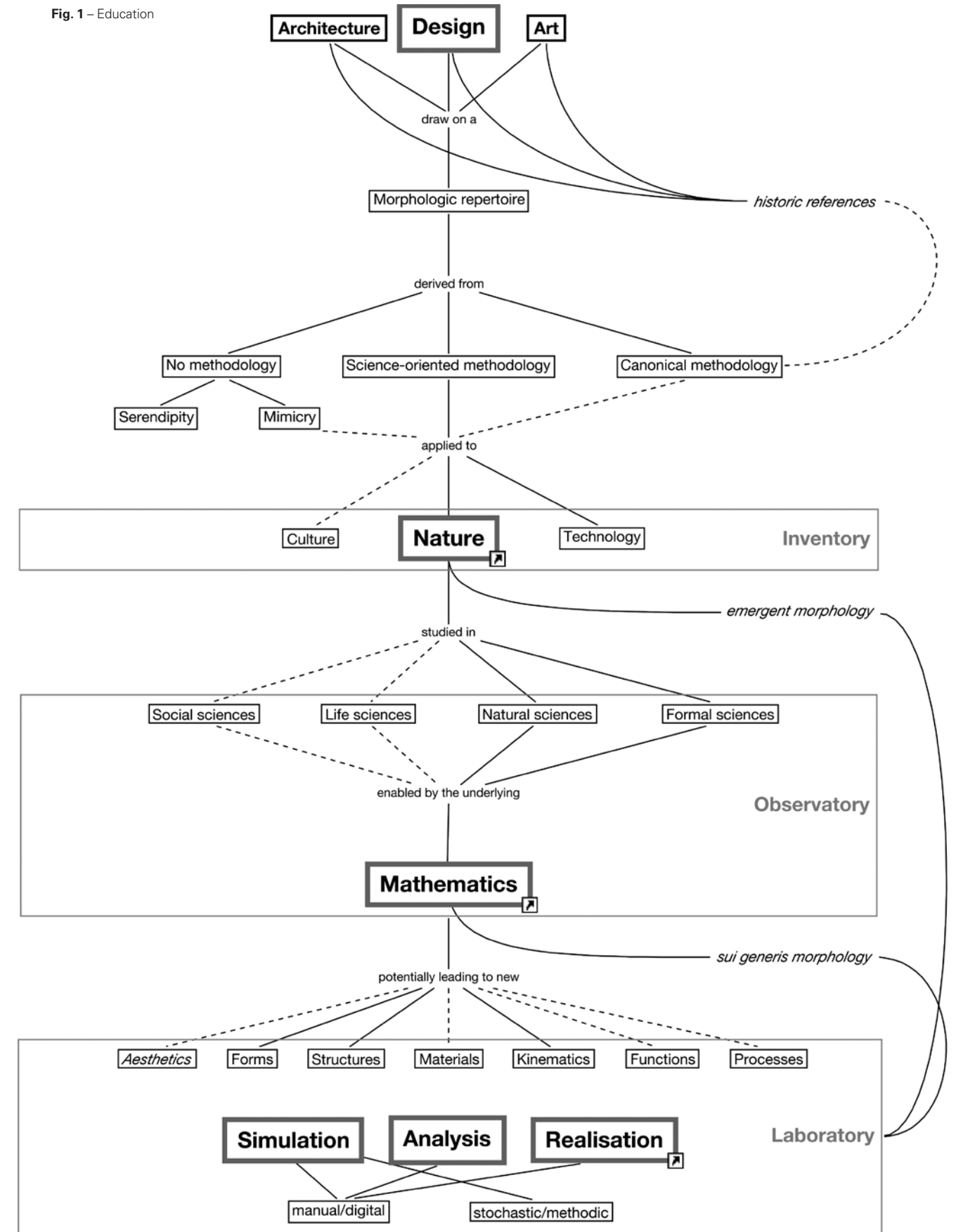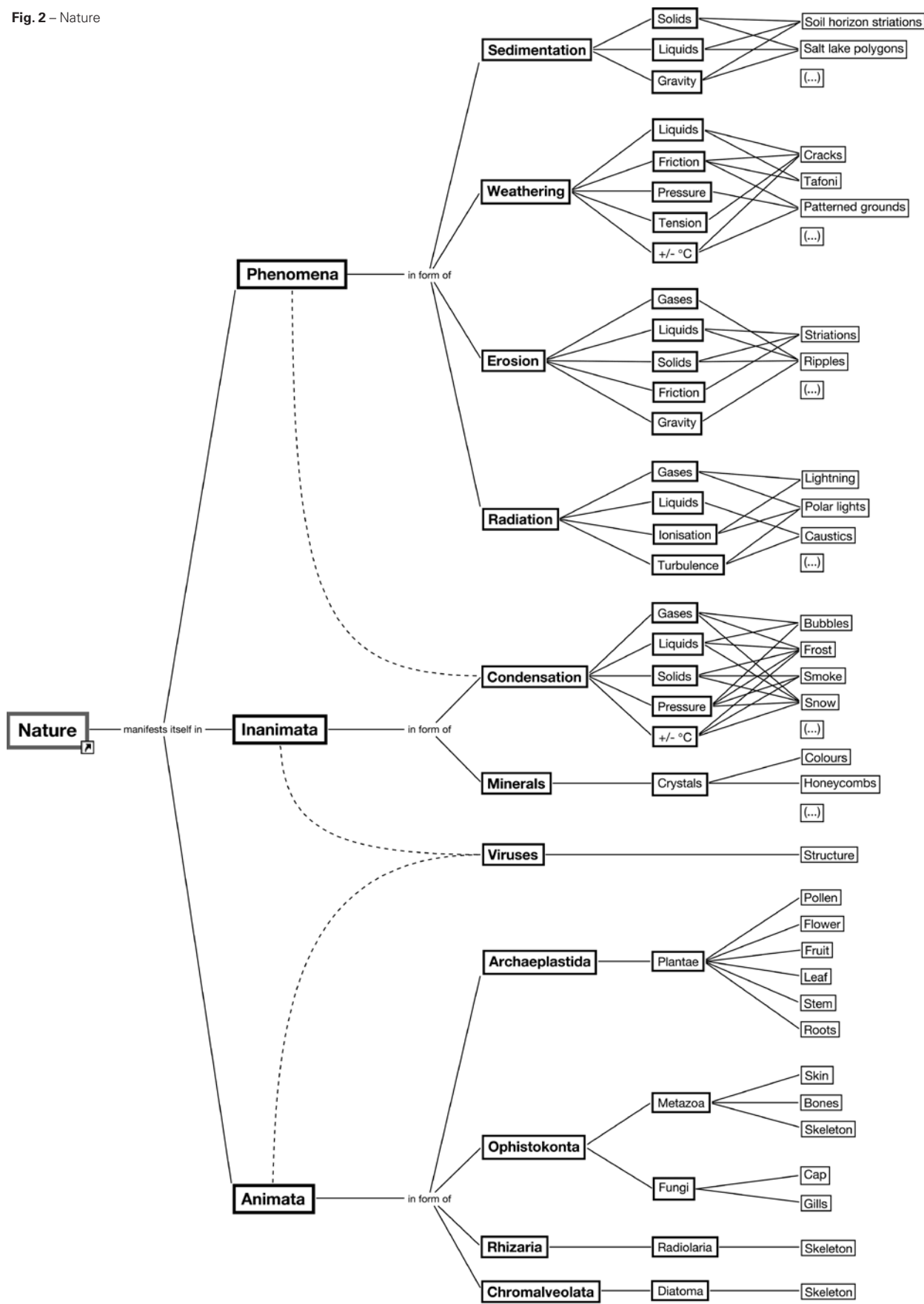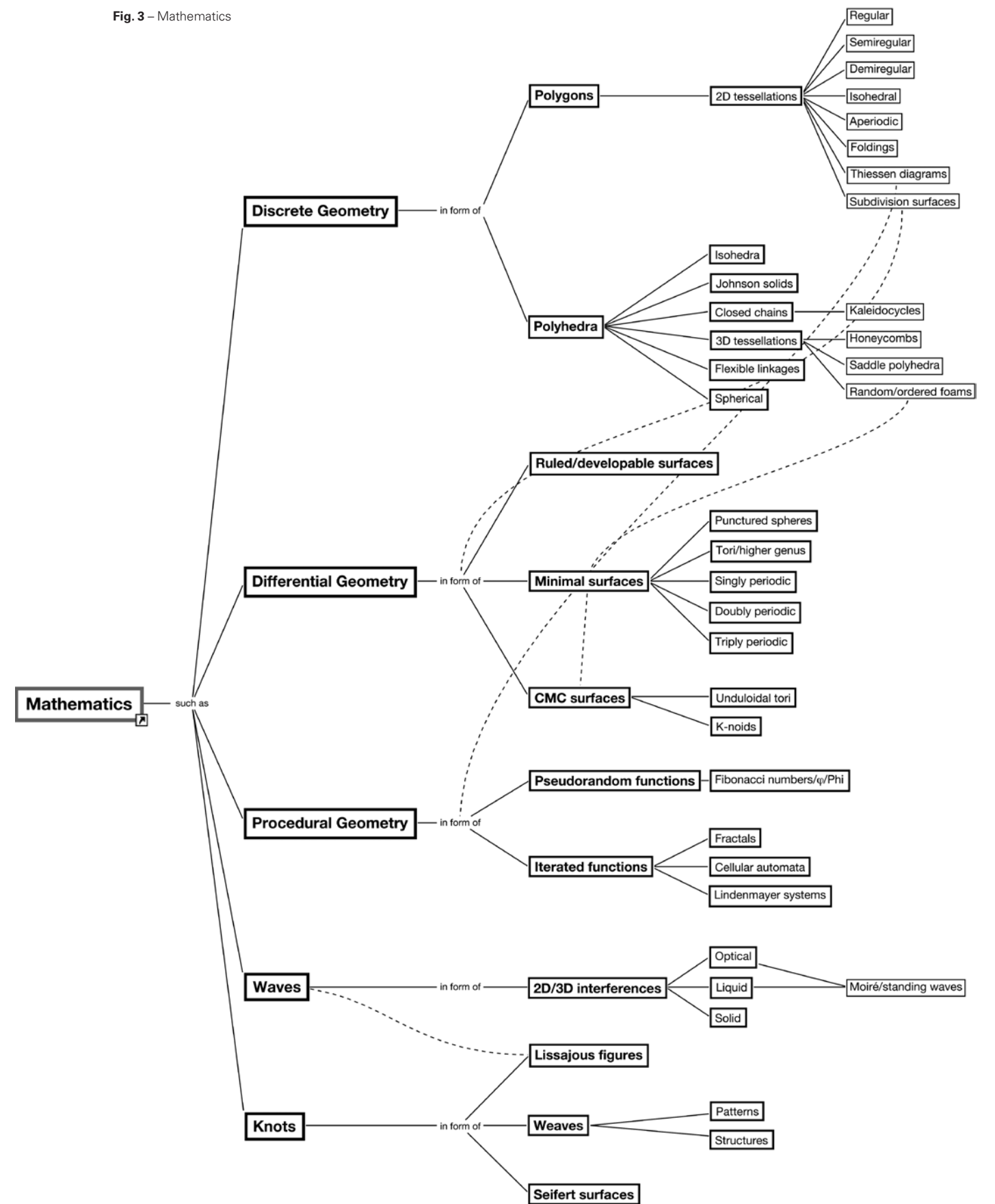

Fig. 1 – Education

Fig. 2 – Nature

Nature — manifests itself in

Phenomena — in form of

Sedimentation
- Solids — Soil horizon striations
- Liquids — Salt lake polygons
- Gravity — (...)

Weathering
- Liquids
- Friction — Cracks
- Pressure — Tafoni
- Tension — Patterned grounds
- +/- °C — (...)

Erosion
- Gases
- Liquids — Striations
- Solids — Ripples
- Friction — (...)
- Gravity

Radiation
- Gases — Lightning
- Liquids — Polar lights
- Ionisation — Caustics
- Turbulence — (...)

Inanimata — in form of

Condensation
- Gases — Bubbles
- Liquids — Frost
- Solids — Smoke
- Pressure — Snow
- +/- °C — (...)

Minerals
- Crystals — Colours
- Honeycombs
- (...)

Viruses — Structure

Animata — in form of

Archaeplastida
- Plantae — Pollen
- Flower
- Fruit
- Leaf
- Stem
- Roots

Ophistokonta
- Metazoa — Skin
- Bones
- Skeleton
- Fungi — Cap
- Gills

Rhizaria — Radiolaria — Skeleton

Chromalveolata — Diatoma — Skeleton

Fig. 3 – Mathematics

Discrete Geometry — in form of

Polygons — 2D tessellations
- Regular
- Semiregular
- Demiregular
- Isohedral
- Aperiodic
- Foldings
- Thiessen diagrams
- Subdivision surfaces

Polyhedra
- Isohedra
- Johnson solids
- Closed chains — Kaleidocycles
- 3D tessellations — Honeycombs
- Flexible linkages — Saddle polyhedra
- Spherical — Random/ordered foams

Mathematics — such as

Differential Geometry — in form of

Ruled/developable surfaces

Minimal surfaces
- Punctured spheres
- Tori/higher genus
- Singly periodic
- Doubly periodic
- Triply periodic

CMC surfaces
- Unduloidal tori
- K-noids

Procedural Geometry — in form of

Pseudorandom functions — Fibonacci numbers/φ/Phi

Iterated functions
- Fractals
- Cellular automata
- Lindenmayer systems

Waves — in form of

2D/3D interferences
- Optical
- Liquid — Moiré/standing waves
- Solid

Lissajous figures

Knots — in form of

Weaves
- Patterns
- Structures

Seifert surfaces

pes, art performances and music scores are algorithms; Johann S. Bach used very complex algorithms – as did composers such as John Cage or Steve Reich. Obviously, most of contemporary music is *programmed* and hence is *algorithmic* in one way or another. The typical way to implement algorithms to explore the MR is via *scripting languages* that control and extend existing software. Algorithmically created morphology quite often displays random behaviour, but that is no sufficient condition to qualify it to be *emergent*.

4.2. Parametric Design

When we speak about *parametric design*, what is actually meant is that elements have a defined relationship in such manner, that they are *constrained* to each other. Therefore, we should rather speak of *relational design*. A relationally designed object is a topological construct of one or many surface elements that are linked through a *hierarchy of constraining relationships*. The difficulty in relational design is, how a theoretically limitless number of elements and relationships can be managed so that the integrity of the topological construct remains modifiable. The key issue is, then, how complexity is being handled on an element *and* object level – if and how the tree of constraints can be controlled. It is above all an issue of software functionality. Relational design does *not* extend the MR *per se*; rather, it allows to manipulate and *dynamise* its synthesis.

4.3. Emergent Design

The paradigm of *emergence* can be traced back to ≈ 400 BC, when Aristotle conjectured in his *Metaphysics* that "the whole is greater than the sum of its parts". In terms of the discourse about the MR and the design professions, emergence can be defined as the *unintentional manifestation* of phenomena on the macroscopic level of a system due to *unforeseeable interaction* of its elements, where the emergent properties of the system cannot be attributed to the properties of its constituent elements on the microscopic level. The weather, a shoal of fish or cellular automata are examples of systems that display *emergent behaviour*.

4.4. Evolutionary Design

Scripted algorithms can also be understood as rules or better as the grammar of a system in which a design can be evolved. Designers encode certain *fitness criteria*, incorporated in the system in order to steer the evolution of an object or system into a *preferable direction*. The implementation of evolutionary principles is often done via *genetic algorithms* that perform a *stochastic search* in order to approach an optimum solution (maximum diversity, minimum weight, highest strength, etc.).

The expression *generative design*, often used in these contexts, is somewhat misleading, because a de-

sign is the *outcome* of a generative process at some point in time. These aforementioned examples make it clear that, in order to implement and master them, programming or scripting skills will become essential for designers who wish to explore the MR and its properties without the semantic limitations imposed by commercial software (Aish, 2005).

4.5. New Ornament

Inevitably, contemplating the expansion of the MR rekindles the controversial debate on the recurrence of decoration, patterns and ornamentation. It has been argued that this trend can be attributed to a number of factors; ranging from a diffuse longing for a discernible codification of cultural roots – to *can-do* enthusiasm for the technological mastery of generative software. However, much of what is claimed to be a manifestation of the *new ornament* is actually *patterns* that have no relation to the *formative necessity* – the *createdness* – of a solution.

In his polemic *Ornament und Verbrechen*, Adolf Loos argued that ornamentation is a manifestation of instinct driven primordiality and thus an intolerable squandering of valuable resources. According to Loos, objects that are not manufactured but fabricated by machines must remain unadorned and pure in restrained and civilised societies so that "soon the streets of the town will glisten like white walls. Like Zion, the holy city, the metropolis of heaven. Then we will have fulfilment." (Loos, 1910). Loos demanded nothing less than cleansing the human environment of humanity by sidelining irrationality to the arts. But ironically, it is precisely the irrationality of evolution that accounts for the fact that no resources are squandered in nature. Adolf Loos – indifferent to the deeper implications of Aristotle's conjecture on nature as well as the theories of Charles Darwin, Ernst Haeckel et al. – reveals his lacking of scientific historical perspective. It is worth to reconsider these issues in the contemporary context, because the etymology (*ornamentum* ≈ apparatus, equipment, furniture and *ornare* ≈ to array, to beautify, to make ready) is indicating the *new ornament*, namely its character as *performative* formal or structural element. The debate, whether or not the ornament can be justified, has now lost its significance a century after it was begun; the question is now, how well it is implemented.

5. Laboratory: Simulation, Analysis and Realisation

The procedural combinatorial methods employed for the extension of the MR, whether in form of algorithms derived from animate or inanimate nature or mathematic descriptions of novel geometry, will lead to momentous paradigm changes in the design professions.

Encoding essential aesthetic (form language, colours, etc.) as well as environment variables (materials, weight, strength, etc.) to which a morphologic development

process should adhere, effectively shifts the focus from *form-giving* to *form-finding* – in the sense that designers *formulate and manipulate a parameterised design-space* within which over time a *solution-space of plausible outcomes is generated*; a wealth of results from which to select and refine further. Through programming such a system with free, limited and constant parameters – thus predetermining the solution-space to a desired degree – designers can endow the system with a certain *degree of freedom* (DOF). A low DOF, then, corresponds to imposing a personal or corporate signature style; a high DOF would suit the requirements of an open-source design system to be released into the public domain with a creative commons license. It is by all means conceivable that – in connection with the emerging *rapid fabrication* technologies (*digital crafts*) – the latter scenario will be instrumental in questioning the prevalent designer-producer-consumer relationship, opening up new horizons for *co-creation*, *micropreneurship* or *inshoring* of production. In this context, the evaluation criteria in design may shift to the assessment of the ethical motivation at the root of the generative process (Picon, 2008).

We can assume that software is on the verge of becoming autopoietic. This fundamental paradigm shift will test our romanticist notions of creativity, control and autonomy. The question is, then: Will designers become moderators, then curators and, at some point in the future, redundant altogether?

6. Renaissance 2.0

The Renaissance was an era of rediscovery and shifting paradigms where the arts and sciences were seen as an *inseparable whole*, in that sense relating to the Hellenistic notion of *techné*, meaning *all that which emerges from human endeavour* by giving form (*morphé*) to matter (*hylé*) from nature (*physis*) by way of transformation (*poiesis*). Intellectual mobility, scientific interest and outstanding creativity went hand in hand, evident in the works and lives of polymaths such as Piero della Francesca, Nicolaus Kopernicus, et al. Albrecht Dürer rejected the mystic notion of creativity in favour of a "selective inward synthesis" (Panofsky, 1943), meaning that only a sufficiently developed repertoire of experiences and consolidated knowledge allows for the creation of works of relevance and meaning. In that sense, Renaissance artists unintentionally provided the blueprint for the ongoing discourse on how designers should address their profession – in order to reunite theory and practice (Friedman, 1997).

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Transnational Experiences

India and China in Australian Industrial Design Education

Abstract

Educational experiences that equip undergraduate Australian Industrial Design students with a practice of design capable of effective engagement with Asian cultures and industries are of increasing professional importance. To enable this, the Industrial Design Program at RMIT University has had to shift paradigms. Long-held and essentially Eurocentric notions of the discipline have given way to being independent in its view of what the future of Australian Industrial Design would look like and where it's main locales of disciplinary engagement would be. The rapid economic development of India and China, and their respective differences in design capabilities to those of Australia, has provided an opportunity to build transnational design relationships through a program of integrated curricula and funded student mobility with partner institutions in China and India. This paper discusses the key issues of training Australian Industrial Designers for transnational practice.

Keywords: Transnational, Industrial Design, Mass-Manufacture, Australia, India, China

1. Introduction

Mass-manufacture in Australia has been in decline for many years, making its inclusion as a curricula priority difficult to authentically facilitate in the situated project modality of studio based learning. Counter to this is the growth of the industrial production base, domestic consumer markets, and considerable export capacities of India and China, and their new focus on training Industrial Designers to service this growth. The rapid economic development of India and China, and the new phase of economic codependence that Australia has with both nations has done two things: firstly, it has highlighted the disjuncture of locales of professional practice and their discourses, the authenticity of curriculums, and the disciplinary aspirations that exist in Australian Industrial Design education; secondly, it has provided an opportunity to reclaim a notion of design for mass-manufacture back into the curriculum. To this end the authors' have conceived and implemented a project of building on the transnational inclinations of students and the university to construct a coupled curricula framework that promotes learning that is both locally and internationally relevant. For the past four years this has involved collaborating with partner institutions in China and India through a program of integrated curricula and funded student and academic mobility.

Within the context of the undergraduate Industrial Design Program at RMIT University the negotiation of a solution to this disjuncture between design capability and the needs and types of design opportunities that local industry presents, could be approached in two ways. The first process is to change the curriculum to train students for a more relevant and localized practice. This requires a transformation from a curriculum that focuses upon mass-manufacture in favor of a curriculum that considers design to be a practical education in the humanities, thereby achieving a 'meaning' of design as a mechanism for the types of redirection needed in a post-industrial economy. Such a curriculum could equally reposition Industrial Design as a generalist multidisciplinary practice capable of adapting to the disparate areas of creative engagement that constitute the contemporary nature of the profession. The second process is to keep enough of the specialized mass-manufacturing oriented design curriculum and attempt to connect students to an Indo-Chinese client base. Activities to achieve both these goals began in 2004. The paper sets up a discussion about establishing a rationale and methodology for educating Australian Industrial Designers for transnational practice through the rethink of current curricula and a revisiting and re-contextualization of the curricula origins and agendas of Industrial Design at RMIT University. The curricula transitions discussed are done so in relationship to broader shifts in the Australian economy and the important roles that the internationalization of Higher Education plays in macro-economic policy. It then goes on to describe the transnational capacity developed in students that have participated in the project.

2. The 'Local'

Since the formalization of the Industrial Design Program at RMIT University in 1949, massmanufacture as a central discourse within the curriculum has provided relevant learning and a proximity to a future client and employer base for students. Here the idea of design for massmanufacture has been elevated, perhaps optimistically, as an integral element of Australian economic development and independence, and as an important practical and political expression of the roles that Industrial Design plays in motivating cultural aspirations and cultures of production. Industrial Design in Australia found its feet as a codified profession in the years following the Second World War as a necessary mediator between building and maintaining Western consumer aspirations with the cost and logistics of pursuing this Western lifestyle on the other side of the world. The import of goods from abroad was both slow and expensive leading to the creation of market conditions favorable to local design and manufacture. While distance provided the incentive, much of the mass-production infrastructure, and many of the large manufacturing business entities were established with significant government support as part of the war effort during the 1940's. The sectors' heritage in many ways became representative of the political desire for Australia to share the socio-economic values of its closest allies who were also its largest trading and strategic partners at that time – Western Europe and North America (Bogle, 2002). Throughout the second half of the Twentieth Century the shifting of populations between rural and urban sites of production via large-scale immigration programs, which in turn brought multiple cultures and social aspirations, kept the complexion of the profession internationally attuned and diverse. Immigration saw the rapid growth of a multicultural urban Australia with comparatively benign class structures, high standards of living, functional governance, and employment stability that ultimately helped to solidify Australia's manufacturing base.

While Industrial Design education in Australia imported many curricula values from Europe and North America throughout the Twentieth Century, it steered away from any deep inclusion of design as a theoretical, abstract and speculative practice. The discourse of design as a practice in the modernization of indigenous crafts was also not deeply privileged. Instead, a technically and industrially grounded discourse of design for mass-production and mass market was largely favored. This preference has a lot to do with the social and curricula histories of many of the institutions that offer Industrial Design training in Australia. The working class technical training colleges that were established in Australia in the late-Nineteenth and early-Twentieth Centuries formed the early incarnations of many of the universities in which Industrial Design education was formalized. Curricula that grew out of industrial arts and engineering education in these colleges have provided a particular linage of disciplinary ideology and pedagogy. This saw trainee designers' work in close proximity to their future client base with a view to participating in the cultural project that was 'building' Australia's creative and productive capacity in the best traditions of industrialization as humanism.

In the 1940's, one of the first modern Industrial Design programs in Australia was started at RMIT under the direction of German émigré, designer and educator Gerard Herbst. Known as Formgestaltung, this program explicitly positioned the role of the designer as a humanities trained design generalist that had the necessary technical skills to productively engage in the realm of massmanufacture. This would later become formalized as the Industrial Design program at RMIT University. Due to the comparatively small size, emergent and diverse nature of Australian manufacturing enterprises, a de-emphasis on specialization in Industrial Design training was seen as critical in equipping designers with the necessarily broad capabilities and cultural awareness to fulfill many organizational roles. The curriculum of Formgestaltung recognized that mass-production and consumption was central to economic development in the post war years and that it would occur regardless of the involvement of designers. Teachings that privileged concepts of product ecology, environmental, behavioral and organizational psychology, philosophy, ergonomics and sociology were balanced against production oriented subjects. This pedagogy aimed at preparing designers with a broad world-view and the ability to act as practical advocates for a uniquely Australian "aesthetic of scarcity" through design (Herbst, 2000). This orientation to the discipline was more focused on the ideological role of design than the technical and was significant to the ways in which design intersected with local mass-production.

The rapid development of the manufacturing sector in post-war Australia began to stabilize in the mid 1970's and began to contract sharply in the early 1990's. Throughout this period the profession (and its education) incrementally re-oriented itself to be more reactive to the specific organizational needs of the main employers of Industrial Designers. This shift saw a reduction in the desire for a broad humanities education and a more focused and vocational approach to teaching a technical skill-set desired by a larger but less diverse local manufacturing industry. The notion of design pursued in the past three decades can be seen as largely producer oriented, where design professionals shifted from a role as mediators between production and society, to specialists in the various sectors of design for manufacture. The specialization of the profession on one hand significantly refined design capability, and on the other it reduced the mobility of designers and the transfer of knowledge from sector to sector. Consequently an education that was more vocationally localized and more technical in its curricula than the broad

and multidisciplinary Formgestaltung came to be.

Hidden under the relative economic prosperity of the past decade has been a shrinking of the local manufacturing base, and a steady drift towards offshore production by Australian companies. This has resulted in a marked contraction of the scale and range of local mass-manufacture that has run counter to the increased size, economic capacity and levels of consumption of the domestic Australian market over the same period (Davidson, 1969; Smith, 2001). This contraction has its roots in a set of macro economic factors that need to be seen in context to appreciate the level of change that the Australian Industrial Design community has had to contend with: the economic deregulation and incremental removal of import trade tariffs of the 1990's; the increase in the export of commodities by primary producers to emerging industrial economies in Asia; a political and cultural aspiration to move away from secondary industrial production activities towards service oriented tertiary industry sectors such as finance and higher education (Zhang, 2005); a cultural aspiration to mark prosperity through a level of material and technological goods consumption not seen since the years following the close of the Second World War (Berry, 2005); and, the rapid expansion of Asia's economic capacity to service the aspirations of a booming Australian economy with a level of diversity that local industry struggles to compete with in the absence of robust organizational and brand structures. Lastly, the causal economic effect of the growth of near neighbors, namely the liberalization and industrialization of the Chinese economy (Zhang, 2005), the growth of the massive middle class of India, and a general increase in role of consumerism in Asian societies (Chua, 2009), has enabled the potential of a new and vibrant Indo-Chinese client base for Australian designers (Dilnot, 2003; Koshy, 2008; Varadarajan, Mayson, & Trathen, 2007).

The consequence of this contraction has been a change in the local contexts of design engagement and the opening up of new contexts and approaches. The privileging of North America and Europe as pivotal to the disciplinary discourse within the curriculum of design for mass-production, as those locales de-industrialize, has shifted towards a greater inclusion of Asia as a key sphere of economic inter-dependence. This has enabled Industrial Design curriculum to begin to grow beyond its traditional and dominant practice discourses of design for mass and medium scale manufacture for local markets into more multifarious and contemporary notions of the discipline. There has also been a reduction in opportunities for Australian Industrial Design graduates to engage in locally based careers within the milieu of design for mass-production or mass market. The nature of employment in Industrial Design in Australia has for many changed from that of being in the service of a company (manufacturer or consultan-

cy), to being a career constituted by forays into design projects where the context of engagement and not the activity, be it production, market or message, defines the method and approach in which design is undertaken. Many designers in contemporary Australia need to orient themselves as multidisciplinary practitioners working on projects: they may work in the realms of art and performance; designing bespoke and batch manufactured products; as researchers, or as generalists working across areas of design, marketing, and production in small and medium sized enterprises. Many designers have little option but to practice in a piecemeal fashion as the nature of employment in design has moved from that of being in the service of an organization to being a contractor within the time frames of a specific project. While moving from project to project has enabled Industrial Designers to increase the ambit of their design repertoires, rarely is there the authentic opportunity to orient careers in the traditional parameters of Industrial Design as a secure career, designing mass-produced objects for a mass-production company. These changes in career structure have also resulted in the diverging and amplifying of the notion of Industrial Design as generalist specialism to becoming two professional modalities: the design specialist and the design generalist. Industrial Design as a generalist specialism is important within the context of design for mass-manufacture in large organizational structures given the diversity of roles and responsibilities that such contexts of practice demand.

3. A Transnational Experience

Australian Industrial Design education in the main continues to educate in view of developing capabilities in designing for a mass market and a large company, despite, as previously argued, it being an unlikely professional activity for the many graduate designers who situate their careers within Australia. Design for mass-manufacture sits as a deeply entrenched and implicit disciplinary expectation, and despite the local condition, it is an important and tightly held aspect of the profession. However the proximity of the designer to the sites of production, user and market is crucial in an effective design education. The context of design for mass-manufacture now sits predominantly in Asia. The experiential engagement with user and market sits in Australia, while disciplinary aspirations remain largely directed at Europe and North America. Such a segregation of locales of practice questions the authenticity of training designers for a full sense of practice in the area of design for mass-production and highlights the disjuncture of Industrial Design curricula. Alongside this is a reluctance in university programs to recast the curriculum to such an extent as to be either 'localized', and therefore entirely representative of the nature contemporary Industrial Design as it is prac-

ticed in Australia, or to remove the 'local' and transition to a curriculum that is 'international' in its entirety. It, therefore sets up both a need for a transitioning of the curriculum so as to be more reflective of the types of local practice opportunities that Industrial Design graduates will have, and a need for a mechanism that can link Australian Industrial Designers with the mass-production opportunities that exist within Asia in order to provide access to an authentic locale of practice.

Depending on their size most Australian undergraduate Industrial Design programs now have a coupled local and internationalized curriculum as central to the ways that design in Australia is to be understood. For these programs this curricula 'coupling' raises questions of direct local relevance of content, and of the depth of meaningful penetration into the international spheres of practice that their graduates will embark on. There is no neat fit for a curriculum that is stretched between two poles, however, most programs cannot afford to not be international in orientation given the origins and trajectories of their students, just as they cannot afford to neglect to service the needs and help direct the futures of the Australian design sector. To make any shift away from the local in the formative training of designers carries the danger of further marginalizing the remnants of a local design industry for which the idea of a design service to local production and consumption is significant.

Of most importance to this reticence to 'localize' the curriculum has been the concomitant increase in the internationalized nature of students of design. When viewed as a 'transnational' disposition two main factors inform this internationalized nature: one, the professional trajectories of international students, and two, local students with a transnational appreciation and the means to effectively practice across multiple cultures (McBurnie & Ziguras, 2001; Ong, 1999; Volet & Ang, 1998). This change in the global orientations and expectations of students sits alongside the broader project of internationalizing the Australian Higher Education sector as a significant aspect of the nations macroeconomic policy directions (Knight, 2006). Most undergraduate Industrial Design programs in Australia have a high proportion of international students that are in Australia for the purposes of professional education with a view to translating that training back into their countries of origin. Within the RMIT Industrial Design Program international students make up about 30 percent of the total student cohort. Many of these students are from Asia, where the notion of mass-manufacture is, and continues to be, a significant element of economic development. Other international students from Europe or the Americas within these programs often come to study design in Australia because of its proximity to Asia. For both groups of international students Australia represents a middle ground between the contextual

opportunities of emerging Asian industries and markets and the design values of developed and de-industrializing Western economies. Additionally the generation of 'local' students that have entered Industrial Design programs over recent years have a different sense of what Asia means to them than previous generations of students. Many have some Asian heritage or have developed a greater value and awareness through studying Asian languages and cultures as part of their primary and secondary education. For these students the Australia is a legitimate part of Asia and therefore a desirable context for design practice (Evans, 1995). This is evidence of a move away from the idea of Australian design being an adjunct of Euro-American design values. Both groups of students engage in educational contexts that provide a highly reflexive enmeshment of cultural values. This enmeshment is further facilitated through the use of universalized information and communications technologies, and visual communication conventions particular to design, such as the sketch and the model, that transcend linguistic barriers.

In response to these changes the authors' developed a project of coupling the local with the transnational via a set of opportunities that students can choose to engage in. Here the 'transnational' is encountered by the student in three different ways. Students can undertake 'transnational coursework' that includes design studio projects that focus on designing for real world client organizations and manufacturers in India or China, and design history and cultural theory courses that provide a focused study of design in either India or China. Alternatively some students can do an 'exchange' which involves spending a semester abroad in a partner university in India or China, or coming to RMIT University with an aim of immersion and familiarization in a culture and design practice of another country. This provides students with a grounded appreciation for other sites of professional activity and the capacity to build lasting professional and social relationships in their host nation. Finally, students can engage in 'localized' coursework. This involves working in a team on a design studio project that is grounded within the local practice discourses of design. Project teams are made up of international students enrolled in the full four-year degree program, local students with some or no prior experience of India or China, and students on exchange to RMIT from partner Universities in India and China.

The co-construction of project-based learning activities by academics from the various Universities involved has been a major aspect of this project so as to ensure that the key learning objectives of each institution are met. Constructed design projects have included the opportunity for participating students to work within the areas of: design for the mass-production of ceramic goods in Foshan, China; the design of

products and services systems with NGO's and fabrication industries in Ahmedabad, India; design projects with Australian automotive companies, and sustainability and social innovation design research projects in Melbourne, Australia. Critical to the learning in these projects has been the amplification of local design and production discourses so that students on exchange have to contend with differences of culture and discover the values of design, production and practice particular to each context. Alongside these design project learning experiences students sit practical and theoretical coursework as normally taught in each of the Universities. For RMIT students in China or India this has provided authentic learning in design for mass-production and mass market. Additionally students have undertaken design studios in Australia directed at both Indian and Chinese contexts of application. These include transportation design projects, product and service design in the areas of health management and diagnostics, sustainability oriented campaign projects, and product design for grass-roots inventors in the process of commercializing inventions.

These projects have involved a linkage between the research agendas of the project teams at participating institutions and the development of direct project relationships with manufacturing companies and client organizations. Constructing projects around ongoing research activities serves two primary aims; firstly it provides a surety that the activities and contexts of learning undertaken have been adequately negotiated and will be monitored in an ongoing way by academics from their home institutions, and secondly it provides academics with a direct, and embedded link into the areas under research. The disciplinary objectives of these projects vary depending on their duration, degree of immersion and levels of complexity. The experience deliberately sets out to connect the Australian experience of moving through a peak of industrialization and into a phase of de-industrialization as a possible model or outcome for Design in India and China. Here the temporal, political and macroeconomic nature of creative industries is highlighted for students so that inter-cultural learning is enabled. This provides Australian students an opportunity to understand the changing conditions of design in Australia through grounded comparison. It provides Indian and Chinese students with a possible future image of the changes that they may encounter through their careers as their nations economic growth peaks and plateaus. Finally, this embedded agenda provides an experiential lesson in the macro-economic and cultural forces that direct the phases, transitions and opportunities of the profession in major economies in the Asian region, giving students agency as designers with a regional appreciation that sits over and above the confines of national constructs of the profession.

Set up by the authors' as an ongoing project, these encounters have involved the development of academic and institutional linkages and the securing of Australian Government and University grant funding and scholarships to facilitate the mobility of students and staff between key institutional partners. Since 2004 the project has enabled the funded exchange of fifteen students from RMIT Industrial Design to India, and sixteen students to China. It has also provided the mechanism for the funded inbound exchange of forty-seven students to RMIT from Indian and Chinese undergraduate Industrial Design programs. To date a total of seventy-eight students have participated in exchange between Australia, India and China. When added to the many hundreds of students and academics at each of the universities involved that have interacted with students on exchange or on their return, either through projects or socially, the project represents a significant quantum of transnational activity. Such a degree of sensitization to different contexts has enabled a familiarity and fluency of working across locales for participants. It has also provided the program with a mechanism to proactively confront the standing and implicit notion of India and China as 'other' to the established values of Industrial Design in Australia.

The learning that happens in these constructed transnational contexts has a few key aspects, as gleaned from the values expressed by the students who have participated in the programs and projects via course experience evaluations and feedback. Students relay the effect of learning new ways of working as a fundmental re-articulation of the design processes previously learned and considered universal by "adapting key routines, rules and practices with each actor acting from a specific sociocultural background" (Hachmann, 2008), when they study and experiment under different conditions, and when they jointly invent new products, services and systems within a transnational or localized project context. Students encounter new parameters of evaluation, where good design is defined in different ways, leading to an understanding that the knowledge constructs of Industrial Design are fundamentally arbitrary and locally contingent. This realization enables a greater openness to an exchange of cultural and disciplinary knowledge, ideas, strategies, and expectations. Many of the students that have participated talk about the act of confronting the 'other', and their own perceived limitations, as a critical and self-actualizing moment. This moment provides a scaffold for developing new ways of looking at the world, appreciating difference, and adapting to environmental and socioeconomic conditions. For some students these changes manifest as incremental enlargements and improvements in ways of functioning, but often they can also be fundamental in their reordering of the very nature of design as understood by the student. In the latter, the degrees

of misalignment felt towards 'localized' curricula suddenly dissolve so that subjective and deep assumptions learned previously are questioned. This often results in the transformation of the very way design projects are constructed, through a "forgetting" or "unlearning" of accustomed routines and outdated knowledge and the replacement of outdated institutions, roles, and procedures with new and more effective ones.

Conclusion

Visualized as an ongoing project of capacity development for future Australian trained Industrial Designers this paper argues the rationale and timeliness of a more effective engagement with Asian cultures and industries as a formative learning experience that is critical to the discipline and its sites of practice. Three project group at RMIT University arrived at the need for this project through a sensitization to the career trajectories of students given the changing nature of the profession and its curriculum in the Australian context. Key to the authors' position is the belief that the role of design for mass-production provides Industrial Design curriculum with the necessary depth of content to impart contextually transferable knowledge and practices that sufficiently account for the social, technical, economic and managerial elements that constitute a robust foundation to the practice. A method of approaching this belief through an integration of the activities of student exchange with curricula design and delivery and its impacts on learning is described. The belief that there is still an important place for a curriculum of design for mass-manufacture for students of the Industrial Design Program at RMIT University, despite the continued shrinking of the sector locally, has provided for the authors' a way of engaging students with the new centers of mass-production. Opening out India and China as legitimate pathways for learning and professional practice has enabled a clearer view of disciplinary and curricula priorities, and a deeper value in the transformative power and authenticity of contextually situated learning.

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CHILE (2)
- Pontificia Universidad Católica de Chile (PUC Chile), FADEU, **Santiago**
- Instituto Profesional DuocUC, School of Design, School of Communication, **Santiago**

CHINA (8)
- Central Academy of Fine Arts CAFA, School of Design, **Beijing**
- Hunan University, School of Design, **Changsha**
- Shandong University of Art and Design (SUAD), **Jinan**
- Hong Kong Polytechnic University, School of Design, **Hong Kong**
- Tongji University, College of Architecture and Urban Planning (CAUP), **Shanghai**
- Tsinghua University, Academy of Arts and Design, **Beijing**

- Cheung Kong School of Art and Design, Shantou University, **Shantou**
- Zhejiang University, Department of Industrial Design, **Hangzhou**

CZECH REPUBLIC (1)
- Academy of Arts, Architecture and Design, **Prague**

DENMARK (4)
- Aarhus School of Architecture, **Aarhus**
- Danmarks Designskole, **Copenhagen**
- Royal Danish Academy of Fine Arts, School of Architecture, **Copenhagen**
- Designskolen **Kolding**

ESTONIA (1)
- Estonian Academy of Arts, **Tallinn**

FINLAND (6)
- Aalto University School of Art and Design **Helsinki** (Coordinator of Cumulus)
- HAMK University of Applied Sciences, Programme in Design, **Hämeenlinna**
- Lahti University of Applied Sciences, Institute of Design, **Lahti**
- University of Lapland, Faculty of Art and Design, **Rovaniemi**
- **Helsinki** Metropolia University of Applied Sciences
- Savonia University of Applied Sciences, Kuopio Academy of Design, **Kuopio**

FRANCE (17)
- Ecole de design Nantes Atlantique, **Nantes**
- Institut d'Arts Visuels (IAV), School of Higher Education in Art and Design, **Orléans**
- Ecole d'Art Maryse Eloy, **Paris**
- **Paris** Institute of Art and Design, Ecole Boulle
- **Paris** Institute of Art and Design, Ecole Duperré
- **Paris** Institute of Art and Design, Ecole Estienne
- Ecole de Communication Visuelle (ECV), **Paris**
- Ecole Supérieure d'Arts Graphiques et d'Architecture Interieure-Design (ESAG)-Penninghen, **Paris**
- Olivier de Serres, **Paris** – École Nationale Supérieure des Arts Appliqués et des Métiers d'Arts
- Les Ateliers – Ecole Nationale Supérieure de Creation Industrielle, **Paris**
- Reims School of Art & Design, Department of Design and Art, **Reims**
- Strate College Designers, **Paris**

- Ecole Supérieure d'Art et Design de **Saint-Etienne** (ESADSE)
- Ecole Internationale de Design (EID), **Toulon**
- University of Toulouse Le Mirail, Art and Design Department, **Toulouse**
- Parsons Paris School of Art and Design, **Paris**
- Higher School of Visual Arts and Design (ENSAD), **Paris**

GERMANY (7)
- University of Applied Sciences **Cologne**, Köln International School of Design (KISD)
- Folkwang University, Faculty of Art and Design, **Essen**
- Burg Giebichenstein University of Art and Design, Faculty of Design, **Halle**
- Hochschule für Gestaltung **Offenbach am Main**
- Pforzheim University of Applied Sciences, School of Design, **Pforzheim**
- Hochschule für Gestaltung, **Schwäbish Gmünd**
- University of Applied Sciences **Würzburg**, Faculty of Design

GREAT BRITAIN (10)
- Arts University College at **Bournemouth**
- **Edinburgh** Napier University, School of Arts and Creative Industries
- **London** Metropolitan University, Sir John Cass Department of Art, Media and Design
- Ravensbourne College of Design and Communication **London**
- Royal College of Art **London**
- University of **Salford,** School of Art & Design
- University College Falmouth, **Cornwall**
- University for the Creative Arts, **Epsom**
- Gray's School of Art, The Robert Gordon University, **Aberdeen**
- **London** College of Communication, University of the Arts

GREECE (1)
- Technological Educational Institution (T.E.I) of **Athens,** Faculty of Art and Design

HUNGARY (1)
- Moholy-Nagy University of Art and Design **Budapest**

ICELAND (1)
- Iceland Academy of the Arts **Reykjavik**

INDIA (2)
- Ujwal Trust, Srishti School of Art, Design and Technology, **Bangalore**
- Indian Institute of Technology **Bombay** (IIT), Industrial Design Centre (IDC)

IRELAND (2)
- National College of Art and Design **Dublin**
- Dublin Institute of Technology (DIT), School of Art, Design and Printing, **Dublin**

ISRAEL (1)
- Bezalel Academy of Arts and Design, **Jerusalem**

ITALY (8)
- Free University of Bozen – **Bolzano**, Faculty of Design and Art
- Domus Academy, **Milan**
- Istituto Europeo di Design – Scuola S.p.A., **Milan**
- Politecnico di Milano, Facolta del Design, **Milan**
- University of Rome "La Sapienza", Industrial Design, **Rome**
- ISIA di Roma, Istituto Superiore Industrie Artistiche, Industrial Design, **Rome**
- Scuola Politecnica di Design (SPD), **Milan**
- ISIA **Florence,** Higher Institute for Artistic Industries

JAPAN (5)
- Kyoto Seika University, Faculty of Art, Design and Manga, **Kyoto**
- Tokyo Zokei University **Tokyo**
- Nagoya City University, School of Design and Architecture, **Nagoya**
- **Chiba** University
- **Kobe** Design University, Faculty of Arts & Design

LATVIA (1)
- Art Academy of Latvia, **Riga**

LEBANON (1)
- Lebanese American University, **Beirut**

LITHUANIA (1)
- Vilnius Academy of Fine Arts, **Vilnius**

THE NETHERLANDS (5)
- Design Academy **Eindhoven**
- Royal Academy of Art, **The Hague**
- **Rotterdam** University, Willem de Kooning Academy
- **Utrecht** School of the Arts, Faculty of Visual Art and Design
- Windesheim University of Applied Sciences, **Zwolle**

NEW ZEALAND (2)
- Unitec New Zealand, Department of Design and Visual Arts, **Auckland**
- Victoria University of Wellington, Faculty of Architecture and Design, **Wellington**

NORWAY (5)
- Bergen National Academy of the Arts (KHiB), **Bergen**
- Akershus University College, Department of Product Design, **Blaker**
- Oslo National Academy of the Arts (KHiO), Faculty of Design, **Oslo**
- Oslo School of Architecture and Design (AHO), **Oslo**
- Oslo University College (HiO), Faculty of Art, Design and Drama, **Oslo**

POLAND (2)
- Jan Matejko Academy of Fine Arts, **Cracow**
- Academy of Fine Arts, Faculty of Industrial Design, **Warsaw**

PORTUGAL (2)
- Instituto de Artes Visuais Design e Marketing (IADE), Escola Superior de Design, **Lisbon**
- Escola Superior de Artes e Design (ESAD), **Senhora da Hora**

REPUBLIC OF KOREA (3)
- Kookmin University, Graduate School of Techno Design, **Seoul**
- Hongik University, International Design School of Advanced Studies (IDAS), **Seoul**
- Seoul National University, Future Culture Design Agency, **Seoul**

RUSSIA (4)
- Moscow State University of Design and Technology, **Moscow**
- **Saint Petersburg** State University of Technology and Design, Department of Design
- **Saint-Petersburg** State Polytechnical University
- NextArt International Foundation of Fashion and Art Development, **Moscow** (Associate Member)

SINGAPORE (1)
- Temasek Polytechnic, Temasek Design School, **Singapore**

SLOVAKIA (1)
- Academy of Fine Arts and Design **Bratislava**

SLOVENIA (2)
- University of **Ljubljana**, Academy of Fine Art and Design
- University of **Ljubljana**, Department of Textiles

SOUTH AFRICA (1)
- Greenside Design Center, College of Design, **Johannesburg**

SPAIN (2)
- Escola Superior de Disseny Elisava, **Barcelona**
- **Mondragon** Goi Eskola Politeknikoa, Mechanical Department and Chair of Industrial Design

SWEDEN (10)
- University College of **Borås,** Swedish School of Textiles
- Chalmers University of Technology, Dept. of Product and Production Development, **Gothenburg**
- University of **Gothenburg**, Faculty of Fine, Applied and Performing Arts
- University of **Gothenburg**, HDK Steneby, School of Design and Craft
- University of **Kalmar**, School of Design
- **Lund** University (LTH), Industrial Design
- Beckmans College of Design, **Stockholm**
- Konstfack **Stockholm**
- **Umeå** University, Umeå Institute of Design
- **Linnaeus** University, Department of Design

SWITZERLAND (5)
- Nordwestschweiz, University of Art and Design (FHNW), **Aarau & Basel**
- **Genève** University of Art and Design (HEAD)
- University of Art and Design **Lausanne** (ECAL)
- **Lucerne** University of Applied Sciences and Arts
- **Zürich** University of the Arts, Department Design & Art Education

TAIWAN (2)
- National Yunlin University of Science and Technology (YunTech), College of Design, **Yunlin**
- National Chiao Tung University, Institute of Applied Arts, **Hsinchu**

TURKEY (2)
- **Istanbul** Bilgi University, Visual Communication Design Department
- Anadolu University **Eskisehir**

USA (5)
- Maryland Institute, College of Art (MICA), **Baltimore**
- Rocky Mountain College of Art and Design, **Denver**
- Art Center College of Design, **Pasadena**
- Parsons The New School for Design, **New York**
- Ringling College of Art and Design, **Sarasota**